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► **To cite this version:**

Vincent Bouvatier, Laetitia Lepetit. Banks' procyclicality behavior: does provisioning matter?. Cahiers de la Maison des Sciences Economiques 2006.35 - ISSN 1624-0340. 2006. <halshs-00115622>

**HAL Id: halshs-00115622**

**<https://halshs.archives-ouvertes.fr/halshs-00115622>**

Submitted on 22 Nov 2006

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## **Banks' procyclicality behavior□ does provisioning matter□**

Vincent BOUVATIER

Laetitia LEPETIT

**2006.35**



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Maison des Sciences Économiques, 106-112 boulevard de L'Hôpital, 75647 Paris Cedex 13  
<http://mse.univ-paris1.fr/Publicat.htm>

ISSN : 1624-0340

# Banks' procyclicality behavior: Does provisioning matter?\*

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\*We would like to thank Christian Bordes, Thérèse Chevallier-Farat, David Dickinson, Andy Mullineux and Amine Tarazi for their assistance and their helpful comments. The usual disclaimer applies.

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**Résumé:**

Un panel de 186 banques européennes sur la période 1992-2004 est utilisé pour déterminer si les fluctuations de l'offre de crédit des banques sont amplifiées par la contrainte réglementaire sur les fonds propres et par les règles de provisionnement. Nos résultats sont en accord avec l'hypothèse du canal du capital bancaire : les banques faiblement capitalisées se trouvent contraintes pour accroître leur offre de crédit. Nous montrons également que les provisions contractées pour couvrir des pertes identifiées (provisions non discrétionnaires) amplifient les fluctuations de l'offre de crédits. En effet, ces provisions non discrétionnaires évoluent de façon cyclique et conduisent à une mauvaise prise en compte des pertes anticipées. L'incitation de la banque à offrir du crédit est donc affectée dans la mesure où les coûts liés à l'accord d'un crédit sont mal évalués. D'autre part, la proportion des provisions utilisée pour des objectifs de management (provisions discrétionnaires) n'affecte pas les fluctuations de l'offre de crédit. Les résultats de cet article conduisent à recommander la mise en place d'un système de provisionnement dynamique en Europe.

**Classification JEL:** G21**Mots-clés:** crédit, provisions, capital réglementaire**Abstract:**

A panel of 186 European banks is used for the period 1992-2004 to determine if banking behaviors, induced by the capital adequacy constraint and the provisioning system, amplify credit fluctuations. Our finding is consistent with the bank capital channel hypothesis, which means that poorly capitalized banks are constrained to expand credit. We also find that loan loss provisions (LLP) made in order to cover identified credit losses (non discretionary LLP) amplify credit fluctuations. Indeed, non discretionary LLP evolve cyclically. This leads to a misevaluation of expected credit risk which affect banks' incentives to grant new loans since lending costs are misstated. By contrast, LLP use for management objectives (discretionary LLP) do not affect credit fluctuations. The findings of our research are consistent with the call for the implementation of dynamic provisioning in Europe.

**JEL classification:** G21**Keywords:** bank lending, loan loss provisions, capital requirement

# 1 Introduction

Much concern has been recently expressed about factors explaining fluctuations in bank lending. Central banks, as well as banking regulators, are concerned since such factors could exacerbate the business cycle, cause financial instability and misallocate lending resources. The literature on fluctuations in bank lending is based on the work of Bernanke and Blinder (1988) who introduced the credit market equilibrium in a textbook IS-LM model and analyzed the interaction between monetary policy and bank lending. A better understanding of the economy's response to a monetary policy shock requires therefore to consider a bank lending channel (Bernanke and Gertler, 1995) which emphasizes the role of imperfections in the market for bank debt. This hypothesis is empirically supported by Kashyap and Stein (1995, 2000) for American banks and by Ehrmann et al. (2003) for European banks. Imperfections in the market for bank capital can also be stressed to explain fluctuations in bank lending. Van den Heuvel (2002) focuses on capital requirements and defines a bank capital channel by which monetary policy can change the supply of bank loans through its impact on bank equity. These two channels do not only operate through changes in monetary policy. They are also relevant in explaining the impact of macroeconomic conditions and changes in banking regulation on bank lending.

In this paper, we point out another factor which may amplify the cyclicity of bank lending: the provisioning system. Provisioning rules and the capital requirement are linked through the coverage of credit risk: the conceptual framework of credit risk management supposes that expected losses have to be covered by loan loss provisions while unexpected losses have to be covered by bank capital. While regulatory constraint explicitly links the expansion of bank lending with bank capital, such a constraint does not exist on provisioning rules. However, loan loss provisions have a direct impact on banks profit. An underestimated expected credit risk could reinforce banks' incentives to grant new loans since lending costs are understated. In addition, increases in loan loss provisions due to deterioration in loan portfolio quality can lead to a decrease in banks capital if losses are too strong. Credit risk management without provisioning rules covering expected credit risk may therefore have procyclical effects. This concern is all the more important as banking regulators and academic researchers focus mainly on capital requirements and tend to disregard provisioning practices. Hence, in this paper we analyze if the management of loan loss provisions may explain changes in

banks' lending behavior over the business cycle.

The relationship between loan loss provisions and credit supply fluctuations has to be cautiously analyzed because loan loss provisions merge different information and behaviors. The literature distinguishes two components<sup>1</sup>. The first one, called the non discretionary component, is made in order to cover expected credit losses in a bank's loan portfolio (Whalen, 1994; Beaver and Engel, 1996). This kind of provisioning system is said to be backward-looking since banks mainly relate non discretionary provisions to identified credit losses. During economic upswings, few credit losses are identified and the level of loan loss provisions is low. During downturns, however, loan loss provisions increase because loan defaults are usually high during this period. As a result, the non discretionary component is a driving force in the cyclicity of loan loss provisions and leads to a misevaluation of expected credit losses. The expected credit risk appears as soon as the loan is granted and not only during the downturn when the losses is finally identified. In particular, Keeton (1999) and Jiménez and Saurina (2005) show that an increase in loan growth during an expansionary phase leads to higher loan losses during the slowdown. Expected credit losses are therefore under-provisioned during an upswing phase. Conversely, banks have to charge provisions too late during the downturn. The cyclicity of loan loss provisions directly affect bank profits and bank capital which could influence the bank's incentive to grant new loans and increase the cyclicity of its lending.

The second component, called the discretionary component, is due to the utilization of loan loss provisions for management objectives. At least three different discretionary actions can be distinguished (Liu et al., 1997; Ahmed et al., 1999; Lobo and Yang, 2001). The first one, the income smoothing behavior, may be countercyclical. Banks have incentives to smooth earnings over time. When earnings are expected to be low, loan loss provisions are deliberately understated to mitigate adverse effects of other factors on earnings. On the other hand, when earnings are unusually high, banks choose discretionary income-reducing accruals. Thus, under the income-smoothing behavior, banks choose accruals to minimize the variance of reported earnings. This implies that loan loss provisions increase during an expansionary phase and decrease during a recession phase. Consequently, the income smoothing behavior may have a positive impact on bank lending.

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<sup>1</sup>Accounting practices distinguish specific provisions and general provisions (Cortavaria et al., 2000). Specific provisions are defined by specific accounting rules. They depend on identified credit losses and they will increase specific loan loss reserves which are deducted from assets. General provisions have to cope with expected losses and will be added to general loan loss reserves on liabilities, but banks do not implement rigorous and statistical methods to compute them. Consequently, general provisions depend partially on expansion of total loans and they are manipulated by discretionary behaviors of bank managers.

The two other discretionary actions are concerned with capital management and signalling. With regard to capital management, capital-constrained banks can use discretionary accruals to achieve regulatory-capital targets. General and specific provisions reduce Tier 1 capital via their effect on earnings. But since general provisions are also included as components of Tier 2 capital and deducted from risk-weighted assets<sup>2</sup>, an increase in general provisions may actually increase the regulatory capital, especially if the increase in Tier 2 is larger than the decrease in Tier 1 capital. To the extent that such discretionary behavior increases regulatory capital without a corresponding reduction in risk of insolvency, it constitutes regulatory capital arbitrage. The last discretionary behavior occurs when banks use loan loss provisions to signal financial strength. The opportunity for signaling through discretionary loan loss provisions arises when managers have information indicating that bank values are higher than those assessed by the market. Such banks may be willing to see their market values revised upwards. One may view this as a signal that the bank is strong enough to absorb future potential losses by increasing current loan loss provisions.

