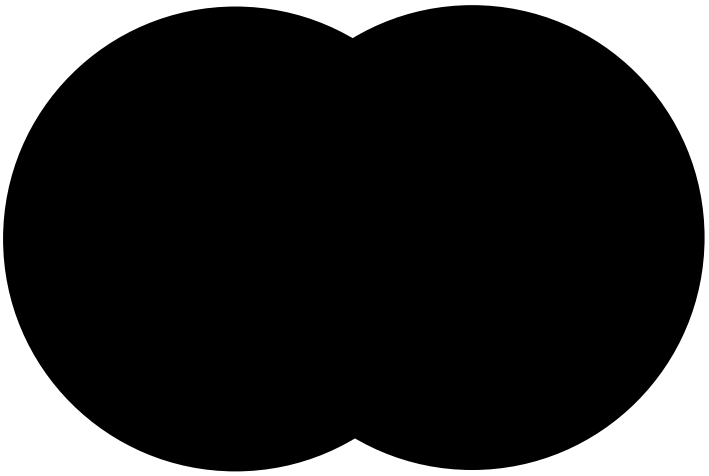
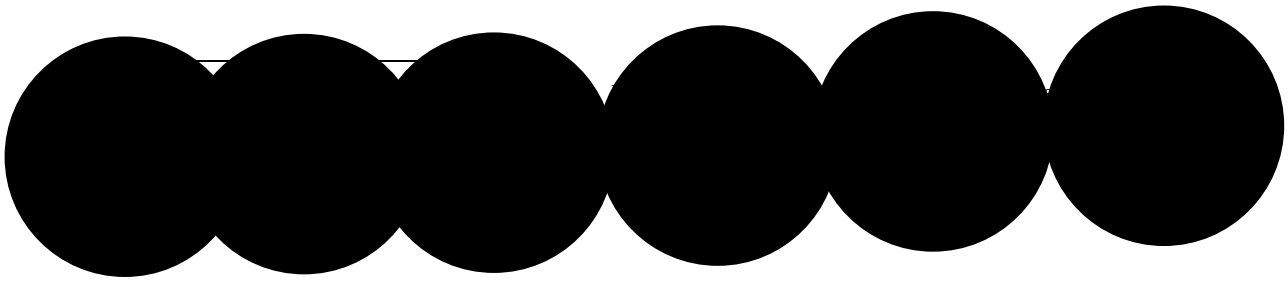
Banks provisioning behavior and Procyclicality: An empirical analysis of European banks



Abstract

The linkage between the business cycle and the financial system has been always the subject of much research. This article investigates the relationship between bank loans loss provisions (LLPs) and the procyclicality in the context of earning smoothing behaviour. This paper also examines the impact of macroeconomic and bank-specific variables in affecting the provisioning behaviour of European banks. By using a panel data analysis from the 2002-2013 periods, our empirical results are in line with the literature work and indicate that European banks follow a procyclical behaviour regarding provisioning. Thus, provisioning turns out to be substantially important when GDP growth is lower, supporting the idea that banks fund much during the downswings business cycle and less during upswings one. The paper also finds that earning management and capital management are an important determinant of LLP. As regards the macroeconomic factors, the Generalized Method of Moments (GMM) is designed to assess the importance of inflation rate and the interest rate spread in influencing the LLP.

Keywords: Loan loss provisioning; Procyclicality; Banking System
JEL Classification: G21, C23, E32



1. Introduction

The recent financial crisis has begun in 2007 and has reached a difficult-to-predict level of complexity. The crisis exhibited a key role in the failure of business and the decline in consumption and economic growth. Thus, it contributed to the 2008-2012 global recession and led to the European Sovereign-debt crisis. This current crisis has considerably influenced countries through structural changes in socio economic and political issues. However, the co-movements of international business cycles have approximately risen following the global financial crisis. In fact, this is due to the concomitant drop in the economic activity in many countries during the global financial crisis.

The relation between financial system and business cycle has been the subject of many investigations. Actually, there are different attitudes on banking operations about the economic role of financial intermediaries. Thus, many researchers have analyzed the situation of excessive cyclicality of banks lending which may intensify the cyclical behavior of the economic activity. In return, in order to improve both financial system and macroeconomic stability, these researches have suggested changes in risk measurement practices, prudential regulation, accounting standards and the control of monetary policy. On the other hand, in the recent debate on procyclicality, not much attention has been paid to the issue of the procyclicality of loan loss provisions. Among the available theoretical justifications, Bikker and Metzemakers (2005) tried to find the relation between provisioning system and the business cycle. In addition, Bouvatier and Lepetit (2008) by using a sample of European banks exhibited that banks adopt a procyclical behavior in the phase lasting from 1992 to 2004. Leaven and Majnoni (2003) showed that banks of OECD countries provide more provisions during the recession phase, which confirms with the economic procyclicality theory.

Motivated by the main debate on loan loss provisions on three important fields such as tool for earning smoothing, capital management and signaling operation whether they are positively or negatively associated to loan loss provisions (Kim and Kross, 1998; Ahmed, Takeda and Thomas, 1999; Laeven and Majnoni, 2003, Anandarajan, Hasan and Lozano Vivas, 2003, among others). We found different indicators affecting loan loss provisions decision. However, most of the researches have focused only either on bank-specific factors or macroeconomic factors and not both. The researches on LLPs are relatively limited and have showed mixed results on the practice of bank specific factors as well as macroeconomic factors.

The present study aims to contribute to the literature on loan loss provisions in several ways: First, our study is among the first research that examines the procyclicality of LLPs in the context of earning smoothing behaviour. To our knowledge, a few studies have examined the relationship between the loan loss provisions and the procyclicality within a context of earning smoothing behaviour. Second, there is a paucity of research that discussed the influence of macroeconomic indicators on loan loss provisions. Thus, this study contributes to the literature on analyzing the impact of macroeconomic and bank specific variables on provisioning system of the European banks. In the majority of empirical studies on loan loss provisions determinants, either macroeconomic or bank specific determinants are studied. By employing an econometric model on a panel of European banks observed over 2002 to 2013, our results indicate strong evidence that European banks follow a procyclical behaviour regarding provisioning. In other words, banks fund more in economic downswing and less during upswings phases. This finding is in line with previous researches such as Bikker and Matzemakers (2005) and Bouvatier and Lepetit (2012). Further, our results confirm the presence of earning smoothing context. Thus, the procyclicality of loan loss provisions is mitigated somewhat by the impact of the banks' earnings on provisions. Additionally, we found that earning management, capital management and signaling are an important determinant of LLP. This result is consistent with the studies of Greenwalt and Sinkey (1988) Collins, Shackelford, and Wahlen (1995), Anandarajan, Hasan, and McCarthy (2007), Kim and kross (1998), Beatty et al., (1995) among others. However, only loan growth variable has an impact on provisioning behaviour and allows to capture bank's default risk.

The remainder of this paper is as follows. Section 2 highlights the notion of procyclicality and the provisioning system. We provide a literature review, developing the macroeconomic and bank specific determinants of loan loss provisions. Section 3 consists on describing the data, the variables used in this research, the sample selection and the methodology we adopt in our analysis. In section 4 we present the model and we exhibit the descriptive statistics and correlations. In section 5 we discuss the empirical evidence and the results found. Section 6 concludes the paper.

2 Literature review and hypotheses development

2.1 Procyclicality and Provisioning behavior

The last 2007 global financial crisis has highlighted a number of ways that may amplify cyclical movements. Private sector behavior, prudential regulation, and macroeconomic policies tend to magnify the business cycle phases. Thus, procyclicality is the phenomenon of

amplifying feedbacks within the financial system and between the financial system and the macro-economy (i.e. monetary policy and fiscal policy). In finance and business cycle theory, we may talk about procyclicality if the measured quantity rises when the overall economic activity increases, and drops when the overall economic activity decreases. For instance, the gross domestic product (GDP), salary levels and crop prices are all procyclical because they rise during the economic expansion and drop during the economic recession. In contrast, counter cyclicality is defined as any economic quantity that moves in the opposite direction with the overall state of the economy. In such cases, the measured quantity increases when the overall economic quantity decreases and vice versa. In other words, the term "procyclicality" is often used for the bilaterally accruing (positive feedback) approaches that permit the financial system to develop business irregularities or aggravate financial instability. These feedback approaches are accurately disruptive and apparent all along the economic downturn or the financial system is braving brands. Moreover, procyclicality is characterized by the ownership of exacerbating the cyclical tendencies of the whole economic activity. Thus, the effort made by policy makers to flatten the peaks and troughs of business cycles through accounting standards, prudential legislation, risk measurement operations and leading to monetary policy is challenging enough without the cycles being exacerbated.

