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Article

Non-Performing Loans and Macroeconomics Factors: The Italian Case

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Abstract: The purpose of this work is to investigate the influence of macroeconomics determinants on non-performing loans (NPLs) in the Italian banking system over the period 2008Q3–2020Q4. We mainly contribute to the literature by being the first empirical article to study this relationship in the Italian context in the recent period, thus providing fresh evidence on the macroeconomic impact on NPLs, i.e., on the credit risk of Italian banks. By employing the Autoregressive Distributed Lag (ARDL) cointegration model, we are able to investigate the short and long-run effects of macroeconomic factors on NPLs. The empirical findings show that gross domestic product and public debt have a negative impact on NPLs. On the other hand, we find that the unemployment rate and domestic credit positively influence impaired loans. Finally, we find evidence of the “gamble for resurrection” approach, i.e., Italian banks tend to support “zombie firms”.

Keywords: NPLs; Italian banking system; macroeconomics factors; zombie firms



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1. Introduction

In a perfect world, every debtor would pay their debt. The banks would then lend more and more money to businesses and households, which would always repay the debt, and so on. Unfortunately, this perfect circuit exists only in a hypothetical world, not in reality. If your consumption is my income, your debt is my credit, from which it follows that if I am in trouble, you will be in a bad situation. This represents the classic example of the connection between finance and the real economy. If we think about the recent financial crises, we can understand what these entail in terms of consequences. When the debtor fails to pay, the bank will have sick credits, or impaired credits, in its belly. Non-performing loans (NPLs), in turn, are the most significant determinants of credit risk: higher credit risk, higher probability of default.

NPLs are the legacy of the great crises that hit the capital market in 2008 and 2012 and were quickly transmitted to the real economy. In Europe, NPLs peaked in 2015, surpassing €1 trillion in gross lending, twice as much as in 2009. During 2015, Italy had the highest number of NPLs in Europe, namely a 16.70% ratio (Bolognesi et al. 2020; Cincinelli and Piatti 2017). Considering that the Italian banking system is bank-centric (Foglia and Angelini 2019), studying the dynamics of NPLs in this context is crucial, especially in light of the recent impact of the COVID-19 pandemic. As a matter of fact, the deterioration of banks’ credit quality is one of the leading causes of financial system fragility that generally leads to banking crises (Bijsterbosch and Falagiarda 2015; Konstantakis et al. 2016). Indeed, the level of NPLs affects the banking efficiency, which in turn affects the financial stability, and the real economy (Khan et al. 2020). Moreover, high non-performing loans reduce banks’ profits. The lower profitability stems from the fact that high NPLs require higher provisions, leading to lower interest income and higher expenses associated with monitoring them. This translates into a contraction in the credit supply to businesses and households, i.e., in the real economy.

Therefore, the work aims to verify the existence of a possible relationship between the increase in impaired loans and their dependence on the economy. We attempt to test

the hypothesis that the macroeconomic environment (GDP, unemployment, public debt, domestic credit) has a significant impact on the NPLs in the Italian context. In particular, we want to identify which are the key macro-variables that influence the NPLs behavior. Indeed, it is urgent to understand and identify the external factors influencing NPLs in order to provide appropriate preventive measures to policymakers. For this purpose, we use an Autoregressive Distributed Lag (ARDL) cointegration model, using quarterly data for the period 2008Q3–2020Q4, which allows us to identify the macroeconomic determinants of non-performing loans in the short and long run. This information can help policy markers on the timing of intervention.

Our results confirm our hypotheses, i.e., macroeconomic factors play a crucial role in the dynamics of impaired loans in Italy. The findings can be summarized as follows. First, the empirical evidence shows a negative relationship between GDP and an increase in NPLs and between public debt and NPLs. On the other hand, we find that the unemployment and credit to the private sector are positively correlated with the NPLs ratio growth. Second, the short-run coefficients have lower values than in the long-run, suggesting that in the short-run the impact of a change in a macroeconomic determinant is less than in the long run. Third, we find that the coefficient of the error correction term (ETC_{t-1}) is small, suggesting that the adjustment to the long-run equilibrium is slow. This means that the imbalance caused in the previous period (quarter in our case) converges to long-run equilibrium in the current quarter only partially (11%).

