

**Can speed kill?**  
**The cyclical effect of rapid credit growth:**  
**evidence from bank lending behaviour in Italy**

**Abstract**

This study analyses bank lending behaviour before and during the most recent financial crisis. Banks are more willing to loan during economic expansion, but this behaviour can lead to a lower portfolio asset quality. The analysis underlines how banks that grew faster (in term of loans) before the start of the financial crisis showed a higher level of non-performing loans during the crisis. Secondly, the study underlines how banks that grew faster during the pre-crisis period slowed down during the crisis period. A third aim of the study is to highlight whether the growth of non-performing loans during the financial crisis negatively impacts the bank's lending behaviour after 2007 and if the impact is strong for banks that grew more quickly during the pre-crisis period.

The analysis is based on a sample of Italian banks, an example of a country undergoing a credit crunch without a lending bubble burst.

The sample consists of 454 listed and unlisted Italian banks observed during 2005 to 2013.

The study's primary results show that most banks that grew faster during the normal period have more NPL in their balance sheet during the financial crisis, even if these banks represent a small portion of the total assets of all of the samples considered. Consequently, banks that grew faster during the normal period and exhibit a high level of non-performing loans tend to reduce their lending activity during the financial crisis.

**JEL classification:** G20, G21

**Keywords:** non-performing loans, banks, bank lending behaviour, credit risk, loans growth

## 1. Introduction

This paper investigates the intertemporal relationship between bank lending behaviour and credit risk. This study analyses whether banks that grow rapidly are subsequently more exposed to an increase in non-performing loans during a financial crisis and whether the increase of non-performing loans in the banks' portfolio causes banks to reduce their lending activity during a crisis period.

The current financial crisis, which started at the end of 2007, is an example of what can go wrong if the banking system does not respect the interplay of growth and risk. In this crisis, the growth in subprime mortgage lending, fuelled by low interest rates, booming housing markets and credit securitization led to unprecedented credit losses and serious consequences for the global economy. All this highlights the importance of the growth-risk nexus in bank lending (Dell'Ariscia et al., 2008; Demyanyk and van Hemert, 2008; Gorton, 2009). Before the crisis, banks were more willing to offer credit. Since the crisis, in what is known as the credit crunch, banks have reduced credit to retail clients as well as to firms.

Usually the literature highlights how a lending boom (linked with a real estate boom) leads to a crisis when the bubble bursts, and after this burst banks reduce credit and their credit portfolio deteriorates (Borio et al., 2002; Borio, 2012). However, can these consequential events also be highlighted in countries where a real bubble did not exist?

The Italian banking system is chosen in this study because Italy can be observed as an example of a country where the banks' lending activity was good before 2007, even if a real estate bubble did not really exist during those years. The beginning of the financial crisis lead banks to reduce their lending activity, at first to firms and later to families (Panetta, 2013). Can growth of lending activity during good times lead to a bad credit portfolio during a financial crisis? And can a bad credit portfolio later impact future bank lending behaviour?

This study focuses on two different periods: the first period from 2005 to 2007 (the pre-crisis period or normal period) and the second period from 2008 to 2013 (the financial crisis)<sup>1</sup>. The first part of the study aims to highlight the differences between banks with fast growth, in terms of the number of loans during the normal period, and banks with slower growth during the same time horizon. Secondly, the study attempts to determine whether banks that grew faster show a high NPL in their credit portfolio during the financial crisis and whether these banks also experienced a decrease in lending activity during the second period. Therefore, the second aim of the study is to understand if

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<sup>1</sup>The choice of periods is determined by the fact that in Italy the financial crisis started after that in the USA, thus we consider the time the crisis began to be in 2008.

the NPL can be observed as a determinant of the decrease in bank lending activity during the financial crisis.

The paper contributes to the literature in various ways. First, most of the literature only covers a relatively small sample of listed banks, whereas here, the sample is larger and includes listed and unlisted banks. Second, the study analyses the cyclical effect of credit growth: banks increase their bank lending behaviour during good times, and this leads to an increase of bad loans and a high credit risk in their portfolio; finally, the increase of bad loans forces banks to reduce their lending activity. These cyclical effects are not knowingly studied together, but usually the literature analyses the single steps of the cycle. The study focuses only on the Italian banking system because it can be viewed as an example of a banking system with a credit crunch, even if the financial crisis is imported from other countries and the reduction in lending activity is not linked to a bubble burst (as in other countries, such as Spain).

The paper is organized as follows. Section 2 provides a literature review and presents the hypothesis. Section 3 describes the sample and the methodology used in the empirical analyses, the results of which are reported in Section 4. Section 5 describes the robustness check. The last section presents the conclusions.

## **2. Literature Review and Hypotheses**

This paper is based upon two main strands of literature.

The former relates to the macroeconomic analyses of bank lending behaviour. The latter relates to the relationship between credit risk and credit growth.