The objective of this paper is to analyze the effect of the provisioning system on fluctuations in bank lending in Europe. In particular, we attempt to determine if loan loss provisions amplify the credit cycle. Using a panel of European banks for the period 1992-2004, we estimate the non discretionary and discretionary components of loan loss provisions in order to isolate individually their impact on banks lending. The concern about the impact of loan loss provisions on credit cycle is particularly relevant for the debate between financial supervisors and accounting authorities about the reform in bank provisioning systems. The current provisioning system in Europe is backward-looking (excluding Spain and Portugal since recent years) and a such system may amplify the cyclicity of bank lending. In recent years, there have been calls (Trichet, 2000; Poveda, 2000; Crockett, 2000 and Borio et al., 2001) for more forward-looking provisioning decisions to mitigate the potential problem that may arise from the cyclicity of lending and bank profitability. But there is no consensus about the way in which this should be achieved: dynamic provisioning<sup>3</sup> promotes banking

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<sup>2</sup>General provisions can increase loan loss reserves of up to 1.25% of risk weighted assets, the excess will be deducted from Tier1.

<sup>3</sup>With a statistical or dynamic provisioning system, general and specific provisions are created continuously in the traditional manner. General provisions are established as usual to cover expected losses as a given proportion of the total loan portfolio, which are, however, not connected with direct assets and are for unspecified losses. Specific provisions are created to cover the expected impairment of assets based on problem loans. In addition to these provisions, the statistical provision is formed with purpose of anticipating risks arising from changes in business cycles for each risk category. The statistical provision records the expected losses connected with the initial portfolio in a way that total provisions (specific, general and statistical) created over the years are smoothed. The statistical provision increases in periods of economic growth, complementing net specific provisions, which are rather low in these periods compared to total loans. Such a system was established in Spain, Portugal and Australia.

stability whereas Full Fair Value Accounting<sup>4</sup> (FFVA) promotes market discipline.

The remainder of the paper is organized as follows. Section 2 reviews the literature on bank behavior and procyclicality. Section 3 reports the empirical methodology employed to differentiate the discretionary and non discretionary components of loan loss provisions. Section 4 presents estimates of the impact of provisioning practices on credit fluctuations. Section 5 discusses the credit cycle and dynamic provisioning practices. Concluding remarks are presented in the final section.

## 2 Related literature on bank behavior and procyclicality

The literature which analyzes fluctuations in bank lending behavior provides some empirical evidence of cyclicity. Asea and Blomberg (1998), using US data from 1977 to 1993, show that bank lending evolves cyclically, affecting aggregate economic activity. In addition, Peek et al. (2003) and Lown and Morgan (2006) clearly identify the effects of loan supply on fluctuations in credit and GDP which supports the existence of the bank lending channel.

These interactions between the credit cycle and the business cycle are underlined on Figure 1 for Germany, France, Italy and United Kingdom over the period 1980-2004<sup>5</sup>. As Figure 1 shows, the growth of bank lending in these four European countries is characterized by significant short term fluctuations. These fluctuations are stronger than the ones of the business cycles. Means on absolute values and standard errors (Table 1) sum up this difference in size exhibited in Figure 1. Nevertheless, the credit and business cycles have a strong and similar persistence since their first order autocorrelations are around 0.90 (Table 1). Moreover, there is significant interdependence between the credit and business cycles. Granger causality tests (Table 1) show that there is a feedback effect between credit and GDP although this effect appears weaker in Germany. Contemporaneous correlations are also significantly positive except for Italy (Table 1). Fluctuations in bank

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For a more detailed discussion on this issue, see Fernandez de Lis et al. (2001), Borio et al. (2001) and Mann and Michael (2002).

<sup>4</sup>Full fair value accounting tries to approximate as closely as possible the value that the asset would have if it were traded on the market. This implies that the value of a bank's problem assets will fall immediately, in contrast with historical accounting where banks have to make reserves for the difference between the book value and the actual value. One of the benefits of fair value accounting is that it offers better information to investors and supervisors. However, the frequent changes in the value of assets exposed to market price fluctuations tend to amplify capital volatility and thus lending cycles. See Jackson and Lodge (2000) and the Joint Working Group Standard Setters (2000) for an overview of the debate on fair value accounting.

<sup>5</sup>The figures for all the European country are not reported to economize on space. We find that the growth of bank lending is cyclical for all them.

credit thus may have significant, indeed critical, effects on the macroeconomic activity and may amplify swings in the economy.

Bikker (2004), for a panel of 26 OECD countries over the period 1979-1999, finds that lending at a macroeconomic level is strongly dependent on demand factors, measured by cyclical variables such as real GDP growth, inflation, unemployment and real money supply. However, such macroeconomic approach understates the role played by bank characteristics. This is because of the identification problem; it is difficult to separate the role of loan demand from that of loan supply. This difficulty has prompted researchers to focus on microeconomic panel data to explore some of the cross-sectional implications of the bank lending view. Much concern focused on the impact of monetary policy. The responses of banks to changes in monetary policy may differ, depending on their characteristics. The idea behind this is that some types of banks are more capable than others to offset a monetary policy shock. Indeed, changes in the money market rate affect the cost of funding but this has a limited effect on lending when banks can easily raise non-deposit funding or when banks own a buffer of liquid assets. Kashyap and Stein (1995) originally proposed a reduced form dynamic equation for bank loans using a panel of American banks over the period 1976-1992. Their findings are consistent with the bank lending channel view and show that loan growth of large banks and small banks respond differently to a monetary policy shock. Other studies on American banks, following the approach of Kashyap and Stein (1995), find that the impact of the bank lending channel is also greater for banks with less liquid assets and less capital (Kashyap and Stein, 2000; Kishan and Opiela, 2000). The bank lending view is relevant for European banks as well (Altunbas et al., 2002; Ehrmann et al 2003) even if studies on the role of banks capital display mixed results. Individual country estimates can give more conclusive results (see Gambacorta and Mistrulli (2004) and Gambacorta (2005) for the Italian case).

The studies mentioned above point out a bank lending channel based on imperfections in the market for bank debt. Imperfections in the market for bank equity are also stressed to explain the impact of bank capital on lending and then to define a bank capital channel (Van den Heuvel, 2002). The bank capital channel assumes a maturity mismatch between assets and liabilities. An increase in the money market rate are therefore supposed to affect more strongly interest rates on bank's liabilities than interest rates on bank's assets. Consequently, the increase in the money market rate implies a reduction in a bank profit and therefore

in the bank's capital. Since issuing equity is costly and banks have to meet capital requirements, a monetary policy shock can affect bank lending. Van den Heuvel (2002) shows that the bank capital channel concerns all low-capitalized banks and not only banks with capital binding constraint. Theoretical investigations (Chami and Cosimano, 2001; Zicchino, 2005; Furfine, 2001) also emphasized the role of macroeconomic conditions and changes in banking regulation to explain the impact of capital requirement on bank lending.

The bank capital channel is consistent with empirical findings related to the 1990-1992 "credit crunch" in the United States. These studies focus directly on the impact of capital requirement on bank lending and try to assess whether there was a "capital crunch" caused by increased capital requirements or if more stringent regulatory practices occurred at the beginning of the 1990's<sup>6</sup>. Bernanke and Lown (1991) find a positive correlation between loan growth and changes in bank capital during 1990-1991 while Hancock and Wilcox (1998) and Peek and Rosengren (1995) detect a positive effect of bank capital requirement on credit growth during the same period. Brinkmann and Horwitz (1995) also find a positive effect on loan growth, but only for large banks. Wagster (1999) shows that stricter supervision, which occurred during the period 1990-92 in Canada, UK and the USA, implies that less credits were extended to lower-risk investments such as government bonds.

Misevaluation of credit risk over the business cycle represents another feature which may explain fluctuations in bank lending. In phases of economic boom, banks are inclined to take on greater risks, owing to their basically positive anticipations as regards the course of the economy and future trends. By contrast, banks are excessively pessimistic during cyclical downturns if they overstate credit risk. Disaster myopia (Guttentag and Herring, 1984, 1986), herd behavior (Rajan, 1994) and the institutional memory hypothesis (Berger and Udell, 2003) account for misevaluation of credit risk. Disaster myopia emphasizes that banks tend over time to underestimate the probability of low-frequency shocks while herd behavior focuses on the idea that banks management is obsessed with short-term concerns and perception of reputation. As for the institutional memory hypothesis, it stresses that current loan officers ease credit standards over time as the previous loan bust is not remembered because of loan officer turnover.