The research contributes to the literature in three respects. First, to our knowledge, it is the first work that studies the impact of the macroeconomic environment in Italy during the recent period. Several papers have analyzed this relationship in the U.S. (Ghosh 2015), European (Makri et al. 2014; Rinaldi and Sanchis-Arellano 2006), Greek (Anastasiou et al. 2019; Konstantakis et al. 2016; Louzis et al. 2012), France and Germany (Chaibi and Ftiti 2015), India (Gaur and Mohapatra 2020; Mishra et al. 2021), and other world regions (Beck et al. 2015; Espinoza and Prasad 2010; Hada et al. 2020; Kjosovski et al. 2019; Nkusu 2011; Tanasković and Jandrić 2015; Zheng et al. 2020; Žunić et al. 2021) contexts. However, only Bofondi and Ropele (2011) studied the relationship between macroeconomic variables and bad loans in the Italian context from 1990 to 2010. Therefore, our research provides fresh evidence on the macroeconomic impact on NPLs, i.e., on the credit risk of Italian banks. Second, using the ARDL methodology, we capture the short- and long-run relationship between impaired loans and the real economy. By analyzing changes in the Italian macroeconomic environment, we show evidence that the adjustment of the long-run equilibrium is slow, namely, a shock in the real economy has a significant impact on the dynamics of NPLs in the long run. Therefore, the slow adjustment to equilibrium allows policymakers to (quickly) intervene to constrain adverse effects on the real economy. Third, we find evidence of the “gamble for resurrection” approach (Angelini 2018). High levels of NPLs could create a “risk shifting” incentive for banks to invest in riskier projects. Our findings suggest that the Italian banking system tend to support “zombie firms”¹ (Acharya et al. 2020; Caballero et al. 2008; Gandrud and Hallerberg 2017; Laeven and Valencia 2018). Hence, poor credit allocation management could generate negative consequences for the economic system, especially in the current context of the pandemic COVID-19.

The paper is organized as follows. Section 2 presents the literature review and our hypotheses, Section 3 describes the methodology employed, while Section 4 shows our data sample. Section 5, reports the empirical results and some discussion of the results, while Section 6 offers concluding remarks.

2. Literature Overview

In recent years, several studies have focused on the determinants of NPLs at the macroeconomic level. One of the first research is the work of Rinaldi and Sanchis-Arellano (2006), who analyze the impact of public debt, income, inflation, interest rate, and unemployment on Eurozone household financial condition. For this purpose, the authors use a Panel Cointegration model. Their results emphasize the role of income as a determinant

of households' financial stability. [Espinoza and Prasad \(2010\)](#) examine the relationship between NPLs and macroeconomics factor in Gulf Cooperative Council (GCC) banks over the period 1995–2008. By dynamic panel model, the authors find how GDP and financial market conditions strongly impact NPLs. Focusing on Advanced Economies context, [Nkusu \(2011\)](#) investigates the macro determinant of impaired loans using a Panel VAR framework. His findings document the close relationship between the macroeconomic environment (unemployment rate, GDP, inflation) and loan repayment problems. Also, in this case, GDP has the most significant (negative) impact on NPLs. [Bofondi and Ropele \(2011\)](#), by single-equation approach, study the macroeconomic factors of banks' loan quality in Italy (1990Q1–2010Q2). The research focuses on both household and corporate NPLs. They find that GDP growth reduces impaired loans, while the unemployment rate positively impacts NPLs. [Louzis et al. \(2012\)](#) use data from 2003Q1 to 2009Q3 and a panel data model to analyze the impact of macro and bank-specific variables on NPLs in the Greek banking sector. Their results show how the GDP growth rate, the lending rates, the unemployment rate, and public debt have a significant impact on NPLs, as well as the quality of management. Investigating the Countries of the CEE region, [Škarica \(2014\)](#) and [Tanasković and Jandrić \(2015\)](#) find that economic slowdown (a decrease of GDP and an increase in unemployment) is the main determinant of bank's quality. In particular, [Tanasković and Jandrić \(2015\)](#) (pp. 59–60) find that the “countries with a high level of euroization will have more problems with the level of NPLs, which is even more pronounced in periods of domestic currency depreciation”. [Makri et al. \(2014\)](#) use a dynamic panel framework covering the period 2000–2008 to investigate the determinants of NPLs of 17 countries of the Eurozone. The authors document how the capital ratio, ROE public debt, GDP, and unemployment, influence the dynamic of NPLs. The same results are reached by [Chaibi and Ftiti \(2015\)](#) that explore specifically two country of the Eurozone area, namely France and Germany. Moving toward the US banking system, [Ghosh \(2015\)](#) analyzes the bank-specific and macro determinants for 50 commercial banks and savings institutions over the period 1984–2013. The paper shows how liquidity risk and profitability have a significant impact on credit quality. Focusing on the macroeconomics environment, the author finds that the unemployment rates and the public debt positively affect NPLs growth. In another study, [Beck et al. \(2015\)](#) investigate the macroeconomics determinant of NPLs across the global sample (75 countries) over the period 2000–2010. Their findings suggest how “a drop in global economic activity remains the most important risk for bank asset quality”. Further, the result reports that a decrease in bank stock prices negatively affects bank asset quality. Regarding the Greek banking system, [Konstantakis et al. \(2016\)](#), by vector error correction model (VECM), figure out the key role played by public debt on NPLs pattern. This suggests how the Greek fiscal problems during the sovereign debt crisis are associated with the NPLs boost. [Anastasiou et al. \(2016\)](#) conduct an investigation on the Euro area banking system for the period 1990Q1–2015Q2. By GMM estimations, the authors find that ROA and ROE negative affect the NPLs, as well as the GDP growth and public debt. Moreover, they evidence a significant positive coefficient for the unemployment rate. Similar results are highlighted by [Anastasiou et al. \(2019\)](#) and [Bussoli et al. \(2020\)](#). In particular, [Anastasiou et al. \(2019\)](#), using a fully modified ordinary least squares (FMOLS) model and a Bayesian panel-cointegration vector autoregression framework, evidence the importance of banking market fragmentation within Eurozone countries. In fact, the analysis highlights the negative effect of austerity policies on periphery countries, namely a positive effect on NPLs. [Kjosevski et al. \(2019\)](#) utilize a multivariate Autoregressive Distributed Lag (ARDL) model to study the bank-specifics and macro determinants to enterprises and households in the Republic of Macedonia. Their results support the notion that macroeconomic factors such as GDP growth and unemployment rate impact the level of NPLs. In addition, bank-specific variables such as profitability, business, and household loan growth have a negative effect, while bank solvency positively affects the NPLs. Focusing on the banking system of Bangladesh, [Zheng et al. \(2020\)](#) document the strong relationship between macroeconomic environment and credit risk. By an ARDL and