Bank lending behaviour is investigated both in connection to economic cycles and as a determinant of financial crises. There is substantial empirical literature showing the growth of loans tends to be positive during an expansion period and negative during a contraction, with loan losses usually increasing during the second period. Asea and Blomberg (1998) emphasize that banks change their lending standards, from tightness to laxity, systematically over the cycle. Lax lending standards occur during expansion periods and have an impact on the aggregate economic activity. Keeton (1999) emphasizes the close relationship between the business cycle and loan growth. In particular, loan growth tends to be high during business expansion, whereas loan losses tend to be high during business contraction. Furthermore, faster loan growth results in higher loan losses. This is because during a good business cycle, banks are more likely to grant loans to clients with weaker credit histories even when collaterals are low. More recent literature (Peek and Rosengren, 2005; Lown and Morgan, 2006; Micco and Panizza, 2006; Gambacorta and Mistrulli, 2004; Bikker and Metzmakers, 2005; Gambacorta, 2005; Di Giulio, 2009; Di Colli and Girardi, 2011; Olokoyo,

2011; Swamy and Sreejesh, 2012; Djiogap and Ngomsi, 2012; Ladime et al., 2013; Ladime et al., 2013) has concentrated on the relationship between credit growth and the economic cycle, emphasizing a real misvaluation of credit risk over the business cycle by banks. In phases of economic boom, banks are more willing to take on greater risk. In contrast, during cyclical downturns, banks are excessively pessimistic and tend to overstate credit risk.

Excessive credit growth, therefore, tends to lead to asset price bubbles. Borio and Lowe (2002) and Borio (2012) show that excessive credit growth represents the primary leading indicator of a financial crisis in a twelve-month horizon in cases where it appears that the flow of loans would remain high for the remainder of the year on the basis of forward-looking indicators. Additionally, IMF (2004) estimates that approximately 75 per cent of credit booms end in a banking crisis. During the expansion period, firms and families are more likely to contract debts because they are optimistic; but a decline in income or asset prices then leads to an increase in non-performing loans and defaults.

Kaminsky et al. (1998) analyse the “twin crisis” and effectively show that a currency crisis is preceded by a banking crisis and this banking crisis is usually preceded by abnormal credit growth. They state that the supervision of some lending indicators may anticipate a currency crisis because the empirical evidence shows that when a lending indicator exceeds a certain threshold value this is interpreted as a warning “signal” that a currency crisis may take place within the following 24 months. Kaminsky and Reinhart (1999) show the anatomy of these events “suggests that crisis occur as the economy enters a recession, following a prolonged boom in economic activity that was fuelled by credit, capital inflows, and accompanied by an overvalued currency”.

With regards to the relationship between non-performing loans and bank lending behaviour, there are many contributions if we consider the literature from Japan (Ueda, 1993; Yoshikawa et al., 1994; Honda et al., 1995; Sasaki, 2000). These studies focus on the crisis referred to as the Hesei recession period (Sasaki, 2014). The primary results show a reduction of lending when the risk-based capital ratio (impact of Basel I) declined and the NPL ratio increased. In particular, the level of non-performing loans is considered to be one of the most important variables that influenced the bank lending behaviour during the recession period.

In a recent study on Japanese banks, Sasaki (2014) shows how banks’ lending behaviour decreases when non-performing loans increase. The results highlight “these effects on lending behaviour across nearly all Japanese industries, except the construction and real estate sectors. This finding may be because banks continued to roll over loans to insolvent borrowers to avoid more bankruptcies, they wished to delay the bailout of the NPL hidden parts”.

With regards to the literature outside of Japan, there are additional contributions to the issue (Borio et al., 2002; Hou and Dickinson, 2007; Di Colli et al., 2001; Foos, 2010; Tracey, 2011; Djiogap and Ngomsi, 2012; Alhassan et al., 2013; Tomak, 2013; Panetta, 2013).

Borio et al. (2002), in a study based on a sample of Spanish banks, highlight that during a recession, problem loans increase as a result of firms' and households' financial distress. When the economy is growing, firms request more loans and can repay them more easily, but when the economy stalls, firms show greater distress and difficulty in repaying debts. Borio et al. (2002) show that in Spain bank lending is strongly pro-cyclical and that in periods of expansion banks are more likely to lend credit to firms with low credit quality. This leads to future problems and default, typically during downturns, with an estimated time lag of approximately three years. Hou and Dickinson (2007) focus their analysis on Asian, US and European commercial banks, wherein they attempt to understand how non-performing loans impact bank-lending behaviour. The main result shows that one implication from the credit crunch view is that increased non-performing loans can cause a decline in commercial bank credits, as banks with a high level of non-performing loans in their portfolio may become increasingly reluctant to take on new risks and commit new loans.

Radelet and Sachs (1998) and Rajan and Dhal (2003) highlight how the fast growth of loans during a period of economic growth exposes the banking system to a higher risk. In particular, Rajan and Dhal (2003), in a study on East Asian banks, showed how banks, before the Asian crisis, were more willing to loan, but this behaviour led to an increase in the NPL during the financial crisis.

Another important contribution on the Italian credit growth is the paper published by the Bank of Italy in 2013. In this study, Panetta (2013) finds that the main obstacle to the growth of loans is the deterioration of the credit risk caused by the prolonged recession. In the first quarter of 2013, the annual rate of input non-performing loans rose to 2.8% of the total credit and to 4.5% for business loans. Panetta shows a positive relationship between non-performing loans and credit reduction by banks or bank lending behaviour. He emphasizes that uncertain economic prospects, high default risk and the difficulty of assessing the soundness of each debtor generate adverse selection and aversion to rising risk among banks, which thus adopt policies on lending restrictions.

Foos et al. (2010), in a study on banks of 16 major countries during 1997–2007, studied if loan growth affects the riskiness of individual banks. Loan growth was shown to effectively lead to an increase in loan loss provisions during the subsequent three years.