As far as the financial system is concerned, banks are said to exhibit procyclical behavior when they tend to amplify the momentum of underlying economic cycles. Likewise, banks exhibit a procyclical behavior when some of their indicators such as, credit risk, provisioning policy, lending, or credit rating indicators are positively correlated with the economy's short-term business cycles. Under the procyclicality hypothesis, the banking sector tends to amplify the impact of a business cycle by intensifying lending during economic booms and by imposing loan restrictions during economic recessions. On the other hand, the real cycle will be magnified by a procyclical banking sector. Policy design that decreases the banking sector's procyclicality will help mitigate the real cycle. In addition, capital or liquidity which presents the procyclicality of banking sector indicators is determined in terms of negative relationships. A rise in bank capital during bad times and a drop during good times are both viewed as procyclical.

On the other hand, provisioning is considered one of the fundamental instruments of analyzing the level of procyclicality in banks' behavior over the business cycle. Such instrument represents one of the best ways of analyzing the importance of procyclicality. Indeed, it is widely believed that analyzing the true extent of the procyclicality of banks'

provisioning system remains a crucial factor in determining any regime of this sort. We will study hereafter the procyclicality of provisioning behaviour in relation with the business cycle. Several researches have been studying the relationship between provisioning behaviour and procyclicality. A stream of literature documents that provisions lead to the procyclicality of the financial system by being higher during expansion periods when output and credit are increasing and lower during recession phases. Research showed that there is a strong correlation between bank lending and the business cycle. Indeed, several studies have confirmed this phenomenon. For instance, Gambacorta and Mistrulli (2004) and Gambacorta (2005), exhibited that bank lending of the Italian banking system moves cyclically which may affect the aggregate economic activity. The same results are achieved by Asea and Blomberg (1998) employing U.S. data from 1977 to 1993. Peek et al. (2003) and Lown and Morgan (2006) presented the impact of loan supply on fluctuations in credit and GDP which suggests the evidence of the bank lending behaviour. The discussion here leads to our first hypothesis:

H1: European banks pursue a procyclical provisioning behaviour.

2.2 Loan loss provisions and macroeconomic factors

It is obvious that there is a large gap in the literature, regarding the determinants of loan loss provisions in Europe, which our empirical study hopes to fill in. The literature generally distinguishes between particular kinds of determinant that can affect loan loss provisions: macroeconomic factors and bank-specific factors. Indeed, several researches have used the gross domestic product growth (GDPG) variable to underline the procyclicality of LLP (Beatty and Liao, 2011; Laeven and Majnoni, 2003). According to Beatty and Liao (2011), the procyclicality in bank lending can be clearly shown through the raising rates in the default loan if the LLP are not well managed in the good times. Similarly, Laeven and Majnoni (2003) by using a sample of banks in Unites States, Japan and Asia have demonstrated the same result. They found an undesirable negative relationship between loan loss provisions and GDPG, implying the less provision during the high GDP growth. Additionally, Fonseca and Gonzalez (2008) and Bikker and Metzemakers (2005) confirm the procyclicality of loan loss provisions. They also suggest that banks increase their income in the event of economic downturn. According to Davis and Zhu (2009), provisions rise in periods of falling GDP growth. Implying that during economic downturns, there is a deterioration of bank loan quality. Thus, when the loan to asset ratio is higher, banks tend to be involved in higher credit risk and hence their loan loss provisions are higher. However, Curcio and Hasan (2015) do

not find evidence of banks' procyclical behaviour. They provide an insignificant relation between LLP and GDPG for both the Euro Area banks and non-Euro Area intermediaries.

Other similar studies have investigated the influence of macroeconomic indicators on loan loss provisions. In the same vein, Greenwalt and Sinkey (1988) by examining a sample of US banks from 1984 to 1987 showed that both internal and external factors have a crucial impact on loan quality. Similarly, Castro (2013) and Festic et al. (2011) have examined the impact of the macroeconomic environment on loan problems and credit risk.

Another strand of literature has focused on the impact of bank specific and macroeconomic factors on the non-performing loan (NPL). For instance, Festić, Kavkler and Repina (2011) have analyzed the linkage between NPL, several banking and macroeconomic factors. According to Louzis et al. (2012), by employing dynamic panel data methods for the Greek banks, found that loan problems are determined primarily by macroeconomic indicators such as GDPG, unemployment rate, interest rate, etc. They also found some bank specific variables which are considered a determinant of NPL such as performance and efficiency. On the other hand, Ali and Daly (2010), by making a comparative analysis, investigated the effect of macroeconomic factors in two countries, Australia and US, and found the same impact of macroeconomic variables for both these two countries. Recently, Castro (2013) studied the link between macroeconomic developments and credit risk. They showed evidence of a significantly impact of GDP growth, housing price indices, unemployment rates, interest rates, credit growth, real exchange rates and the recent financial crisis on the credit risk.

These theoretical and empirical developments lead us to put forward the following hypothesis:

H2: the impact of macroeconomic variables such as interest rate spread and inflation rate on loan loss provisions.

2.3 Loan loss provisions and bank specific factors

Loan loss provisions are used to cover expected losses. However, due to the discretionary behavior of bank managers, provisions represent an important tool to achieve goals that are not similar to a fair representation of the predicted development of a bank's loan losses. Thereby, previous researches have presented the determinants of loan loss provisions by taking into account two different behavioral components. Banking literature defines these two as discretionary and non-discretionary components (Hasan and Wall, 2004). The first one is the non-discretionary component. It is made to cover expected future credit losses (Whalen,

1994; Beaver and Engel, 1996). This component is associated to the credit risk problem, where banks provide loan loss provisions depending on the quality of their loan portfolio. Thus, some credit risk considerations should be taken into account before providing provisions such as: default risk, risk tolerance, and the macroeconomic environment among others.

Provisioning practices are considered backward-looking because banks mainly associate non-discretionary provisions to the identification of problem loans. During the expansion phase, there are few problems of loans and low level of loan loss provisions. In contrast, during recession phase, loan loss provisions rise due to the increase of loan defaults. According to the research of Laeven and Majnoni (2003) and Bikker and Metzemakers (2005) the ratio of loan loss provisions to total assets exhibits a cyclical pattern. Hence, the non discretionary component is considered a driving force in the cyclicality of loan loss provisions and conduct to a misevaluation of expected credit losses.