VECM cointegration model, the authors find a negative impact of GDP and unemployment rate on NPLs dynamics. At the same time, they document a positive effect of the domestic credit and exchange rates on NPLs. [Hada et al. \(2020\)](#) investigate, by a linear regression approach, the macroeconomic determinants for the NPLs of Romanian banks over the period 2009–2019. Their findings show that unemployment and the exchange rate are the main determinants of NPLs. [Gaur and Mohapatra \(2020\)](#) and [Mishra et al. \(2021\)](#) study the nexus between NPLs and macroeconomic variables in the Indian banking system. Both papers document policymakers' importance of monitoring macroeconomic conditions to ensure a more robust Indian financial system. Moreover, [Kjosevski and Petkovski \(2021\)](#) examine the bank-specific and macro determinants on NPLs for the Baltics States. By a Panel framework, their empirical work documents that the GDP, unemployment, public debt, and inflation significantly impact NPLs. Focusing on bank-specific variables, they find that the total asset, ROE, ROA, and loans growth are crucial determinants of credit risk. More recently, the work of [Ari et al. \(2021\)](#), by machine learning approach and a new global database, aims to understand the “risk factors” underlying credit quality. Their fresh results highlight how high credit growth, high public debt, low bank profitability, and high corporate debt are the main factors in the dynamics of NPLs.

Theoretical Hypothesis

The literature review found that macroeconomic variables play a crucial role in the evolution of NPLs. In this section, we present the four following hypotheses that we want to test.

Hypothesis 1. *There is a negative relationship between GDP and NPLs. Indeed, a GDP increase indicates higher income stream for households and higher profitability for businesses. Therefore, improved financial conditions for businesses and households imply a reduction in NPLs as they are able to repay their debts ([Anastasiou et al. 2016](#); [Bofondi and Ropele 2011](#); [Espinoza and Prasad 2010](#)).*

Hypothesis 2. *There is a positive correlation between public debt and NPLs. The reason goes back to the close connection between banking and sovereign crises, namely the diabolical loop ([Reinhart and Rogoff 2011](#); [Shambaugh et al. 2012](#)). For example, in conditions of low liquidity, banks may be forced to cut back on lending and thus refinancing credit to their customers ([Ghosh 2015](#)). This suggests that an increase in government debt could spill over into banks' asset quality.*

Hypothesis 3. *The unemployment has a positive impact on NPLs. The general idea is that an increase of unemployment rate curtail the purchasing power of households, i.e., they are unable to meet their debt obligations ([Anastasiou et al. 2016](#); [Bofondi and Ropele 2011](#); [Kjosevski et al. 2019](#); [Rinaldi and Sanchis-Arellano 2006](#)).*

Hypothesis 4. *The link between domestic credit could be either negative or positive contingent on the economic cycle and banks' preferences. For example, in an economic growth phase, banks might lend more money as consumers have sufficient income streams to repay their debts. In contrast during economic downturns ([Ari et al. 2021](#); [Konstantakis et al. 2016](#)). The relationship also depends on the bank's predisposition to risk. For instance, a more risk-averse bank might only lend to “more financially sound” customers. This would imply less risk of NPLs ([Anastasiou et al. 2019](#)).*

3. Research Methodology

In order to investigate the relationship between NPLs and macroeconomics determinants, we use the ARDL cointegration model proposed by [Pesaran et al. \(2001\)](#)². This framework has two main advantages. First, the ARDL model can be applied regardless of the cointegration order of the variables, i.e., $I(1)$, $I(0)$, or a mixture of both. Second, it can

be performed to a small sample size (Bahmani and Kutan 2010; Mah 2000) such as in our case. The ARDL model is given by:

$$\Delta y_t = \beta_0 + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \sum_{j=0}^p \beta_j \Delta x_{t-j} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \varepsilon_t \quad (1)$$

