UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

AN ANALYSIS OF FACTORS AFFECTING NON-PERFORMING LOANS IN THE BANKING SECTOR OF NORTH MACEDONIA

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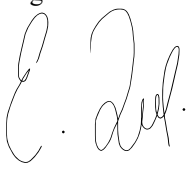
Ljubljana, 27.11.2024 Author's signature: 

ABSTRACT

This thesis examines the macroeconomic and bank-specific factors affecting non-performing loans (NPLs) in North Macedonia. Using quarterly data from 2012 to 2023, it applies the ARDL model to evaluate the impact of variables like GDP growth, unemployment, and inflation, as well as bank-specific factors such as profitability, capital adequacy, loan growth, and loan-to-deposit (LTD) ratio. The findings show that macroeconomic stability significantly influences NPL levels, while from bank-specific factors, metrics like ROAA, loan growth and capital adequacy ratio exhibit significant relationships with NPLs. These insights offer valuable implications for policy formulation aimed at improving credit risk management within North Macedonia's banking sector.

KEY WORDS: non-performing loans, NPLs, ARDL model, macroeconomic determinants, bank-specific factors, North Macedonia

SUSTAINABLE DEVELOPMENT GOALS

POVZETEK

Ta magistarska naloga proučuje makroekonomske in bančne dejavnike, ki vplivajo na slaba posojila (NPL) v Severni Makedoniji. Na podlagi četrtletnih podatkov od leta 2012 do 2023 uporablja ARDL model za oceno vpliva spremenljivk, kot so gospodarska rast (BDP), brezposelnost in inflacija, ter bančnih dejavnikov, kot so donosnost, ustreznost kapitala, rast posojil in razmerje med posojili in depoziti (LTD). Ugotovitve kažejo, da makroekonomska stabilnost pomembno vpliva na raven slabih posojil, medtem ko pri bančnih dejavnikih metrike, kot so ROAA, rast posojil in kazalnik ustreznosti kapitala, izkazujejo pomembne povezave s slabimi posojili. Ti vpogledi ponujajo dragocene implikacije za oblikovanje politik, ki so usmerjene v izboljšanje upravljanja kreditnega tveganja v bančnem sektorju Severne Makedonije.

KLJUČNE BESEDE: nedonosni krediti, NPL-ji, ARDL model, makroekonomski dejavniki, bančno specifični dejavniki, Severna Makedonija

CILJI TRAJNOSTNEGA RAZVOJA

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1 INTRODUCTION

In the banking sector, financial institutions are exposed to a wide range of risks, the complexity of which evolves over time. Given that extending credit is the primary source of profit for banks, effective credit risk management remains one of the most critical tasks for both banks and regulators. Non-performing loans (NPLs), measured as the ratio of non-performing loans to total loans, serve as one of the most important indicators for assessing credit risk. This indicator reflects the quality of a bank's assets and highlights the potential risk that borrowers may fail to meet their financial obligations. Considering the critical role that the banking sector plays in the economic development of any country, it is crucial to examine the factors influencing the emergence and dynamics of non-performing loans.

This thesis is situated within a growing body of literature that seeks to understand the determinants of NPLs, particularly in the context of emerging economies. Previous studies have demonstrated that macroeconomic variables such as GDP growth, unemployment, and inflation play a significant role in shaping the level of NPLs, while bank-specific factors like profitability, capital adequacy, and loan growth are also critical. This study builds on the work of authors like Louzis et al. (2012), who explored the Greek banking sector, and Klein (2013), who analysed NPLs in Central and Southeastern Europe (CESEE). By focusing specifically on North Macedonia, this research fills a gap in the literature, offering a region-specific analysis of NPL determinants.

The main objectives of this research are to determine the relationship between key macroeconomic indicators (GDP growth, unemployment, and inflation) and bank-specific variables (profitability, capital adequacy, loan growth and loan-to-deposit ratio) with NPLs in North Macedonia. Further, we will separately analyse the relationships between these factors and NPLs to non-financial institutions and NPLs to households in N. Macedonia. This analysis will provide significant value to policymakers and banking professionals who aim to improve credit risk management tactics and establish more robust banking procedures in anticipation of future economic crises.

To achieve these objectives, the study addresses the following research questions:

1. Do macroeconomic indicators have a statistically significant relationship with NPLs to non-financial institutions in North Macedonia?
2. Do bank-specific factors have a statistically significant relationship with NPLs to non-financial institutions in North Macedonia?
3. Do macroeconomic indicators have a statistically significant relationship with NPLs to households in North Macedonia?
4. Do bank-specific factors have a statistically significant relationship with NPLs to households in North Macedonia?

Additionally, the hypotheses tested in this research are as follows:

1. GDP growth has a statistically significant negative relationship with NPLs, as economic expansion should improve borrowers' ability to meet financial obligations.
2. Unemployment has a statistically significant positive relationship with NPLs, as higher unemployment reduces household incomes, increasing the likelihood of loan defaults.
3. Bank profitability, measured by return on average assets (ROAA) and return on average equity (ROAE), has a statistically significant negative relationship with NPLs, suggesting that higher profitability is associated with better credit risk management and fewer loan defaults.

The study employs an Autoregressive Distributed Lag (ARDL) model, using quarterly data from 2012 to 2023. Time series analysis was selected due to limitations in the availability of panel data, particularly the lack of comparable data on individual bank level and across different countries over the period under study.

This thesis is structured into six chapters:

Chapter 1 introduces the research topic and presents the study's objectives, research questions, and hypotheses, providing the framework for the analysis of NPL determinants in North Macedonia.

Chapter 2 provides an introduction to the topic and a detailed review of the existing literature on NPLs, focusing on both macroeconomic and bank-specific determinants, and highlights studies relevant to the region of North Macedonia and Central Eastern European (CEE) countries.

Chapter 3 offers an overview of the banking sector in North Macedonia, detailing its structure, transformation, and regulatory environment, providing context for the study of NPLs.

Chapter 4 presents the empirical analysis, detailing the econometric model (ARDL) used to test the research questions and the hypotheses and providing an interpretation of the results.

Chapter 5 conducts a comparative analysis of NPLs in North Macedonia and other CEE countries, providing a broader context for understanding the dynamics of NPLs across the region.

Chapter 6 concludes the thesis by summarizing the findings, discussing policy implications, and suggesting avenues for future research.

2 DEFINITION AND REVIEW OF THE LITERATURE ON NON-PERFORMING LOANS

2.1 Credit risk in banks

Risk-taking, or risk management, is a key aspect of banking, especially considering the evolving complexity of financial markets and the increased regulatory scrutiny of banking operations. In the literature, there are various definitions of risk in banking.

Allan (1998), defines risk in banking as "the perceived uncertainty connected to some aspect related to the banking business" (p.708-709), highlighting the importance of robust risk management practices.

The Risk Management Decision Policy by the National Bank of North Macedonia (NBRNM) defines risk as the probability of certain activities or events to have a direct negative impact on profit and/or equity, or to cause difficulties in achieving the bank's objectives (Law on the National Bank of the Republic of Macedonia, 2010b, Article 47, Paragraph 1, Point 6, Official Gazette of the Republic of Macedonia, No. 158/2010, 2010b).

In banking theory, the most significant risks that banks encounter are credit risk, liquidity risk, market risk, operational risk, reputation risk and legal risk (Koch, 2015). Considering that for the majority of banks, loans are the largest and most obvious source of credit risk, effectively managing this risk is crucial for their successful operations (Principles for credit risk management, 2013).

The Risk Management Decision Policy by the National Bank of North Macedonia defines credit risk as the risk of loss for the bank due to the inability of its clients to fulfil their obligations in the agreed amount and/or within the agreed terms (Article 47, NBRNM).

Christoffersen (2012) highlights that credit risk encompasses not only the possibility of a counterparty fully failing to meet its obligation, but also the risk of a partial or delayed repayment. The nature of commercial banks has traditionally been to take on significant amounts of credit risk through their loan portfolios and today, they place great emphasis on managing credit risk.

Non-performing loans (NPLs) serve as an important measure of a bank's financial "health", representing a key factor in assessing credit risk in the banking system. An increase in NPLs signals a growing number of economic entities facing challenges to service their financial obligations under existing credit arrangements, thereby increasing the probability of credit defaults. NPLs present a major concern for banks, as well as market participants since their negative impact poses risks to the overall economy and financial system. Additionally, NPLs

affect banks' profitability, consume productive resources and limit banks' capacity to lend to the real economy (EBA, 2019; IMF, 2015).

According to Ari et al. (2020), NPLs also play a crucial role in post-crisis economic recovery, with unresolved NPLs often linked to deeper recessions and slower growth. While some countries manage to resolve NPLs quickly, nearly a third face high NPL levels for over seven years, and two-thirds of those impacted by the global financial crisis failed to resolve them within that timeframe. Advanced economies, although typically seeing lower NPL levels, tend to take longer to resolve them. The authors highlight that countries with unresolved NPLs experience an output shortfall of over 10 percentage points within six years, underscoring the importance of effective NPL resolution.

Against this context, the issue of NPLs, the factors which contribute to them, and their impact on the overall economy have emerged as major concerns for almost all countries globally. Therefore, the resolution of this issue is nowadays considered imperative for restoring the functionality of financial markets (Klein, 2013).

2.2 Definition of non-performing loans (NPLs)

The lack of a universally accepted definition of NPLs requires a comprehensive review of the existing criteria proposed by prominent international financial institutions. The International Monetary Fund (IMF), the Basel Committee on Banking Supervision (BCBS), and the Institute for International Finance (IIF) have different perspectives on the categorization of NPLs.

According to IMF's definition, a loan is classified as non-performing if the debtor is at least three months (90 days) overdue in principal and/or interest payments, as specified in the credit agreement. In addition, the IMF considers instances where the interest has been capitalized, refinanced, or deferred for a period of three months or more as an indication of a non-performing loan (IMF, 2006).

The BCBS advises compliance with the "90 days" rule, which indicates default when a debtor exceeds the 90-day limit for meeting obligations to the bank (BCBS, 2006). This straightforward criterion is in line with IMF's definition which also focuses on time, hence, both definitions providing a clear standard for determining non-performing loans.

In contrast, the IIF proposes a more sophisticated categorization system which classifies loans into five groups: standard, under observation, substandard, doubtful, and irrecoverable loans. According to the IIF, non-performing loans fall under the substandard, doubtful, and irrecoverable categories. Substandard loans are defined as loans with overdue payment by more than 90 days, doubtful loans by more than 180 days, and irrecoverable loans are considered losses when the debtor is over a year late with the payment of principal and/or interest (IIF, 1999).

Table 1 outlines the categorization of NPLs in Eastern, Southeastern, and Central European countries as established by a working group of the Vienna Initiative. Differences in definitions arise as some countries adopt a customer-based perspective, while others adopt a product-based perspective. According to the customer-based perspective, if a customer's loan defaults, all their loans are categorized as non-performing. Conversely, the product-based perspective assesses each loan on an individual basis. According to the European Banking Coordination "Vienna" Initiative in 2012, all countries consistently applied either the customer or product-based perspective to both non-financial companies and consumers. The surveyed countries provided the following short descriptions of their NPL definitions:

Table 1:Definition of nonperforming loans in countries covered by Vienna Initiatives

Country	Definition
Bosnia	NPLs are loans, which do not provide revenues. Banks must consider a loan as NPL if: a) the principal and/or interest are due and have not been collected for over 90 days after the original maturity date, therefore they are classified as: Substandard, Doubtful and Loss and b) beneficiary's interest debt, due for over 90 days after the original maturity date, is capitalized.
Bulgaria	Standard loans are defined as past-due less than 30 days and watch loans as past-due between 31 and 90 days or when the debtor's financial state may deteriorate to an extent that calls the full repayment of the obligation into question. Non-performing loans are defined as past-due 91 to 180 days or when the debtor's financial state has substantially deteriorated and may result in inability to repay his obligations. Loss loans are defined past-due over 180 days or when the debtor suffers a permanent shortage of money other conditions providing grounds to consider that the risk exposure becomes uncollectible.
Croatia	NPLs are 1) placements for which evidence of partial impairment is identified, i.e. partly recoverable placements (risk categories B-1/B-2/B-3), and 2) placements for which evidence of impairment is identified, equal to their carrying amount, i.e. fully irrecoverable placements (risk category C). Placements mean financial assets in a form of granted loans, debt instruments and other receivables, classified by a credit institution into categories of financial instruments designated as "loans and receivables" and "held-to-maturity investments".
Estonia	Loans which are past due more than 90 days or loans placed in the default category by the lending bank based on other information.
Hungary	Non-performing loans are transactions with more than 90 days delinquency. In the case of corporations, we apply a customer view while in the case of households we apply both a customer and a contract view.

To be continued

Table 1:Definition of nonperforming loans in countries covered by Vienna Initiatives (cont.)

Kosovo	NPLs are defined as the loans that are past due over 90 days, that include the "Doubtful" and "Loss" category of loans. According to the Central Bank of the Republic of Kosovo definition doubtful loans include loans that are overdue in repayment 91-180 days and loss loans include the category of loans that are overdue in repayment over 180 days.
Latvia	No explicit definition of NPLs. For analysis purposes loans with 90 days overdue are considered as NPLs.
Lithuania	NPL = not impaired but past due >61 days loans + impaired loans + individual specific allowances + collective specific allowances
Macedonia	The claim (any claim -principal, interest, fees) which has not been collected for more than 90 days after the maturity date, the bank shall record on a special account for non-performing claims - credits, interest, and other claims. The claim may be excluded from the category of non-performing claims only if the portion of the claim that fell due has been collected.
Moldova	Assets/contingent engagements classified as substandard, doubtful and compromised are considered nonperforming
Montenegro	NPLs are considered as loans past overdue more than 90 days, but that is not the only criterion. NPLs correspond to “substandard”, “doubtful”, and “loss” loans.
Romania	NPLs = Loans past due more than 90 days and/or with legal proceeding initiated. NPL s ratio = Loans and interest past due more than 90 days and/or with legal proceeding initiated, gross exposure per Total loans and interest classified
Slovenia	NPLs cover classified claims with delays over 90 days. Classified claims include financial assets at amortised cost and some risk-bearing off-balance-sheet items on which a payment liability could arise. NPLs definition accounts for the total amount of classified claims (in case that the amount of the overdue customer's liabilities to the bank exceeds EUR 1.000, the number of delays has to be started to count and the entire exposure to customer has to be assigned as non-performing - not only the overdue part).

Source: European Banking Coordination "Vienna" Initiative (2012)

The treatment of NPLs in N. Macedonia is regulated with the Decision on Credit Risk Management published by the NBRNM. Per this regulation, the non-performing classification applies to all credit exposures which are overdue for more than 90 days, regardless of whether the outstanding amount is for the principle, interest, or other non-interest claims (NBRNM, 2010b). Therefore, North Macedonia’s definition of NPLs is aligned with the definitions used by major financial institutions.

2.3 Literature review

The study of non-performing loans (NPLs) is essential for understanding the health of the banking industry. Many researchers have analysed the factors which influence NPLs, especially following financial crises. This literature review will focus on relevant studies that investigate the impact of both macroeconomic and bank-specific factors on NPLs, with a particular emphasis on research relevant to North Macedonia and the surrounding region.