The second component is called the discretionary component. It is due to the use of loan loss provisions for management objectives. Following Beaver and Engel (1996), Kanagaretnam et al. (2005), Anandarajan et al. (2007) and Ahmed et al. (1999), three different discretionary actions could be distinguished. The first one is the earning smoothing behavior. It represents our context of work. Banks tend to smooth their earnings over time. When earnings are anticipated to be low, loan loss provisions are deliberately understated to attenuate adverse effects of other factors on earnings. In contrast, when earnings are expected to be high, banks opt for discretionary income-decreasing accruals. Therefore, banks may lead to accruals in order to reduce the variance of reported earnings by applying the income smoothing practice. This leads to the increase of loan loss provisions during upswings and drop during downswings. Additionally, Bhat (1996) analyzed the reasons of why banks smooth their earnings. He found that earning smoothing allows stabilizing managers' compensation. It leads to enhance the risk perception of a bank regulators by decreasing earnings volatility, earning smoothing. By doing so, bank stock price will be kept stable. The two other discretionary behaviors analyze the capital management and signaling. As regards the capital management, capital constrained banks can employ discretionary accruals to reach regulatory-capital objectives. Due to their impact on earnings, general and specific provisions may reduce Tier 1 capital and then poorly capitalized banks may be less inclined to make loan loss provisions. Thus, this discretionary behaviour allows the development of regulatory capital without a necessary decline in risk of insolvency. According to Ahmed et al. (1999), Moyer

(1990), Beatty et al. (1995), Collins et al. (1995), and Perez et al. (2008), banks employ loan loss provisions in order to manage their capital, aiming to satisfy capital requirements specified by regulators. The same result is found by Anandarajan et al. (2007), by using a sample of Australian banks. Lobo and Yang (2001) exhibited that in order to decrease the regulatory costs imposed by capital requirements, banks with a low capital ratio can raise their loan loss provisions. Nevertheless, during downswings capital will be expensive and loan loss provisions will be high. In contrast, Leventis et al. (2011) who employed a sample of 91 European listed banks do not find evidence of capital management behaviour. The last discretionary action happens when banks employ loan loss provisions to signal their financial soundness. Hence, according to the bank manager, the earning power of the bank can easily absorb future potential losses by raising current loan loss provisions. In accordance with the signaling behaviour, Beaver et al. (1989) showed that for investors the raise of the rate of loan loss provisions is considered a sign of strength. Besides, Wahlen (1994) found a "positive relationship between loan loss provisions and future pre-loan loss earnings changes as well as contemporaneous stock returns". Similarly, Bouvatier and Lepetit (2008) confirmed the existence of a signaling behaviour using sample of European banks. In contrast, Ahmed et al. (1999), Anandarajan et al. (2007) who employed a sample of US and Australian banks, do not find evidence of signaling hypothesis. With regard to the existing works, we suggest the following hypothesis:

H3: *bank-specific variables such as non-performing loans, total loans, total capital ratio and signaling influence loan loss provision.*

3 Data and Macroeconomic issues

3.1 Data

In this research, our objective is twofold: On one hand, to study the procyclicality of loan loss provisions (LLPs) under the context of earning smoothing behaviour. On the other hand, to identify the main determinants that could affect LLPs. For this purpose, we employ a sample consisting of an unbalanced panel[3] of annual reported data from 2002 to 2013 for a set of 88 European commercial and cooperative banks. These banks are established in 5 European countries: France, Germany, Spain, Italy and United Kingdom. This period covers a full

[3] The data were not available for a uniform period for each bank. Therefore, the number of observations on any variable considered in this study varies across banks, leading us to conduct estimations over an unbalanced panel.

business cycle for all the countries included. The macroeconomic data used for the estimation are from the world development indicators database, whereas the balance sheet data comes from Thomson One Banker database[4]. A majority of banks do not provide information on some variables needed for this study, especially non-performing loan and total capital ratio. However, banks give more balance sheet information about the loan loss provisions central to our analysis.

3.2 Modeling bank loan loss provisions

In order to examine the procyclicality of the provisioning behaviour under the earning smoothing context, we need to study the different determinant of loan loss provisions, whether there are macroeconomic variables or bank specific variables. Thereby, we follow the methodology of Bouvatier and Lepetit (2008, 2012) and Bikker and Metzemakers (2005). Factors which may impact the behaviour of LLPs are grouped into two classes.

3.2.1 Bank specific variables

Earnings before tax and LLP (EBTP): This variable is defined as a discretionary component of LLP. Thus, earnings management is the manipulation of established results. By doing so, that the bottom line of the profit and loss account does not explain the real economic result of a bank's activity. Specifically, we are interested in the earning smoothing behaviour which aims to decrease the variability of net profits over time. Indeed under the income smoothing behavior, banks decrease (increase) their LLP when earnings are expected to be high (low) compared to the other years. Therefore, we can expect a positive sign between earnings and LLP.

Non-performing loan (NPL): This variable reflects the risk of a bank's portfolio and represents the expected losses. According to the literature, a backward-looking practice based on identified credit losses gives a strong cyclicality to the NPL (Bouvatier and Lepetit 2008). Hence, LLPs are expected to be positively linked to the non-performing loans.

Total capital ratio (TCR): loan loss provisions can be employed to manage regulatory capital even when banks are poorly capitalized. Thus, we define total capital ratio as the sum of Tier1 and tier II capital. "Tier I capital is defined as the sum of book value of equity, qualifying non-cumulative perpetual preferred stock, and minority interest in equity accounts of subsidiaries less goodwill and other intangible assets. Tier II capital is the sum of loan loss reserves (up to a maximum of 1.25% of risk-weighted assets), perpetual preferred stock, hybrid capital instruments, perpetual debt, mandatory convertible debt securities, term

[4] All the banks in our sample publish their annual financial statements at the end of the calendar year.

subordinated debt, and intermediate preferred stock"(Ahmed et al. 1999). Therefore, LLPs are negatively correlated to tier 1 and positively to tier2 (Shrieves and Dahl, 2002). In other words, the relationship between TCR and LLPs should be negative.

Total Loans (L): The ratio of loans to total assets allows measuring the risk of default for the overall credit portfolio. This variable highlights the importance of loans in the bank's portfolio. We assume that, during economic upswings, banks should reduce their LLP or do not add further reserves if the rate of loans in the total assets is higher. In contrast, during economic downswings, the probability of default of borrowers that materializes the credit risk is high. The coefficient associated with this variable should be positive.

SIGN: This variable presents the signaling effect. It occurs when banks employ LLP to signal their financial strength. "The bank manager can signal that the earning power of the bank is strong enough to absorb future potential losses by increasing current loan loss provisions." (Bouvatier and Lepetit 2008). We compute the variable SIGN as follows: SIGNit = (ER_{it+1} − ER_{it})/0.5(TA_t+TA_{t+1}). A positive sign is expected between this variable and LLP.

3.2.2 Macroeconomic variables

GDPG: the gross domestic product growth is considered among the efficient macroeconomic variable that allow capturing the procyclicality of loan loss provisions (Beatty and Liao 2011). Several researches have employed the gross domestic product growth (GDPG) variable to describe the business cycle behaviour (Bikker and Matzemakers, 2005; Beatty and Liao, 2011; Laeven and Majnoni, 2003).

INF: Is the inflation rate measured by the Consumer Price Index (CPI). Thus, the increase of the inflation rate in a country leads to the increase of the LLP, due to the inability of the borrower to pay their debt. Hence, the expected sign is positive.

SPREAD: Is the interest rate spread, which is equal to the long interest rate minus short interest rate. We predicted a positive sign between this variable and the LLP. Indeed, the interest rate spread reflects the notion that banks lead to push the cost of non-performing loans to customers. Hence, the rise of loan loss provisions generates the increase of debts write offs and as a result interest rate spread increases.

Money supply (M3): Is a leading economic variable. Thus, we expect a negative sign between this variable and LLP. Banks raise their loan loss provisions when the money supply is weak.

Stock index (SI): This variable is defined as a leading indicator. Indeed, a negative sign is expected between loan loss provisions and stock index.

UNEMPL: The unemployment rate should be positively related to loan loss provisions. During economic upswing, unemployment decreases. In contrast, during economic

downswing, unemployment increases and the possibility of default rise. Thus, the positive coefficient of the unemployment exhibited that provisioning is procyclical. Unlike, GDP shows only the degree of change in the business cycle. The unemployment rate is included in the model because it indicates the actual phase of the cycle.

A complete description of all the variables described above, and their expected signs can be found in Table 1.