Di Battista and Nieri (2012) analysed a group of Italian banks before and during the crisis, wherein the banks are shown to exhibit more heterogeneous credit behaviour before the financial crisis. The results underline also that the more dynamic banks observed during the crisis period show similar

characteristics than the dynamic banks observed during the pre-crisis period. The characteristics are: relatively small in size, a higher core tier 1, similar loans to the total asset ratio and similar interest on loans to the total loans ratio. In addition, dynamic banks during the crisis period show a better asset quality, measured by the NPL to the total loans ratio.

Additionally, Tomak (2013) studied the determinants of bank lending behaviour on a sample of Turkish banks, and found a significant relationship between the NPL and bank lending behaviour in State owned banks, and the NPL showed a negative impact on the growth of total loans.

Finally, relevant literature has focused on the determinants of non-performing loans, which could be divided into two main groups: bank specific and macro specific variables (Keeton and Morris, 1987; Sinkey and Greenwalt, 1991; Gambera, 2000; Hoggarth et al. 2005; Bofondi and Ropele, 2011; Louzis et al., 2011; Vogiazas and Nikolaidou, 2011; Farhan et al. 2012; Klein, 2013; Messai and Jouini, 2013). The main results show a strong sensitivity of the NPL to the macroeconomic factor, in particular to the GDP annual growth rate, inflation growth rate and unemployment growth rate. The banks' specific variables such as performance, size and efficiency process provide additional explanatory power.

Therefore, Di Colli et al. (2011) demonstrate how banks' loans exhibit a pro-cyclical trend: lending and credit quality show an inverse relation with the economic cycle phases. Outstanding loans grew rapidly in good times and tended to stabilize or even shrink in downturns. Non-performing loans, observed as one of the measures of credit quality, are relatively stable during periods of strong economic growth and grow exponentially in a downturn. Finally, an increase in the banks' non-performing loans pushes banks to reduce their lending activity. This evidence could be the basis of a theory based on the strong relationship between the cyclical bank lending behaviour and the trend of bank credit risk.

Before a financial crisis, banks have a higher risk appetite and are willing to lend at greater risk. At the beginning of a financial crisis, the NPL begins to grow rapidly, which results in banks reducing their risk taking and their lending behaviour.

Based on the existing literature, we introduce the following hypotheses concerning the relationship between credit risk (NPL) and credit growth.

*H<sub>1</sub>: The increase in NPLs during the financial crisis is higher for banks that grew faster during 2005–2007.*

*H<sub>2</sub>: Banks that grew faster before the financial crisis and had subsequently higher NPLs reduce their credit growth more than banks that grew slower during the same period*

### **3. Sample and Methodology**

#### 3.1 Sample

Our sample consists of 454 banks, whereas the initial sample was based on 566 Italian banks<sup>2</sup>. Banks are both listed and unlisted, and the period analysed is 2005–2013.

The time horizon is divided in two sub-periods: the first period (2005–2007), which is a normal period, and a second period (2008–2013) in which the financial crisis occurs. Banks are considered if present in the sample for at least 4 out of 6 years in the second period (2008–2013) and at least 2 of the 3 years observed in the first period (2005–2007). The sample is composed of commercial banks (50), cooperative banks (360) and other banks (44), demonstrating how the Italian banking sector is dominated by cooperative banks in term of numbers, but not in term of total assets, in which commercial banks represent the majority of the sample<sup>3</sup>.

#### 3.2 Methodology

To answer the research questions (hypothesis 1 and 2), we need to detect which banks grew faster during the normal time (2005–2007) and which grew slower in the same time horizon.

The bank lending behaviour in the normal time is divided in three parts corresponding to the first through the third quartile of the loan growth distribution during 2005–2007. Fast growing banks are those pertaining to the third quartile, whereas slow growing banks are those pertaining to the first quartile.

Subsequently, the paper analyses the level of credit risk (measured by the non-performing loans' growth) during the financial crisis period (2008–2013) and finally the change in the bank lending behaviour during the trouble period (2008–2013).

The Chi-test is the first methodology used to test the existence of a dependence or an independence among the variables analysed.

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<sup>2</sup>The analysis considers commercial banks, savings banks, cooperative banks, mortgage and real estate banks and investment banks.

<sup>3</sup>In terms of numbers, of the 454 banks there are 360 cooperative banks, 50 commercial banks and 44 other banks. In terms of size (total assets), commercial banks represent 64% of the total assets of the sample, cooperative banks represent only 25% and the other banks represent 11%. In terms of Italian banking system (in total assets), the sample represents 78% of the total assets, commercial banks represent 50%, cooperative banks represent 20% and other banks only 8%.

In addition, the study analyses the main characteristics of the banks in the sample (total assets, total deposits, return on equity and tier 1 ratio), with a distinction made between faster/slower banks and a higher/lower NPL level.

For these banks, the paper proposes to demonstrate the relationship between the banks' lending behaviour and credit risk, in particular how an increase of non-performing loans (due to rapid loan growth during a normal period) can have an impact on the bank lending behaviour during the financial crisis. The methodology used is a fixed effect regression on unbalanced panel data. The regression is run for each growth group of banks: one for the total sample (which includes faster, moderate and slower banks), one for faster banks and one for slower banks. With this method it is possible to separately observe the impact of the NPL on the bank lending behaviour of each group of banks and it is possible to understand the sign of impact.

In the regression the dependent variable is the bank lending behaviour measured by the growth of gross loans ( $BB_{i,t}$ ), and the independent variable is the non-performing loans on gross loans at time t-1 ( $NPL_{i,t-1}$ ).