Backward-looking provisioning systems also contribute to the misevaluation of credit risk. Whalen (1994)

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<sup>6</sup>The BIS risk-based capital standards began to phase in at the end of 1990 and were fully implemented in 1992.

and Beaver and Engle (1996) identify a non discretionary component in loan loss provisions related to contemporaneous problem loans. Besides, Laeven and Majnoni (2003) and Bikker and Metzmakers (2005) show that provisioning behavior is related to the business cycle. These studies therefore highlight that the ratio of loan loss provisions to total loans exhibit a strong cyclicity. This is notably documented for France (Clerc et al., 2001), Austria (Arpa et al., 2001), Spain (Fernandez de Lis et al., 2001) and United Kingdom (Pain, 2003). Expected credit losses are therefore understated during upswings and overstated during downturns. A time-lag can notably be stressed between riskier loans which are granted during the peak of the business cycle (Keeton, 1999; Jiménez and Saurina, 2005) and loan loss provisions which are built up only during the next downturn according to backward-looking rules. This pattern is a major factor in driving the cyclical nature of recorded bank profits and bank capital. In particular, Jordan et al. (2002) emphasize that the cyclicity of loan loss provisions is reflected in bank capital. As a result, provisioning rules in a backward-looking system can be seen as contributing to the overall cyclicity of the financial system and the macro-economy more generally (Borio et al., 2001).

Although the recent debate about whether current practices of provisioning are biased towards procyclical bank behavior, there is no study to our knowledge which explicitly examines the impact of loan loss provisions on bank lending. Shrieves and Dahl (2002) - analyzing the utilization of the discretionary accounting practice of the Japanese banks during 1989-1996 - find a negative and significant relationship between loan loss provisions and year-on-year change in total loans. This result is consistent with the hypothesis that loan loss provisions influence credit cycles. However, to test explicitly the impact of loan loss provisions on the fluctuations of bank lending, the discretionary component and the non discretionary component need to be distinguished. Indeed, the cyclical behavior of non discretionary provisions should reinforce the cyclical nature of bank lending. On the contrary, the discretionary component, through the income smoothing behavior, may reduce the procyclicality of bank lending.

### 3 Estimation of the discretionary and non discretionary components of loan loss provisions

To test the impact of loan loss provisions (LLP) on fluctuations in bank lending, we need to estimate the discretionary and the non discretionary components of LLP. We use a methodology similar to the one developed by Ahmed et al. (1999).

#### 3.1 Data and descriptive statistics

We use a sample consisting of an unbalanced panel of annual report data from 1992 to 2004 for a set of European banks in 15 European countries<sup>7</sup>: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom (see Appendix, Table A1). The bank data used for the estimates come from Bankscope Fitch IBCA<sup>8</sup>. A majority of banks do not give information on some variables needed by this study (especially non performing loans and total capital ratio). Also we delete banks with less than five years of time series observations. Moreover, we exclude all the outliers by eliminating the extreme bank/year observations (2.5% lowest values and 2.5% highest values) for each considered variable<sup>9</sup>. The final sample consists of 186 European banks out of the 2 513 available at the beginning (see Table A1 in the appendix for details). However, our unbalanced sample represents a significant part of total loans available in Bankscope Fitch IBCA. The average cover rates of total loans are around 37% in 1992 and 54% in 2004 (see Appendix, Table A1).

Descriptive statistics of our sample are presented in Table 1. Deposits are the main resource (65.67%) and loans are the main banks' assets (58.53%). These assets seem carefully managed as mean ratios of LLP to total assets and nonperforming loans to gross loans are respectively 0.41% and 5.08%. Furthermore, the total capital ratio is 12.43%. Thus, on average, banks are well capitalized with sufficient capital buffers.

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<sup>7</sup>The European banking system can be considered as unified since the Second European Banking Directive of 1989. Thus, we consider a sample of European banks without taking into account countries of origination.

<sup>8</sup>All the banks in our sample publish their annual financial statements at the end of the calendar year.

<sup>9</sup>The outliers represent around 5% of the banks excluded of our sample (approximately 125 banks). Thus most of the banks were thrown out because we miss data about some variables.

## 3.2 Modelling bank provisions

Empirical evidence and economic theory (Beaver and Engel, 1996; Liu et al., 1997; Ahmed et al., 1999; Lobo and Yang, 2001) suggest a number of factors which may explain the choice of LLP. These may be grouped into three classes.

### 3.2.1 Non discretionary behaviors

The non discretionary component of LLP reflects expected losses but backward-looking rules based on identified credit losses give a strong cyclical to this component. The model includes three variables which represent the risk of a bank's portfolio. The ratio of non performing loans to gross loans at the end of the year  $t$  ( $NPL_{it}$ ) and the first difference of  $NPL_{it}$  ( $\Delta_{t+1/t}NPL_{it} = NPL_{it+1} - NPL_{it}$ ) are good indicators of the risk of default on banks' loans. Hence, we expect a positive relationship between these two variables and LLP. We also include the risk of default for the overall credit portfolio, measured by the ratio of loans to total asset ( $L_{it}$ ). The coefficient associated with this variable should also be positive.

### 3.2.2 Discretionary behaviors

The discretionary component of LLP results from three different management objectives.

*The income smoothing behavior:*

Under the income smoothing hypothesis, banks understate (overstate) LLP when earnings are expected to be low (high) relative to that of other years (inter-temporal smoothing). If banks use LLP to smooth earnings, then we would expect a positive relation between earnings before taxes and loan loss provisions ( $ER_{it}$ ) and LLP. As the propensity to smooth income is higher for banks with good performance relative to banks with moderate current performance, we introduce a dummy variable which takes the value of  $ER_{it}$  for banks with positive earnings before taxes and loan loss provisions and 0 otherwise ( $ER\_H_{it}$ ). We should find a positive coefficient for  $ER\_H_{it}$  if there is non linearity in the relation between LLP and earnings.

*The capital management behavior:*

Poorly capitalized banks can use LLP to manage regulatory capital. We compute the variable  $TCRL_{it}$  which takes the value of the total capital ratio (TCR) minus 8 and divided by 8 when observations for

bank  $i$  are in the first quartile of TCR and 0 otherwise. A positive correlation between LLP and  $TCRL_{it}$  could be expected if poorly capitalized banks are less willing to make LLP (Shrieves and Dahl, 2002). However, accounting relations could also influence the relation between bank capital and loan loss provisions. Regulatory capital is composed of Tier 1 - which includes equity and retained earnings - and Tier 2 - which includes subordinated debt and loan loss allowances (depending on general provisions). LLP are therefore positively correlated to Tier 2 and negatively to Tier 1. If regulatory capital variations are more related to retained earnings than loan loss allowances, correlation should be negative between LLP and  $TCRL_{it}$ <sup>10</sup>.

*The signalling behavior:*

Banks can use LLP to signal financial strength. The variable  $SIGN_{it}$ , defined as the one-year-ahead changes of earnings before taxes and loan loss provisions ( $SIGN_{it} = (ER_{it+1} - ER_{it}) / 0.5(TA_t + TA_{t+1})$ , where TA is the total asset), is computed to test the signalling hypothesis. A positive correlation with LLP is expected (Beaver et al., 1989; Whalen, 1994; Ahmed et al., 1999).

### 3.2.3 Macroeconomic influences on asset quality

The macroeconomic environment should affect the ability of borrowers to repay banks' assets. The private sector wealth will vary with the economic cycle, so we introduce the annual growth rate of GDP,  $\dot{y}_{it}$ . Some studies have empirically studied the economic cycle as a determinant of loan loss provisions (see Pain (2003) for UK banks, Fernandez de Lis et al. (2001) for the Spanish case, Cavallo and Majnoni (2001), Laeven and Majnoni (2003) and Bikker and Metzmakers (2005)). They find a significant and negative impact on provisions: loan losses increase (and hence LLP) when  $\dot{y}_{it}$  decreases. Thus, we expected a negative sign for the variable  $\dot{y}_{it}$ .

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<sup>10</sup>We use in our study the total capital ratio (TCR = TIER1+TIER2) because a majority of banks do not give specific information on their level of TIER 1 and TIER 2.