Table 1: Description of variables

Variable	Definition	Expected Sign
Loan loss provisions (LLP)	LLP/Total Assets	
Bank specific		
Earnings before tax and loan loss provisions (EBTP)	EBTP/Total Assets	+
Total capital ratio (TCR)	(Tier1+Tier2)/Risk-weighted assets	-
Signaling (SIGN)	$(ER_{it+1}-ER_{it})/0.5(TA_t+TA_{t+1})$	+
Non-performing loan (NPL)	NPL	+
Loans (L)	L/Total Assets	+
Macroeconomic		
Gross Domestic Product Growth (GDPG)	GDP Real Growth Rate	-
Inflation (INF)	Consumer Price Index (CPI)	+
Interest Rate Spread (SPREAD)	Long interest rate-short interest rate	+
Money Supply (M3)	M3 Aggregate	-
Stock Index (SI)	SI of each country	-
Unemployment rate (UNEMPL)	Unemployment rate	+

4 Empirical model

Equation (1) presents the generic specification of the empirical model, including proxies of the business cycle and the different bank specific variables defined above.

$$LLP_{i,t} = \alpha_0 + \alpha_1 LLP_{t-1} + \alpha_2 GDPG_{i,t} + \alpha_3 EBTP_{i,t} + \alpha_4 NPL_{i,t} + \alpha_5 TCR_{i,t} + \alpha_6 L_{i,t} + \alpha_7 SIGN_{i,t} + \alpha_8 INF_{i,t} + \alpha_9 SPREAD_{i,t} + \alpha_{10} UNEMPL_{i,t} + \alpha_{11} SI_{i,t} + \alpha_{12} M3_{i,t} + \xi_{i,t} \quad (1)$$

Where $LLP_{i,t}$ is the ratio of loan loss provisions to total assets at the end of the year *t* for bank *i*. In an attempt to study the procyclicality of the LLP, we use the GDP growth as a proxy of the business cycle. In our model, economic growth is considered as the main indicator of the business cycle. If LLPs behave in a procyclical manner, the GDP growth will be negatively linked to the provisioning, indicating that provisions increase when the business cycle falls. On the other hand, we use the variable $EBTP_{i,t}$ as we examine the behaviour of LLP in the context of earning smoothing. The latter leads to decrease the variability of net profit over time. Thus, for the purpose of stabilize net profit, banks will rise (drop) LLPs when earnings before tax and LLPs are high (low). Regarding the macroeconomic variables, we employ the variables that have an impact on loan loss provisions namely the inflation rate, the interest rate spread, unemployment rate, the stock index of each country and the money supply M3. On the other hand, bank specific variables include the discretionary and the non discretionary component of loan loss provisions.

Table A (Appendix A) provides some general descriptive statistics for European commercial and cooperative banks on average over the period 2002-2013. Table 2 reports the geographical distribution of banks. The sample contains 88 banks and 294 observations which are dominated by French and Italian banks. Thus, French banks are predominant in our European dataset due to the important number of banks in France and to the excellent reporting of these banks. Finally we end up with an unbalanced panel of 294 observations.

Table 2: Distribution of banks by country over the period 2002-2013

Countries	Number of banks	Number of observations retained in our sample
France	24	51
Germany	17	55
Spain	15	34
Italy	21	126
United Kingdom	11	28
Total	88	294

Note: Bank data are from Thomson One Banker database

Descriptive statistics and Correlations

Table 3 shows some descriptive statistics about the selected variables in our estimation sample for the period of 2002-2013. The mean and the median ratio of loan loss provision to total assets is 82.103 and 0.461 respectively. This result proves that banks do make enough provisions for loan losses. The median ratio of earnings before LLPs and taxes is 1.527. Thereby loan loss provisions represent a good accrual for banks. As regard the credit risk level, measured by the non performing loan (NPL) and the loan ratio (L), we conclude that on average, European banks have a higher credit risk. Moreover, in order to capture the procyclicality of the LLPs, we use gross domestic product growth with a mean value of 0.485 meaning that when loan loss provisions grow by 10 percent, GDPG grows by 0.485 percent. Additionally, the lower mean value of inflation indicates that the inflation has been falling since 2002 for the European countries.

Table 3: Descriptive statistics

	Mean	Median	Std.Dev	Min	Max
Dependent variable					
LLP	82.103	0.461	531.202	-7.499	10741.05
Independent variables					
GDPG	0.485	0.845	2.130	-5.911	4.250
EBTP	48.479	1.527	150.274	-147.61	1340.52
Control Variables					
NPL	8062.193	1360.27	15053.63	0.02	105194
L	0.689	0.719	0.212	0.041	3.046
TCR	0.204	0.124	0.879	0.04	17.859
SIGN	0.085	0.000	0.991	-26.951	73.194
SPREAD	1.617	1.654	1.347	-0.981	5.267
INF	2.251	2.008	3.904	-0.287	77.421
UNEMPL	9.600	8.9	3.744	4.7	26.6
M3	5.263	2.2	4.394	1.01	13.7
SI	51.882	12.891	151.775	0.25	1954.774

Notes: This table presents the summary statistics of the dependent variable, independent variables, as well as the control variables. LLP is the ratio of LLPs to total assets; EBTP is the ratio of earnings before taxes and LLPs to total assets, L is the ratio of loans to total assets; NPL is the total of non-performing loans; GDPG is the GDP growth; INF is the consumer price index; SPREAD is the long interest rate minus short interest rate; TCR is the total capital ratio, is defined as (tier1+tier2/$RWA_{i,t}$) with RWA is the risk weighted assets; SIGN is the one-year-ahead changes of earnings before taxes and loan loss provisions, SIGNit = (EBPTAit+1 − EBPTAit)/0.5(TAt + TAt+1), with TA is the total asset.

Table 4 represents the Pairwise Pearson correlation coefficients between sample data. We find a negative and significant correlation between the dependent variable LLP and GDPG, indicating that the provisioning behaviour is procyclical. In other words, LLP increases during economic downswings and decreases during upswings. This finding is consistent with prior research (Bikker and Metzemakers, 2005; leaven and Majnoni, 2003). Furthermore, there is a positive correlation between loan loss provisions and earnings before tax and loan loss provisions. This result is consistent with previous researches such as Greenwalt and Sinkey (1988), Beatty et al., (1995) and Collins et al., (1995) implying that banks have followed an income smoothing pattern. According to Bouvatier and Lepetit (2008) "when earnings are expected to be low, loan loss provisions are deliberately understated to mitigate the adverse effects of other factors on earnings". However, LLP is not significantly correlated with INF SPREAD, NPL, L, TCR, and SIGN.

In order to analyze the problem of multicollinearity, we compute the Variance Inflation Factor (VIF). According to Gujarati (2004), a problem of multicollinearity appears when correlations between independent variables exceed 0.8. The results in table 4 show that the correlation among explanatory variables is relatively weak and statistically insignificant at usual levels. Moreover, the value of the VIF is equal to 1.28 below the critical value 10 (Neter et al., 1989) for all the explanatory variables. The VIF-test indicates the absence of multicollinearity among the independent variables. Thus, the latter can be incorporated together, without estimation bias, in a multiple linear regression.

Table 4: Pairwise Pearson correlation analysis for the period 2002–2013

	LLP	GDPG	EBTP	NPL	L	TCR	SIGN	INF	SPREAD	UNEMPL	M3	SI	VIF	1/VIF
LLP	1.000													
GDPG	-0.063*	1.000											1.10	0.911
EBTP	0.251***	-0.061*	1.000										1.03	0.974
NPL	-0.043	-0.071*	-0.014	1.000									1.18	0.845
L	0.0320	-0.017	-0.101***	-0.262***	1.000								1.83	0.546
TCR	-0.020	0.018	-0.036	-0.031	0.047	1.000							1.19	0.842
SIGN	-0.005	0.019	-0.019	-0.019	0.028	-0.004	1.000						1.05	0.951
INF	0.035	0.038	0.080	-0.035	0.111***	0.001	-0.096***	1.000					1.14	0.876
SPREAD	0.002	0.073**	-0.040***	-0.153***	0.045	-0.010	-0.056	-0.024	1.000				1.12	0.892
UNEMPL	-0.023	-0.066	-0.086**	0.152***	0.065**	0.253***	-0.016	-0.014	0.018	1.000			1.33	0.750
M3	0.132***	-0.161***	-0.031	0.099**	0.029	0.026	-0.021	0.014	0.168	0.423	1.000		1.91	0.524
SI	-0.035	0.009	-0.066*	-0.109***	0.039	-0.037	-0.011	-0.036	-0.055	-0.050	-0.210***	1.000	1.23	0.815