The other variables can be devised in two groups: the banks' specific variables and macroeconomic variables. In the first group the equity-to-total assets ratio at time t-1 ( $E_{A_{i,t-1}}$ ) represents the key measure of bank solvency (Foos et al., 2010); the loans on deposit at time t-1 ( $LTD_{i,t-1}$ ) is a measure of the bank liquidity, which if the ratio is too high means banks might not have enough liquidity to cover any unforeseen fund requirements, and if the ratio is too low, banks may not be earning as much as they could be; and the growth of total customer deposits at time t-1 ( $DEP_{i,t-1}$ ) is a measure of a bank's funding (Hou and Dickinson, 2007; Tracy, 2011).

The macroeconomic variables include the unemployment growth rate at time t ( $UNEMP_t$ ) and the inflation growth rate at time t ( $INF_t$ ), which is in line with the literature (Gambacorta and Mistrulli, 2004; Djiogap and Ngomsi, 2012; Klein, 2013).

The level of the banks' specific variables is measured at t-1 to mitigate a possible endogeneity bias (Gambacorta and Marque-Ibanes, 2011).

$$BB_{i,t} = \alpha + \beta_1 NPL_{i,t-1} + \beta_2 LTD_{t-1} + \beta_3 DEP_{t-1} + \beta_4 E_{A_{i,t-1}} + \beta_5 UNEMP_t + \beta_6 INF_t + \varepsilon_{it}$$

Table 1 reports all variables used in the regression. It shows how each variable was obtained (means), the source and the expected sign.

**Table 1. Variables**

Variable	Means	Source	Sign
BB <sub>i,t</sub>	Growth of gross loans rate (GL <sub>t</sub> -GL <sub>t-1</sub> )/GL <sub>t-1</sub>	Bankscope	Dep.
NPL <sub>i,t-1</sub>	Non-performing loans on gross loans at time t-1. NPL <sub>t-1</sub> /GL <sub>t-1</sub>	Bankscope	-
INF <sub>t</sub>	Inflation growth rate at time t	International Monetary Fund	+
UNEMP <sub>t</sub>	Unemployment rate at time t	International Monetary Fund	-
LTD <sub>t-1</sub>	Loans on total customer deposit at time t-1 (loan to deposit ratio)	Bankscope	-
DEP <sub>i,t-1</sub>	Growth of customer deposit at time t-1	Bankscope	+
E_TA <sub>i,t-1</sub>	Equity on total assets at time t-1 (measure of bank solvency)	Bankscope	+

**Descriptive Statistics**

The descriptive statistics of the variables are provided in Table 2, which shows the average, median, minimum value, maximum value, standard deviation, asymmetry and kurtosis of the variables described in Table 1.

**Table 2. Descriptive Statistics**

Variable	Mean	Median	Min	Max	Std.dev	Coeff.	Asymmetry	Kurtosis
BB	5.688	3.930	-79.400	437.490	16.106	2.831	13.445	309.185
NPL <sub>t-1</sub>	8.513	7.400	0.001	40.668	5.150	0.604	1.337	2.960
LTD <sub>t-1</sub>	148.524	149.320	4.840	704.970	56.364	0.379	1.750	13.131
DEP <sub>t-1</sub>	7.424	3.982	-79.508	3,529.640	70.940	9.554	45.828	2,262.350
E_TA <sub>t-1</sub>	10.944	10.230	1.240	47.280	3.926	0.358	1.235	4.708
UNEMP	9.051	8.416	6.775	12.210	1.831	0.202	0.585	-0.985
INF	2.232	2.270	0.764	3.500	1.050	0.470	-0.094	-1.671

Before performing the empirical analyses, the correlation between the independent and control variables was checked. This analysis appears to support the hypothesis that each independent variable has its own specific information value that is able to explain bank-lending behaviour (Table 3).

**Table 3. Correlation Table**

	BB	NPL	LTD	DEP	E_TA	UNEMP	INF
BB	1						
NPL	-0.1305	1					
LTD	-0.0745	-0.1023	1				
DEP	-0.0119	-0.0171	0.0049	1			
E_TA	0.0400	0.0459	-0.1967	-0.0169	1		
UNEMP	-0.1983	0.3642	0.0185	-0,0174	-0.1413	1	
INF	0.0469	-0.0469	0.0091	-0.0413	-0.0033	-0.2073	1

The significance of the coefficients was calculated at the level of 95%.

## 4. Results

### 4.1 The Chi-square analysis

Table 4 shows the relationship between the growth of gross loans during the normal period and the growth of non-performing loans on gross loans during the crisis period.

**Table 4. Bank lending behaviour and NPL trend**

Growth of Gross loans '05–'07	Growth of NPL '08–'13		
	Higher	Lower	Total
<b>Faster</b>	71	43	114
<i>% of the total</i>	62%	38%	100%
<b>Slower</b>	34	80	114
<i>% of the total</i>	30%	70%	100%
<b>Total</b>	227	227	454

Table 4 shows there were 114 faster banks during the normal period (the first quartile of the total sample), 71 of which presented a high level of NPL growth during the financial crisis period (62% of the total sample<sup>4</sup>). For banks with a slower growth rate of loans during 2005–2007, there were 34 banks that had a high level of NPL growth during the financial crisis (30% of the total) and 80 that exhibited a lower NPL growth rate than the median (70% of the total)<sup>5</sup>.