where y is the dependent variable (NPLs in our case), x are the macroeconomics factors (Gross Domestic Products, Public Debt, Unemployment rate, and Domestic Credit), Δ stands for the first difference operator while ε_t is the error term. The β coefficients are the short-term representation of the model, while λ parameters capture the long-term relationship. To test the presence of long-run relationship, Pesaran et al. (2001) develop two tests of asymptotic critical values for the F -test. The first one assumes that all variables are $I(0)$ while the second that they are $I(1)$. Accordingly to Pesaran et al. (2001), the null hypothesis of no cointegration is defined as follows: $H_0 = \lambda_1 = \lambda_2 = 0$ against $H_1 = \lambda_1 \neq \lambda_2 \neq 0$. Therefore, if the F -statistic turns out to be greater than its upper bound, the null hypothesis of no cointegration between the variables can be rejected, so long-run cointegration exists. Conversely, if the F -statistic is less than its lower limit, the null hypothesis cannot be rejected, i.e., no cointegration among variables.

4. Data

The data sample covers the period from the third quarter of 2008 to the fourth quarter of 2020 (50 obs.)³. Table 1 reports the source and the unit measure of variables. Figure 1 shows the behavior of NPLs ratio throughout the analysis. As we can see, the dynamic follows a “bell-shaped” pattern. A substantial increase from 2008 to 2014 is matched by a decrease since 2017.

The NPLs substantially increased after the sovereign debt crisis, recording its highest point. As the literature has shown (Anastasiou et al. 2019; Bussoli et al. 2020; Foglia and Angelini 2021; La Torre et al. 2019), the sovereign debt crisis has had repercussions on the balance sheets of banks as a result of impaired loans. In fact, the drastic reduction in the profitability of companies has split over to the liquidity of households, which have had great difficulty in repaying their loans. In addition, rising unemployment has played a key role in the transmission of financial risks. The close relationship between corporate profitability, households, and unemployment has triggered the emergence of deteriorating credit problems in the Eurozone and especially in Italy.

From 2014 onward, we can observe a gradual reduction in the relationship. This reduction can be attributed to better general economic conditions, but also to structural changes in the Italian banking system, such as reform of the cooperative credit banks by Decree-law No. 18 of 14 February 2016, the Guarantee on Securitization of Non-Performing Loans (GACS) package, as well as the Atlante fund.

Table 1. Data detail.

| Variable | Abbr. | Unit | Source | Expected Sign |
|-------------------------|-------|-------------------------|-----------|---------------|
| Non-performing loans | NPLs | per cent of total loans | CEIC Data | |
| Gross Domestic Products | GDP | log-level | OECD | – |
| Gross Public Debt | PD | log-level | Eurostat | + |
| Unemployment rate | UR | per cent | OECD | + |
| Domestic Credit | DC | log-level | ECB | + / – |

In Table 2, we display the summary statistics of our data. The skewness coefficients are negative, implying a thicker lower tail. The kurtosis coefficient is greater than 3 for the GDP, indicating that this variable is more peaked than in the case of a normal distribution. This is confirmed by the Jarque-Bera test, which rejects the null hypothesis of the normal distribution at the 1% significance level for the GDP. The Variable Inflation Factors (VIF) test indicates the absence of multicollinearity problem, i.e., all values are less than 10. Finally,

in order to evaluate the characteristics of these variables, we perform the Augmented Dickey-Fuller (ADF) unit-root test. The reported numbers are the t-statistics, while the appropriate lag length for the ADF test is selected using Schwarz Bayesian criterion. As the ADF test indicates, only the GDP is stationary at level ($I(0)$), while the NPLs, PD, UR, and DC become stationary after their first differentiation ($I(1)$). Hence, our sample is fully compliant with the ARDL model; then, we can perform the ARDL model without further transformation.

Table 2. Summary statistics. Notes: **, and *** indicate 5%, and 1% significance level.

| | NPL | GDP | PD | UR | DC |
|----------------------------------|--------------|--------------|--------------|--------------|--------------|
| Mean | 11.48 | 12.88 | 14.55 | 10.22 | 14.43 |
| Median | 11.12 | 12.89 | 14.58 | 10.55 | 14.44 |
| Maximum | 17.14 | 12.94 | 14.76 | 12.71 | 14.49 |
| Minimum | 4.97 | 12.71 | 14.31 | 6.71 | 14.35 |
| Std. Dev. | 4.02 | 0.03 | 0.11 | 1.73 | 0.04 |
| Skewness | −0.02 | −2.81 | −0.25 | −0.33 | −0.19 |
| Kurtosis | 1.55 | 15.92 | 2.12 | 1.88 | 1.59 |
| Jarque-Bera | 4.33 | 413.93 *** | 2.13 | 3.53 | 4.41 |
| VIF | | 1.14 | 2.13 | 2.55 | 1.91 |
| ADF _{level} | 0.66[0] | −3.91[0] ** | −1.39[5] | −0.68[0] | −2.48[0] |
| ADF _{first-differences} | −6.15[0] *** | −9.81[1] *** | −9.66[3] *** | −6.68[0] *** | −6.78[0] *** |

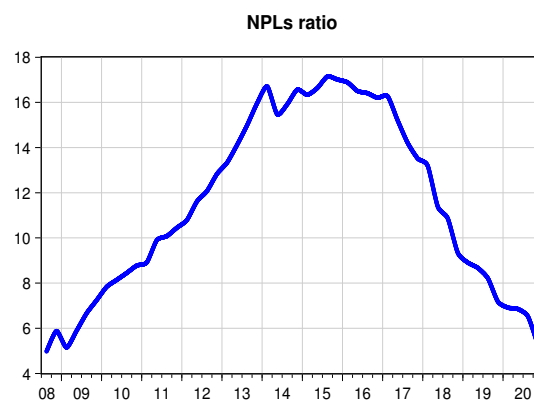


Figure 1. Non-performing ratio. The data sample spans from 2008Q3 to 2020Q4. Source: CEIC Data.