NOTE: This table reports Pairwise Pearson correlation matrix between the regressions variables used in the estimation. The sample consists of 88 European commercial and cooperative banks from 2002 to 2013. LLP is the ratio of LLPs to total assets; EBTP is the ratio of earnings before taxes and LLPs to total assets, L is the ratio of loans to total assets; NPL is the total of non-performing loans; GDPG is the GDP growth; INF is the consumer price index; SPREAD is the long interest rate minus short interest rate; TCR is the total capital ratio, is defined as (tier1+tier2/$RWA_{i,t}$) with RWA is the risk weighted assets; SIGN is the one-year-ahead changes of earnings before taxes and loan loss provisions, SIGNit = (EBPTAit+1 − EBPTAit)/0.5(TAt + TAt+1), with TA is the total asset. ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

5 Econometric Results

We have employed panel data in order to provide a conducive and a favorable framework for the development of estimation techniques and theoretical results. The main advantage of the panel-data methodology is to allow us to control the unobservable individual heterogeneity in the data. Therefore, our model can be estimated by fixed effects (FE), random effects (RE) and GMM methods. The fixed effects (FE) model stems from the fact that the individual effects are represented by individual constants which exhibited the only source of heterogeneity. The main advantage of the FE method is that regardless of the correlation between specific effects and the explanatory variables, it provides consistent estimates. However, the FE approach is not adequate for models including invariant variables in time.

The random effect (RE) method takes into account the time series and the cross-transversal dimension of the data, it considers interception as common random variables across the member countries. Indeed, this method may present efficient estimates, especially when there is little variation in the time series. However, if the specific effect is correlated with some explanatory variables, biased and inconsistent estimates may appear. Hence, it is necessary to test the presence of this bias by using the Hausman test (1978). Thus, the Hausman test allows determining whether the coefficients of the two estimations (fixed and random) are statistically different. The aim of this test is to verify that under the null hypothesis of independence between the errors and the explanatory variables, both estimators are unbiased and the estimated coefficients are identical.

In order to resolve the contradictions and/or limitations of the static model and the difference GMM, we use the "system GMM" estimator proposed by Blundell and Bond (1998). They showed by using Monto Carlo simulations that the system GMM estimator is more efficient, more robust and generally higher than the difference GMM estimator. The later gives biased results in finite samples when the instruments are weak.

The system GMM estimator includes two equations, the original equation and a transformed one. The transformed equation can be the first difference of the original equation. Thus, we take into account the dynamic adjustment of loan loss provisions, by introducing the lagged dependent variable as explanatory variable. "If banks adjust their provisions slowly to recognize potential losses against loans or if default events are concentrated in time, then provisions could exhibit time dependency" (Bouvatier and Lepetit, 2012). In addition, GMM avoids the problem of correlation of unknown form and provide an unbiased and consistent estimation. This method allows the analysis of three main econometric issues: (1) the

presence of unobserved bank-specific effects, which is moved by taking the first differences of all the variables: (2) the dynamic nature of loan loss provisions through the adding of a lagged dependent variable; (3) the endogeneity problem of the explanatory variables.

Table 5 represents the results of the fixed effect (FE), random effect (RE) and GMM estimator. We start by interpreting the results of the fixed and random effect. First and foremost, we point out that the earning smoothing context is confirmed through the positive and significant relationship between loan loss provisions and EBTP. Indeed, banks raise loan loss provisions when earnings before taxes and loan loss provisions increase. This result is consistent with Greenwalt and Sinkey (1988), Collins, Shackelford, and Wahlen (1995) and Wahlen (1994). They all found strong evidence that banks employ loan-loss provisions to smooth earnings. Collins et al., (1995) found a positive relation between earnings management and LLPs. Supporting the fact that banks smooth income overtime to a firm-specific mean. Bhat (1996) shows that banks with small and poor financial conditions are more likely to be involved in income smoothing operations. In contrast, Wetmore and Brick (1994), Beatty et al., (1995), and Ahmed et al., (1999), among others, find no evidence of income smoothing. On the other hand, we find a negative and significant relationship between the ratio of loan loss provisions and GDP growth, implying the procyclical behaviour of European banks. The significant relationship shows the relevance of the macroeconomic conditions which reinforces the cyclical behavior of LLP. The business cycle affects the financial soundness of firms and households. Hence, it is linked to problem loans. Our result is in line with those of Laeven and Majnoni (2003), Bikker and Metzemakers (2005) and Bouvatier and Lepetit (2008), who suggested that provisions rise in periods of falling GDP growth. In other words, the negative relation between GDP growth and provisioning approves that provisioning depends significantly on the business cycle. Hence, this strong cyclical effect involves that banks' provisioning behaviour might be procyclical. The procyclical impact is mitigated somewhat by the effect of the banks' earnings on provisions. This earnings impact is related either to dubious income smoothing or to recommendable farsighted dynamic provisioning (Bikker and Metzemakers, 2005).

As regards the macroeconomic indicators which are supposed to affect the provisioning behaviour, we find that only the M3 variable has a significant coefficient. In contrast with our expectation, M3 indicator has a positive impact on LLP. In addition, we find a positive but an insignificant linkage between the inflation rate and loan loss provisions. Our finding is contradictory to the result of Borio and Zhu (2012). The latter find that the inflation rate is significantly correlated with the loan loss provisions. Indeed, LLP raise with raising inflation

and possibly with raising nominal interest rates, which lead to a costly financing conditions of borrowers, and consequently to a higher default risk. Similarly, the interest rate spread, unemployment and the stock index are not significantly correlated with LLP.

As to our bank specific variables, the discretionary component and the non discretionary component are insignificant. More specifically, the coefficient of both the NPL and loan are insignificant. Indeed, this result indicates that European banks make less provision when the credit risk of bank assets is higher. The coefficient of loan to total assets is insignificantly negative, suggesting that this indicator does not lead to capture the risk of default, or loan loss provisions are not affected by this credit risk measure in our sample. This finding is consistent with Bouvatier and Lepetit (2012). As regarding the signaling variable, we find an insignificant negative relation between loan loss provisions and one-year ahead future change in earnings for the fixed effect but a negative coefficient for a random effect. Thus, signaling is not an important incentive in determining loan loss provisions. Our result is consistent with the finding of Anandarajan, Hasan, and McCarthy (2007), by using a sample of US and Australian banks; they do not find evidence of signaling behaviour. While, Bouvatier and Leptit (2008) and wahlen (1994) find evidence that supporting the signaling behaviour. Finally, we do not find a significant relation between total capital ratio and loan loss provisions. This result is in line with Collins et al., (1995). However, Moyer (1990) and Beatty et al., (1995) find evidence of a negative and significant relationship between loan loss provisions and capital ratios. They exhibited the employ of loan loss provisions to decrease anticipated costs related to violating capital requirements.

The regression findings in table 5 reveal the result of the impact of the variables on loan loss provisions (LLP). This research will compare the results obtained from GMM-Diff and GMM-Sys. The explanation is based on the GMM-Sys. We check the validity of estimates with the AR (2) test and the Hansen test. The AR (2) test which corresponds to the Arellano-Bond test measures the autocorrelation aside from the fixed effects. The Hansen test permits to check the validity of the whole set of instruments. The results show the acceptance of the null hypothesis that the restriction on the identification is valid. The results of the AR (2) tests presented in the bottom of table 5 underline the presence of the second order correlation. The estimated coefficient of the lagged variable is positive and statistically significant only for the GMM-Sys, showing that previous LLP affects the present decision of LLP. As found above for the static estimation the earning smoothing and the procyclical behaviour are present even for the GMM-Sys. In addition, we find an unexpected significant negative sign of INF rate, implying that INF is considered as an economic variable, raising in economic booms and

dropping during economic busts. This behaviour is consistent with the procyclicality hypothesis highlighting that loan loss provisions fall in economic upswings and increase in economic downswings. However, Albertazzi and Gambacorta (2009), by finding a positive coefficient of inflation variable, deduced that inflation is considered as a determinant of LLP. Thus, LLP raise when consumer price are higher. Similarly, we find an unexpected negative sign of the SPREAD variable, implying that the increase of loan loss provisions generates the decrease of debts write offs and as a result interest rate spread decreases. However, we don't find a significant coefficient for the unemployment rate, M3 and the stock index.