Louzis et al. (2012) examined the determinants of NPLs in the Greek banking sector from 2003 to 2009. Their research focused on mortgage, business, and consumer loan portfolios, revealing that consumer loan NPLs were particularly sensitive to fluctuations in the unemployment rate, while business loans were more affected by changes in GDP. Conversely, mortgage loans demonstrated greater resilience, showing less sensitivity to macroeconomic shifts. This study highlighted the significance of sectoral differences in understanding the drivers of NPLs during economic downturns.

Klein (2013) investigated NPLs in the CESEE region from 1998 to 2011 and found a positive relationship between NPLs and inflation. unemployment rates and loan growth, while GDP growth and higher profitability contributed to lower NPL levels.

Jakubik and Reininger (2013) conducted a study on nine CESEE countries using quarterly data from 2004 to 2012. The authors found that an increase in real GDP growth and stock prices leads to a decrease in NPLs. On the other hand, the country's exchange rate and the ratio of private credit to GDP had a positive impact on NPLs. Their discoveries emphasise the significance of maintaining economic stability and implementing prudent financial strategies to reduce credit risk.

Stakić (2014) investigated the factors influencing the occurrence and dynamics of non-performing loans in Serbia during the period from 2008 to 2013. His research covered a total of six variables. From the group of bank-specific variables, these were: profitability, capital adequacy ratio, provisions for potential losses, ownership structure of banks, and bank concentration. Among macroeconomic variables, the author analysed the GDP growth rate. He concluded that the capital adequacy ratio, return on assets, level of concentration in the banking sector, and state-owned banks' ownership share are significant variables in predicting the movement of non-performing loans.

Škarica (2014) conducted a study on select CEE countries from 2007 to 2012 and highlighted that the main factors contributing to the growth of NPLs were a decline in GDP and rising unemployment and inflation rates.

Makri et al. (2014) investigated the impact of macroeconomic factors (GDP growth rate, inflation rate, unemployment rate, public debt as a percentage of GDP, and budget deficit or

surplus as a percentage of GDP) and bank-specific determinants (capital adequacy ratio, profitability indicators (ROA, ROE), and liquidity indicator LTD) on the movement of non-performing loans in 14 Eurozone countries from 2000 to 2008. Their results indicate a significant relationship between NPLs and various macroeconomic determinants (public debt, unemployment, GDP growth rate) as well as bank-specific factors (capital adequacy ratio, return on equity).

Beck et al. (2015) conducted a global analysis of the determinants of NPLs in 75 countries from 2000 to 2010. Their study indicated that real GDP growth, share prices, exchange rates, and lending interest rates were key macroeconomic determinants affecting NPLs. They discovered that economic downturns, depreciating exchange rates, and higher interest rates elevated NPL ratios, particularly in countries with foreign-currency loans, which are especially susceptible to exchange rate fluctuations.

Tanasković and Jandrić (2015) conducted a study on NPLs in 11 countries, from 2006 to 2013, examining macroeconomic and institutional determinants. They discovered that GDP had a negative relationship with NPLs, whereas the credit-to-GDP ratio and exchange rate had a positive relationship. This study also emphasised the significance of financial market growth and institutional quality in effectively managing NPL levels.

Radivojević and Jovović (2017) conducted research on the determinants of non-performing loans in a sample of 25 developing countries over the period from 2000 to 2011. The results demonstrated that the movement in NPL levels in these countries can be explained by key macroeconomic factors, such as GDP and inflation rate, as well as bank-specific factors, such as return on assets and the capital adequacy ratio.

A study by Jovanovic (2022) examined both macroeconomic and bank-specific factors affecting NPLs across Montenegro, Serbia, and Bosnia and Herzegovina, covering the period from Q1 2009 to Q4 2019. The macroeconomic factors included GDP growth rate and gross earnings, while bank-specific factors focused on capital adequacy ratio, return on assets (ROA), return on equity (ROE), loan-to-deposit ratio, and loan growth rate. The findings indicated a negative relationship between ROA and NPLs, suggesting that higher profitability reduces NPL levels. Additionally, GDP growth and gross earnings showed a negative impact on NPLs, underscoring the stabilizing effect of economic growth on credit risk.

In a more recent study, Salas (2023) performed a global analysis of NPL determinants utilising data from 2007 to 2021 across 111 countries. The study found that bank profitability, unemployment, interest rates, and exchange rates were the primary determinants affecting NPLs globally. Nonetheless, it also observed that GDP growth, although significant in certain regions, did not have a globally uniform effect on NPLs. This divergence underscores the significance of regional economic characteristics in shaping credit risk.

Alnabulsi et al. (2023) performed a systematic review of 76 studies published from 1987 to 2022 regarding the drivers of NPLs. Their review highlights that macroeconomic and bank-specific factors, not industry factors, can hinder borrowers' ability to repay loans, thus increasing NPL levels.

Empirical studies on the determinants of non-performing loans NPLs in North Macedonia are currently limited but growing. Ilijevska et al. (2012) did one of the earliest studies where they used a GMM model to analyse the time period spanning from 2003Q1 to 2011Q4. The study revealed that inflation and the real exchange rate had a positive relationship with NPLs, whereas GDP growth, net wage growth, and exports had a negative effect. Their study established a fundamental understanding of the macroeconomic factors that affect NPLs in North Macedonia.

In a study conducted by Poposka (2015), the author investigated the bank specific factors that contribute to NPLs in banks. These factors include the difference in interest rates between loans and deposits for both domestic and foreign currency, personnel expenses and non-interest expenses, equity and reserves in relation to total assets, and the proportion of liquid assets to total assets. The study found a significant relationship between majority of the variables and the level of NPLs in North Macedonia.

Kjosevski et al. (2019) conducted a comprehensive analysis of the entire banking sector from 2003Q4 to 2014Q4 using an Autoregressive Distributed Lag Modelling Approach (ARDL). It was shown that there was a negative relationship between NPLs and bank profitability, loan growth, and GDP growth. Conversely, bank solvency and unemployment had a positive relationship with NPL levels. Their study also emphasised that the exchange rate has a significant positive impact on NPLs for corporate loans, whereas inflation has a significant negative impact on household NPLs.

The reviewed literature emphasises the substantial influence of both macroeconomic conditions and bank-specific factors on non-performing loan (NPL) levels. While previous studies have established a solid basis, this research seeks to expand on these findings by investigating the time frame spanning from 2012 to 2023. This timeframe encompasses the distinctive difficulties presented by the COVID-19 pandemic.

3 AN OVERVIEW OF THE BANKING SECTOR OF NORTH MACEDONIA

Since gaining independence from the former Socialist Federal Republic of Yugoslavia (SFRY) in 1991, the banking sector in North Macedonia has undergone significant transformations. Initially characterised by a government-owned structure in line with a centrally controlled economy, this sector has evolved into a contemporary banking system that aligns with global

financial practices. This chapter provides a comprehensive overview of the current state of the banking sector in North Macedonia, with a focus on its structure, effectiveness, and resilience, particularly during economic downturns, such as the global financial crisis and the COVID-19 pandemic.

3.1 Transformation of the banking system

Upon gaining independence, North Macedonia inherited a banking system that was inadequately equipped to handle the challenges of a market economy. The process of restructuring the banking sector began in 1995 with the implementation of the Law on Sanitation and Reconstruction of Banks. The legislation was intended to address issues related to illiquidity and insolvency, leading to the rehabilitation of large banks such as Stopanska Banka AD - Skopje. By the end of the 1990s, the cost of restoring the banking system had grown to roughly 46% of the Gross Domestic Product (GDP), positioning it as one of the costliest banking sector reforms globally (Radzic & Yuce, 2008).

The transformation was driven by both domestic factors and global trends, requiring fundamental reforms to adjust to emerging economic conditions. Developing a stable and contemporary banking system became critical for facilitating economic development, as banks are primary investment sources in economies with underdeveloped capital markets (Claessens, 1996).

3.2 Structure of the banking sector

According to the Report on Risks in the Banking System in 2023 by the National Bank of the Republic of North Macedonia, the structure of the Macedonian banking system can be delineated as follows:

In the structure of N. Macedonia's financial system, banks hold dominant participation. As of December 31, 2023, the N. Macedonian banking system comprised fifteen deposit-taking institutions, namely thirteen banks and two savings houses[1] (NBRNM, 2023).

Gathering deposits and granting loans are the primary activities of the N. Macedonian banking system. In 2023, total deposits (excluding deposits from financial institutions) represented 77.4% of the total liabilities. The main source of funding for banks is household deposits, constituting 47.4% of the total liabilities of the banking system. Over the analysed period, the

[1] The participation of savings houses in the banking system is negligible, in fact their participation in the total assets of deposit-taking financial institutions (banks and savings houses) was 0.3% (as of December 2022), in the total loans to non-financial subjects it was 0.4%, and in the total deposits from households it was 0.2%.

assets of the banking sector saw a steady growth, which was facilitated by a stable deposit base and corresponding credit operations (NBRNM, 2023).

On the asset side, loans to the non-financial sector hold the largest share, accounting for 56.6% of total assets. Household loans have a slightly higher share (29.6%) compared to loans provided to non-financial institutions (26.6%) (NBRNM, 2023).

Since the late 1990s, there has been a trend of increasing dominance of foreign capital in the Macedonian banking system, reaching 73.5% of total capital in 2023. In 2023, there were nine banks with dominant foreign capital. Currently, foreign banks, primarily from the surrounding region, have a significant role in the banking industry. Foreign direct investments (FDI) have contributed to the economy by introducing new practices and modernising business-related processes (Bitzenis et al., 2012; Cikovic, 2016).

Banks primarily granted loans mostly to the corporate sector, creating portfolios that lacked diversification. As a result, when major state-owned companies were privatised, many of them faced bankruptcy and were unable to service their debt (Angelova & Boskovska, 2016). Consequently, there was a shift in the allocation of loans towards private entities and small-medium enterprises, resulting in substantial portfolio diversification. From 2003 to 2008, there was also a significant growth in retail lending due to the previously unmet loan demand in the retail sector (NBRNM, 2003; NBRNM, 2008). Nevertheless, the majority of the loans (66.3% in 2012) were issued by the three largest banks and corporate loans accounted for more than half of the gross loans outstanding. To increase their market share in a constrained market, banks often provided incentives such as reduced interest rates and loan costs, which made their products attractive to a wide range of clients. Additionally, loan products were offered with a foreign currency clause, typically denominated in the Euro, and included periods of fixed interest rates, in an attempt to make them more affordable and attractive (Delova-Jolevska & Andovski, 2015; Poposka, 2015).

The banking sector of N. Macedonia is highly concentrated, with most of the assets (81.0%) and loans to the non-financial sector (81.5%) held by the biggest banks (NBRNM, 2023). This concentration indicates a potential imbalance in market power, where large banks hold significant dominance over the majority of financial resources in the sector. Such dominance can have implications for competition, consumer options, and the overall market dynamics.

Between 2006 and 2023, the Macedonian financial system consistently demonstrated steady growth and development. The sector maintained a solid level of capitalisation, as evidenced by a capital adequacy ratio of 18.1% at the end of 2023 (NBRNM, 2023).

The aforementioned developments indicate a stable and growing banking sector, heavily influenced by foreign investments and characterised by significant concentration within a few large banks. This highlights both the potential for growth and the potential risks in terms of financial stability and market competition (NBRNM, 2023).

3.3 Impact of the global financial crisis

During the global financial crisis of 2008, the banking sector in North Macedonia demonstrated a significant resilience compared to other countries in Central, Eastern, and Southeastern Europe (CESEE). This can be attributed to various factors, such as the banking sector's limited exposure to global financial markets, conservative lending practices, and solid regulatory measures. Macedonian banks predominantly relied on domestic funding sources, which shielded them from the global liquidity challenges that impacted many international banks. As a result, Macedonian banks managed to avoid substantial liquidity issues and maintained a stable financial position (NBRNM, 2009; NBRNM, 2010a).

Nevertheless, the overall Macedonian economy was not entirely immune to the repercussions of the global crisis. The recessionary trends in key trading partners, namely Germany, Greece, and Italy had a spillover effect on N. Macedonia, leading to an economic slowdown. The country's GDP experienced a decline in early 2009, indicating the onset of an economic recession. Despite the challenges, the N. Macedonian economy managed a modest recovery by the end of 2009, with growth rates returning in the second half of the year. The recovery was partially attributed to the country's successful implementation of monetary policies and the conservative nature of its banking sector, which played a role in minimising the severe impacts of the global economic crisis (NBRNM, 2009; NBRNM, 2010a).

In response to the 2008 crisis, the NBRNM implemented measures to reduce credit activities. These measures included obligatory monthly deposits based on the amount of loans issued in the retail sector, as well as modifying the methodology for determining capital adequacy ratios and increasing the required reserves for foreign currency liabilities. As a result, banks were limited in their ability to issue credit and instead prioritised improving the quality of their loan portfolios. They also focused on restructuring the portfolios where necessary and feasible (Boskovska & Gligorova, 2014).

During the crisis, the share of NPLs in total loans increased but remained manageable due to regulatory measures, such as the mandatory write-off of fully provisioned NPLs. By 2019, the NPL ratio had reduced to 4.2% of total loans, reflecting improved credit risk indicators and stability (NBRNM, 2020).

3.4 Effects of the COVID-19 pandemic

The onset of the pandemic in early 2020 resulted in significant disruptions to economic activities. The government implemented stringent lockdown measures, including the closure of schools, non-essential businesses, and restriction of movement, leading to a substantial decline in economic activity. These measures, although necessary for public health, resulted in a severe economic downturn, with a 4.5% decline in GDP in 2020, and substantial job losses in many industries, particularly in services and tourism. Moreover, the pandemic exacerbated existing socio-economic vulnerabilities, specifically impacting the poor and unemployed.

Many companies faced liquidity shortages as a result of a rapid decrease in revenues. This, in turn, made it more challenging for economic entities to fulfil their responsibilities to banks (World Bank 2020a; World Bank, 2020b).

The NPL ratio in N. Macedonia recorded an increase from 5% in 2019 to 7.8% in 2020, stabilising at 7.5% in 2022, due to regulatory forbearance measures, which allowed loan restructuring. Government interventions, such as implementing loan moratoriums and providing state guaranteed loans, were crucial in providing support to the sector and minimising the negative impacts of the pandemic (NBRNM, 2022b).

In response to the economic fallout from the pandemic, the government of North Macedonia, along with the National Bank of the Republic of North Macedonia (NBRNM), implemented various measures to aid the banking sector and the overall economy. The measures included:

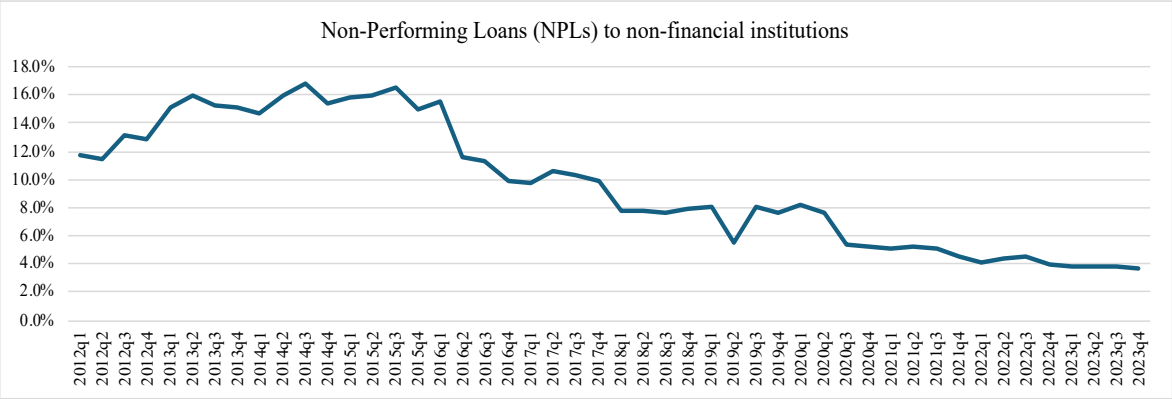
- Loan moratoriums: Temporary suspension of loan repayments for affected borrowers.
- State-Guranteed Loans: Implementation of state-guaranteed loans to secure continued access to credit for companies.
- Interest Rate Cuts: The NBRNM implemented interest rate cuts, lowering the policy rate to historically low levels, with the objective of stimulating economic activity.