5. Empirical Findings

In Table 3, we report the F -values for testing the existence of the long-run cointegration⁴. The F -statistics must be compared with the critical bounds developed by Pesaran et al. (2001). To choose the optimal lag, we applied the Schwartz-Bayesian criterion (SBC), imposing a maximum of four lags. The table shows that the F -statistic (12.03) is higher than the critical upper bound value at the 1% significant level, therefore we can reject the null hypothesis, i.e., existing long-term cointegration.

Table 3. Cointegration test.

| | 10% | | 5% | | 2.50% | | 1% | |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| F-Statistics | Lower Limit | Upper Limit | Lower Limit | Upper Limit | Lower Limit | Upper Limit | Lower Limit | Upper Limit |
| 12.03 | 2.45 | 3.52 | 2.86 | 4.01 | 3.25 | 4.49 | 3.74 | 5.06 |

After checking for the existence of cointegration between NPLs and the macroeconomic factors, we obtain the estimates of the long-run coefficients. Table 4, reports the ARDL model estimates, along with the diagnostic tests. As we can observe from Table 4, all

variables are statistically significant, and the coefficients have the signs in agreement with our assumptions, except for the public debt.

Table 4. Long-run coefficients. LM(n) = Lagrange multiplier test for the n th order autocorrelation; RESET = Ramsey's test for functional misspecification; HET = Breusch-Pagan-Godfrey' test for heteroskedasticity.

| Variables | Coefficient | Std. Error | t-Statistic | p-Value |
|------------------------|--------------|--------------|-------------|--------------|
| GDP | −0.456 | 0.249 | −1.831 | 0.073 |
| PD | −0.388 | 0.152 | −2.551 | 0.014 |
| UR | 0.024 | 0.004 | 5.615 | 0.000 |
| DR | 0.491 | 0.181 | 2.696 | 0.010 |
| c | 4.336 | 4.361 | 0.994 | 0.325 |
| Diagnostic test | LM[1] | LM[2] | HET | RESET |
| F-statistic | 1.881 | 1.215 | 0.563 | 1.944 |
| p-value | 0.177 | 0.306 | 0.727 | 0.171 |

Gross domestic product (GDP), has a significant negative relationship with NPLs. GDP growth of 1% leads to a decrease in non-performing loans (credit risk) of 0.45%. In fact, an increase in economic conditions increases the ability of the borrower to repay the debt due to the increase in income. Our results are perfectly in line with the studies by Bofondi and Ropele (2011), Anastasiou et al. (2016) and Anastasiou et al. (2019), suggesting the procyclicality of credit risk (Kjosevski et al. 2019).

Public debt (PD), contrary to our assumptions, has a negative impact on NPLs. This controversial result can be explained by the fact that the analysis was conducted during the period from 2008 to 2020, i.e., during the recent financial crises that hit the Italian financial system. A series of reforms were made to combat the problem of impaired loans, for example, the reform of the cooperative credit banks by Decree-law No. 18 of 14 February 2016, the Guarantee on Securitization of NonPerforming Loans (GACS) package, the Atlante fund and the Italian Recovery Fund. While on the one hand, they are not state aid (Please see Galand et al. (2017)) (as they are prohibited in a Eurozone monetary union), on the other hand, sovereign debt has increased due to the various bank bailouts (such as the Montepaschi bank case⁵). Moreover, the shock caused by COVID-19 is expected to generate a sharp increase in new NPL flows in the coming years. However, this has not yet happened, thanks to the government measures that have essentially “frozen” the portfolios through the so-called *moratoria*. Therefore, the Italian government's intervention has a strong impact on NPLs. Our findings suggest that a 1% increase of PD implies a reduction of 0.38% of non-performing loans. This result is in disagreement with the main literature results (Ghosh 2015; Makri et al. 2014; Reinhart and Rogoff 2011), but in accordance with the work of Anastasiou et al. (2016), who find a negative impact of public debt on Euro area impaired loans (NPLs).

Focusing on the unemployment rate (UR), we find that the coefficient is positive and statistically significant at 1%. These findings evidence the important role played by the labor market on NPLs. In fact, an increase in unemployment implies a decrease in effective demand, i.e., a significant drop in output. This in turn will result in a decline in wealth for households and firms, hence lower-income, namely lower ability to repay debts. All of this translates into an increase in non-performing loans for the financial sector. These findings are fully consistent with the literature (Anastasiou et al. 2019; Bofondi and Ropele 2011; Kjosevski et al. 2019; Konstantakis et al. 2016; Louzis et al. 2012; Makri et al. 2014).