Concerning the bank specific variables, the discretionary component and the non discretionary component are significant except the non-performing loan ratio. As expected, we find a negative significant coefficient of total capital ratio. This finding supports the capital management hypothesis, suggesting that loan loss provisions increase when the capital ratio is relatively low. By using a sample of Australian commercial banks, Anandarajan, Hasan, and McCarthy (2007) report evidence that supports the capital management hypothesis. In addition, our result is consistent with those of Kim and kross (1998), they showed that after the implementation of Basel I, banks with low capital lead to decrease LLP in order to raise capital ratios, while banks which hold a higher capital ratio did not find any interest to change their loan-loss provisioning. In the same vein, Beatty et al., (1995), Ahmed et al., (1999), Laeven and Majnoni (2003), and Bikker and Metzemakers (2005) exhibited that LLP is negatively related to capital. However, Collins et al. (1995) find a positive relationship between total capital ratio and loan loss provisions, implying that managers tend to decrease LLP when bank capital is low, and they exhibited that banks employ write-offs more than LLP to manage capital ratios. Similarly, Bouvatier and Lepetit (2008), Fonseca and González (2008) and Pérez et al. (2008) find some evidence of a positive relation in different countries.

On the other hand, table 5 shows that the loan growth ratio is significantly associated with the ratio of LLP. Thus, this variable is used as a proxy of increased credit risk; it aims to capture the risk of default for the overall credit portfolio, and appears to be a determinant of provisioning. In other words, when the credit risk of bank assets is important, banks set aside more provisions. In contrast, Bouvatier and Lepetit (2012), find an insignificant coefficient of loan growth for South and East Asian banks.

In order to signal financial strength, banks use their loan loss provisions. Thus, "the idea behind this behaviour is that bank manager may signal that the earning power of the bank is strong enough to avoid potential losses by raising current loan loss provisions" (Bouvatier and Lepetit 2012). Our results show a negative relation between loan loss provisions and future

pre-loan loss earnings, implying that signaling don't represent an important incentive in determining loan loss provisions. This finding is consistent with Ahmed et al., (1999) and Anandarajan et al. (2007), who exhibited a negative linkage between bank stock returns and loan loss provisions. While, Liu et al., (1997) by using a sample of US banks, find a positive reaction of the market towards an increase in loan loss provisions. They showed that raising loan loss provisions generate higher cash flow predictions as this signals the willingness of bankers to meet their non-performing loan problems.

Besides, our results exhibit a negative and insignificant coefficient of the non-performing loan (NPL). Indeed, this result indicates that European banks make less provision when the credit risk of bank assets is higher. Finally, we deduce that the procyclical behaviour may be mitigated by the impact of earnings on provisions or/and by the positive effect of loan growth on provisioning. This outcome is in line with Bikker and Metzemakers (2005), who argued that credit risks are build up during a boom. However, Laeven and Majnoni (2003) exhibited a significant negative impact of loan growth.

Table 5: the estimation result of the static and dynamic model

Variables	**Static estimations**		**Dynamic estimations**	
	FE	**RE**	**GMM-Diff**	**GMM-Sys**
$LLP_{i,t-1}$	-	-	0.178	0.548***
			(0.92)	(11.65)
EBTP	0.500*	0.494*	-0.133	0.304***
	(1.96)	(1.95)	(-0.41)	(7.38)
GDPG	-4.448**	-4.647**	-25.143**	-13.632*
	(-2.51)	(-2.53)	(-2.74)	(-1.76)
NPL	-0.000	-0.000	0.031*	0.001
	(-0.46)	(-0.54)	(1.75)	(0.86)
L	100.985	80.636	1065.06	750.431***
	(1.00)	(1.05)	(0.92)	(5.76)
TCR	0.983	-1.044	3386.83	-6.148**
	(1.31)	(-1.17)	(1.09)	(-2.41)
SIGN	0.416	-0.411	-87.780**	-3.560***
	(0.25)	(-0.88)	(-1.99)	(-5.05)
INF	1.639	0.423	-148.663**	-5.985***
	(0.64)	(0.55)	(-2.22)	(-3.62)
SPREAD	-4.869	-3.597	-58.127*	-15.265**
	(-1.00)	(-0.66)	(-1.73)	(-2.14)
M3	6.597	6.077*	175.304**	-0.224
	(1.06)	(1.66)	(2.04)	(-0.03)
SI	0.012	0.002	4.323	0.592
	(0.09)	(0.02)	(0.63)	(0.43)

UNEMPL	0.710	-0.091	-12.754	10.751
	(0.45)	(-0.07)	(-0.27)	(0.64)
R^2	0.299	0.197	-	-
***F*-statistics**	67.12	1057.15	20.56	440.07
AR (2)	-	-	-0.92	0.69
Hansen Test	-	-	14.95	19.87
Number of observations	288	288	221	268

Notes: This table reports the estimation of the fixed effect, random effect and the GMM estimation using robust standard errors. The sample consists of 88 European commercial and cooperative banks from 2002 to 2013. LLP is the ratio of LLPs to total assets; EBTP is the ratio of earnings before taxes and LLPs to total assets, L is the ratio of loans to total assets; NPL is the total of non-performing loans; GDPG is the GDP growth; INF is the consumer price index; SPREAD is the long interest rate minus short interest rate; TCR is the total capital ratio, is defined as (tier1+tier2/$RWA_{i,t}$) with RWA is the risk weighted assets; SIGN is the one-year-ahead changes of earnings before taxes and loan loss provisions, SIGNit = (EBTPit+1 − EBTPit)/0.5(TAt + TAt+1), with TA is the total asset. Difference GMM and two-step system GMM using robust standard errors and lag options (1–2). Hansen test: Test of over-identifying restrictions in GMM estimation (p-value). AR (2) Arellano–Bond test for analyzing the autocorrelation existence of second order (p-value). The fixed and random effects models are estimated using the heteroskedasticity consistent covariance estimates of standard errors ‘‘robust’’. *, **, *** Indicate significance levels at 10%, 5% and 1%, respectively. The values in parentheses are t-statistics.

5.1 Decomposition of loan loss provisions

The purpose of this section is to analyze the relationship between loan loss provisions and the independent variables of the model such as the discretionary component, the non-discretionary component and the macroeconomic variables. From the previous section we have kept only the significant macroeconomic variables that have an impact on loan loss provisions. Thus, we follow the research of Ahmed et al., (1999) to decompose the components of loan loss provisions. We consider three alternative specifications. In specification (a), we only consider the macroeconomic variables. In specifications (b) and (c), the discretionary and non-discretionary components are respectively regarded. Table 6 shows the different results obtained for equation 1. Indeed, studying separately the component of LLP allows to understand exactly the variables that have a direct impact on LLP. Firstly, the lagged dependent coefficient is significant for the three specifications, implying that the present decision of LLP depending on previous LLP. Secondly, we find only the earning before tax and provision is significant among the discretionary variables of LLP. Unlike our prediction and previous researches, the coefficient of earning before tax and provisions is negative which means that European countries do not use loan loss provisions to smooth their income. This finding is inconsistent with the research of Kanagaretnam et al., (2005), Bikker

and Metzemakers, (2005), Liu and Ryan, (2006), Anandarajan et al., (2007), Fonseca and Gonzales, (2008) and Leventis et al., (2011). However, we note a positive and significant coefficient of the loan growth and the non-performing loan, implying that the non-discretionary variables aim to correctly capture the risk of default for the overall credit portfolio. Thus, these two credit risk measures have a direct impact on loan loss provisions. This result shows that when the credit risk of bank assets is important European banks make higher provisions, which is in line not only with standard accounting principles but also with previous researches. As regards the macroeconomic factor, we find an insignificant relationship between gross domestic product and loan loss provisions. This finding suggests the absence of banks' procyclical behavior. In contrast, we underscore a significant negative coefficient of the inflation rate. Indeed, this variable is considered as a business cycle determinant.