These measures played a crucial role in stabilising the banking sector and reducing the negative impacts of the pandemic (NBRNM, 2022a).

3.5 Non-Performing Loans (NPLs) in N. Macedonia

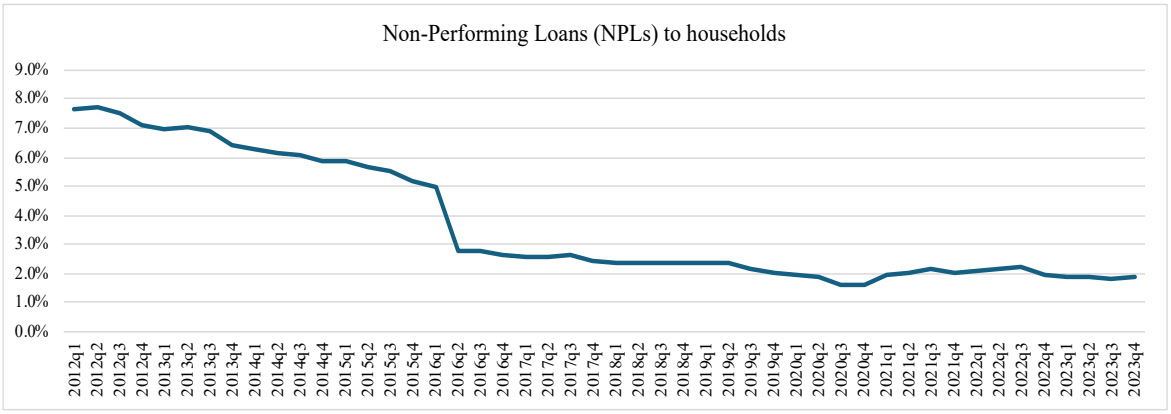
Between 2012 to 2023, the trend of NPLs in North Macedonia experienced significant shifts, which were influenced by economic conditions, regulatory actions, and global events.

Figure 1: NPLs to non-financial institutions in N. Macedonia (2012-2023)



Source: NBRNM (n.d.b)

Figure 2: NPLs to households in N. Macedonia (2012-2023)



Source: NBRNM (n.d.b)

During the early years following the global 2008 financial crisis, N. Macedonia experienced relatively high NPL levels, which were a result of the lasting impacts of the crisis. By the end of 2012, the NPL ratio of the banking sector was around 10.5%, with non-financial institutions contributing significantly to this figure. The construction, manufacturing, and trade sectors were particularly affected with the NPL ratios of these sectors frequently above 15%. Households, albeit somewhat more resilient, still experienced difficulties, with the NPL ratio of the sector around 8-9% (NBRNM, 2013). The elevated NPL ratios were mainly a result of economic stagnation and high unemployment, leading to a reduction in the repayment capacity of both households and businesses. As illustrated in Figure 1, in the second quarter of 2014, NPLs to non-financial institutions recorded a notable spike which was particularly pronounced in certain sectors like retail, construction and real estate activities. It is noteworthy that one of the key vulnerabilities of the banking sector at the time, was the high concentration of credit exposure to these sectors, as well as large corporations which exacerbated the impact of economic challenges on the NPL levels. As a response to this situation, the banking sector implemented stricter lending standards, especially for industries deemed high-risk. Additionally, banks focused on recovery strategies for existing bad loans influenced by regulatory changes which required revisiting loan classification and provisioning standards. This reassessment revealed previously underreported or misclassified loans, leading to a temporary but significant increase in NPLs. However, by the end of 2014, the efforts alongside a gradual economic recovery, started to show results, shown by the overall NPL ratio decreasing to around 11.3% after spiking to 12.3% in 2013 (NBRNM, 2014).

From 2015 to 2019, there was a continuous decline in NPL ratios in the banking sector, reflecting improving economic conditions and the effectiveness of regulatory changes. By 2015, the overall NPL ratio had declined to 10.8% by 2015 and continued to decrease in the subsequent years. The NPLs to non-financial institutions ratio experienced a gradual decrease, dropping to 10.0% by the end of 2017, and further reducing to 7.6% by the end of 2019. The NPL to households ratio also had a decline from roughly 5.6% in 2015 to approximately 2.3%

by 2019, benefitting from the improving economy. The decrease was mainly driven by the increase in household incomes, lower unemployment rates, and the adoption of stricter credit assessments by banks. The regulatory environment during this period had a significant impact on this improvement, as the National Bank of the Republic of North Macedonia implemented more stringent capital adequacy requirements and strengthened oversight of loan portfolios to ensure better risk management (NBRNM, 2016; NBRNM, 2017; NBRNM, 2018; NBRNM, 2019; NBRNM, 2020b).

The onset of the COVID-19 pandemic in 2020 disrupted this positive trend, resulting in a temporary spike in NPL ratios. The overall NPL ratio recorded an increase from 4.8% at the end of 2019 to 5.0% at the end of the first quarter of 2020. The NPL ratio for households remained relatively stable, however, non-financial institutions, especially those in industries like hospitality and retail, experienced a rise in their NPL ratios to more than 8% due to lockdowns and reduced consumer demand. Households were also impacted, although the impact on this sector was mitigated by government support measures and loan restructuring programs implemented by banks. Nevertheless, the NBRNM's prompt actions, as described in Chapter 3.4, effectively helped stabilize the situation (NBRNM, 2020b). By the end of 2021, the overall NPL ratio had decreased to 3.2%, showing progress in both households and non-financial institutions (NBRNM, 2021).

In 2022, the banking sector continued its recovery with NPL ratios returning to pre-pandemic levels. By the end of 2022, the overall NPL ratio declined to 2.9%, reflecting the continuing economic recovery and the effectiveness of the measures taken during the pandemic. The NPL ratio for non-financial institutions decreased to 3.9%, while the households sector maintained stability with the NPL ratio at 1.9% (NBRNM, 2022b). This stability persisted throughout 2023, despite global economic uncertainties and rising interest rates. The NPL ratio remained stable, with minimal increases in certain sectors as a result of the economic pressures caused by rising costs and geopolitical tensions. The NPL ratio for non-financial institutions hit a record low of 3.7% by the end of 2023, supported by the mandatory write-offs of non-performing loans and the banks' acquisition of collateral. The household NPL ratio stayed stable at 1.9%, despite the rising cost of living, which negatively impacted the repayment capacity of some borrowers (NBRNM, 2023).

The trajectory of NPLs in North Macedonia from 2012 to 2023 reflects a decade marked by significant challenges and gradual recovery. Although the early years were characterised by elevated NPL ratios as a result of the lasting impact of the global financial crisis, the following period witnessed a consistent decrease in these ratios. The COVID-19 pandemic presented a major challenge, but the sector's resilience and timely measures by the NBRNM aided in stabilising the situation. By the end of 2023, the NPL ratios had reached a stable point at historically low levels with the household NPL ratio standing at 1.9% and the non-financial institutions NPL ratio standing at 3.7%. This indicates that the credit risk has been effectively managed, and the Macedonian banking sector remains strong.

4 ANALYSIS OF FACTORS AFFECTING NON-PERFORMING LOANS IN THE BANKING SECTOR OF NORTH MACEDONIA

4.1 Purpose and objectives of the research

The purpose of this master thesis is to assess the relationship between macroeconomic and bank-specific factors and non-performing loans to non-financial institutions and households in North Macedonia. The methodology and results of the research can be useful to a wide range of readers - primarily bank managers, investors and regulators, but also everyone else who is interested in improving credit risk management, and thus reducing non-performing loans in commercial banks, that is, the banking sector as a whole.

Taking into consideration the purpose of the research, the analysis should give answers to the below research questions.

Research questions:

1. Do macroeconomic indicators have a statistically significant relationship with non-performing loans to non-financial institutions in North Macedonia?
2. Do bank-specific factors have a statistically significant relationship with non-performing loans to non-financial institutions in North Macedonia?
3. Do macroeconomic indicators have a statistically significant relationship with non-performing loans to households in North Macedonia?
4. Do bank-specific factors have a statistically significant relationship with non-performing loans to households in North Macedonia?

The quarterly presentation of data for macroeconomic indicators comprises the real gross domestic product growth rate, the unemployment rate, and the consumer price index (inflation). The data for various banking variables are aggregated, meaning that the numbers pertain to the whole banking sector. These variables will also be presented quarterly. The category of bank-specific variables consists of the return on assets, return on equity, capital adequacy ratio, loan-to-deposit ratios, and loan growth rate.

Given the stronger theoretical and empirical support for the relationship between GDP growth, unemployment, and profitability with non-performing loans, this research will focus on developing hypotheses for these three variables. While other macroeconomic and bank-specific factors are also part of the analysis, the existing literature does not provide as clear or consistent evidence regarding their relationship with NPLs. Therefore, the following hypotheses are proposed:

Hypothesis 1: GDP growth has a statistically significant negative relationship with non-performing loans.

Economic theory suggests that as GDP grows, overall economic conditions improve, leading to better financial stability for borrowers. As income levels rise and business conditions strengthen, the likelihood of loan defaults diminishes. This hypothesis aligns with findings discussed in Chapter 4.2.1.1, which references relevant literature supporting the inverse relationship between economic growth and NPL levels.

Hypothesis 2: The unemployment rate has a statistically significant positive relationship with non-performing loans.

Unemployment is widely regarded as a key determinant of loan defaults. As unemployment rises, household incomes decline, making it more difficult for individuals to meet their loan obligations, thus increasing the level of NPLs. This hypothesis is corroborated by the literature reviewed in Chapter 4.2.1.2, which underscores the direct impact of rising unemployment on loan performance and default risk.

Hypothesis 3: Bank profitability (measured by ROAA and ROAE) has a statistically significant negative relationship with non-performing loans.

While profitability is generally a sign of financial health, higher profitability may also indicate more effective credit risk management, leading to lower levels of NPLs. This indicates that profitable banks have greater abilities to manage loan portfolios to minimise defaults. Chapter 4.2.2.1 discusses studies that lend support to this hypothesis, establishing a negative association between bank profitability and NPL ratios.

4.2 Identification of factors influencing non-performing loans

In recent years, non-performing loans have emerged as one of the key challenges in modern banking. Consequently, there is a pressing need to identify the factors influencing the instability of the banking system. Hawkins and Turner (1999) delineate three main groups of factors affecting the instability of the banking system:

- microeconomic factors,
- macroeconomic factors, and
- systemic solutions.

Each type of instability in the banking sector has its specificities, making it almost impossible to pinpoint its cause by examining only one group of these factors. It is primarily the result of their collective interaction (Mishkin, 1997).

4.2.1 Macroeconomic factors

Understanding the influence of macroeconomic variables on non-performing loans (NPLs) is essential, particularly during periods of economic instability. Recent literature and theoretical

frameworks underscore how broader economic conditions directly impact loan performance, making it an essential issue for financial stability.

One of the leading perspectives ties NPL trends to economic cycle. The financial accelerator theory, explored by Bernanke et al. (1999) posits that during economic expansions, borrowers experience greater capacity to service their obligations due to increased income and financial stability. During economic downturns, however, reduced cash flow, rising unemployment, and deteriorating business conditions result in more defaults, rising NPLs. The theory has been augmented to address the challenges encountered during crises, such as the 2008 Global Financial Crisis and other banking crises, where sharp declines in GDP and other economic indicators led to significantly higher NPL ratios in both developed and developing economies (Ari et al., 2020).

Recent studies highlight the significance of GDP growth, inflation, and unemployment as key macroeconomic determinants affecting NPLs. Nkusu (2011) emphasised the significant relationship between macroeconomic shocks, such as recessions, and rising NPL levels. The author found that NPLs have a positive relationship with unemployment and inflation, and a negative relationship with GDP growth. This was also confirmed by Louzis et al. (2012). in their study conducted on the nine largest banks in Greece from the first quarter of 2003 to the third quarter of 2009. Their focus lies on the relationship between non-performing loans and key macroeconomic indicators such as public debt, GDP, lending interest rates, and unemployment rate. Shingjergji (2013) investigated the correlation between macroeconomic indicators and non-performing loans in Albania from 2005 to 2012. The author conducted a detailed analysis of how GDP, inflation rate, interest rate, and exchange rate affect non-performing loans. The findings revealed a positive relationship between GDP, exchange rate, and interest rate and non-performing loans. Conversely, the inflation rate has a negative impact on non-performing loans.

Additionally, the Global Financial Crisis of 2007-2009 revived the interest in the role of macroeconomic and institutional factors in driving NPLs. Makri et al. (2014) analysed the Eurozone and found that macroeconomic variables such as GDP contraction and rising unemployment, played a significant role in NPLs, reflecting the broader impact of economic downturns on banking sector stability. Furthermore, the study by Ari et al. (2020) demonstrated that during banking crises, NPLs typically follow an inverse U-shaped pattern, peaking after the onset of a crisis and declining only after several years. Their research, which examined NPL levels across 88 banking crises since 1990, suggests that unresolved NPLs are associated with more severe recessions and slower economic recoveries. This finding emphasises the importance of timely NPL resolution solutions, particularly following the COVID-19 pandemic, to mitigate long-term economic damage.

These findings correspond with the theoretical premise that macroeconomic volatility disrupts

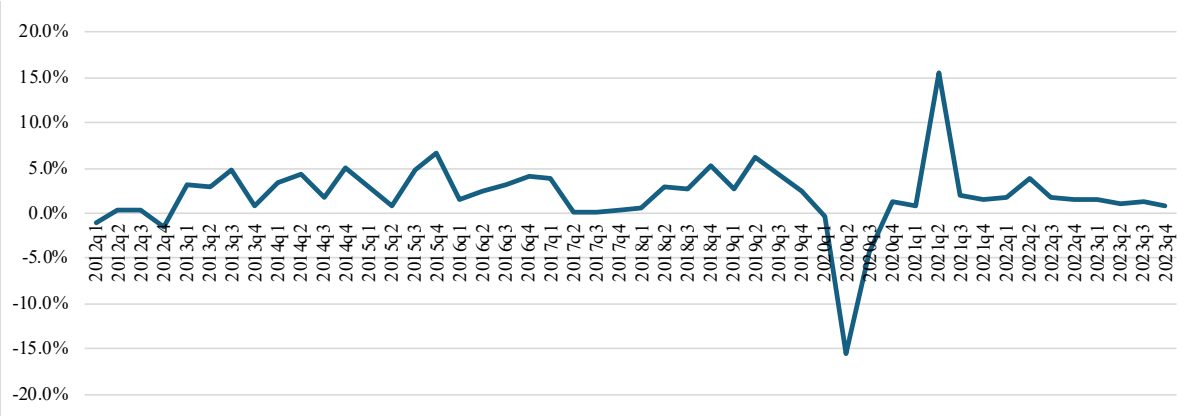
loan performance by weakening borrowers' capacity to fulfil their commitments, resulting in increased defaults. Therefore, we have decided to include GDP growth, unemployment, and inflation as our macroeconomic variables.