Finally, we can note the positive impact of domestic credit on NPLs. This positive relationship may reflect a credit boom with lower credit quality. In fact, excessive loan growth is often coupled with lower lending standards and collateral requirements (Kirti 2018; Schularick and Taylor 2012). Aikman et al. (2015) suggest how credit booms can sow the seeds of the subsequent credit crises. The results are in line with the work Konstantakis et al. (2016), Zheng et al. (2020), and Ari et al. (2021) which find a positive

impact of the bank credit ratio on NPLs. According to the estimation results, an increase of 1% in domestic credit generates a rise of 0.49% in the long-run rate of NPLs. This finding highlights the presence of the risk-taking effect of the Italian banking system.

We perform several diagnostic tests to assess the adequacy of the model. The Lagrange multiplier (LM) test for two different lags is not significant. This implies that the disturbances are serially unrelated. In addition, the Breusch-Pagan-Godfrey test indicates the absence of heteroskedasticity. Moreover, the model is correctly specified as suggested by the insignificant RESET test.

Once the long-run relationship is estimated, we report the estimates of the short-term dynamic model in Table 5. As we can note, the results obtained are relatively similar to those observed with the long-run dynamics. In fact, also, in this case, all variables are statistically significant, and the signs are the same. In the short-run estimate, the coefficients take on lower values, suggesting that in the short-run the impact of a change in a macroeconomic determinant is less than in the long run. For example, a 1% increase in GDP will cause a 0.05% reduction in NPLs, compared to the long-run reduction (0.45%). Regarding the error correction term (ETC_{t-1}) is negative and statistically significant at the 1% level, i.e., the model is statistically stable. Moreover, a significant ETC_{t-1} implies causality from GDP, PD, UR, and DC to NPLs. This result suggests that the adjustment to the long-run equilibrium is slow. In fact, the imbalance caused in the previous period (quarter in our case), converges to long-run equilibrium in the current quarter only partially (11%). The slow adjustment to equilibrium allows policymakers to (quickly) intervene to constrain adverse effects on the real economy. The magnitude of the ETC_{t-1} coefficient is in agreement with the work of [Rinaldi and Sanchis-Arellano \(2006\)](#). The authors, by a Cointegration Panel analysis for seven Eurozone countries from 1989 to 2004, find a error correction term of 9% value.

To assess the stability of the short/long-run relationship between NPLs and macroeconomics factors, we compute the CUSUM and CUSUM-squared analysis ([Brown et al. 1975](#)). The tests are based on residual of the ARDL estimations. The CUSUM test is based on the cumulative sum of recursive residuals. Specifically, the test is based on the first set of n observations, and it is recursively updated and plotted against the breakpoints. The interpretation is straightforward. If the graph of the CUSUM statistic remains within the 5% significance level, then the estimates are stable. The CUSUM-squared test, on the other hand, relies on squared recursive residuals. Figure 2, shows the CUSUM and CUSUM-squared statistics, respectively. As we can observe, the blue line (the value of the tests) remains within the critical limits (red dashed line). The result suggests that there are no evidence of statistically significant breaks (structural instability), namely, our model is stable.

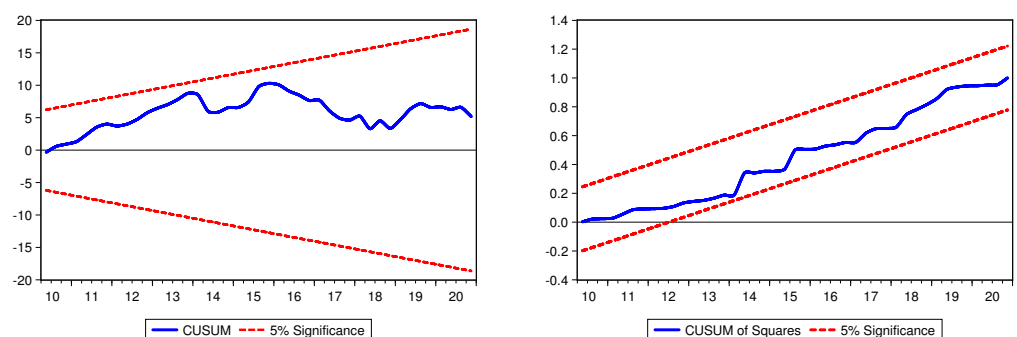


Figure 2. Stability test. CUSUM plot on left-side; Squares CUSUM plot on the right-side. The red dot-lines represent critical bounds at the 5% significance level.