The growth of NPL is defined taking the median into consideration because the high and low level of the NPL increase was of interest, whereas the growth of loans during 2005–2007 is defined with

<sup>4</sup> The total sample also included moderate banks.

<sup>5</sup> With regards to loan growth during the normal period, of the 226 moderate banks, 122 showed a higher growth level of NPL and 104 showed a lower growth of NPL during 2008–2013.

regard to the first and third quartile because the different banks' behaviour (slower, moderate and faster growth) was of interest.

With regards to the impact of the NPL on the banks' loan portfolios, Table 4 shows how effective faster banks were during the first period in which they showed a higher level of NPL during the crisis period, whereas the majority of the slower banks showed a lower level of NPL in their loan portfolios.

To test this hypothesis, a Chi-square test is used for the analysis. Table 5 shows the results from the test.

**Table 5. Chi-square test (2)**

<b>Growth of Gross loans '05-'07</b>	<b>Growth of NPL '08-'13</b>	
	<b>Higher</b>	<b>Lower</b>
<b>Faster</b>	1.854345	-1.85435
<b>Slower</b>	-3.04642	3.046424
<b>Degrees of freedom</b>	2	
<b>Chi-square</b>	26.872	
<b>P-value</b>	1.4614E-06	

The Chi-square test demonstrates a dependence between the variables analysed at the 99% confidence level (p-value < 0,01).

In particular, Table 5 shows the banks that grew effectively faster during the pre-crisis period have a positive attraction with a high growth of NPL during the crisis period, whereas banks that grew slower during 2005–2007 show a strong positive attraction with a lower level of NPL growth rate during the crisis period.

The first hypothesis is accepted and the null hypothesis of the Chi-square test is rejected. Therefore, the variables are not independent: banks that grew rapidly during the pre-crisis period, in terms of gross loans, show a higher growth of non-performing loans than the banks that grew slower in the first period.

In light of these results, the second hypothesis is accepted: the banks that grew effectively faster during 2005–2007 show a higher NPL during the crisis period.

Table 6 shows the growth of banks' gross loans in the two period analysed (2005–2007; 2008–2013).

**Table 6. Bank lending behaviour pre- and post-crisis**

Growth of gross loans '05–'07	Growth of gross loans 2008–2013		
	Same cluster	Other cluster	Total banks
<b>Faster</b> <i>% of the total</i>	37 32%	77 67%	114 100%
<b>Slower</b> <i>% of the total</i>	39 34%	75 66%	114 100%
<b>Total banks</b>			<b>228</b>

Table 6 shows the trend in bank lending behaviour before and during the financial crisis. The study expects a consequent behaviour in the second period: the faster growth of banks in the first period slows down during the crisis period. With regards to the moderate and slower banks of the first period, an increase in bank lending activity is expected.

The majority of the banks exhibited a different behaviour, however. Banks that grew faster during the normal period tended to reduce the lending activity during the crisis period (67% became slower or moderate banks). The same thing happened to the slower banks; 66% of them became moderate or faster banks during 2008–2013. The bank behaviour is similar both for faster and slower banks, in terms of percentage.

To test this hypothesis, the Chi-test was run to show whether the variables are independent.

**Table 7. Chi-test (1)**

Growth of gross loans '05–'07	Growth of gross loans '08–'13	
	Same cluster	Other cluster
<b>Faster</b>	-1.64656	1.415913
<b>Slower</b>	-1.35927	1.168863
<b>Degrees of freedom</b>	2	
<b>Chi-square</b>	15.857	
<b>P-value</b>	0.00036	

The Chi-square test has a low p-value and the null hypothesis<sup>6</sup> can be rejected at the 99% confidence level; therefore, a dependence exists between the gross loans growth rate before the crisis and during the crisis. With regard to both the faster and slower banks during the pre-crisis period, these banks show a different level of gross loans growth during the financial crisis. In particular, the faster banks (2005–2007) show a positive attraction with other clusters (moderate and slower growth during 2008–2013) and the slower banks (2005–2007) show a positive attraction with other clusters (moderate and faster growth during the financial crisis).

<sup>6</sup> The Chi test's null hypothesis is that the variables analyzed are independent.

In light of these results, the first hypothesis is accepted. The banks grew effectively faster before the financial crisis reduced their credit growth more than the banks that grew slower during the same period (in particular, the majority of banks that grew slower during the pre-crisis period exhibited an increase in their lending behaviour in the second period).

Indeed, banks that grew effectively faster during the normal period are characterized by an increase in NPL and a decrease in lending activity during the crisis period. Could the decrease in lending activity during the second period depend on the increase in NPL?

What characterises the banks that are faster in the normal period and show a lower incidence of NPL in the crisis period? What characterises the banks that are slower in the normal period and show a higher level of NPL during the crisis period?

Table 8 shows the most important bank characteristics in relation to the growth of loans during the first period and the NPL level during the financial crisis.