4.2.1.1 Gross Domestic Product (GDP)

Gross Domestic Product (GDP) is one of the key indicators of an economy's state. Multiple authors have observed that GDP is the factor most clearly linked to NPLs. In most of the empirical research focusing on factors impacting the level of NPLs, a real growth in GDP generally indicates increased income levels and, consequently, improved financial capacity among borrowers. However, in times of economic recessions, the number of NPLs might grow as a result of higher unemployment rates, leading borrowers to struggle with debt repayment (Espinoza & Prasad 2010; Nkusu 2011). Most studies have found a negative correlation between GDP and NPLs. This was concluded by Saba et al. (2012) who analysed the impact of GDP, inflation rates, and total loans on non-performing loans in the US banking sector between 1985 and 2010. The study conducted by Kuzucu and Kuzucu (2019) examined the impact of key macroeconomic factors on non-performing loans in developing and developed nations. The findings reveal that GDP has a significant negative relationship on non-performing loans, both before and after the 2007 financial crisis. The studies done by Louzis et al. (2012), Beck at al. (2015), Makri et al. (2014), among others, have also found a significant negative relationship between GDP and NPLs.

Interestingly, a study by Shingjergji (2013) on the Albanian banking sector found a positive relationship between GDP growth and NPLs, contrary to the commonly observed negative relationship. The real GDP growth rate in N. Macedonia from 2012 to 2023 is illustrated in Figure 3.

Figure 3: Real GDP Growth Rate in N. Macedonia (2012-2023)



Source: NBRNM (n.d.a)

During the analyzed period, negative GDP growth rates were recorded in N. Macedonia in the first three quarters of 2020. This development is attributed to the health and economic crisis

caused by the COVID-19 pandemic, leading to reduced external demand, temporary disruptions in production chains, and increased economic caution amidst heightened uncertainty and measures to contain the virus spread. In such circumstances, both domestic and export demand decreased in 2020. Notably, an increase was observed only in public consumption, driven by the need to protect and maintain public health during the pandemic.

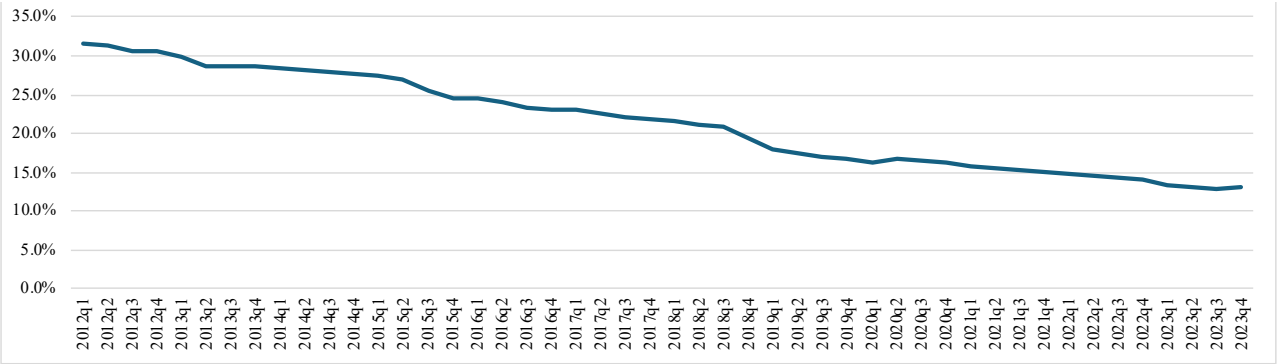
Yet, in 2021, economic recovery gained momentum, driven by several factors. These include the gradual adaptation of behaviors and habits amidst the pandemic, the country's vaccination efforts, the reopening of economies, and the implementation of targeted and less restrictive measures to address the crisis. Additionally, measures supporting the economy contributed to this upturn. Notably, the growth in economic activity in 2021 was primarily fueled by the positive contribution of domestic demand, including personal consumption, gross investment, and public consumption, although net export contribution remained negative due to higher import growth relative to exports (NBRNM 2020a; NBRNM, 2021).

4.2.1.2 Unemployment Rate

Unemployment is an important factor when studying non-performing loans. In the study "Consumer Default and the Life Cycle Model," Lawrence (1995) examined the matter by introducing the concept of probability of default. The study found that borrowers with lower incomes are riskier and are more likely to default on loans. Thus, as a result of the possibility of unemployment, these borrowers carry a greater risk, leading to the imposition of higher interest rates on them. It may be generally concluded that a rise in the unemployment rate has an impact on the growth of non-performing loans. This conclusion was derived by many studies, including Glogowski (2008), Louzis et al. (2012), Messai and Jouini (2013), Klein (2013), and Škarica (2014).

Figure 4 illustrates the unemployment rate in North Macedonia from 2012 to 2023.

Figure 4: Unemployment rate in N. Macedonia (2012-2023)



Source: NBRNM (n.d.a)

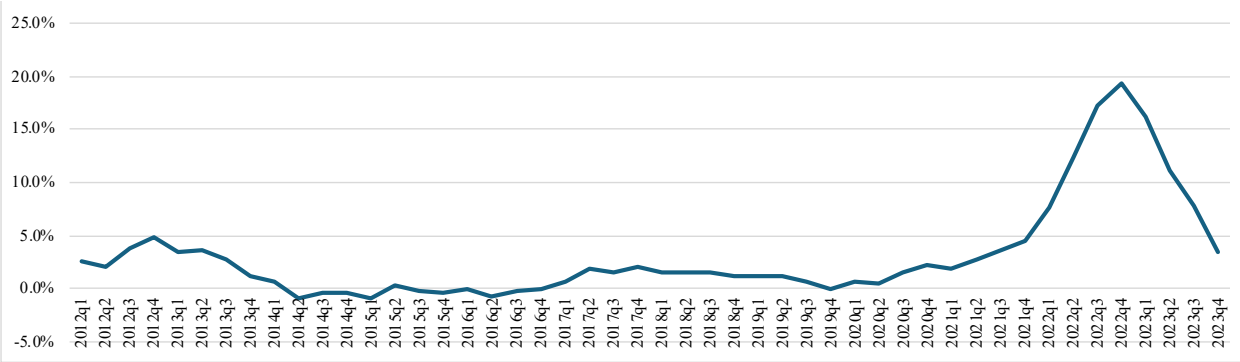
During the analyzed decade, the trend of the unemployment rate in North Macedonia exhibits a consistent downward trajectory. Notably, in the final quarter of 2023, the unemployment rate in North Macedonia stood at 13%. By contrast, during the same period, the unemployment rate within the European Union was recorded at 5.9%, underscoring a significant disparity between the two regions (NBRNM, 2023; Eurostat, 2024).

4.2.1.3 Inflation Rate

Inflation has also stood out as a factor that affects the level of non-performing loans. In "The Economic Consequences of the Peace" published in 1920, Keynes discussed the concept of "inflation" and said that there is no more effective way to disrupt the established foundation of society than by devaluing the currency (Keynes, 1920). The economic literature offers multiple explanations of this phenomenon but as a general definition - inflation leads to an increase in the overall price level.

Empirical research findings provide evidence for both positive and negative impacts of inflation on non-performing loans. Klein (2013) and Škarica (2014) conducted empirical analyses that indicate a positive relationship between inflation and non-performing loans. Namely, during periods of rising inflation, the number of non-performing loans also increases. A study conducted by Gerlach et al. (2005) on the banking sector in Hong Kong reveals that increased inflation leads to a decrease in non-performing loans. This phenomenon can be explained by the fact that higher inflation reduces the real value of existing debt, making it easier for borrowers to meet their commitments to the bank. Nevertheless, certain studies indicate that there is no statistically significant correlation between inflation and non-performing loans. Swamy (2012) analysed the influence of macroeconomic and endogenous factors on non-performing loans, using various banking groups as examples, covering the period from 1997 to 2009. His research suggests there is no statistically significant correlation between the inflation rate and non-performing loans. This was also concluded by Makri et al. (2014), Khemraj (2009) and Tanasković and Jandrić (2015).

Figure 5: Inflation rate in N. Macedonia (2012-2023)



Source: NBRNM (n.d.a)

In 2022, North Macedonia experienced a significant rise in inflation, reaching 14.2% annually, primarily driven by global supply-side shocks. These shocks were due to disrupted global supply chains post-COVID-19 pandemic and adverse effects from the war in Ukraine. The increase in prices was mainly fueled by historically high import costs of energy and food, which contributed to nearly three-quarters of the overall price changes. Additionally, domestic factors such as the increase in the minimum wage by 18.5% in March 2022 and higher wages in the public sector in September 2022 also played a role in the inflationary pressures (NBRNM, 2022a). Inflation stabilized at 3.4% in the last quarter of 2023 (NBRNM, 2023).

4.2.2 Bank-specific Factors

Aside from macroeconomic indicators, multiple authors have also examined the impact of bank-specific factors, such as the quality of management, size, and market position, on non-performing loans.

Louzis et al. (2012) and Abid et al. (2014) emphasise that performance and efficiency measures are crucial indicators of problematic loans. In their study, Abid et al. studied the impact of banking system determinants on the credit portfolio quality on a sample of 16 Tunisian banks throughout the period from 2003 to 2012, emphasizing the importance of management in the risk management process. Research conducted by Jovanovic (2022), Kjosevski et al. (2019), Klein (2013), Makri et al. (2014) and others confirm that bank-specific factors which impact non-performing loans include, among others, the capital adequacy ratio, return on assets, return on equity, liquidity, and credit growth. These findings underline the necessity for regulators to prioritise the examination of risk management systems in banks in order to avert business crises and mitigate non-performing loans.

Nevertheless, there is consensus among authors that the emergence and dynamics of non-performing loans are influenced by a range of factors, including both macroeconomic and specific banking characteristics.

4.2.2.1 Profitability of banks

The stability of a country's financial system is contingent upon the profitability of its banking sector as higher profitability is negatively associated with systemic and idiosyncratic risks (TengTeng & Das, 2019). Given the critical role of the banking sector in the economy, it is imperative that the profitability of banks is not compromised. The profitability of a bank can be assessed through two indicators - return on assets (ROA) and return on equity (ROE). The Bad Management Hypothesis argues that banks with weaker management practices often lack effective loan screening and monitoring, leading to increased problem loans over time. Essentially, poor management not only results in operational inefficiencies but also encourages risky lending that eventually raises non-performing loan levels (Berger & DeYoung, 1997). Conversely, banks with stronger management are generally more profitable and better at controlling risks. Well-managed and profitable banks typically adopt stricter lending standards

and maintain better credit risk management practices, resulting in a reduction of NPL levels (Makri et al., 2014).

The majority of empirical studies also support the negative relationship between profitability and NPLs. A study conducted by Škrabić and Konjušak (2017) found that banks with higher profitability tend to have lower levels of NPLs, since these banks refrain from undertaking high-risk lending activities. Kingu (2018) similarly found a negative correlation between profitability and non-performing loans (NPLs) in Nigerian and Tanzanian commercial banks, with higher ROAA associated with fewer non-performing loans. These results are consistent across several banking environments and further underscore the importance of profitability in mitigating credit risk.

This variable is included in the study due to its critical influence on the financial soundness of banks. The established link between profitability, as represented by ROAA and ROAE, risk-taking behavior, and the potential increase in non-performing loans makes it a key factor to examine in this analysis.

4.2.2.2 Return on Average Assets (ROAA)

ROAA represents the ratio of a bank's net profit to total assets. Over the analyzed period, the banking sector in North Macedonia saw an improvement in the Return on Average Assets (ROAA), with this metric reaching its peak in 2018. This positive trend is an indication that banks were enhancing their efficiency and profitability. Despite the slight dip after 2018 and during the COVID-19 pandemic, the ROAA remained positive demonstrating that banks were able to sustain profitability amidst challenges, like the global downturn triggered by the COVID 19 pandemic in 2020 (NBRNM, 2018; NBRNM, 2020b).

Studies by Radivojević and Jovović (2017), Jovanovic (2022), Alihodžić (2014) and Kjosevski et al. (2019) found a significant negative relationship between NPLs and ROAA.

4.2.2.3 Return on Average Equity (ROAE)

ROAE, another important profitability indicator, represents the ratio of net profit to equity capital. Relative to the ROAA, the Return on Average Equity (ROAE) in N. Macedonia experienced more fluctuations throughout the analyzed period. This metric recorded a significant peak in 2018 as it reached an impressive 28.0%. This surge can be attributed to enhanced banking operations, more efficient risk mitigation, and favorable economic circumstances. Key factors included reduced expenses for loan loss provisions, profits from divesting investments in other financial institutions, and improved operational efficiency. The ROAE plummeted to 7.5% in 2020, following the COVID-19 pandemic. However, it began to recover after 2020, indicating that financial institutions adjusted to the new economic climate and successfully implemented countermeasures against the adverse impacts of the pandemic (NBRNM 2018; NBRNM, 2020b).

4.2.2.4 Capital Adequacy Ratio

The sufficiency of capital is crucial in banking operations to protect against unforeseen losses or market disruptions. The capital adequacy ratio (CAR) is a measure of a bank's capital strength and is used to regulate and prevent excessive risk-taking by banks (Gup, 2011). Studies have not universally accepted the relationship between NPLs and the capital adequacy ratio. Boudriga et al. (2009) and Makri et al. (2014) found a negative relationship between NPLs and CAR, while Godlewski (2005) argues that bank capital regulation is positively associated with excessive risk-taking.

We include CAR in the analysis as it plays a pivotal role in determining a bank's capacity to absorb losses, and despite mixed findings in the literature, its potential impact on non-performing loans warrants further investigation in the context of North Macedonia.

4.2.2.5 Loan Growth Rate

The loan growth rate can have both positive and negative effects on the quality of the loan portfolio. During the analyzed time frame, there were periods of decline in the loan growth rate, particularly around mid-2016 which can be attributed to the political instability in the country during this year. A significant drop is also observed in 2020 due to the COVID-19 pandemic, which led to decreased loan demand as business and households faced financial difficulties. Recently, there has been a slowdown in loan growth, in 2023, which can be linked to the lingering effects of the global macroeconomic events including inflation and high interest rates (NBRNM, 2016; NBRNM, 2020b; NBRNM, 2023).

Studies examining how loan growth affects non-performing loans (NPLs) have shown mixed results. Swamy (2012) found that faster loan growth tends to reduce NPLs, suggesting that when banks expand lending, they may be responding to stronger economic conditions or exercising prudent credit practices, leading to healthier loan portfolios. In contrast, Klein (2013) found that higher loan growth can lead to higher levels of NPLs. This perspective suggests that rapid expansion in lending may sometimes lead to riskier loans, which then raises the chance of defaults. These differing views highlight that the impact of loan growth on NPLs is not straightforward and can depend heavily on broader economic conditions and how carefully loans are managed.

4.2.2.6 Loans to Deposits Ratio

The loans to deposits ratio (LTD) is often used as an indicator to assess a bank's liquidity. A ratio above 1 indicates that the bank may not be able to cover its lending activity from its own funds, signaling a liquidity crisis. Over the analyzed period, the LTD ratio of N. Macedonia’s banking sector does not exceed 100% and its average is 87%, indicating that the banking sector has maintained a relatively healthy balance between lending and deposit activities (NBRNM, 2023).