Table 5. Short-run coefficients.

| Variables | Coefficient | Std. Error | t-Statistic | p-Value |
|--------------|-------------|------------|-------------|---------|
| Δ GDP | −0.051 | 0.015 | −3.361 | 0.001 |
| Δ PD | −0.043 | 0.006 | −6.759 | 0.000 |
| Δ UR | 0.003 | 0.001 | 3.299 | 0.002 |
| Δ DC | 0.054 | 0.016 | 3.201 | 0.025 |
| ECT_{t-1} | −0.111 | 0.038 | −2.859 | 0.006 |

Discussion of the Results

Since the financial crisis of 2007, non-performing loans have become an increasingly popular term. In fact, as a result of recent financial crises (the US and Eurozone Sovereign debt crises), the quality of banks' loan portfolios in all countries of the world has substantially changed (worsened). The reduction of output, high unemployment, lower liquidity of households and enterprises, lower consumption, and lower-income has given rise to so-called impaired debts (NPLs).

After the US financial and Eurozone sovereign debt crises, NPLs are in the spotlight of regulators and banks, as high levels of impaired loans are symptoms of banking crises (Bijsterbosch and Falagiarda 2015; Foglia et al. 2021). In fact, the share of NPLs is considered an indicator of credit risk, and the macroeconomic conditions play a key role in their dynamic. Indeed, as the literature has well shown (Anastasiou et al. 2016; Ghosh 2015; Konstantakis et al. 2016; Louzis et al. 2012; Makri et al. 2014; Rinaldi and Sanchis-Arellano 2006), there is a vicious circle between the real economy and NPLs. On the one hand (from the real economy to NPLs), the lower output will cause a reduction in income, therefore a reduction in the ability to repay debt. On the other hand (from NPLs to the real economy), the pattern of NPLs will influence the credit supply channel. For example, the increase in uncertainty about the bank's capital (access to finance) will increase the risk premium required, and this raises interest rates. This will can result in a credit crunch (Anastasiou et al. 2019; Ari et al. 2021). Therefore, the positive correlation between the level of impaired loans and the supply of credit will cause by a deterioration in economic conditions that acted simultaneously on three finance actors: banks, households, and firms.

Our results are in perfect agreement with such relational dynamics between economic conditions and NPLs. The ARDL model found that macroeconomic factors play a crucial role in the dynamics of impaired loans in Italy, broadly agreeing with the relevant literature. In particular, our research suggests (both in the short and long-run) a negative relationship between GDP and an increase in NPLs and between public debt and NPLs. Unemployment and credit to the private sector are positively correlated with an increase in the NPL ratio. We find evidence of the “gamble for resurrection” approach (Angelini 2018). High levels of NPLs could create a “risk shifting” incentive for banks to invest in riskier projects. Banks will tend to support so-called “zombie firms” (Acharya et al. 2020; Caballero et al. 2008; Gandrud and Hallerberg 2017; Laeven and Valencia 2018), namely, banks will not be able to lend to healthy businesses (households). As a result, poor credit allocation management will generate negative consequences for economic growth.

In the Italian context, we can see that non-performing loans have substantially decreased during the last years. This reduction derives from improved general economic conditions and the effects of government measures to support businesses and households (*moratoria*, debt guarantees, subsidies, contributions, and salary increases)⁶. In the current pandemic context, the impact of the crisis triggered by the spread of COVID-19 on future credit quality is difficult to assess. However, a desirable recommendation would be to promote the proactive management of NPLs. Accordingly to Haynes et al. (2021), to avoid zombie loans, policymakers should ensure that banks assess the current values of loans as correctly as possible. This control can be achieved with effective asset quality reviews (AQRs), stress tests, and the new IFRS-9 standard. Our results suggest that macroprudential policies can play a significant role in preventing NPL problems (Ari et al. 2021).

For example, a monetary policies to curb high credit growth and limit risk-taking by banks would be desirable.

The empirical analysis conducted allows regulators to determine how the macroeconomic environment impacts the dynamics of impaired loans. Our paper provides evidence of the interconnections between NPLs, and the real economy. Hence, a better understanding of individual factors can prevent an increase in credit risk, and thus reduce negative feedback between the Italian banking sector and the real economy.

6. Conclusions

In this work, we investigated the relationship between NPLs and the macroeconomic environment in the Italian context in the period 2008–2020. For this purpose, we performed an ARDL cointegration model analysis that shows how the GDP, the public debt, unemployment, and domestic credit, has a short and long-run impact on NPLs. Specifically, we find that GDP and Public Debt have a strong (negative) impact on the level of NPLs. Further, the empirical model suggests that the unemployment rate and the credit to the private sector positively impact NPLs. The positive effect of domestic credit testifies how Italian banks support so-called zombie companies.

The main limitation of this study relates to data availability, both from a temporal (historical data) and sectoral perspective. Therefore, there are several ways in which the present study could be extended. For instance, one could investigate the relationship further using new econometric techniques at different time frequencies (e.g., the MIDAS model). This would allow financial market variables (e.g., stock price, VaR, VIX, term-spread) to be included in the analysis at the daily level. For example, by applying a quantile ARDL model (Guo et al. 2021), we can explore the quantile-specific short- and long-term impacts of macro variables on NPLs. In addition, it would be interesting to study the dynamics of NPLs by separating the different sectors of the financial system (banks, insurance companies, shadow-banking).