Table 6: The decomposition of loan loss provisions

Variables	**(a)**	**(b)**	**(c)**
$LLP_{i,t-1}$	1.261***	0.922***	1.008***
	(23.03)	(8.66)	(21.14)
EBTP	-	-0.291*	-
		(-1.76)	
GDPG	-11.300	-	-
	(-0.29)		
NPL	-	-	0.002*
			(1.79)
L	-	-	54.507*
			(1.67)
TCR	-	-1830.651	-
		(-1.4)	
SIGN	-	-1.310	-
		(-1.05)	
INF	-52.525*	-	-
	(-1.64)		
SPREAD	-13.827	-	-
	(-0.98)		
***F*-statistics**	2271.21	145.39	214.45
AR (2)	0.89	0.12	1.44
Hansen Test	48.79	21.25	27.14
Number of Observations	701	343	390

Note: This table reports the decomposition of loan loss provisions by using the GMM method. *, **, *** Indicate significance levels at 10%, 5% and 1%, respectively. The values in parentheses are t-statistics. Variables definitions: LLP is

the ratio of LLPs to total assets; EBTP is the ratio of earnings before taxes and LLPs to total assets, L is the ratio of loans to total assets; NPL is the total of non-performing loans; GDPG is the GDP growth; INF is the consumer price index; SPREAD is the long interest rate minus short interest rate; TCR is the total capital ratio, is defined as (tier1+tier2/$RWA_{i,t}$) with RWA is the risk weighted assets; SIGN is the one-year-ahead changes of earnings before taxes and loan loss provisions, SIGNit = (EBTPit+1 − EBTPit)/0.5(TAt + TAt+1), with TA is the total asset. Difference GMM and two-step system GMM using robust standard errors and lag options (1–2). Hansen test: Test of over-identifying restrictions in GMM estimation (p-value). AR (2) Arellano–Bond test for analyzing the autocorrelation existence of second order (p-value). The fixed and random effects models are estimated using the heteroskedasticity consistent covariance estimates of standard errors ‘‘robust’’.

Comparison between the European Union (EU) countries and the Eurozone countries

Table 7 displays the results of the comparison between the European Union (EU) countries and the Eurozone countries. We find a positive coefficient of the lagged variable, implying the dynamic adjustment of LLP even for the Eurozone countries. Likewise, our results show that banks which belong to the Eurozone area tend to smooth their earnings, through the positive linkage between LLP and EBTP. Contrary to the EU countries, we don’t find procyclical behaviour of the Eurozone banks. Thus, the insignificant and negative coefficient of GDP growth indicates the weakness of the macroeconomic condition. This outcome contradicts those of Bikker and Metzemakers (2005), Bouvatier and Lepetit (2008), and Fonseca and González (2008) who pointed out a significant negative coefficient of GDP growth, highlighting a strong cyclical impact of bank’s provisioning behaviour. As regards the non-discretionary component namely the non-performing loan and the loan growth, we find the same result for both of the banks of European Union and Eurozone area**.** Thus, the loan loss provisions are totally affected by this credit risk measure, and the risk of default is rightly captured. Although the total capital ratio and the signaling variable are significant for the European countries, we find an insignificant negative coefficient of both of the two variables for the eurozone countries. Indeed, there is no evidence of capital management and signaling for banks of Eurozone area from 2002 to 2013. This outcome is consistent with the findings of Ahmed, Takeda, and Thomas (1999) and Anandarajan, Hasan, and McCarthy (2007), who do not report any evidence of signaling behavior by employing a sample of US and Australian banks respectively. Besides, our result is in line with those of Beatty et al., (1995), Ahmed et al., (1999), Laeven and Majnoni (2003), and Bikker and Metzemakers (2005) who find that LLP is negatively related to capital. With regard to the macroeconomic variables, only the inflation rate is significant, implying that INF variable is considered as economic cycle variable.

Table 7: comparison between the Eurozone and the European Union (EU) countries

Variables	EU	Eurozone
$\mathbf{LLP_{i,t-1}}$	0.548***	0.621***
	(11.65)	(13.22)
EBTP	0.304***	0.300***
	(7.38)	(4.62)
GDPG	-13.632*	-7.930
	(-1.76)	(-0.77)
NPL	0.001	0.000
	(0.86)	(1.00)
L	750.431***	545.037***
	(5.76)	(2.91)
TCR	-6.148**	-2.999
	(-2.41)	(-1.57)
SIGN	-3.560***	-29.548
	(-5.05)	(-0.75)
INF	-5.985***	-26.461*
	(-3.62)	(-1.85)
SPREAD	-15.265**	-9.143
	(-2.14)	(-1.55)
***F*-statistics**	440.07	291.20
AR (2)	0.69	0.57
Hansen Test	19.87	21.19
Number of observations	268	242

Notes: This table presents the comparison between the countries of European Union and Eurozone using GMM estimation from 2002 to 2013. LLP is the ratio of LLPs to total assets; EBTP is the ratio of earnings before taxes and LLPs to total assets, L is the ratio of loans to total assets; NPL is the total of non-performing loans; GDPG is the GDP growth; INF is the consumer price index; SPREAD is the long interest rate minus short interest rate; TCR is the total capital ratio, is defined as (tier1+tier2/$RWA_{i,t}$) with RWA is the risk weighted assets; SIGN is the one-year-ahead changes of earnings before taxes and loan loss provisions, SIGNit = (EBTPit+1 − EBTPit)/0.5(TAt + TAt+1), with TA is the total asset. . *, **, *** Indicate significance levels at 10%, 5% and 1%, respectively. The values in parentheses are t-statistics.

5.2 Cross crises analysis

In order to present and modulate the fluctuation of the business cycle, we use the GDP growth rate. A stream of research has investigated the stationary problem of the GDP growth (Rudebusch 1993). According to Nelson and Plosser (1982), GDP is considered as the best determinant of difference stationary.

Figure 1 plots the business cycle component of GDP growth rate indicator for the five countries studied throughout our research by using the Hodrick-Prescott (1980) filter. Indeed the latter presents the macroeconomic series as a sum of non-stationary trend component and a stationary cyclical component. The Hodrick-Prescott filter contains a program for

minimizing a criterion function for the filtered series solved by the Lagrangian. This function in fact minimizes the sum of squared deviations of values of the series and the values of the trend component. According to figure 1 we distinguish between the recession phases and expansion phases. Indeed, three periods have marked the expansion phase: 2002-2004, 2005-2007 and 2009-2010. This phase is characterized by an increase in the demand witch followed by both an increase in the need for raw materials and employment. Hence, consumption rises more than the rise of wages, interest rates and taxes that achieves a higher profit margin. During this phase, investment activity increases due to an increase in demand for consumption goods. Figure1 shows that the expansion phase is identical for all the countries except the UK for the period 2005- 2007. Indeed, during this period, the UK country is going through a severe recession phase. Similarly, three periods emphasized the recession phase: 2004-2005, 2007-2009 and 2010-2013. This phase is marked by a transient decrease in economic activity, it happens when there is a decline in the growth rates and in the other measure of the economy. Likewise, all the investment seems unprofitable which leads to a drop in the employment situation. This is referred to as mild recession but when recession is severe it is called crises.