According to Makri et al. (2014), the LTD ratio does not have a statistically significant impact on non-performing loans. In contrast, Ahmad and Ariff (2007) examined key credit risk factors for commercial banks in developing countries, comparing them to those in developed economies, and found a positive relationship between the LTD and NPL ratios. Offering a different perspective, Karim (2016) concluded that this relationship is actually negative, highlighting the complexity and variability in how these ratios interact across different contexts.

LTD is included in the study due to its direct relevance to liquidity management and its potential role in influencing the stability of loans, particularly as it pertains to the risk of NPLs when lending activity outpaces available deposits.

4.3 Data specification

A review of the existing literature on this topic indicates that authors use two categories of bank-specific factors: aggregate at the banking sector level and individual at the level of individual banks. According to Makri et al. (2014) employing aggregate data at the banking sector level is more appropriate as it reduces the risk of the sample not being representative.

Based on the aforementioned observation, this study will use aggregated data to identify the factors that influence non-performing loans in N. Macedonia. An additional rationale for deciding to use aggregate data is the unavailability of time series data for some variables at the individual bank level for the analysed period.

A total of 48 observations are analyzed in this study, which employs quarterly data from Q1 2012 to Q4 2023. The quantitative analysis' time period was determined by the availability of comparable data. However, we are confident that the quantity of data is adequate for conducting a high-quality econometric analysis.

Specification of the dependent variables:
The predominant approach in the existing empirical literature utilizes the ratio of non-performing loans to total loans as the dependent variable as seen in studies by Nkusu (2011), Makri et al. (2014) and Boudriga et al. (2009). This ratio is widely accepted due to its effectiveness in reflecting the proportion of non-performing loans within the overall loan portfolio, thus serving as a reliable indicator of credit risk.

Therefore, in this study we will use the ratio of non-performing loans to non-financial institutions to total loans to non-financial institutions and non-performing loans to households to total loans to households as the dependent variables. The data for the dependent variables – non-performing loans to individuals and non-performing loans to non-financial institutions,

was obtained from the National Bank of the Republic of N. Macedonia (NBRNM) website, specifically from the annex datasets that are part of the quarterly reports on the banking system under the Financial Stability section (NBRNM, n.d.b). The data is presented as percentages.

Specification of the independent variables:
The independent variables used in this study will be the macroeconomic and bank-specific factors described in Chapter 4.2. In addition to these real determinants, an artificial (dummy) variable will also be included to capture the impact of the COVID-19 pandemic in N. Macedonia.

Data for the macroeconomic factors was obtained from the NBRNM website, specifically from the Statistics section, under the sections Real Economic Indicators and Bulletins which include datasets with figures from the real sector (NBRNM, n.d.a). Data for the bank-specific sector factors was obtained from the NBRNM website, from the datasets under the Financial Stability section, specifically the sections Indicators for Financial Stability and Data and Indicators for the Banking System of the Republic of North Macedonia (NBRNM, n.d.b). The data is presented as percentages.

4.4 Model specification

Most studies investigating the factors which impact non-performing loans use a linear regression model, including both macroeconomic and bank-specific determinants including Klein (2013), Jakubik and Reininger (2013) and Škarica (2014).

The basic models are represented through a linear regression function that connects non-performing loans to non-financial institutions and non-performing loans to households with macroeconomic and specific banking determinants in the following form:

Model 1:

$$NPLN_t = \beta_0 + \beta_1 GDP\_growth_t + \beta_2 Inflation_t + \beta_3 Unemployment_t + \beta_4 ROAA_t + \beta_5 ROAE_t + \beta_6 Cap\_Adequacy_t + \beta_7 Loan\_Growth_t + \beta_8 Loan\_Deposit_t + \beta_9 Covid\_Dummy_t + \epsilon_t \quad (1)$$

Model 2:

$$NPLH_t = \beta_0 + \beta_1 GDP\_growth_t + \beta_2 Inflation_t + \beta_3 Unemployment_t + \beta_4 ROAA_t + \beta_5 ROAE_t + \beta_6 Cap\_Adequacy_t + \beta_7 Loan\_Growth_t + \beta_8 Loan\_Deposit_t + \beta_9 Covid\_Dummy_t + \epsilon_t \quad (2)$$

The description of each variable is presented in Table 2.

Table 2: Description of Variables

Variable	Description
NPLN	Non-Performing Loans to non-financial institutions as a percentage of Total Loans to non-financial institutions in the banking sector of N. Macedonia
NPLH	Non-Performing Loans to households as a percentage of Total Loans to households in the banking sector of N. Macedonia
GDP_growth	Real GDP growth
Inflation	Inflation rate measured with the Consumer Price Index
Unemployment	Unemployment rate as a percentage of the total working-age population in N. Macedonia
ROAA	Return on Average Assets
ROAE	Return on Average Equity
Cap_Adequacy	Capital Adequacy Ratio
Loan_Growth	Loan Growth rate
Loan_Deposit	Loan-to-Deposit ratio (Gross Loans/Gross Deposits)
Covid_Dummy	Dummy variable which has a value of 1 for the period from Q2 2020 until Q2 2021 and 0 for all the other periods

Source: own work

All data processing, statistical analyses, and model estimations will be conducted using the Stata software package, version 18.5.

Table 3: Descriptive Statistics

Variable	Mean	Std. Deviation	Skewness	Kurtosis	Min value	Max Value	N
NPLN	0.0969	0.0446	0.1849	1.6041	0.0367	0.1689	48
NPLH	0.0368	0.0211	0.7331	1.8128	0.0158	0.0769	48
GDP_Growth	0.0202	0.0381	-1.1543	13.2184	-0.1542	0.1541	48
Unemployment	0.2145	0.0600	0.1387	1.6222	0.1285	0.3160	48
Inflation	0.0310	0.0470	2.1104	6.7941	-0.0096	0.1935	48
ROAA	0.0127	0.0067	-0.0049	3.2052	-0.0028	0.0310	48
ROAE	0.1110	0.0578	0.0001	3.6160	-0.0246	0.2803	48
Cap_Adequacy	0.1676	0.0078	-0.0642	2.3047	0.1522	0.1836	48
Loan_Growth	0.0676	0.0236	-0.4388	2.9318	0.0035	0.1071	48
Loan_Deposit	0.8700	0.0276	-0.3539	2.2348	0.8165	0.9227	48

Source: own work

Table 3 presents a summary of the descriptive statistics for the variables in this study, including the mean, standard deviation, skewness, kurtosis, and the range (minimum and maximum values). These statistics provide significant insights into the distribution and variability of the data.

The mean values for most variables fall within reasonable ranges, with relatively low standard deviations signifying moderate variability throughout the dataset. Nevertheless, certain variables exhibit noticeable skewness and kurtosis. For instance, GDP Growth displays a skewness of -1.1543 and a kurtosis of 13.2184, indicating a negative skew and the presence

of outliers. Similarly, inflation exhibits positive skewness (2.1104) and high kurtosis (6.7941), suggesting occasional large spikes in the inflation rate.

Such discrepancies in macroeconomic variables are not unusual. GDP growth and inflation are inherently sensitive to external shocks, like financial crises, policy changes or, more recently, the COVID-19 pandemic. Such events can lead to abrupt contractions or expansions in economic activity, resulting in distorted distributions and high kurtosis as the data reflects periods of unusual volatility. In this case, the skewness and kurtosis observed in these variables can be attributed to external shocks, which are well-documented in the literature and should be expected in time-series data.

Despite these deviations from normality, the levels of skewness and kurtosis are generally within acceptable limits for macroeconomic data. A Covid dummy variable has been included to account for the substantial economic disruptions during the pandemic (Q2 2020 to Q2 2021), hence enhancing the robustness of the model by isolating the effects of that extraordinary period. This dummy variable helps mitigate concerns about the relatively high values observed in GDP growth and inflation.

4.5 Multicollinearity analysis

Next, we will check for the presence of multicollinearity among the independent variables. Multicollinearity is the occurrence of strong correlations among the independent variables. This can cause the coefficient estimates to have large variance, leading to an unstable model that is challenging to interpret (Gujarati & Porter, 1999). To check for multicollinearity, we will use both the correlation matrix and the Variance Inflation Factor (VIF).

The correlation matrix offers a preliminary assessment of the relationships among variables. High correlation coefficients between independent variables indicate potential multicollinearity. Additionally, the VIF measures the extent to which the variance of an estimated regression coefficient increases when the predictors are correlated (Montgomery et al., 2012). Generally, a VIF score greater than 10 is considered a threshold indicating significant multicollinearity that may require corrective measures.

The correlation matrix of our model is presented in Table 4, with the values in bold indicating statistically significant correlations at the 5% significance level. We can observe a significant correlation between Return on Average Assets (ROAA) and Return on Average Equity (ROAE), with a correlation coefficient of 0.9931, indicating a nearly perfect collinearity. Given this, we decide to exclude ROAE from the model and retain ROAA. The selection is based on the literature, which suggests that ROAA is a more comprehensive indicator of a bank's profitability. It evaluates the efficiency of asset utilisation in a bank, regardless of the bank's financial leverage and the degree of capital adequacy. This makes it a more reliable indicator for assessing the bank's overall performance (Jakubik & Reininger, 2013). Further, higher

ROAA is frequently linked to better risk management strategies and reduced levels of NPLs. This is because more profitable banks tend to be better at managing credit risk, as evidenced by research conducted by Louzis et al. in 2012.

The correlations between the other variables were not as pronounced, which justified their inclusion in the model. However, it is important to note that unemployment exhibited statistically significant correlations with the largest number of other variables.

Table 4: Correlation matrix of the independent variables

Variables	GDP_Growth	Unemployment	Inflation	ROAA	ROAE	Cap_Adequacy	Loan_Growth	Loan_Deposit
GDP_Growth	1							
Unemployment	0.04841	1						
Inflation	-0.04487	**-0.48714**	1					
ROAA	0.08016	**-0.72261**	0.27636	1				
ROAE	0.08558	**-0.67567**	0.20057	**0.99314**	1			
Cap_Adequacy	-0.11565	**-0.37123**	**0.64361**	0.03753	-0.05709	1		
Loan_Growth	0.01139	0.02499	0.24864	-0.11309	-0.12227	0.21043	1	
Loan_Deposit	0.09473	**0.71495**	-0.22646	**-0.33520**	-0.28720	**-0.49030**	0.15538	1

Source: own work

The VIF analysis further helps in evaluating multicollinearity. In this thesis, we will use the common threshold of VIF, which is 10. As presented in Table 5, all variables have VIF values below the threshold, and all except one have values below 5. Unemployment has the highest VIF value of 6.1, which might be considered relatively high. However, it is still below the threshold, and we have decided to retain this variable given it is a significant macroeconomic determinant that has a strong impact on credit risk and NPLs. Studies have consistently demonstrated that higher unemployment leads to an increase in NPLs as borrowers face greater financial difficulties (Glogowski, 2008; Louzis et al., 2012).

Table 5: VIF analysis

Variables	VIF	1/VIF
Unemployment	6.1	0.164039
Loan_Deposit	3.7	0.270568
ROAA	2.74	0.364668
Cap_Adequacy	2.72	0.367363
Inflation	2.66	0.375337
Loan_Growth	1.21	0.829858
GDP_Growth	1.04	0.965042
Mean VIF	2.88	

Source: own work

4.6 Unit root tests

One of the fundamental assumptions when working with time series data is the verification of stationarity. A time series is deemed stationary if it exhibits a trend. According to Gujarati and Porter (1999, p. 386), "using non-stationary time series can lead to 'spurious' regression, i.e., inaccurate coefficients with independent variables." Gujarati (2003) defines a stationary series

as one that has a constant mean and variance over time, and where the covariance between two time periods depends solely on the distance or gap or lag between them, rather than the actual time at which the variance is calculated. In order to determine the stationarity of our variables, we will apply two tests: the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. Both tests examine the hypothesis that the time series exhibits a unit root, indicating non-stationarity.

Stationarity tests were conducted using both intercept and trend criteria. The intercept criterion accounts for the potential presence of a constant mean around which the data fluctuates while the trend criterion considers a systematic, long-term increase or decrease in the data (Enders, 2014). Applying both specifications allows for a comprehensive analysis of the statistical properties of the time series, as recommended in the literature (Stock & Watson, 2015; Hamilton, 1994).

The level trend specification was suitable for most variables; hence, we relied on this criterion for those variables. However, for GDP growth and ROAA, we deem the intercept criterion as more suitable. This decision is based on the attributes of these variables, which often demonstrate mean-reverting behaviour. For example, GDP growth usually fluctuates around a constant mean throughout time, in line with cyclical economic patterns and the lack of a significant deterministic trend (Nelson & Plosser, 1982). Similarly, ROAA adjusts to economic and regulatory changes, leading to a reversion to its mean value (Demirgüç-Kunt & Detragiache, 1998; Angbazo, 1997). A 5% significance level is used in this research as the critical value to determine whether the time series is stationary or not. The results are shown in Table 6.

Table 6: ADF and PP unit root tests

Variables	Stationarity Tests	ADF test		PP test		Conclusion
		test results	p value	test results	p value	
NPLN	at level	-3.0970	0.1068	-3.0240	0.1254	I(1)
	1st difference	-3.9170	0.0115	-7.9200	0.0000	
NPLH	at level	-1.1570	0.9190	-0.9420	0.9514	I(1)
	1st difference	-3.7840	0.0174	-6.8730	0.0000	
GDP_growth	at level	-3.9870	0.0092	-5.0960	0.0000	I(O)
	1st difference	-	-	-	-	
Inflation	at level	-3.6680	0.0246	-2.1560	0.5146	Inconclusive
	1st difference	-	-	-2.5430	0.3068	
Unemployment	at level	-1.2160	0.9072	-1.3810	0.8663	Inconclusive
	1st difference	-3.2850	0.0687	-4.8530	0.0004	
ROAA	at level	-1.7390	0.0447	-2.4910	0.1176	I(1)
	1st difference	-8.7210	0.0000	-8.7210	0.0000	
ROAE	at level	-1.8810	0.0335	-2.6110	0.0908	I(O) or I(1)
	1st difference	-	-	-2.9410	0.0000	
Cap_Adequacy	at level	-1.2660	0.8961	-1.8260	0.6923	I(1)
	1st difference	-5.9230	0.0000	-7.0960	0.0000	
Loan_Growth	at level	-3.4120	0.0498	-2.6510	0.2572	I(O) or I(1)
	1st difference	-	-	-5.7540	0.0000	
Loan_Deposit	at level	-2.2900	0.4395	-3.0540	0.1175	I(1)
	1st difference	-4.9130	0.0003	-6.3960	0.0000	

Source: own work

As presented in Table 6, according to the ADF and PP tests, all variables, except for inflation and unemployment, are stationary at level or after first differencing. Since the ADF and PP tests gave inconclusive results for these two variables, we conducted the KPSS test to make a more informed decision about the stationarity of these variables. The KPSS test has a fundamental difference in its hypothesis structure relative to the ADF and PP tests. Here, the null hypothesis (H0) assumes that the series exhibits trend stationarity, whereas the alternative hypothesis assumes the presence of a unit root. This difference makes the KPSS test a valuable addition for assessing stationarity, since it enables for a cross-validation of the results obtained from the ADF and PP tests. Charemza and Syczewska (1998) suggest that using both unit root tests (ADF or PP) and stationarity tests (KPSS) provides a comprehensive assessment of a time series' properties. The dual approach is especially helpful in cases where one test may fail to reject its null hypothesis due to low statistical power, a common issue in small sample sizes. The results showed that both variables were not trend stationary in their levels, but they do become stationary after first differencing. We will consider these findings as we proceed with our research.