### 3.2.4 Model specification

Equation (1) models the relationship between loan loss provisions and the explanatory variables defined above:

$$\begin{aligned}
 LLP_{it} = & \alpha_0 + \underset{(+)}{\alpha_1} LLP_{it-1} + \underset{(+)}{\alpha_2} NPL_{it} + \underset{(+)}{\alpha_3} \Delta_{t/t+1} NPL_{it} + \underset{(+)}{\alpha_4} L_{it} + \underset{(-)}{\alpha_5} y_{it} & (1) \\
 & + \underset{(+)}{\alpha_6} ER_{it} + \underset{(+)}{\alpha_7} ER\_H_{it} + \underset{(+)}{\alpha_8} TCRL_{it} + \underset{(+)}{\alpha_9} SIGN_{it} + \varepsilon_{it},
 \end{aligned}$$

where  $LLP_{it}$  is the ratio of loan loss provisions (specific provisions plus general provisions) to total assets at the end of the year  $t$  for bank  $i$ . We introduce the lagged dependent variable as explanatory variable to take into account a dynamic adjustment of  $LLP_{it}$ . If banks adjust their provisions slowly to recognize potential losses against loans following a default event, then provisions could be systematically related each period. The model accounts for the possibility that the use of discretionary LLP for one purpose is conditional on the effects of the other two motivations; this is done by jointly estimating the relationships between loan loss provisions and income smoothing, capital management and signalling behaviors.

The estimation of equation (1) is used to compute the non discretionary component ( $NDISC_{it}$ ) and the discretionary component ( $DISC_{it}$ ) of the LLP. We assume that these two components are linear functions of the variables included in equation (1). Thus, the non discretionary component of LLP is estimated as the sum of the products of its explanatory variable times the corresponding estimated coefficient from equation (1). The same method is used to compute the discretionary component.

### 3.3 Empirical results

As we consider a dynamic adjustment of LLP, the estimation of equation (1) is performed with the generalized method of moments (GMM) using first differences (Arellano and Bond, 1991) and orthogonal deviations (Arellano and Bover, 1995). The results are reported in Table 2. This estimation is robust to heteroskedasticity and autocorrelation. We also ensure that the correlations between exogenous variables are weak.

The coefficients on  $NPL_{it}$  ( $\alpha_2$ ) and on  $\Delta_{t/t+1} NPL_{it}$  ( $\alpha_3$ ) are significantly positive at the 1% level. This result implies that the cyclical evolution of non performing loans influences provisioning via the backward-

looking rules. Bank profits are therefore also influenced by the cyclical nature of identified credit losses via loan loss provisions. The other variable introduced to assess the effect of expected credit losses on LLP choices, the ratio of loans to total asset  $L_{it}$ , is not significant at the 10% level (the t-stat is 1.30). The significant and negative coefficient for GDP growth ( $\alpha_5$ ) indicates that the macroeconomic situation is relevant which strengthens the cyclical behavior of LLP. Business cycle influences financial strength of firms and households and therefore has a close relationship with problem loans. This implies not only an increase in specific provisions according to backward-looking rules but also an increase in the general provisions as the GDP growth modifies the credit exposure of banks.

Concerning the discretionary behaviors, our results show that poorly capitalized banks use LLP to manage regulatory capital. Poorly capitalized banks' provisions vary directly with their surplus regulatory capital ( $\alpha_8 > 0$ ). Thus, banks with low capital are less inclined in making LLP since it reduces Tier 1 via its impact on earnings. The estimated coefficient of the variable earnings before taxes and loan loss provisions ( $\alpha_6$ ) is significant and negative. This is not consistent with the hypothesis of an income smoothing behavior. On the contrary, banks reduce loan loss provisions when earnings before taxes and loan loss provisions increase. This result emphasizes the cyclical nature in loan loss provisions already underscored by the non discretionary component since high earnings are recorded during economic upswings. However, there is non linearity in the relation between LLP and earnings. The variable  $ER\_H_{it}$ , accounting for banks with a relatively good performance, exhibits a positive and significant coefficient ( $\alpha_7$ ). Wald tests show that the total impact ( $\alpha_6 + \alpha_7$ ) of earnings on loan loss provisions is negative and significantly different from zero at the 5% level for banks with a relatively good performance. Therefore, these banks are more able to offset the cyclical nature of loan loss provisions. With regard to the signalling behavior, banks may use discretionary LLP to signal financial strength when the stock market underestimates their earnings. We find that the coefficient on  $SIGN_{it}$  ( $\alpha_9$ ) is positive and significant, which is consistent with the signalling hypothesis.

We use the estimates of equation (1) to compute the non discretionary (NDISC) and the discretionary (DISC) components of LLP. It is assumed that these two components are linear functions of the different variables included in equation (1). Thus, they are estimated as the sum of the products of its explanatory variables times the corresponding estimated coefficients from equation (1). To check for robustness, we com-

pute different non discretionary and discretionary variables. The following three non discretionary variables are computed for each of two methods of estimation (Arellano and Bond (1991) and Arellano and Bover (1995))

$$NDISC1_{it} = \alpha_1 LLP_{it-1} + \alpha_2 NPL_{it} + \alpha_3 \Delta_{t/t+1} NPL_{it} + \alpha_4 L_{it} + \alpha_5 \dot{y}_{it}, \quad (2)$$

$$NDISC2_{it} = \alpha_1 LLP_{it-1} + \alpha_2 NPL_{it} + \alpha_3 \Delta_{t/t+1} NPL_{it} + \alpha_5 \dot{y}_{it}, \quad (3)$$

$$NDISC2_{it} = \alpha_2 NPL_{it} + \alpha_3 \Delta_{t/t+1} NPL_{it} + \alpha_5 \dot{y}_{it}. \quad (4)$$

The variable  $NDISC1_{it}$  includes all the variables which may explain NDISC whereas  $NDISC2_{it}$  only includes the significant variables at the 10% level, which implies that the variable  $L_{it}$  is excluded. The third non discretionary variable ( $NDISC3_{it}$ ) excludes the lagged dependent variable  $LLP_{it-1}$  and the variable  $L_{it}$  which is not significant at the 10% level. On the same way, two discretionary components are computed

$$DISC1_{it} = \alpha_6 ER_{it} + \alpha_7 ER\_H_{it} + \alpha_8 TCRL_{it} + \alpha_9 SIGN_{it} \quad (5)$$

$$DISC2_{it} = \alpha_7 ER\_H_{it} + \alpha_9 SIGN_{it}. \quad (6)$$

We consider the set of explanatory variables that are significant to compute the first discretionary variable,  $DISC1_{it}$ . For the second one, we only keep the variables that may have a countercyclical effect:  $ER\_H_{it}$  and  $SIGN_{it}$ . The income smoothing and signalling behaviors may offset the evolution of non discretionary provisions, increasing loan loss reserves in good times. This could positively affect banks' ability to supply credits, whereas the capital management may have no clear impact on the cyclicity of bank lending.

These discretionary and non discretionary variables are used to test the impact of provisioning behaviors on bank loans fluctuations.

## 4 Credit fluctuations and provisioning practices

### 4.1 Specification of credit fluctuations

An empirical model on bank lending fluctuations is used to investigate macroeconomic implications of bank's procyclicality behavior. Most theoretical models on bank lending fluctuations are drawn on Bernanke and Blinder (1988) which originally introduced the credit market equilibrium in a textbook IS-LM model. However, empirical investigation with panel data calls several digressions. The empirical model has to fit microeconomic data and explain credit fluctuations at the bank level. We use a methodology similar to Kashyap and Stein (1995) who originally proposed a reduced form dynamic equation for bank loans. The model we estimate is written as

$$\begin{aligned} \Delta_{t-1/t}L_{it} = & \beta_0 + \beta_1\Delta_{t-2/t-1}L_{it-1} + \beta_2\Delta_{t-1/t}D_{it} + \beta_3\dot{y}_{it} + \beta_4i_{it} + \beta_5\pi_{it} + \beta_6TCRL_{it} \\ & + \beta_7NDISC_{it} + \beta_8NDISC_{it} * Dum + \beta_9DISC_{it} + u_{it}, \end{aligned} \quad (7)$$

where  $\Delta_{t-1/t}L_{it} = (L_{it} - L_{it-1})/0.5(TA_{it} + TA_{it-1})$ ;  $TA_{it}$  is the total asset;  $\Delta_{t-1/t}D_{it}$  is the growth rate of deposits between year  $(t - 1)$  and  $t$ ;  $\dot{y}_{it}$  is the GDP growth rate between the year  $(t - 1)$  and  $t$ ;  $i_{it}$  is the money market rate;  $\pi_{it}$  is the inflation rate;  $TCRL_{it}$  equals  $(\text{total capital ratio}-8)/8$  when observations for bank  $i$  are in the first quartile of the total capital ratio (TCR) and 0 otherwise;  $NDISC_{it}$  equals to  $NDISC1_{it}$ ,  $NDISC2_{it}$  or  $NDISC3_{it}$ ;  $DISC_{it}$  equals to  $DISC1_{it}$  or  $DISC2_{it}$ ;  $NDISC_{it} * Dum$  equals to the non discretionary variable ( $NDISC1_{it}$ ,  $NDISC2_{it}$  or  $NDISC3_{it}$ ) multiplied by a dummy variable which takes the value of 1 if the bank  $i$  is classified as poorly capitalized ( $TCRL_{it}$ ) and 0 otherwise.