**Table 8. Banks' characteristics**

Growth of GL '05-'07	Growth of NPL 2008–2013														
	Number of banks			Total assets in the euros			Total customer deposits in th euros			Tier 1 ratio %			ROE ratio %		
	H	L	T	H	L	T	H	L	T	H	L	T	H	L	T
<b>FASTER</b>	71	43	114	300,406,800	894,236,600	1,194,643,400	139,870,000	392,202,200	532,072,200	12.94	18.72	15,12	-3.09	2.86	-0.84
(%)	62%	38%	100%	25%	75%	100%	26%	74%	100%	-	-	-	-	-	-
Commercial banks	11	5	16	41,630,000	878,628,200	920,258,200	23,004,800	385,245,400	408,250,200	12.00	19.41	14,32	-4.38	3.27	-1.99
(%)	69%	31%	100%	5%	95%	100%	6%	94%	100%	-	-	-	-	-	-
Cooperative banks	51	37	88	175,692,000	14,378,600	190,070,600	76,138,800	6,226,200	82,365,000	12.69	18.84	15,28	-2.97	2.81	-0.53
(%)	58%	42%	100%	92%	8%	100%	92%	8%	100%	-	-	-	-	-	-
Other banks	9	1	10	83,084,800	1,229,800	84,314,600	40,726,400	730,600	41,457,000	15.44	10.58	14,95	-2.21	2.67	-1.72
(%)	90%	10%	100%	99%	1%	100%	98%	2%	100%	-	-	-	-	-	-
<b>SLOWER</b>	34	80	114	357,998,700	181,828,700	539,827,400	130,976,400	77,788,500	208,764,900	16.39	18.21	17,67	0.40	1.88	1.44
(%)	30%	70%	100%	66%	34%	100%	63%	37%	100%	-	-	-	-	-	-
Commercial banks	4	8	12	46,394,800	80,480,800	126,875,600	25,013,100	50,999,500	76,012,600	22.45	16.07	18,19	6.95	-0.11	2.24
(%)	33%	67%	100%	37%	63%	100%	33%	67%	100%	-	-	-	-	-	-
Cooperative banks	20	65	85	199,341,100	64,611,000	263,952,100	78,772,800	13,010,800	91,783,600	14.85	18.97	18,01	-1.71	2.26	1.32
(%)	24%	76%	100%	76%	24%	100%	86%	14%	100%	-	-	-	-	-	-
Other banks	10	7	17	112,262,800	36,736,900	148,999,700	27,190,500	13,778,200	40,968,700	17.05	13.52	15,60	2.00	0.61	1.43
(%)	59%	41%	100%	75%	25%	100%	66%	34%	100%	-	-	-	-	-	-
<b>TOTAL<sup>7</sup></b>	<b>227</b>	<b>227</b>	<b>454</b>	<b>1,913,110,500</b>	<b>1,238,895,300</b>	<b>3,152,005,800</b>	<b>741,335,200</b>	<b>527,734,100</b>	<b>1,269,069,300</b>	<b>14.34</b>	<b>18.24</b>	<b>16,28</b>	<b>-2.22</b>	<b>1.93</b>	<b>-0.14</b>

\*H is higher, L is lower and T is total.

<sup>7</sup> Total also includes the moderate banks of the sample. The total sample is composed of 454 banks.

The number of banks that grew faster during the pre-crisis period was 114: 16 commercial banks, 88 cooperative banks and 10 other banks; the number of banks that grew slower was 114: 12 commercial banks, 85 cooperative banks and 17 other banks; finally, the number of moderate banks was 226: 22 commercial banks, 187 cooperative banks and 17 other banks.

If we consider the banks with the fastest growth during 2005–2007, we can observe that the majority of these banks had a high level of non-performing loans (62% of the total), but these banks represent only 25% of the total assets of all faster banks, approximately the same as the total customer deposits (only 26% of the total). With reference to the commercial banks, in terms of the amount, the banks with fast growth had a high level of NPL, but if we consider size and funding activity, these banks represent only 5% and 6% of the total, respectively. The majority of the commercial banks (in terms of size and funding activity), even if they grew rapidly during the pre-crisis period, had a low level of non-performing loans during the financial crisis.

With regards to the faster cooperative banks, 58% of the total had a high level of NPL during the financial crisis, but in this case these banks represented approximately all (92%) of the total assets and 92% of the total customer deposits.

Conversely, banks with a slower credit growth during 2005–2007 generally had a lower NPL during the financial crisis period (both commercial (67%) and cooperative (76%) banks).

In particular, in the subsample of the slower banks, commercial banks with a lower NPL comprise 63% of the total assets and 67% of the total customer deposits, whereas slower cooperative banks with a low NPL during 2008–2013 represent only 24% of the total assets and 14% of the total customer deposits.

Banks with a lower tier 1 ratio are faster banks, whereas slower banks have the highest tier 1 ratio level (moderate banks have a ratio equal to 16.18). With regards to the return on equity ratio, the only group with a positive level of performance ratio consists of the slower banks (ROE equal to 1.44); the other groups have a negative ROE: faster banks (-0.84) and moderate banks (-0.59).

In particular, usually the tier 1 ratio is higher for banks with a lower level of NPL during 2008–2013. Slower commercial banks are an exception because slower banks with a high NPL show a better tier 1 ratio level than slower banks with a low level of credit risk.

We can observe the same situation if we consider the return on equity ratio. The performance ratio is better for banks with a lower level of credit risk, with the only exception being that represented by commercial slower banks. Commercial slower banks with a high level of NPL exhibit a better ROE than the commercial banks with a low level of NPL.

In conclusion, if we do not consider the number of banks but their size (in terms of total assets), the results show that the biggest commercial banks usually present a low level of NPL during the crisis period (independent of the growth of the loans during the first period). Conversely, the biggest cooperative banks (in terms of total assets) usually show a high level of NPL during the crisis period, for faster, moderate and slower banks.