4.7 Econometric Model Selection

From the perspective of methodology in econometric investigations, it is very important to choose the approach that corresponds to the character and specifics of the data series for the analysed relationship in order to obtain economically reasonable insights and results. Several authors (Pesaran & Shin, 1997; Caporale & Chui, 1999; Catão & Falcetti, 2002; and others) highlight several advantages of the Autoregressive Distributed Lag (ARDL) model over other models. First, the ARDL model can be applied regardless of the order of integration of the variables, which can be I (0) or I (1). However, it is important that no variable is integrated of order I (2) because this can lead to spurious and unreliable results in the ARDL model (Pesaran & Pesaran, 1997). Second, this model is more suitable for small samples consisting of 30 to 80 observations (Pattichis, (1999); Mah, (2000)). Third, according to Laurenceson and Chai (2003), this model allows for a sufficient number of lags through the general-to-specific modelling framework, capturing the data-generating process. Fourth, the dynamic error correction model (ECM) can be derived from the ARDL model through a simple linear transformation (Banerjee et al., 1993).

Based on the stationarity tests conducted in Chapter 4.6, which concluded that all of our variables are either stationary at level I(0) or I(1), and given our relatively small sample size of 48 observations, we are confident that the ARDL model is the appropriate choice for our analysis.

The ARDL on the bounds testing co-integration method, initially developed by Pesaran et al. (2001), can be mathematically represented as follows:

$$\Delta y_t = \beta_0 + \Sigma\beta_i \Delta y_{t-i} + \Sigma\beta_j \Delta x_{t-j} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \varepsilon_t \qquad (3)$$

Where y_t represents the dependent variable, x represents the independent variables, β are the short-term coefficients to be calculated, while λ are the long-term coefficients. Thus, the first part of the equation represents the short-term dynamics of the model, while the second part represents the long-term relationship between the dependent variable and the independent determinants. Pesaran et al. (2001) use the terms "conditional Error Correction Model (ECM)" or "unrestricted ECM" to describe this method. We will employ an F-test to test the following hypothesis: $H_0: \gamma_0 = \gamma_1 = \gamma_2 = 0$. A rejection of the H_0 hypothesis implies the presence of a long-run relationship. Additionally, we will calculate the long-term and short-term relationship coefficients, as well as the ECM term, based on the determined ARDL model. The obtained coefficient before the ECM represents the speed of adjustment or the correction coefficient of the deviation from equilibrium, indicating how quickly the long-term equilibrium between the variables can be restored following a short-term shock to one of the determinants.

4.8 Optimal lag length

For determining the optimal lag length for the models, we will employ the general-to-specific (GETS) framework. This method employs a systematic approach to reduce the complexity of the model. It begins with a relatively higher number of lags and subsequently removes those that do not make a significant contribution to the explanatory power of the model. By using this approach, we will ensure that the final model is parsimonious and theoretically sound.

When working with quarterly data, it is standard practice to begin with four lags. However, due to the small sample size and the relatively large number of variables, we decided to start with two lags. Additionally, we believe that two quarters are sufficient for the economic effects to take impact, ensuring that the model captures the relevant dynamics without introducing unnecessary complexity. This approach balances the need for sufficient lag structure alongside the limitations imposed by the sample size (Charemza & Deadman, 1992; Lütkepohl, 2005).

To determine the maximum lag length, we will rely on the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). These criteria help in determining the model that best balances goodness-of-fit and complexity, by penalising models with excessive parameters. The models with the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values will be selected as the optimal model (Burnham & Anderson, 2002).

Table 7: Results from the GETS framework

Model	Lag Length 1		Lag Length 2		Lag Length 3	
	AIC	BIC	AIC	BIC	AIC	BIC
Model 1	-284.7517	-251.4491	-299.3382	-249.9649	-290.8562	-225.8164
Model 2	-400.2576	-366.955	-397.2255	-347.8522	-417.865	-352.8251

Source: own work

For Model 1, where the independent variable is NPLs to non-financial institutions, the analysis revealed that the model with a lag length of two had the lowest AIC and BIC values. In the case of Model 2, with NPLs to households as the independent variable, the results indicated that a lag length of one was optimal. Therefore, the maximum lag length for Model 1 will be set at two, while the maximum lag length for Model 2 will be set at one.

After determining the maximum lag lengths for the models, we proceeded to determine the optimal lag length for each variable in both models using the AIC. We decided to rely on this criterion because the model based on this criterion produces a smaller standard error compared to the model based on the BIC (Pesaran and Pesaran, 1997; Alexiou and Toro, 2006).

Consequently, for Model 1, where the independent variable is NPLs to non-financial institutions, the optimal lag structure was identified as (1 1 2 2 1 1 2 1 1). In Model 2, with NPLs to households as the independent variable, the optimal model was identified with the lag structure (1 1 0 0 1 0 0 0 0).

4.9 Model diagnostic tests

After identifying the optimal lag lengths, we can now proceed with estimating the ARDL models. However, before presenting and interpreting the results of the ARDL models, we must first test whether the models' assumptions are met. Specifically, the diagnostic checks conducted on the ARDL models include tests for autocorrelation, heteroskedasticity, and normality of residuals. These tests are crucial because violations of these assumptions can result in biassed estimates, inefficient estimators, and unreliable inference. Therefore, by ensuring that these assumptions are valid, we can have more confidence in the robustness of our findings and conclusions.

Autocorrelation refers to the correlation between a variable and its past values, specifically within the residuals of a regression model. In the ARDL model, autocorrelation may result in biased standard errors, which in turn can compromise the validity of hypothesis tests and confidence intervals. The Durbin-Watson test and the Breusch-Godfrey Lagrange Multiplier (LM) test are commonly used to evaluate autocorrelation. The Durbin-Watson statistic is used to test for first-order autocorrelation, with a value close to 2 suggests no autocorrelation (Durbin & Watson, 1951). The Breusch-Godfrey LM test expands on this by checking for

higher-order autocorrelation. A non-significant result suggests an absence of serial correlation (Breusch 1978; Godfrey, 1978).

Table 8: Autocorrelation test results

Model	Durbin-Watson Statistic	Breusch-Godfrey LM Test			
		Lag 1		Lag 2	
		chi2	p-value	chi2	p-value
Model 1	2.153	0.693	0.4052	0.948	0.6226
Model 2	2.03	0.042	0.8377	1.079	0.5829

Source: own work

The Durbin-Watson statistic of 2.153 in Model 1 is close to 2 and indicates that there is no autocorrelation in the residuals. The Breusch-Godfrey LM test further supports this, as indicated by the p-values of 0.4052 and 0.6226 for lags 1 and 2, respectively, indicating that we cannot reject the null hypothesis of no serial correlation. Similarly, in the case of Model 2, the Durbin-Watson statistic of 2.030 indicates that there is no significant autocorrelation. Additionally, the results of the Breusch-Godfrey test, with p-values of 0.8377 and 0.5829 for lags 1 and 2 respectively, confirm the absence of serial correlation in the residuals.

Heteroskedasticity happens when the variance of the error terms is not constant among observations. The presence of homoskedasticity is crucial as heteroskedasticity can lead to inefficient estimators and invalid hypothesis tests. To check for heteroskedasticity, we will use the Breusch-Pagan/Cook-Weisberg test and White's test. The Breusch-Pagan test specifically assesses whether the residuals' variance is constant, while White's test analyses more general forms of heteroskedasticity (Breusch and Pagan, 1979; White, 1980). In both tests, the null hypothesis assumes homoskedasticity, meaning the variance of the error terms is constant. If the p-value is below a certain significance level (typically 0.05), we reject the null hypothesis, indicating the presence of heteroskedasticity. Conversely, a p-value above this threshold indicates that the variance is constant, confirming homoskedasticity.

Table 9: Heteroskedasticity test results

Model	Breusch-Pagan Test (p-value)	White's Test (p-value)
Model 1	0.0781	0.4306
Model 2	0.0000	0.4313

Source: own work

In Model 1, the Breusch-Pagan test has a p-value of 0.0781, hence we fail to reject the null hypothesis of homoskedasticity at the 5% significance level. The White's test results in a p-value of 0.4306, indicating that there is no significant heteroskedasticity in Model 1 and supporting the assumption of homoskedasticity. Model 2 exhibits significant

heteroskedasticity, demonstrated by the Breusch-Pagan test with a p-value of 0.0000. This suggests that the assumption of homoskedasticity has been violated. However, White's test, with a p-value of 0.4313, did not detect evidence of heteroskedasticity. In order to address the presence of heteroskedasticity detected through the Breusch-Pagan test in Model 2, we have run the model with robust standard errors, which adjust for heteroskedasticity, ensuring that the inference remains valid (Wooldridge, 2013). These results will be presented in the next section together with the results of the ARDL model.

The assumption of normality of residuals is crucial for making valid statistical inferences. The presence of non-normal residuals might impact the dependability of confidence intervals and hypothesis tests. The skewness and kurtosis test, known as the Jarque-Bera test is typically used to assess the assumption of normality of residuals (Jarque and Bera, 1980). If the p-value is higher than 0.05, we cannot reject the null hypothesis which states that the residuals are normally distributed.

Table 10: Jarque-Bera test results for normality of residuals

Model	Skewness (p-value)	Kurtosis (p-value)	Joint Test (p-value)
Model 1	0.9504	0.3162	0.5906
Model 2	0.0000	0.0000	0.0000

Source: own work

The results of Model 1 show that the skewness and kurtosis test suggest that the residuals follow a normal distribution, with a combined p-value of 0.5906. This indicates that the assumption of normality is not violated in this model. In contrast, Model 2 displays a significant deviation from normality, as evidenced by a joint p-value of 0.0000, suggesting that the residuals are not normally distributed. Nevertheless, it is important to note that normality is not always critical for economic time series models as economic data often exhibits skewness and kurtosis as a result of underlying structural factors (Lütkepohl, 2005). Hence, the non-normality of the residuals in Model 2 does not pose a significant limitation for the model's validity results.

Finally, we conducted the Cumulative Sum (CUSUM) test on both models to assess the stability of the estimated parameters over time. The CUSUM test is a statistical method employed to identify structural changes or instability in the coefficients of a regression model over time. It evaluates whether the cumulative sum of the residuals deviates from zero, which would suggest a potential change in the relationship between the variables. If the cumulative sum remains within the set boundaries, it indicates that the model's parameters are stable. According to the results from the CUSUM test, both models showed stable parameters, with cumulative sums falling within the acceptable limits. The graphical presentations of these findings are provided in Appendix 1.

In conclusion, the diagnostic tests confirm that Model 1 meets the key assumptions for the ARDL model, while Model 2 has issues related to heteroskedasticity and normality of residuals. As explained earlier, the issue of heteroskedasticity will be addressed through the use of robust standard errors, while the issue of non-normality of residuals is not considered a serious limitation in economic time series models. As a result, we conclude that the models provide a valid basis for drawing conclusions about the relationship between non-performing loans and the selected macroeconomic and bank-specific factors.

4.10 Empirical analysis (ARDL model) and interpretation of results

Before interpreting the short-term and long-term coefficients, it is essential to first review the results of the bounds test for cointegration, which assesses the presence of a long-term relationship among the variables. The bounds test, developed by Pesaran et al. (2001), examines the presence of a level relationship between the dependent and independent variables, with the null hypothesis (H0) stating that there is no cointegration.

The results of the bounds test for cointegration are presented in Table 11 and Table 12, where the F-statistics are compared against critical values for I (0) and I (1) bounds at the 10%, 5%, and 1% significance levels. The null hypothesis (H0) states that there is no cointegration; if the estimated F-statistic is higher than the upper bound (I (1)), the null hypothesis is rejected, indicating cointegration.

Table 11: Bounds test results for Model 1

F-statistic	10%		5%		1%		p-value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4.464	2.113	3.56	2.526	4.173	3.525	5.644	0.002	0.036

Source: own work

Table 12: Bounds test results for Model 2

F-statistic	10%		5%		1%		p-value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
3.906	2.163	3.455	2.561	4.009	3.505	5.307	0.005	0.057

Source: own work

In Model 1, where the dependent variable is NPLs to non-financial institutions, the F-statistic is 4.464. At a significance level of 10%, the critical bounds for I (0) and I (1) are 2.113 and 3.560, respectively. Given that the F-statistic exceeds the upper bound, we can reject the null hypothesis that there is no cointegration, indicating the presence of a long-term equilibrium relationship. The null hypothesis is also rejected at a 5% significance level, while at the 1% significance level the F-statistic is lower than the upper bound, hence we do not reject the null hypothesis. Given the results indicate that we can reject the null hypothesis at the 10% and 5%

significance levels, we can confidently conclude that there is a long-term relationship between NPLs to non-financial institutions and the independent variables.

In Model 2, where the dependent variable is NPLs to households, the estimated F-statistic is 3.906. The results of the bounds test indicate that we can reject the null hypothesis at the 10% significance level, while at the 5% significance level the F-statistic is slightly below the upper bound, indicating moderate evidence of cointegration. When considering the 1% significance level, we fail to reject the null hypothesis.

Overall, the analysis shows that both models have evidence of cointegration, with stronger evidence found in Model 1 (NPLs to non-financial institutions) compared to Model 2 (NPLs to households). These findings indicate that the variables in both models likely have a long-term-equilibrium relationship, although the strength of this relationship varies between the two models.

Consequently, we can proceed with interpreting the long-term coefficients presented in Table 13 and Table 14.

Table 13: Long-term coefficients based on ARDL model for Model 1

Variables	Coefficients	Standard Error	t-statistics	p-value
GDP_growth	0.375106	0.14193	2.64	0.014
Unemployment	0.347356	0.129259	2.69	0.013
Inflation	-0.027854	0.126661	-0.22	0.828
ROAA	-2.921993	0.798742	-3.66	0.001
Cap_Adequacy	-0.76208	0.77843	-0.98	0.337
Loan_Growth	0.326834	0.141293	2.31	0.029
Loan_Deposit	0.362591	0.235647	1.54	0.136
Covid_Dummy	0.004648	0.013208	0.35	0.728
_cons	-0.086243	0.152007	-0.57	0.576

Source: own work

Table 14: Long-term coefficients based on ARDL model for Model 2

Variables	Coefficients	Standard Error	t-statistics	p-value	
				ARDL model	RSE model
GDP_growth	0.0812	0.0391	2.08	0.045	0.024
Unemployment	0.3417	0.0473	7.23	0.000	0.070
Inflation	0.0216	0.0348	0.62	0.539	0.594
ROAA	-0.5457	0.2975	-1.83	0.075	0.122
Cap_Adequacy	0.6824	0.2133	3.20	0.003	0.018
Loan_Growth	0.1469	0.0470	3.13	0.004	0.134
Loan_Deposit	-0.1157	0.0787	-1.47	0.151	0.334
Covid_Dummy	0.0010	0.0051	0.20	0.841	0.802
_cons	-0.0243	0.0377	-0.64	0.524	0.413

Source: own work

Based on the coefficients derived from the ARDL model for the long-term relationship, we can conclude that there are several relationships between macroeconomic factors, bank-specific factors, and non-performing loans (NPLs) for non-financial institutions and households.