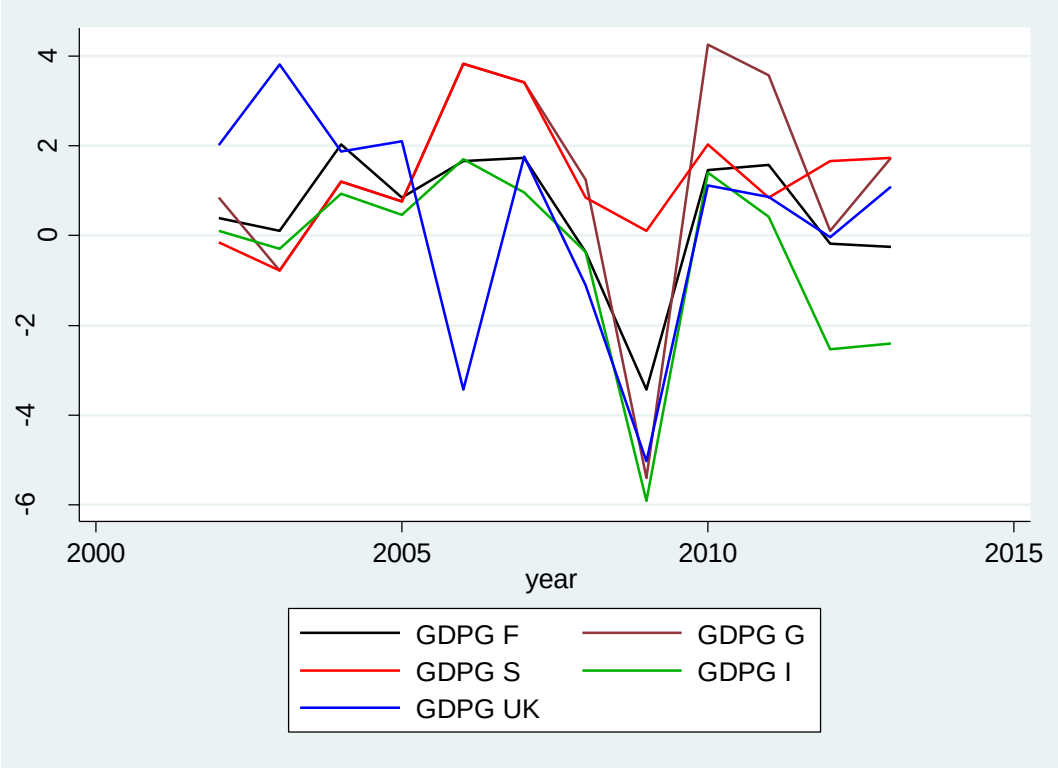


Figure1: GDPG cyclical component from HP filter

To illustrate the two phases of the economic cycle, we study the expansion phase and the recession phase from 2002-2007 and 2008-2011 respectively. As regards the first phase, more precisely the expansion phase, we note that the coefficient of the lagged dependent variable is significant. Indeed, banks adjust their loan loss provisions to identify potential losses against loans. In addition, the earning smoothing behaviour is confirmed by the positive and significant coefficient of the earning before tax and provisions. Besides, the default risk is well captured by the loan growth variable. Thus, we find a positive significant relationship between loan loss provisions and loan growth. The latter is considered as a provisioning determinant. Concerning the macroeconomic factors, only the interest rate spread and the inflation rate are significant with a negative linkage with provisioning. Contrary to our expectation, the inflation rate plays a role of economic measure. It increases during economic booms and decreases during economic busts. This result appears to contradict the result of Albertazzi and Gambacorta (2009), who exhibited a positive impact of inflation on provisioning behaviour. On the other hand, the unexpected sign of the SPREAD variable involves that the raise of loan loss provision leads to a drop of debts write offs and consequently interest rate spread decreases. Lastly, the second period that marked the recession phase is characterized by an insignificant coefficient of the entire variable with the dependent variable. Indeed, this phase includes two crises: the subprime crisis and the sovereign debt crisis. Lastly, the second period that marked the recession phase is characterized by an insignificant coefficient of the entire variable with the dependent variable. Indeed, this phase includes two crises: the subprime crisis and the sovereign debt crisis.

Table 8: cross crises analysis

Variables	2002-2007	2008-2011
$\mathbf{LLP_{i,t-1}}$	0.613***	0.417
	(18.37)	(0.23)
EBTP	0.148**	0.295
	(1.89)	(0.18)
GDPG	-10.476	-1.612
	(-0.97)	(-0.04)
NPL	0.004	0.001
	(1.25)	(0.833)
L	450.654***	488.379
	(3.83)	(0.22)
TCR	2.612	85.120
	(0.02)	(0.25)
SIGN	-43.154	-74.045
	(-0.69)	(-0.35)

INF	-25.750**	-27.802
	(-2.77)	(-0.31)
SPREAD	-12.694***	-7.288
	(-2.84)	(-0.04)
***F*-statistics**	493.65	461.75
AR (2)	0.66	-
Hansen Test	4.53	2.19
Number of observations	129	85

Note: This table presents the comparison between the two phases of the business cycle using GMM estimation from 2002 to 2013. LLP is the ratio of LLPs to total assets; EBTP is the ratio of earnings before taxes and LLPs to total assets, L is the ratio of loans to total assets; NPL is the total of non-performing loans; GDPG is the GDP growth; INF is the consumer price index; SPREAD is the long interest rate minus short interest rate; TCR is the total capital ratio, is defined as (tier1+tier2/$RWA_{i,t}$) with RWA is the risk weighted assets; SIGN is the one-year-ahead changes of earnings before taxes and loan loss provisions, SIGNit = (EBTPit+1 − EBTPit)/0.5(TAt + TAt+1), with TA is the total asset. . *, **, *** Indicate significance levels at 10%, 5% and 1%, respectively. The values in parentheses are t-statistics.

6 Conclusion

The global financial crisis shed light on the importance of the financial regulation in terms of nature and effectiveness. In other words, it reveals that central banks tend to make financial stability objectives more explicit in the monetary policy. Designing the macroprudential instruments was a crucial action. Indeed, it is used to help the mitigation of the financial system's procyclicality. In other words, the inherent cyclicality of lending and distort investment decisions are exacerbated by credit booms and busts. This is could be done by either charging excessive growth in credit or minimizing access to bank finance. Thus, the linkage between the business cycle and the financial system has been always the subject of much research. Thus, everyone is aware of the importance of the business cycle in the world of finance which is not only a serious issue but also an ambiguous notion in macroeconomics. When talking about business cycle, it is very important to remember the concept of pro-cyclicality. Indeed, pro-cyclicality and business cycle are two sides of the same coin. Procyclicality is considered among the most popular phenomenon in the field of financial risk management. Indeed, financial system procyclicality is defined as the ability of the financial system to magnify the variations of the economic activity during the business cycle through procyclicality in financial institutions' lending and other activities. The easy funding of expenditure, investment in good times and financial restrictions that may lead to a declining demand in bad times helps the procyclical behavior of financial markets to be in the real economy in amplified form.

In this context, this research examines the procyclicality of loan loss provisions under the earning smoothing context. Using a sample of five European countries such as France, Germany, Italy, Spain and UK from 2002 to 2013, the paper aims to detect the macroeconomic and bank specific determinants of loan loss provisions.

Overall, we found evidence that provisioning depends significantly on the business cycle through the direct negative relation between GDP growth and banks' provisioning. This strong cyclical impact involves the procyclicality of banks' provisioning behavior as their buffers need to increase during downturns. Unlike most of the literature, the procyclical effect can be mitigated by the impact of the banks' earnings since we have found that our earning smoothing context is confirmed through our research. According to Bikker and Matzemakers (2005), "Procyclicality is also mitigated by the positive effect of loan growth on provisioning, explaining the effect that credit risks are built up during a boom". On the other hand, the discretionary components of LLP have a strong impact on the provisioning behaviour. Thus our research confirms the finding of the literature through the effect of earning management, capital management and signaling on loan loss provisions. However, among the non-discretionary components, only the loan growth variable is significant. We find an insignificant coefficient of non-performing loan. This result is consistent with the study of Bouvatier and Lepetit (2012). As regards the macroeconomic factor, we note the significance of the interest rate spread and the inflation rate. Indeed, they exhibit a negative linkage with loan loss provisions.

Last but not least, this research could be improved by carrying out some extensions. For instance, one may consider the segmentation of banks according to the importance of their lending activities or the segmentation by region which might provide more precise results.

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Appendix. A

Table A: General Descriptive statistics for European commercial and cooperative banks over the period 2002-2013

	Size	*ROA*	*ROE*	*D*	*L*	*NBI*
Mean	0.045	0.014	10.420	819.747	798.961	44.773
Max	0.012	0.621	9376,927	1483.369	1456.324	8657.53
Min	0.069	0.001	0.001	0.008	0.0138	0.001
S.D	0.011	0.030	310.497	199.550	194.491	106.993

Variable definitions: All variables are in percentage. *Size*: log assets; *ROA:* return on assets*; ROE:* return on equity; *D*: total deposits *L*: loans; *NBI*: net banking income.