Therefore, the banks that grew faster show a high level of NPL during the financial crisis, in terms of the number of banks but not in terms of size. Only cooperative banks show a real increase in the NPL after fast growth, not only in terms of the amount but also in terms of total assets. In agreement with Panetta (2013), cooperative banks expand their activity significantly during a pre-crisis period and their market share increases, but this strong risk appetite is translated into a deterioration of asset quality during a financial crisis.

#### 4.2 The regression analysis

The results of each banks' group are presented below.

The first table shows the overall results. A fixed effect regression is performed on the sample of 454 banks, which shows how the NPL over gross loans impact the bank lending behaviour.

Table 9 shows the results of the first regression.

**Table 9. TOTAL**  
**Fixed effect regression**  
**Dependent variable: growth of gross loans (BB)**

	<i>Coefficient</i>	<i>Std. error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	10.290	6.448	1.595	0.110	
NPL <sub>i, t-1</sub>	-0.225	0.100	-2.239	0.025	**
LTD <sub>i, t-1</sub>	-0.033	0.019	-1.751	0.079	*
DEP <sub>i, t-1</sub>	-9.531e-05	0.004	-0.020	0.983	
INF	0.331	0.268	1.233	0.217	
UNEMP	-1.242	0.206	-6.009	<0.001	***
E_TA <sub>i, t-1</sub>	1.143	0.332	3.436	0.001	***
R-squared LSDV	0.266	R-squared intra-group		0.0906	
LSDV F(455, 2110)	1.682	P-value(F)		2.57e-14	

One, two, or three asterisks represent the significance of the coefficients, i.e., the rejection of the null hypothesis of the coefficient, with a level of probability of 10%, 5%, and 1%, respectively.

Results show that the increase of NPL over gross loans at time t-1 has a significant negative impact on the growth of gross loans. This result is in line with the literature (Hou and Dickinson, 2007; Tracey, 2011; Alhassan et al., 2013; Tomak, 2013).

In line with previous literature (Asean and Blomberg, 1998;Lown and Morgan, 2006; Micco and Panizza, 2006; Gambacorta and Mistrulli, 2004; Bikker, 2004; Gambacorta, 2005; Swamy and Sreejesh, 2012; Ladime et al., 2013), the results underscore that the impact of the economic cycle on the bank lending behaviour is significant, particularly with regards to the unemployment rate, which shows a negative impact on the dependent variable. However, the inflation rate does not show a significant relationship with bank lending behaviour.

The equity on the total assets ratio highlights a significant relationship with the bank lending behaviour, whereas LTD highlights a negative impact on the bank lending behaviour, in line with the author’s expectation. In regards to the total deposits, the expectations were if banks have large deposit amounts, they are more willing to loan in the following period, which is in line with the literature (Tracy, 2011). For most of the commercial banks, deposits are the primary funding sources for the commercial banks’ assets, and in a normal situation, the growth of the gross loans rate is expected to move in the same direction as the banks’ deposits; but the growth rate of the deposits does not show a significant relationship with the growth rate of the gross loans. According to the non-performing loan hypothesis of Hou and Dickinson (2007), when banks are in poor condition and ridden by a high level of NPL, the willingness for the banks to expand loans is decreased, which implies that loan growth will not be consistent with the expansion of deposits.

The following tables show the results divided into two clusters: slower and faster. The classification refers to the growth of gross loans during the normal period (2005–2007). The sample is divided into three different sections according to quartiles, and the first and the third quartile are considered.

**Table 11. SLOWER**

**Fixed effect**  
**Dependent variable: growth of gross loans**

	<i>Coefficient</i>	<i>Std. error</i>	<i>t-ratio</i>	<i>p-value</i>
Const	5.618	16.617	0.338	0.73543
NPL <sub>i, t-1</sub>	0.024	0.313	0.078	0.93747
LTD <sub>i, t-1</sub>	-0.057	0,041	-1.398	0.16272
DEP <sub>i, t-1</sub>	0.001	0.003	0.577	0.56404
E_TA <sub>i, t-1</sub>	1.177	0.599	1.964	0.04996 **
UNEMP	-1.055	0.474	-2.222	0.02672 **
INF	0,924	0.814	1.135	0.25685
R-squared LSDV	0.206127	R-squared intra-group		0.029857
LSDV F(117, 515)	1.142891	P-value(F)		0.167395

One, two, or three asterisks represent the significance of the coefficients, i.e., the rejection of the null hypothesis of the coefficient, with a level of probability of 10%, 5%, and 1%, respectively.

In this case, the only variables that show a significant relationship with the dependent variable are the solvency measure and the unemployment rate. With regard to these variables, the sign confirms the total results. In particular, the economic cycle, represented by the unemployment rate, negatively impacts the bank lending behaviour, and the equity on the total assets ratio positively impacts the bank lending behaviour.

The level of NPL does not show a significant relationship with the dependent variable. This may be an effect of the results highlighted in the previous section where the majority of slower banks have a low level of NPL during the financial crisis (2008–2013)<sup>8</sup>.

**Table 12. FASTER**  
**Fixed effect**  
**Dependent variable: growth of gross loans**

	<i>Coefficient</i>	<i>Std. error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	34.412	7.926	4.341	0.00002	***
NPL <sub>i, t-1</sub>	-0.313	0.131	-2.384	0.01745	**
LTD <sub>i, t-1</sub>	-0.103	0.036	-2.882	0.00410	***
DEP <sub>i, t-1</sub>	-0.149	0.048	-3.103	0.00201	***
E_TA <sub>i, t-1</sub>	0.666	0.43	1.610	0.10785	
INF	0.049	0.426	0.117	0.90691	
UNEMP	-1.758	0.297	-5.904	<0.00001	***
R-squared LSDV	0.396581	R-squared intra-group		0.240709	
LSDV F(118, 526)	2.929660	P-value(F)		6.36e-17	

One, two, or three asterisks represent the significance of the coefficients, i.e., the rejection of the null hypothesis of the coefficient, with a level of probability of 10%, 5%, and 1%, respectively.