Regarding bank-specific factors, several significant relationships have been identified. The coefficient for ROAA in Model 1 suggests that profitability has significant effect on NPLs to non-financial institutions. A 1% rise in ROAA results in a substantial 2.921993% decline in NPLs to non-financial institutions at the 1% level. This aligns with the theory that banks with higher profitability are better at credit risk management and have lower levels of NPLs, consistent with the findings by Louzis et al. (2012). This suggests a robust inverse correlation between profitability and NPLs. While in Model 2, a 1% rise in ROAA results in a 0.5457% decrease in NPLs to households, significant at the 10% level in the ARDL model. However, according to the p-value in the Robust Standard Errors model, ROAA does not have a statistically significant impact on NPLs to households.

The results for loan growth show a statistically significant explanatory power with a positive sign in Model 1, where a 1% increase in loan growth leads to a 0.326834% increase in NPLs to non-financial institutions, which is statistically significant at the 5% level. These results indicate that during periods of rapid credit expansion, banks might lower their lending requirements, leading to a rise in bad loans. In Model 2, a 1% increase in loan growth, leads to an increase of 0.1469% in NPLs to households which is statistically significant at the 1% level in the ARDL model, however, this coefficient is not significant according to the Robust Standard Errors model. Notably, Kjosevski et al. (2019) found a negative relationship between loan growth and NPLs to households and non-financial institutions in North Macedonia.

Capital adequacy has a statistically significant relationship only in Model 2, with a positive coefficient of 0.6824. This suggests that higher levels of capital adequacy ratios are associated with higher NPLs, potentially due to the fact that banks with larger capital buffers take on

riskier loans. This is consistent with the findings of Makri et al. (2014) and Boudriga et al. (2009).

In examining the impact of macroeconomic factors, the analysis reveals a significant positive relationship between GDP growth and NPLs in both models. Specifically, in Model 1, a 1% increase in GDP growth is associated with a 0.375106% increase in NPLs to non-financial institutions, which is statistically significant at the 5% level. Similarly, in Model 2, a 1% increase in GDP growth leads to a 0.0812% increase in NPLs, which is statistically significant at the 5% level. These results suggest that economic expansion might stimulate lending activities to higher-risk borrowers. This finding contradicts the conclusions of the most studies discussed in Chapter 4.2.1.1, which generally observe a negative relationship between GDP growth and NPLs, indicating that economic growth tends to reduce credit risk. Interestingly, our finding also contradicts the research by Kjosevski et al. (2019), who examined factors influencing NPLs in Macedonia from 2003-2014 and found a negative relationship between GDP growth and NPLs. This suggests a shift in the dynamics of credit risk in the Macedonian banking sector, with economic growth in more recent years potentially leading to higher financial instability. Nevertheless, our findings align with those of Shingjergji's study on the Albanian banking sector, which also identified a similar positive relationship between GDP growth and NPLs.

This counterintuitive result might have several possible explanations. Between 2012 and 2023 more aggressive lending practices during economic booms might have played an important role. Given economic expansion and loan growth are generally positively correlated, the positive relationship we found between NPLs and loan growth in both models suggest that banks might not be practicing sufficient caution in their lending during periods of growth, leading to higher NPLs on the long term. The influence of GDP growth on NPLs is more pronounced for non-financial institutions, suggesting that economic expansion has a stronger impact on credit risk in this sector. Furthermore, as discussed in Chapter 3.5, weaknesses in the banking sector, such as significant concentration of credit exposure in industries like retail, construction, and real estate, could have amplified the NPL ratio, as these industries faced financial challenges. Moreover, the regulatory changes implemented during that period, which included more rigorous lending standards and the reassessment of loan portfolios, likely revealed previously underreported loans, further inflating the NPL ratios. Another factor that might have contributed to the observed dynamics is the impact of the COVID-19 pandemic. During this period, there was a substantial decline in GDP growth in N. Macedonia; yet non-performing loans remained relatively stable. The stability can be credited to the actions taken by the NBRNM as outlined in Chapter 3.4.

Unemployment has a positive and statistically significant relationship with NPLs in both models. In Model 1, a 1% rise in unemployment leads to a 0.347356% increase in NPLs to financial institutions, statistically significant at the 5% level. In Model 2, a 1% rise in unemployment results in a 0.3417% increase in NPLs to households, statistically significant at

the 1% level (this coefficient remains statistically significant in the Robust Standard Errors model as well, at the 10% level). These findings indicate increased unemployment rates lead to lower demand, reduced production, and consequently lower revenues, which in turn affect the ability of borrowers to meet their obligations. These results align with the research conducted by Louzis et al. (2012) on Greek banks, Bofondi and Ropele (2011) on Italian banks a well as with most of the literature we reviewed in Chapter 4.2.1.2.

Nevertheless, it is important to acknowledge that certain variables, including inflation, the loan-to-deposit ratio, and the COVID-19 dummy variable, were found to be statistically insignificant in both models. This implies that these factors do not have a substantial long-term influence on NPLs in both sectors.

Next, based on the short-term coefficients calculated from the ARDL model, we can observe and interpret the significant interactions between the macroeconomic and bank-specific factors with NPLs in the short-term relationship. We note that in the analysis of the short-term dynamics, certain variables were excluded from Model 2, where the dependent variable is NPLs to households, given their optimal lag length was determined to be zero. This indicates that these variables do not exhibit significant lagged effects on NPLs to households, reflecting their immediate rather than delayed impact, or lack of influence on household NPLs.

Table 15: Short-term coefficients based on ARDL model for Model 1

Variables	Coefficients	Standard Error	t-statistics	p-value
ECM term	-0.5600	0.1445	-3.87	0.001
GDP_growth D1.	-0.1634	0.0507	-3.22	0.004
Unemployment D1.	-0.8851	0.4269	-2.07	0.049
Unemployment LD.	1.3544	0.4516	3.00	0.006
Inflation D1.	-0.1859	0.1417	-1.31	0.202
Inflation LD.	-0.1961	0.1477	-1.33	0.196
ROAA D1.	0.7708	0.5198	1.48	0.151
Cap_Adequacy D1.	0.5837	0.4993	1.17	0.253
Loan_Growth D1.	0.0590	0.1043	0.57	0.577
Loan_Growth LD.	-0.0261	0.1046	-0.25	0.805
Loan_Deposit D1.	-0.2026	0.1216	-1.67	0.108
Covid_Dummy D1.	0.0156	0.0089	1.75	0.092

Source: own work

Table 16: Short-term coefficients based on ARDL model for Model 2

Variables	Coefficients	Standard Error	t-statistics	p-value	
				ARDL model	RSE model
ECM term	-0.4239	0.0932	-4.55	0.000	0.041
GDP_growth	-0.0196	0.0138	-1.43	0.163	0.058
ROAA	0.1796	0.1442	1.25	0.221	0.192

Source: own work

The ECM term in Model 1 is -0.5600, significant at the 1% level. This suggests that approximately 56% of the disequilibrium in NPLs to non-financial institutions from the previous period is corrected in the current period, demonstrating a rapid rate of adjustment towards long-term balance. This finding aligns with the research conducted by Pesaran et al. (2006), which highlights the impact of economic cycles on NPLs. In contrast, Model 2, demonstrates an ECM term of -0.4239, also significant at the 1% level in the ARDL model and at the 5% level in the Robust Standard Errors model. Approximately 42.39% of the disequilibrium is corrected in the current period, indicating a moderate rate of adjustment. The slower adjustment in the household sector could be attributed to distinct lending practices or a more gradual response to economic changes.

When analysing the short-term effects of GDP growth, the models demonstrate differing results as opposed to the long-term coefficients. In Model 1, the coefficient for GDP growth is -0.1634 and statistically significant at the 1% level, indicating that an increase in GDP growth results in a reduction in NPLs to non-financial institutions. We observe similar results in Model 2 as well, where the GDP growth coefficient is -0.0196 at the 10% significance level according to the Robust Standard Errors model. This negative relationship is in line with economic theory as economic growth improves borrowers' repayment capacity, resulting in lower levels of NPLs. Most of the empirical studies which investigate the relationship between NPLs and GDP growth have also concluded a negative relationship, as discussed in Chapter 4.2.1.1.

Regarding the short-term effect of the unemployment rate on NPLs to non-financial institutions we can observe a rather interesting situation. The first difference of unemployment is statistically significant at the 5% and has a negative coefficient, indicating that an immediate rise in unemployment initially leads to a reduction in NPLs, potentially due to short-term policy interventions or repayment deferrals. For example, this can be explained by the measures implemented by North Macedonia during the COVID-19 pandemic, as outlined in Chapter 3.4, which aimed to ease the burden of NPLs. These measures likely mitigated the immediate impact of rising unemployment on NPL levels. Nevertheless, the lagged difference of unemployment exhibits a significant positive coefficient of 1.3544 at the 1% level. This implies that as economic effects become more evident, the long-term impact of rising unemployment leads to more NPLs. This finding is consistent with Louzis et al. (2012), who observed that unemployment had a delayed but significant impact on NPLs.

Inflation, both in its first difference and its lagged form does not show a statistically significant relationship with NPLs to non-financial institutions. Given the long-term coefficients of inflation were also insignificant in both models, this suggests that the impact of inflation may be more nuanced and context-dependent, which contrasts with the conclusions drawn by Klein (2013) who observed a positive relationship between inflation and NPLs in CESEE countries.

Regarding bank-specific factors, in Model 1, the coefficient for ROAA is 0.7708, but it is not statistically significant. Similarly, in Model 2, the coefficient is 0.1796, and it is also not significant. This indicates a more extensive pattern in which profitability has a long-term effect on NPLs rather than an instantaneous one. Similarly, the capital adequacy ratio in Model 1, is not statistically significant, indicating that capital strength is important for long-term stability but does not have an immediate impact on NPLs. This is consistent with the findings of Boudriga et al. (2009), who highlight the importance of capital adequacy. Lastly, in Model 1, the loan growth variables (both first difference and lagged difference) as well as the loan to deposit ratio are not statistically significant, suggesting that short-term fluctuations in loan growth and liquidity positions do not significantly influence NPLs. This supports the findings of Keeton (1999), who observed that a rapid rise in loans could result in higher loan losses only over an extended period. The COVID-19 dummy variable exhibits marginal significance, at the 10% level, indicated by a coefficient of 0.0156, suggesting that the pandemic-related disruptions had a relatively moderate immediate effect on NPLs to non-financial institutions.

Finally, in Table 17, we present the results for the R-squared and adjusted R-squared values for our ARDL models. R-squared, referred to as the coefficient of determination, estimates the proportion of the variance in the dependent variable that can be explained by the independent variables in the model. The term essentially indicates the extent to which the independent variables may account for variation in the dependent variable (Wooldridge, 2016). Whereas the adjusted R-squared adjusts for the number of predictors in the model. This adjustment is critical because R-squared can artificially inflate when more variables are included, regardless of whether these variables contribute significantly to the model's explanatory power (Gujarati and Porter, 2009).

Table 17: R-squared and Adjusted R-squared values

Model	R-squared	Adj R-squared
Model 1	0.7007	0.4612
Model 2	0.5018	0.3452

Source: own work

The R-squared value in Model 1 is 0.7007, indicating that 70.07% of the variation in NPLs to non-financial institutions can be explained by the independent variables included in the model. The adjusted R-squared value is 0.4612, suggesting that 46.12% of the variation is explained

after accounting for the number of variables. The adjusted R-squared value highlights the model's satisfactory explanatory power while accounting for the potential overfitting.

In Model 2, the R-squared is 0.5018, indicating that 50.18% of the variation in NPLs to households can be explained by the model. The adjusted R-squared value of 0.3452 confirms the model's robustness, after considering the number of variables included. The adjusted R-squared value is relatively lower, suggesting that the model has a moderate fit but loses some explanatory power when considering the number of predictors.

While R-squared and adjusted R-squared provide insight into model fit, they have limitations, particularly in econometric models, where they don't capture dynamic relationships over time and may reflect overfitting with the inclusion of additional variables (Greene, 2018; Wooldridge, 2013). Nonetheless, these metrics are standard in similar studies assessing NPLs, such as those by Klein (2013), Škarica (2014), Tanasković and Jandrić (2015), and Kjosevski et al. (2019). Therefore, we have included them here to maintain consistency with prior research in this area.

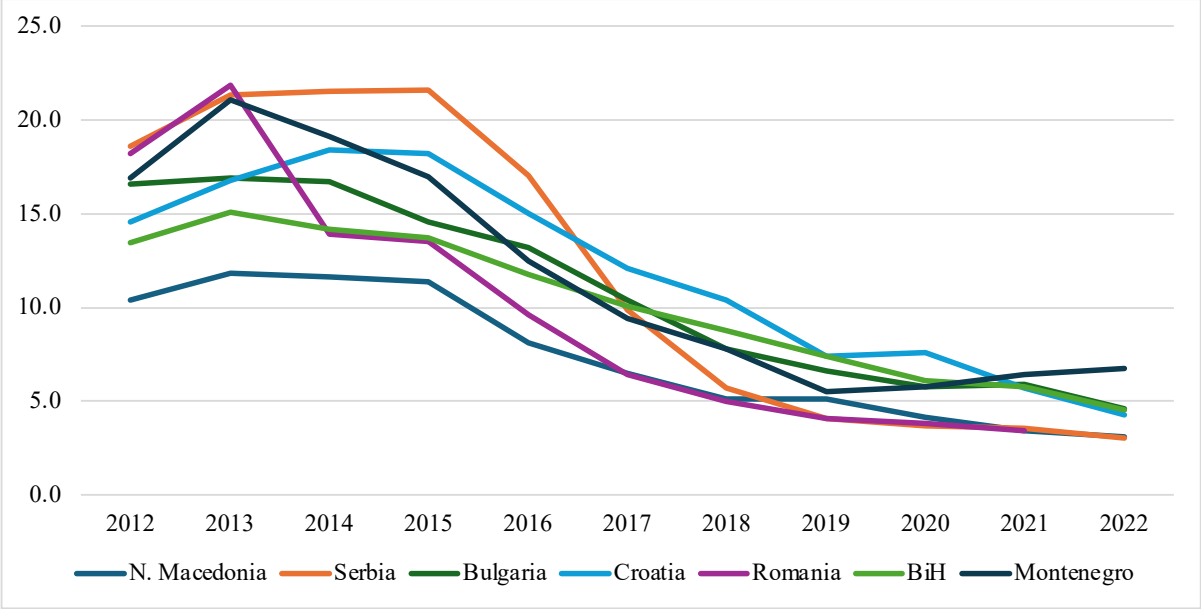
5 COMPARATIVE ANALYSIS OF NON-PERFORMING LOANS IN THE BANKING SECTOR OF NORTH MACEDONIA AND CESEE COUNTRIES

5.1 Overview of NPL Trends in North Macedonia and CESEE Countries

Between 2012 and 2022, North Macedonia successfully reduced its NPL ratio from 11.9% to 3.1%. This significant improvement can be attributed to stronger regulatory frameworks, conservative lending practices, and post-crisis economic recovery. This mirrors a regional trend seen across CEE countries. For instance, Serbia reduced its NPL ratio from 21.4% in 2013 to 3.0% in 2022, largely due to the implementation of the National NPL Resolution Strategy and strong government-led initiatives to clean up bank balance sheets (BDK Advokati, 2022). Romania also made remarkable progress, with NPL ratios falling from 21.9% in 2013 to 3.3% by 2022, driven by robust economic growth and structural reforms in the banking sector (World Bank, 2021).