Three groups of variables are considered in the model. Firstly, three macroeconomic variables are introduced. By including inflation and GDP growth rate, the model accounts for the economic environment. We should find a positive sign for the GDP growth rate ( $\beta_3 > 0$ ) since this variable is related to loan demand. The annual inflation rate should have a negative sign ( $\beta_5 < 0$ ). The sign of the coefficient associated with the money market rate should be negative ( $\beta_4 < 0$ ) according to the effect of a contractionary monetary policy on bank lending.

Secondly, we consider bank specific variables. We expect a positive relationship between bank loans

fluctuations and the growth rate of deposits between year  $(t - 1)$  and  $t$  ( $\beta_2 > 0$ ). Furthermore, one variable is computed to take into account the bank capital channel,  $TCRL_{it}$ . We should find a positive sign for the coefficient associated to  $TCRL_{it}$  ( $\beta_6 > 0$ ) since the regulatory capital requirement should represent a constraint for poorly capitalized banks.

Finally, three variables are introduced to analyze the relationship between loan loss provisions and credit supply fluctuations. First, the non discretionary component of LLP ( $NDISC_{it}$ ) takes up reserves that the bank have to charge to offset its problem loans. This component of loan loss provisions is therefore expected to reduce bank's incentive to expand its credit supply ( $\beta_7 < 0$ ) as it directly affects profits. During a downturn, the overall return on lending is particularly affected by the upsurge in loan loss provision resulting from backward looking rules. We expect a negative coefficient whatever the non discretionary variable considered:  $NDISC1_{it}$ ,  $NDISC2_{it}$  or  $NDISC3_{it}$ . Second, we introduce an interaction variable  $NDISC_{it} * Dum$  ( $Dum$  is a dummy variable which takes the value of 1 if the bank  $i$  is classified as poorly capitalized) to test if there is non-linearity in the relation between non discretionary provisions and credit fluctuations. Indeed the effect of non discretionary provisions on credit fluctuations could be stronger for poorly capitalized banks ( $\beta_8 < 0$ ) since these banks cannot use a capital buffer to face an upsurge in loan losses. Third, we consider two discretionary variables:  $DISC1_{it}$  or  $DISC2_{it}$ . The second one takes only into account discretionary behaviors that may have a counterbalancing effect on the cyclical evolution of non discretionary provisions and could therefore be considered as a kind of unregulated dynamic provisioning (Bikker and Metzmakers, 2005): the income smoothing and the signalling. These discretionary behaviors reduce the volatility of bank profits, increasing provisions during the expansionary phase and decreasing provisions during the recession phase. As a result, profits as well as provisions are smoothed, which should positively affect banks ability to supply credits. We therefore expect a positive relationship between the discretionary variable  $DISC2_{it}$  and credit fluctuations in equation (7) ( $\beta_9 > 0$ ). The discretionary variable  $DISC1_{it}$  accounts for different behaviors. As the capital management behavior may have no clear effect on the cyclicity of bank lending and as the variable  $ER_{it}$  does not have the expected sign, the sign of the coefficient associated with the discretionary variable  $DISC1_{it}$  is unknown.

## 4.2 Results

The estimation of equation (7) is performed with the generalized method of moments (GMM). This method is relevant because the provisioning constraints (variables  $NDISC_{it}$  and  $DISC_{it}$ ) are built using the coefficients from the regression of equation (1) and therefore contains measurement error. In addition, the lag of the endogenous variable can lead to a simultaneity bias. These variables are therefore instrumented. Tables 2 and 3 report estimates obtained using respectively the GMM estimator proposed by Arellano and Bond (1991) and by Arellano and Bover (1995). As we have three different non discretionary variables ( $NDISC1_{it}$ ,  $NDISC2_{it}$  and  $NDISC3_{it}$ ) and two different discretionary variables ( $DISC1_{it}$  and  $DISC2_{it}$ ), Tables 2 and 3 display results for six estimations.

As expected, macroeconomic variables are relevant in credit fluctuations in all estimates. The coefficient of the GDP growth rate ( $\beta_3$ ) is significant and positive whereas the coefficient of the inflation rate ( $\beta_5$ ) is negative and significant. The coefficient of the money market interest rate ( $\beta_4$ ) is significant and negative. It means that monetary policy affects bank lending. We also find that banks use deposits to expand credit as the coefficient  $\beta_2$  is positive and significant.

With regard to the institutional constraints, we find that the coefficient associated with the regulatory capital requirement for poorly capitalized banks ( $\beta_6$ ) is positive and significant at the 1% level, which is consistent with the bank capital channel. These banks are therefore constrained in their lending activities.

The provisioning rules also appear relevant in all estimates. Non discretionary loan loss provisions ( $\beta_7$ ) affect credit fluctuations negatively and significantly at the 1% level. Backward-looking provisioning rules therefore amplify credit cycle: weak specific provisions during upswing phases encourage banks to expand credit whereas the sudden identification of problem loans during downturns constrains banks to make provisions, which reduces their incentive to supply new credits. As expected, poorly capitalized banks appear more constrained by the provisioning system. Indeed, the coefficient associated by the interacting term  $NDISC_{it} * Dum$  is negative and significant, except two estimates in Table 4. Jordan et al. (2002) emphasize that the cyclicity of loan loss provisions is reflected in bank capital. Indeed, bank capital can also be used to face expected credit losses following a sudden quality deterioration of the loan portfolio. Capital requirements force poorly capitalized banks to shrink further lending.

On the contrary, discretionary provisions associated with the income smoothing and signalling behaviors and acting like dynamic provisions ( $DISC2_{it}$ ), do not affect credit fluctuations at the 10% level in most estimates. Likewise, we do not find a robust relation between the discretionary variable  $DISC1_{it}$  and credit fluctuations. Thus, discretionary accounting practices do not seem to perform as an unregulated dynamic provision system which could efficiently counterbalance cyclical behavior of non discretionary provisions. The findings of our research are thus consistent with the call for the implementation of a dynamic provisioning in Europe to eliminate the effect of backward-looking provisioning practices on credit fluctuations.

## 5 Credit cycle and dynamic provisioning

The model estimated in this paper concerns bank lending fluctuations. Long term and short term factors cannot be properly isolated (as in Figure 1) since panel data with a short time period are used. However, the accounting constraint – linked to the evolution of non discretionary provisions – is relevant for short term fluctuations. This factor is driven by the cyclicity of identified credit losses as long as banks and regulators will not implement a proper recognition of expected credit losses. Several other banks' behaviors – for example, bias toward optimism, herd behavior or disaster myopia – are more frequently highlighted to explain the credit cycle. The supervision of these behaviors is difficult to implement and the importance of such behaviors tends to increase. The competition in the banking sector is strong and regulators promote internal risk management approaches, which is notably favourable for herd behavior and disaster myopia. Conversely, the implementation of a forward-looking provisioning system could more easily reduce the credit cycle since bank regulators can adopt this system unilaterally.

A forward-looking provisioning system could break or more precisely offset the correlation between non discretionary provisions and credit fluctuations. This system consists of implementing statistical provisions linking loan loss provisions with long term expected losses and not with contemporaneous problem loans. Statistical provisions are computed as the difference between expected losses and specific provisions, i.e. they can either be positive or negative. Banks therefore have to estimate precisely their expected losses using their own internal models or a standard approach developed by the regulator (Fernandez de Lis et al, 2001). As a result, banks build up statistical provisions during upswing phases – when actual losses and consequently

specific provisions are weak compared to total loans – and draw down these “reserves” during downturns. For the full business cycle, loan loss provisions are therefore smoothed.