The final regression performed on the faster banks showed a rapid increase of gross loans during the normal period. The results demonstrate that the NPL negatively impacted the bank lending behaviour during the financial crisis. Additionally, the ratio of loans to customer deposits and the growth rate of deposits at time t-1 demonstrates a significant negative relationship with the lending behaviour of banks.

The results of the faster banks are in agreement with the total results.

With regards to the total deposit growth at time t-1, the relationship may be negative because even if banks have an increase in the level of deposits, this does not mean that banks increase their lending activity at time t, especially in a crisis period and at a time when the NPL is high.

In conclusion, in the first part of analysis, the study emphasises that banks grew rapidly in terms of the gross loans during the normal period, exhibiting both a decrease in bank lending behaviour and an increase in the NPL during 2008–2013. According to the regression, we can confirm that the

<sup>8</sup>Of a total of 114 banks, 87 banks had a level of NPL less than the median and 27 had a level greater than the median.

decrease in bank lending activity during the financial crisis for faster banks is a result of the increase in NPL.

That banks were more cautious in terms of lending behaviour before the crisis (slower banks) demonstrates a lending behaviour during the crisis independent from the NPL level. In addition, the first part of the analysis emphasises that the majority of slower banks are more willing to lend during the crisis period (to increase their lending activity).

In light of the results, the second hypothesis can be accepted entirely. Non-performing loans negatively impacted bank lending behaviour overall as banks grew faster during the normal period (2005–2007).

## **5. Robustness Check**

A number of checks were performed to assess the robustness of the analysis.

The growth of NPL is not the only variable used in Chi-test; other variables of credit risk are tested: the stock of NPL in 2013 and the compound annual growth rate of NPL during the second period (2008-2013). The results obtained are practically identical. In all cases banks that grew faster during pre-crisis period show a higher level of credit risk than banks that grew slower. The same is made on the growth of gross loans for the first and the second period.

Specifically, variations on the equation were estimated to assess the robustness of the results in terms of the relationships between bank lending behaviour, macroeconomic variables and bank specific variables.

Additional variables, comprised of the total capital ratio, tier 1 ratio, total assets, investment on gross domestic product, GDP rate, loan loss reserve and loan loss provisions were input into the regression. They show no significant relevance for the independent variable and no problem of collinearity.

In particular, the gross domestic product's annual growth rate exhibits a positive correlation with the growth of gross loans but also shows a negative relationship with the dependent variable in the regression. These results may be explained by the presence of a collinearity bias between the variables inserted in the regression. The decision to not include the GDP growth rate is to eliminate this bias.

The non-performing loans of the gross loans at time  $t-1$  is the independent variable and is the measure of a bank's portfolio quality. Other variables are used to measure the portfolio quality, such as the loan loss reserve at time  $t-1$  and loan loss provision at time  $t-1$ . The same results are obtained in the regressions.

The model chosen the first time was an OLS regression. The Hausman test is used and the results suggest using a fixed effect regression (with respect to the OLS and random effect).

To test the virtue of the fixed effect regression, two different tests are used: an F-statistic test to understand if all intercepts are the same and an F-statistic test to highlight an absence of a problem with the repressors. Both F-statistic tests result in a low p-value. Therefore, the null hypothesis can be rejected in both cases, the fixed effect regression is considered to be the best regression and the variables used are adequate to the analysis.

A Wald test is then used to test the presence of a homoscedasticity problem, which shows an absence of this problem with a 99% confidence interval.

To eliminate the endogeneity problem, balance-sheet variables at time t-1 are used.

## **6. Conclusions**

The study investigates the relationship between credit risk and credit growth.

Since the crisis of 2007, the lending behaviour of banks has changed significantly and the term “credit crunch” has become widespread. The existence of a credit crunch was investigated by examining the growth in the number of loans in recent years to identify the reason for the decrease in loans by banks to families and firms.

First, the study investigates how banks change their lending behaviour from the normal to crisis period. The results show that banks that effectively grew faster during the normal period tended to reduce their lending activity during the financial crisis.

Second, the analysis studies if the banks that grew faster in terms of the gross loans in the normal period show a high level of credit risk (measured by non-performing loans). Also, in this case, the results effectively show that these banks have a high level of credit risk in their portfolio.

Finally, the study attempts to understand if one reason for the decrease in the banks’ lending activity may be a result of the increase in non-performing loans, or if the two variables are independent. The results show that non-performing loans negatively impact the lending behaviour of banks. Overall, banks grew faster during the normal period, whereas banks that grew slower, in most cases, exhibited an increase in their bank lending activity during the financial crisis period, and non-performing loans did not have an impact on the banking behaviour.

In conclusion, in agreement with Panetta (2013), before the financial crisis banks had a higher risk appetite and were willing to lend at greater risk. As a result of the financial crisis the number of NPLs began to rapidly increase, which caused banks to reduce their risk-taking and lending behaviour. Only banks with a slower growth of gross loans during the pre-crisis period were not

affected by the amount of non-performing loans associated with their lending decisions during the financial crisis.

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