While all countries in the region experienced similar downward trends, the speed of recovery and the methods employed varied. Croatia, for example, reduced its NPL ratio from 16.8% in 2013 to 4.3% in 2022, benefiting from EU membership, which provided access to financial assistance and regulatory oversight. Bulgaria also saw its NPL ratio decline from 16.9% in 2013 to 4.6% in 2022, largely due to improved credit risk management and a shift toward more conservative lending practices. The different speeds and approaches highlight the importance of tailored strategies based on each country's economic and banking structure.

Figure 6: NPL ratio in N. Macedonia and selected CESEE countries (%)



Source: NBRNM (n.d.b), NBS (n.d.), BNB (n.d.), CNB (n.d.), NBR (n.d.), Statista (n.d.), CBM (n.d.)

5.2 Macroeconomic and Bank-Specific Determinants of NPLs

Our analysis of the relationship between GDP growth and NPLs in North Macedonia suggested a positive relationship, contrasting from the negative relationship commonly observed in other CESEE countries. Generally, higher GDP growth should result in lower NPL ratios, as economic expansion strengthens borrowers' capacity to fulfil their financial obligations. This has been the case in countries like Serbia, Romania, Croatia, and other CESEE countries where substantial GDP growth after the global financial crisis (GFC) contributed to a reduction in NPL levels (Jakubik and Reininger, 2013). In North Macedonia, the positive relationship indicates that credit expansion during periods of economic growth may have resulted in riskier lending practices, with banks extending loans to less creditworthy borrowers, thereby elevating NPLs despite the strengthening economy. The divergence indicates differences in the regulatory landscape during growth periods, where other CSEEE countries may have implemented stricter oversight, hence limiting the buildup of NPLs (Klein, 2013).

Unemployment plays a similarly significant role across the region, with our findings in North Macedonia aligning with those in other CSEEE countries. Higher unemployment rates generally result in elevated NPL ratios as more borrowers struggle to meet their loan commitments. In North Macedonia, as well as other CESEE countries, unemployment growth has been a significant indicator of deteriorating loan portfolios Škarica (2014) (Klein, 2013). A study by Szarowska (2018) which examined data from 11 Central and Eastern European (CEE) countries over the period 1999–2015, identified unemployment as a primary

macroeconomic determinant affecting non-performing loans (NPLs). In contrast, a more recent study by Jovanovic (2022) which focused on NPLs in Serbia, Montenegro, and BiH, from 2009 to 2019, found that unemployment did not exhibit a statistically significant relationship with NPL levels. This disparity in findings suggests that the impact of unemployment on NPLs may vary across different CESEE countries and economic periods, highlighting the complex interplay of region-specific economic factors in influencing NPL ratios.

In the analysis of bank-specific determinants, profitability, measured by ROAA, consistently exhibits a negative relationship with NPLs in North Macedonia and other CESEE countries. In more profitable banks, stronger risk management and credit assessment methods reduce the likelihood of defaults. In Romania, Montenegro, Bosnia and Herzegovina (BiH), and Serbia, improved profitability has been linked to more effective management of credit risks, mirroring our findings in North Macedonia (Jovanovic, 2022; Bunea et al., 2022). Profitability enables banks to sustain robust loan portfolios, indicating that banks with strong profitability levels engage in less risky lending.

Loan growth in North Macedonia generally mirrors regional patterns, where rapid loan expansion has been associated with higher NPL levels. The relationship between loan growth and NPLs is generally positive in CESEE countries, especially during periods of economic growth when banks may ease lending criteria to increase market share. For instance, Klein (2013) found that exessive lending led to higher NPLs. On the other hand, Škarica (2014) found that loan growth had a statistically insignificant relationship with NPLs in CEE countries, which might attributed to the levels of outstanding loans during the analyzed period of 2007-2012 when the global financial crisis caused liquidity shocks which halted credit growth. The primary concern remains that during phases of rapid loan expansion, banks might prioritise growth over quality, leading to a decline in the quality of their loan portfolios.

In summary, although North Macedonia shares many commonalities with other CESEE countries regarding the factors influencing NPLs, significant disparities in economic structure, regulatory frameworks, and banking practices explain some of the distinctive patterns we observed. The positive relationship between GDP growth and NPLs in North Macedonia, in contrast to the negative relationships typically seen in the region and globally, underscores the necessity for enhanced regulatory monitoring and more prudent lending practices during economic expansions. Understanding these dynamics and drawing insights from the experiences of other CESEE countries might help North Macedonia develop more effective strategies for the management of NPLs in the future.

5.3 Sensitivity of NPLs to External Crises

The banking sector of North Macedonia demonstrated considerable resilience in comparison to other CESEE countries, primarily due to its insulation from global financial markets and reliance on domestic funding sources. Unlike many CESEE countries, which are significantly

influenced by fluctuations in foreign exchange and external financial events, North Macedonia's banks rely primarily on loans denominated in the local currency. This approach has been instrumental in shielding the sector from the economic shocks experienced in other countries, particularly during global crises such as the 2008 financial downturn (Jakubik and Reininger, 2013).

The data presented in Figure 6 further contributes to the conclusion about North Macedonia's lower sensitivity to economic crises. In 2012, amidst the Euro debt crisis, North Macedonia had the lowest level of NPLs at 10.4% with Romania and Serbia having the highest NPL levels at 18.2% and 18.6%, respectively. Simililary, after the COVID-19 pandemic, in 2022, North Macedonia's NPL ratio was amongst the lowest at 3.1%, as compared to other CESEE countries like Montenegro (6.8%), BiH (4.5%), Bulgaria (4.6%), Croatia (4.3%), and Romania (3.3%). In 2013, at the peak of the financial crisis, North Macedonia's NPL ratio was 11.9%, significantly lower than Serbia's (21.4%) and Romania's (21.9%). The disparity underscores North Macedonia's ability to sustain stability throughout global downturns.

In summary, North Macedonia's banking sector has consistently demonstrated resilience in the face of global financial crises, distinguishing itself from other CESEE countries. This stability can be attributed to the sector's insulation from foreign financial markets and its reliance on loans in the local currency, which reduces vulnerability to exchange rate fluctuations and external economic shocks. The data reinforces this stability, with North Macedonia maintaining lower NPL ratios across multiple crises, including the 2008 financial crisis, the 2012 Euro debt crisis, and the 2022 COVID-19 aftermath. This consistent performance highlights the sector's structural strengths, which help mitigate the impact of global economic volatility.

6 CONCLUSION

The findings of this thesis provide meaningful insights into the complex relationships between non-performing loans (NPLs) and both macroeconomic and bank-specific factors within North Macedonia's banking sector. The application of an Autoregressive Distributed Lag (ARDL) model facilitated the capture of both short-term and long-term effects, providing a nuanced understanding of the drivers behind NPLs of households and non-financial institutions.

In addressing the first research question, the results indicate that macroeconomic indicators, specifically GDP growth and unemployment, have statistically significant impacts on NPLs to non-financial institutions. In the short term, GDP growth exhibits a negative relationship with NPLs, suggesting that economic expansion initially mitigates default risks by improving borrowers' ability to fulfil their financial obligations. In the long term, however, GDP growth has a positive relationship with NPLs suggesting that extended periods of growth might foster riskier lending practices, which ultimately contribute to an increase in NPLs. Meanwhile, unemployment has a consistent and positive relationship with NPLs indicating that rising unemployment diminishes repayment capacity and increases defaults among non-

financial institutions. However, inflation was not found to have a statistically significant impact on NPLs to non-financial institutions.

Concerning the second research question, bank-specific factors, particularly profitability and loan growth, also play significant roles in influencing NPLs to non-financial institutions. Profitability, measured by Return on Average Assets (ROAA), exhibits a negative relationship with NPLs, indicating that more profitable banks are more effective at managing credit risk, hence maintaining lower NPL levels. Conversely, loan growth exhibits a positive relationship with NPLs in the short term, suggesting that rapid credit expansion may compromise loan quality as banks engage in riskier lending to achieve growth objectives. It is important to note, however, that capital adequacy and loan-to-deposit (LTD) ratio were not statistically significant in influencing NPLs to non-financial institutions.

Regarding the third research question, macroeconomic indicators again prove to be significant in explaining NPLs to households. Like the case with non-financial institutions, unemployment has a positive relationship with household NPLs, reinforcing the notion that rising unemployment reduces household incomes and increases loan default risks. Interestingly, same as in the case of NPLs to non-financial institutions, the short-term negative relationship between GDP growth and household NPLs transitions to a positive one in the long term, suggesting that while initial economic improvements help households to fulfil their financial obligations, prolonged growth may result in over-leveraging, hence increasing defaults. Similar to findings regarding NPLs to non-financial institutions, inflation did not have a statistically significant effect on NPLs to households.

The fourth research question highlights the influence of bank-specific factors on household NPLs, with capital adequacy playing an important role. This determinant exhibits a positive relationship with household NPLs, indicating that banks with larger capital buffers may engage in riskier lending practices, relying on their reserves to to absorb potential losses. However, other bank-specific factors did not have a statistically significant relationship with NPLs to households, underscoring the limited influence of internal banking metrics compared to macroeconomic conditions when it comes to household credit risk.

In terms of the hypotheses, the first hypothesis—that GDP growth would exhibit a negative relationship with NPLs—is only partially supported. While GDP growth does show a short-term negative effect on NPLs, its long-term influence is positive, indicating a dynamic relationship that shifts over time. The second hypothesis, which posited a positive relationship between unemployment and NPLs, is partially confirmed, as unemployment had statistically significant positive relationship with NPL levels in both non-financial institutions and households when considering long-term coefficients. However, in the immediate short term, unemployment has a negative relationship with NPLs to non-financial institutions, likely due to short-term policy measures like repayment deferrals. When considering the lagged effect of rising unemployment significantly increases NPL levels. The third hypothesis, which posited a negative relationship between bank profitability (ROAA) and

non-performing loans (NPLs), is validated in Model 1, as higher profitability has a statistically significant negative relationship with NPLs to non-financial institutions considering both the short-term and long-term coefficients. However, in Model 2, ROAA did not have a statstically signifcant relationship with NPLs to households.

In light of the findings, several key conclusions can be derived regarding the N. Macedonian banking system. The results indicate that although macroeconomic stability—exemplified by GDP growth—provides temporary relief from rising NPLs, sustained economic expansion may inadvertently increase credit risk as banks potentially lower lending criteria to capitalise on growth opportunities. This highlights a potential systemic vulnerability in the N. Macedonian banking system, where periods of economic growth must be closely monitored to prevent the accumulation of risk in loan portfolios. Additionally, the significant impact of unemployment on NPLs underscores the banking system's sensitivity to labour market conditions, emphasising the importance of macroeconomic policies designed to stabilise employment levels.

On the institutional side, the negative relationship between bank profitability and NPLs indicates that financial institutions with strong profitability metrics tend to exercise better credit risk management. However, the significant relationship between capital adequacy and NPLs to households suggests that N. Macedonian banks with larger capital buffers may engage in riskier lending practices, utilising capital reserves as a safeguard. The finding stresses the need for regulatory bodies to ensure that high capital adequacy does not translate into complacency in risk management practices, promoting for a balanced approach to capital requirements and credit expansion objectives.

Additionally, the statistical insignificance of the COVID-19 dummy variable suggests that N. Macedonia’s banking sector was not as severely affected by global crises, implying a degree of resilience to external shocks, though the short-term coefficient for NPLs to non-financial institutions showed marginal significance with quite moderate impact.This pattern mirrors the 2008 financial crisis, reinforcing the idea that N. Macedonia’s banking system consistently demonstrates a certain level of insulation from global economic disruptions. Lastly, while macroeconomic variables similarly affect NPLs to households and non-financial institutions, bank-specific factors play a more prominent role in influencing NPLs to non-financial institutions, indicating that credit risk management strategies may need to differ between these two sectors.

For future research, it would be beneficial to explore sector-specific trends in NPLs and include individual bank-level data to gain a better understanding of how these factors influence NPLs among different banking institutions. Expanding the quantitative analysis to include other countries in the region could also yield valuable cross-country insights.

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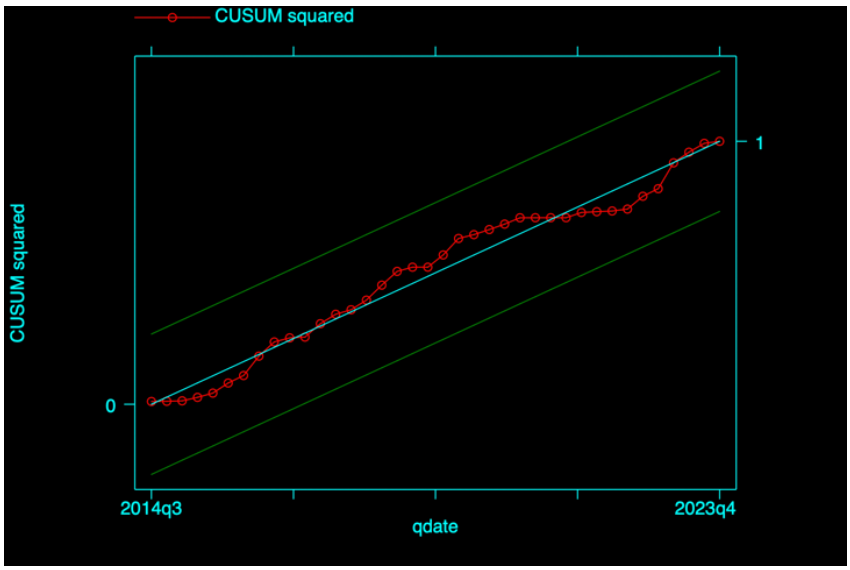
APPENDIX

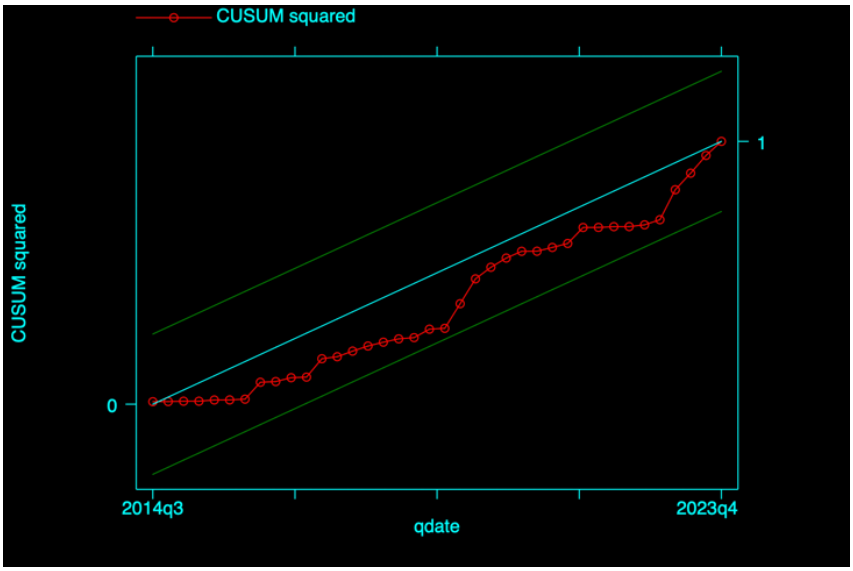
Appendix 1: CUSUM Test Results

Figure 7: CUSUM Test Results for Model 1



Source: own work

Figure 8: CUSUM Test Results for Model 2



Source: own work