Previous researches (Fernandez de Lis et al, 2001; Borio et al., 2001; Mann and Michael, 2002; Jiménez and Saurina, 2005) emphasize the effect of dynamic provisioning to smooth bank income and to stabilize bank capital. The improvement in the evaluations of both credit risks and bank profits explain these positive outcomes. Furthermore, our findings show that provisioning also influences credit fluctuations. Our estimations can be used to graphically illustrate the relevance of backward-looking provisioning practices to amplify credit fluctuations. Figure 2 illustrates the contributions of deposits, non discretionary provisions and GDP to changes in credit fluctuations. We represent the average situation which means that Figure 2 has to be cautiously analyzed. Credit fluctuations ( $\Delta_{t-1/t}L_{it}$ ) are consistently positive from 1994 to 2003. They are particularly strong in 1999 and 2000, respectively at 9.20 and 9.78. Figure 2 shows that changes in credit fluctuations record numerous swings, which is consistent with the occurrence of a credit cycle. The weakest credit fluctuation was recorded in 1994 (3.85) and peaked in 2000, followed by a slowdown. Changes in credit fluctuations are broken down into several variables according to equation (7). Deposits are the main factor explaining variations in credit fluctuations. In particular, they have strong and positive contributions in 1995 and 1999 and negative ones in 1996 and 1998. Non discretionary provisions also contribute significantly to explain changes in credit fluctuations. They also appear as important as the effect of variations in the GDP growth rate. The reduction in non discretionary provisions – i.e. in identified credit losses – is significant for the credit expansion specifically in 1995, 1999 and 2000. Their importance was limited during the slowdown of credit fluctuations from 2001. Indeed, banks weathered the slowdown particularly well; identified credit losses had been limited on average. The decline in GDP growth rate was more relevant to explain this slowdown in credit fluctuations but we can also point that non discretionary provisions have been more restrictive for poorly capitalized banks according to the effect emphasized by the variable  $NDISC'_{it} * Dum$  in our estimates. Finally, we point out that credit fluctuations related to non discretionary provisions displayed on Figure 2 result directly from an unsatisfactory backward-looking provisioning system. This factor is not the main source of fluctuations, but it could be easily removed from the credit cycle.

Our research gets to the heart of the differences in opinion between financial supervisors and account-

ing authorities. Over recent years, different approaches have been proposed to change both national and international accounting standards<sup>11</sup> in order to include more forward-looking practices. The Full Fair Value Accounting (FFVA) suggests that all financial instruments – including loans – should be measured at market value. As a result, gains and losses should be recognized in the profit and loss account as soon as they are expected. A dynamic provisioning system represents the main alternative to take into account more cautiously expected losses. Given the cyclicity of bank lending, our result support a dynamic provisioning system as it provides a more satisfactory institutional arrangement. Indeed, FFVA is not appropriate to support financial stability. It can enhance the procyclical character of bank lending because immediate recognition of unrealized value might reinforce the effects of shocks (Enria, 2004). It also increases banks' earnings and regulatory capital volatilities (Barth et al., 1995) which can impact the volatility of banks' balance sheets. Moreover, FFVA could affect the liquidity transformation role of banks and could reduce their contribution to inter-temporal smoothing (Freixas and Tsomocos, 2004). Furthermore, FFVA does not adequately recognize the specific nature of bank lending. It views banks as portfolio managers rather than as institutions that solve informational problems<sup>12</sup>. As a result, the banking industry and banking supervisor are opposed to FFVA (Chisnall, 2000).

## 6 Conclusion

The purpose of this research was to determine if the current provisioning system in Europe amplifies credit fluctuations. Using a panel of 186 European banks for the period 1992-2004, we empirically investigated the effect of LLP on bank lending fluctuations. In the first step, we analyzed whether the choice of LLP reflects identified credit losses (non discretionary LLP) and/or management objectives (discretionary LLP). Then, in the second step, we examined the variables which have an effect on bank credit fluctuations.

Our results show that macroeconomic variables are relevant to explain credit fluctuations. We also find that poorly capitalized banks are constrained in their lending activities. With regards to the provisioning rules, the results show that the non discretionary component of LLP amplifies the credit cycle. During an

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<sup>11</sup>For a more detailed discussion of this issue, see Borio et al. (2001).

<sup>12</sup>This is because the market value of banks' loan is difficult to define due to the underlying special information which is only available for banks (Berger et al., 1991).

upswing, banks tend to underestimate expected credit risk and then reduce non discretionary LLP. Banks' incentives to grant new loans are therefore reinforced since lending costs are understated. Conversely, sudden identification of problem loans during a downturn constrains banks to make non discretionary provisions, which reduces their incentive to supply new credits. In addition, this effect is stronger for poorly capitalized banks since these banks cannot use a capital buffer to face an upsurge in loan losses. On the contrary, the discretionary component of LLP does not affect credit fluctuations.

Our findings are consistent with the call for the implementation of a forward-looking principle in Europe through a dynamic provisioning system as in Spain and Portugal. Such dynamic provisioning system will require a recalibration of the Basel Accord. A fourth pillar – perhaps to be called the accounting pillar – could therefore be included in the Basel Accord especially to cope with expected credit losses. Moreover, the bank regulatory capital which incorporates general provisions up to a ceiling would also need to be changed in order to solely cover unexpected losses.

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**Table 1:** Statistics on the business and credit cycles from 1980 to 2005

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|  | <b>Germany</b> |        | <b>France</b> |        | <b>Italy</b> |        | <b>UK</b> |        |
|--|----------------|--------|---------------|--------|--------------|--------|-----------|--------|
|  | GDP            | Credit | GDP           | Credit | GDP          | Credit | GDP       | Credit |
| Mean on absolute values                        | 0.718          | 0.994  | 0.486         | 1.275  | 0.513        | 1.421  | 0.715     | 3.667  |
| Standard error                                 | 0.888          | 1.207  | 0.617         | 1.538  | 0.660        | 1.685  | 0.883     | 4.540  |
| Autocorrelation                                | 0.889          | 0.927  | 0.896         | 0.917  | 0.869        | 0.908  | 0.900     | 0.954  |
| Correlation                                    | 0.344          |        | 0.461         |        | 0.004        |        | 0.319     |        |
| GDP does not Granger<br>cause Credit (p-value) | 0.107          |        | 0.000         |        | 0.005        |        | 0.000     |        |
| Credit does not Granger<br>cause GDP (p-value) | 0.066          |        | 0.000         |        | 0.002        |        | 0.000     |        |

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**Table 2:** Non discretionary and discretionary components of LLP

|                                 | 2.1<br>(Arellano-Bond)           | 2.2<br>(Arellano-Bover)          |
|---------------------------------|----------------------------------|----------------------------------|
| $LLP_{it}(-1)$<br>(+)           | 0.2624 <sup>a</sup><br>(7.35)    | 0.2723 <sup>a</sup><br>(8.09)    |
| $NPL_{it}$<br>(+)               | 0.0261 <sup>a</sup><br>(2.65)    | 0.0248 <sup>a</sup><br>(2.94)    |
| $\Delta_{t/t+1}NPL_{it}$<br>(+) | 0.0009 <sup>b</sup><br>(2.12)    | 0.0011 <sup>a</sup><br>(2.75)    |
| $L_{it}$<br>(+)                 | 0.0029<br>(1.30)                 | 0.0026<br>(1.31)                 |
| $\dot{y}_{it}$<br>(-)           | -0.0113 <sup>a</sup><br>(-2.53)  | -0.0120 <sup>a</sup><br>(-2.88)  |
| $ER_{it}$<br>(+)                | -0.3522 <sup>a</sup><br>(-11.78) | -0.3541 <sup>a</sup><br>(-12.73) |
| $ER\_H_{it}$<br>(+)             | 0.2271 <sup>a</sup><br>(7.42)    | 0.2204 <sup>a</sup><br>(7.53)    |
| $TCRL_{it}$<br>(+)              | 0.4148 <sup>a</sup><br>(2.81)    | 0.4190 <sup>a</sup><br>(2.95)    |
| $SIGN_{it}$<br>(+)              | 2.9986 <sup>c</sup><br>(1.83)    | 3.3505 <sup>b</sup><br>(2.25)    |
| J-stat                          | 45.16                            | 43.23                            |
| Obs.                            | 739                              | 739                              |

**Note:** a, b and c indicate significance respectively at the 1%, 5% and 10% levels.  $t$ -statistics are corrected for heteroskedasticity following White's methodology.

**Variable definitions:**  $LLP_{it}$ : ratio of loan loss provisions to total assets at the end of the year  $t$ ;  $NPL_{it}$ : ratio of non performing loans to gross loans at the end of the year  $t$ ;  $\Delta_{t/t+1}NPL_{it}$ :  $NPL$  growth rate between year  $t$  and  $(t+1)$ ;  $L_{it}$ : ratio of loans to total assets at the end of the year  $t$ ;  $\dot{y}_{it}$ :  $GDP$  growth rate between the year  $(t-1)$  and  $t$ ;  $ER_{it}$ : ratio of earnings before taxes and loan loss provisions to total asset;  $ER\_H_{it}$ : take the value of  $ER_{it}$  for banks with positive earnings before taxes and loan loss provisions and 0 otherwise;  $TCRL_{it}$ :  $(TCR_{it}-8)/8$  when observations for bank  $i$  are in the first quartile of the total capital ratio ( $TCR$ ) and 0 otherwise;  $SIGN_{it}$ : take the value of the one-year-ahead change of  $ER_{it}$ .