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Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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Appendix A

Appendix A.1. Regression Results with Breaks

In this section, we perform the ARDL cointegration model with structural breaks. For this purpose, we use the Bai and Perron (2003) test. Table A1 reports the results, indicating three specific breaks. Therefore, we include them in our estimation, building a dummy series variable. A dummy variable (*dummy*) is introduced in our framework to represent the breakpoint in series, where takes the value 1 at breaks (otherwise zero).

In Tables A2 and A3, we shows the ARDL estimation with breaks. As we can note, the findings are qualitative, the same as the ARDL model without breaks. The estimated explanatory variables remain consistent with previous findings, which confirms the robustness of the main results (Tables 4 and 5). Also, as we can observe, the results of the long-run and short-run estimates indicate that the coefficient of the *dummy* variable is not significant. This result indicates that none of the breaks are strong enough to impact the dynamics of NPLs in both the short and long run. This result is further confirmed by the CUSUM test (Figure 2).

Table A1. Bai-Perron Multiple Breakpoint Tests. * Significant at the 5% level. ** Bai-Perron critical values.

| Break Test | F-Statistic | Scaled F-Statistic | Critical Value ** |
|---------------------|-------------|--------------------|-------------------|
| 0 vs. 1 * | 25.47 | 25.47 | 8.58 |
| 1 vs. 2 * | 92.68 | 92.68 | 10.13 |
| 2 vs. 3 * | 30.14 | 30.14 | 11.14 |
| 3 vs. 4 | 3.68 | 3.68 | 11.83 |
| Break dates: | | | |
| | Sequential | Repartition | |
| 1 | 2011Q4 | 2011Q2 | |
| 2 | 2018Q2 | 2013Q3 | |
| 3 | 2013Q3 | 2018Q2 | |

Table A2. Long-run coefficients with break.

| Variables | Coefficient | Std. Error | t-Statistic | p-Value |
|-----------|-------------|------------|-------------|---------|
| GDP | −0.443 | 0.238 | −1.861 | 0.072 |
| PD | −0.376 | 0.162 | −2.317 | 0.025 |
| UR | 0.023 | 0.005 | 4.328 | 0.000 |
| DR | 0.493 | 0.239 | 2.058 | 0.045 |
| dummy | −0.028 | 0.026 | −1.106 | 0.274 |
| c | 3.698 | 5.258 | 0.703 | 0.485 |

Table A3. Short-run coefficients with break.

| Variables | Coefficient | Std. Error | t-Statistic | p-Value |
|----------------|-------------|------------|-------------|---------|
| Δ GDP | −0.048 | 0.022 | −2.147 | 0.037 |
| Δ PD | −0.043 | 0.008 | −4.988 | 0.000 |
| Δ UR | 0.002 | 0.001 | 2.446 | 0.018 |
| Δ DR | 0.056 | 0.022 | 2.468 | 0.017 |
| Δ dummy | −0.003 | 0.002 | −1.187 | 0.241 |
| ECT_{t-1} | −0.114 | 0.044 | −2.576 | 0.013 |

Appendix A.2. The Johansen Test

Table A4. The Johansen results. Trace test indicates 3 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level.

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistics | 0.05 Critical Value |
|---------------------------|------------|------------------|---------------------|
| $r = 0$ | 0.588 | 90.85 * | 60.06 |
| $r \leq 1$ | 0.379 | 48.27 * | 40.17 |
| $r \leq 2$ | 0.291 | 25.39 * | 24.27 |
| $r \leq 3$ | 0.169 | 8.93 | 12.32 |
| $r \leq 4$ | 0.000 | 0.01 | 4.12 |

Notes

- There is no definition of a zombie firm, however it is recognized that these “firms are economically unviable and manage to survive by tapping into banks and capital markets” (Favara et al. 2021).
- To ensure the reliability of the empirical findings, we estimated the ARDL model with structural breaks in the Appendix A. As we can see, the results are perfectly in line with the base model, i.e., the econometric model is stable.
- The choice of the period analyzed is conditioned by the data available. NPLs at an aggregate Italian level are not always available continuously, hence we intended to use data from the CEIC. In this database, the 2008Q3 is the first available data.
- Moreover, to test the long-run cointegration, we also estimate the Johansen Tests (Table A4 in Appendix A.2). The test suggests the existence of three cointegration relationships between NPLs, and the four macroeconomics factors. This implies that exists a long-run equilibrium relationship among the variables.

- 5 During the 2009–2010 years, the bank obtained a first recapitalization by the government in the form of 1.9 billion euros in bonds purchased by the government, namely the “Tremonti bonds” (Gandrud and Hallerberg 2017).
- 6 Speech by the Governor of the Bank of Italy Ignazio Visco at Italian Banking Association, Executive Committee Meeting Rome, 16 September 2020 (https://www.bancaditalia.it/pubblicazioni/interventi-governatore/integov2020/en-Visco-ABI-16092020.pdf?language_id=1, accessed on 1 December 2021).

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