**Table 3:** Bank loan fluctuations (Arellano Bond (1991) estimator)

|                                   | (3.1)                            | (3.2)                            | (3.3)                           | (3.4)                            | (3.5)                            | (3.6)                            |
|-----------------------------------|----------------------------------|----------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------------------|
| $\Delta_{t-1/t}L_{it}(-1)$<br>(+) | 0.0298 <sup>a</sup><br>(8.13)    | 0.0200 <sup>a</sup><br>(4.07)    | 0.0143 <sup>a</sup><br>(3.05)   | 0.0613 <sup>a</sup><br>(11.42)   | 0.0320 <sup>a</sup><br>(10.55)   | 0.0552 <sup>a</sup><br>(17.76)   |
| $\Delta_{t-1/t}D_{it}$<br>(+)     | 0.2276 <sup>a</sup><br>(59.31)   | 0.2414 <sup>a</sup><br>(45.16)   | 0.2329 <sup>a</sup><br>(33.25)  | 0.2590 <sup>a</sup><br>(58.08)   | 0.2705 <sup>a</sup><br>(85.06)   | 0.2691 <sup>a</sup><br>(96.96)   |
| $\dot{y}_{it}$<br>(+)             | 0.9571 <sup>a</sup><br>(24.37)   | 0.9571 <sup>a</sup><br>(24.37)   | 0.8187 <sup>a</sup><br>(8.94)   | 0.9425 <sup>a</sup><br>(29.16)   | 0.9661 <sup>a</sup><br>(61.29)   | 0.7383 <sup>a</sup><br>(46.70)   |
| $i_{it}$<br>(-)                   | -0.4507 <sup>a</sup><br>(-12.00) | -0.4681 <sup>a</sup><br>(-14.73) | -0.2870 <sup>a</sup><br>(-3.84) | -0.4714 <sup>a</sup><br>(-18.01) | -0.3033 <sup>a</sup><br>(-11.82) | -0.2584 <sup>a</sup><br>(-11.83) |
| $\pi_{it}$<br>(-)                 | -0.2218 <sup>a</sup><br>(-8.68)  | -0.3064 <sup>a</sup><br>(-7.69)  | -0.5293 <sup>a</sup><br>(-6.83) | -0.5612 <sup>a</sup><br>(-10.54) | -0.5994 <sup>a</sup><br>(-21.94) | -0.8772 <sup>a</sup><br>(-43.91) |
| $TCRL_{it}$<br>(+)                | 0.2384 <sup>a</sup><br>(21.94)   | 0.2077 <sup>a</sup><br>(24.58)   | 0.2035 <sup>a</sup><br>(12.50)  | 0.2330 <sup>a</sup><br>(12.95)   | 0.1679 <sup>a</sup><br>(14.81)   | 0.2424 <sup>a</sup><br>(19.29)   |
| $NDISC1_{it}$<br>(-)              | -0.0401 <sup>a</sup><br>(-12.42) | -                                | -                               | -0.0353 <sup>a</sup><br>(-10.29) | -                                | -                                |
| $NDISC2_{it}$<br>(-)              | -                                | -0.0672 <sup>a</sup><br>(-21.25) | -                               | -                                | -0.0777 <sup>a</sup><br>(-24.90) | -                                |
| $NDISC3_{it}$<br>(-)              | -                                | -                                | -0.1852 <sup>a</sup><br>(-8.97) | -                                | -                                | -0.1319 <sup>a</sup><br>(-20.96) |
| $NDISC_{it} * Dum$<br>(-)         | -0.0369 <sup>a</sup><br>(-3.94)  | -0.0583 <sup>a</sup><br>(-5.84)  | -0.0896 <sup>a</sup><br>(-6.03) | -0.0750 <sup>a</sup><br>(-8.42)  | -0.1098 <sup>a</sup><br>(-11.48) | -0.1915 <sup>a</sup><br>(-7.92)  |
| $DISC1_{it}$<br>(?)               | -0.0039 <sup>b</sup><br>(-2.28)  | -0.0013<br>(-0.69)               | -0.0006<br>(-0.19)              | -                                | -                                | -                                |
| $DISC2_{it}$<br>(-)               | -                                | -                                | -                               | -0.0086<br>(-1.13)               | -0.0201 <sup>a</sup><br>(-3.99)  | 0.0045<br>(1.04)                 |
| J – stat                          | 97.35                            | 98.21                            | 93.68                           | 100.46                           | 101.39                           | 98.03                            |
| Obs.                              | 556                              | 556                              | 556                             | 556                              | 556                              | 556                              |

**Note:** a, b and c indicate significance respectively at the 1%, 5% and 10% levels.  $t$ -statistics are corrected for heteroskedasticity following White's methodology.

**Variable definitions:**  $\Delta_{t-1/t}L_{it}$ : loans' variation of bank  $i$  between years  $(t-1)$  and  $t / 0.5*(\text{total assets of year } (t-1) + \text{total assets of year } t)$ ;  $\Delta_{t-1/t}D_{it}$ : growth rate of deposits between year  $(t-1)$  and  $t$ ;  $\dot{y}_{it}$ : GDP growth rate between the year  $(t-1)$  and  $t$ ;  $i_{it}$ : money market rate;  $\pi_{it}$ : inflation rate;  $TCRL_{it}$ :  $(TCR_{it}-8)/8$  when observations for bank  $i$  are in the first quartile of the total capital ratio ( $TCR$ ) and 0 otherwise;  $NDISC1_{it}$ ,  $NDISC2_{it}$  and  $NDISC3_{it}$ : the three specifications of the non discretionary component of  $LLP$ ;  $NDISC_{it} * Dum$ : the non discretionary component of  $LLP$  when observations for bank  $i$  are in the first quartile of the total capital ratio ( $TCR$ ) and 0 otherwise;  $DISC1_{it}$  and  $DISC2_{it}$ : the two specifications of the discretionary component of  $LLP$ .

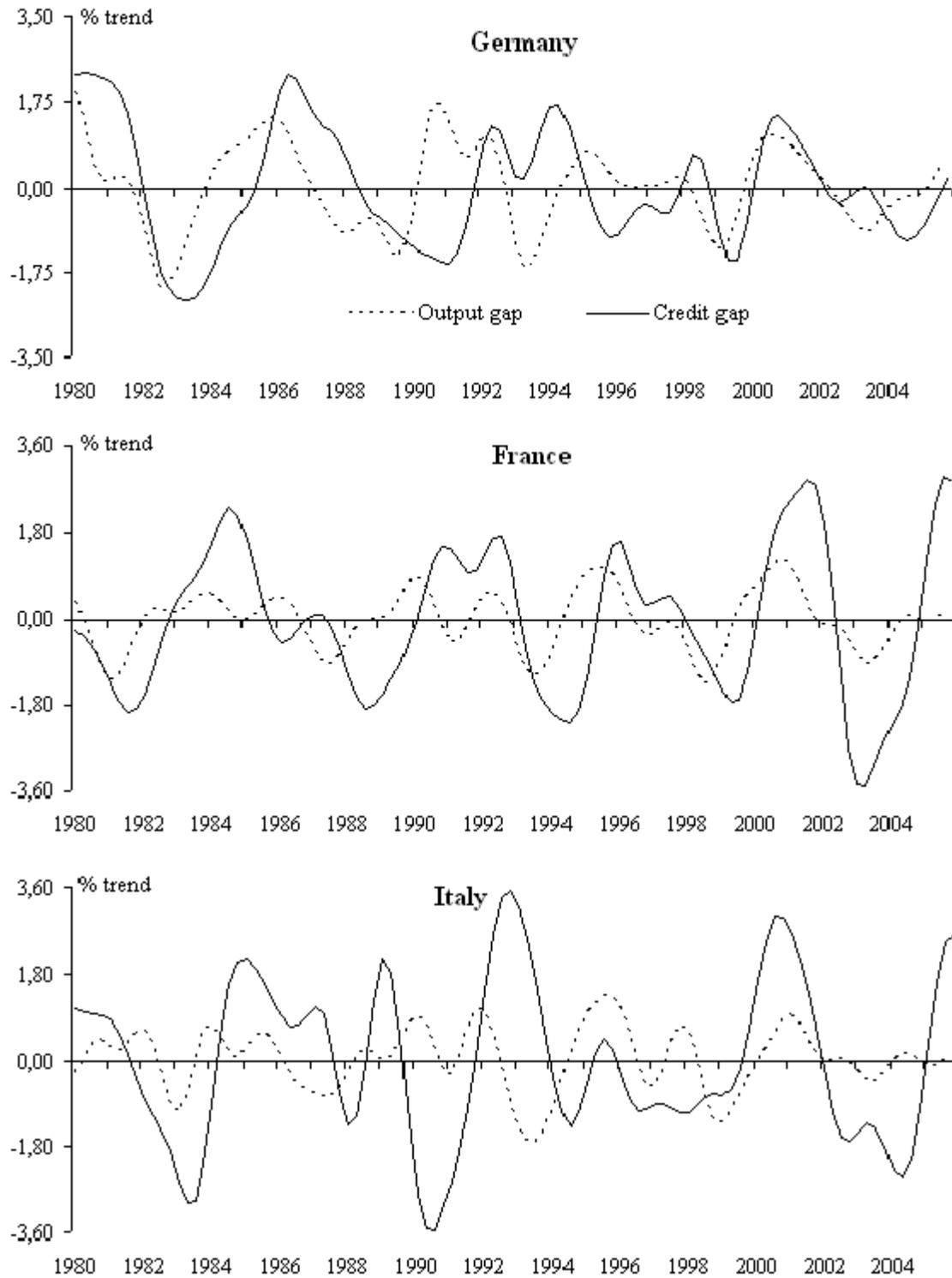
**Table 4:** Bank loan fluctuations (Arellano Bover (1995) estimator)

|                                   | (4.1)                            | (4.2)                            | (4.3)                            | (4.4)                            | (4.5)                            | (4.6)                            |
|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| $\Delta_{t-1/t}L_{it}(-1)$<br>(+) | 0.0268 <sup>a</sup><br>(8.40)    | 0.0159 <sup>a</sup><br>(9.72)    | 0.0164<br>(5.48)                 | 0.0440 <sup>a</sup><br>(21.36)   | 0.0430 <sup>a</sup><br>(9.98)    | 0.0374 <sup>a</sup><br>(16.64)   |
| $\Delta_{t-1/t}D_{it}$<br>(+)     | 0.2270 <sup>a</sup><br>(71.34)   | 0.2363 <sup>a</sup><br>(132.62)  | 0.2339 <sup>a</sup><br>(48.78)   | 0.2517 <sup>a</sup><br>(55.87)   | 0.2716 <sup>a</sup><br>(130.51)  | 0.2451 <sup>a</sup><br>(117.93)  |
| $\dot{y}_{it}$<br>(+)             | 0.9673 <sup>a</sup><br>(28.06)   | 0.9644 <sup>a</sup><br>(59.42)   | 0.8134 <sup>a</sup><br>(36.14)   | 0.8865 <sup>a</sup><br>(50.23)   | 0.9329 <sup>a</sup><br>(28.61)   | 0.7198 <sup>a</sup><br>(38.60)   |
| $i_{it}$<br>(-)                   | -0.5383 <sup>a</sup><br>(-20.89) | -0.5050 <sup>a</sup><br>(-31.32) | -0.4479 <sup>a</sup><br>(-17.11) | -0.4955 <sup>a</sup><br>(-27.64) | -0.5414 <sup>a</sup><br>(-6.95)  | -0.3223 <sup>a</sup><br>(-15.02) |
| $\pi_{it}$<br>(-)                 | -0.3903 <sup>a</sup><br>(-11.44) | -0.4525 <sup>a</sup><br>(-24.77) | -0.6583 <sup>a</sup><br>(-14.00) | -0.3830 <sup>a</sup><br>(-13.26) | -0.6597 <sup>a</sup><br>(-15.37) | -0.8425 <sup>a</sup><br>(-62.55) |
| $TCRL_{it}$<br>(+)                | 0.1985 <sup>a</sup><br>(29.12)   | 0.1874 <sup>a</sup><br>(55.97)   | 0.1342 <sup>a</sup><br>(13.78)   | 0.2040 <sup>a</sup><br>(16.17)   | 0.2399 <sup>a</sup><br>(19.74)   | 0.1635 <sup>a</sup><br>(19.82)   |
| $NDISC1_{it}$<br>(-)              | -0.0488 <sup>a</sup><br>(-8.14)  | -                                | -                                | -0.0526 <sup>a</sup><br>(-15.40) | -                                | -                                |
| $NDISC2_{it}$<br>(-)              | -                                | -0.0683 <sup>a</sup><br>(-26.13) | -                                | -                                | -0.0581 <sup>a</sup><br>(-10.02) | -                                |
| $NDISC3_{it}$<br>(-)              | -                                | -                                | -0.1484 <sup>a</sup><br>(-15.04) | -                                | -                                | -0.1518 <sup>a</sup><br>(-14.41) |
| $NDISC_{it} * Dum$<br>(-)         | -0.0250 <sup>a</sup><br>(-8.04)  | -0.0520 <sup>a</sup><br>(-27.36) | -0.0076<br>(-0.64)               | -0.0154 <sup>a</sup><br>(-2.58)  | -0.0619 <sup>a</sup><br>(-5.38)  | 0.0158<br>(1.27)                 |
| $DISC1_{it}$<br>(?)               | -0.0104 <sup>a</sup><br>(-4.71)  | -0.0056 <sup>a</sup><br>(-4.16)  | -0.0079 <sup>b</sup><br>(-2.28)  | -                                | -                                | -                                |
| $DISC2_{it}$<br>(-)               | -                                | -                                | -                                | 0.0189 <sup>a</sup><br>(6.47)    | 0.0088<br>(0.81)                 | -0.0014<br>(-0.39)               |
| J – stat                          | 98.02                            | 98.50                            | 101.40                           | 98.94                            | 93.56                            | 106.35                           |
| Obs.                              | 556                              | 556                              | 556                              | 556                              | 556                              | 556                              |

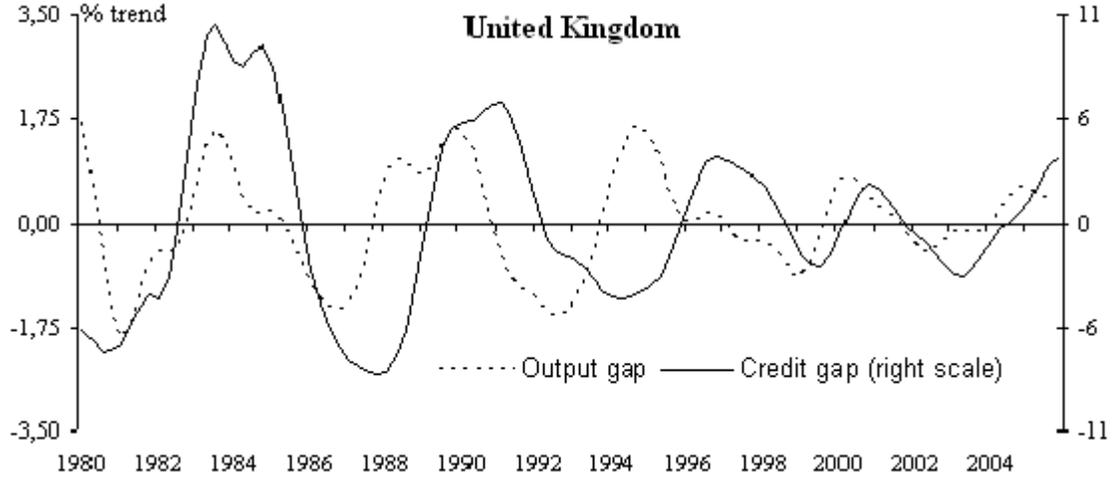
**Note:** a, b and c indicate significance respectively at the 1%, 5% and 10% levels.  $t$ -statistics are corrected for heteroskedasticity following White's methodology.

**Variable definitions:**  $\Delta_{t-1/t}L_{it}$ : loans' variation of bank  $i$  between years  $(t-1)$  and  $t / 0.5*(\text{total assets of year } (t-1) + \text{total assets of year } t)$ ;  $\Delta_{t-1/t}D_{it}$ : growth rate of deposits between year  $(t-1)$  and  $t$ ;  $\dot{y}_{it}$ : GDP growth rate between the year  $(t-1)$  and  $t$ ;  $i_{it}$ : money market rate;  $\pi_{it}$ : inflation rate;  $TCRL_{it}$ :  $(TCR_{it}-8)/8$  when observations for bank  $i$  are in the first quartile of the total capital ratio ( $TCR$ ) and 0 otherwise;  $NDISC1_{it}$ ,  $NDISC2_{it}$  and  $NDISC3_{it}$ : the three specifications of the non discretionary component of  $LLP$ ;  $NDISC_{it} * Dum$ : the non discretionary component of  $LLP$  when observations for bank  $i$  are in the first quartile of the total capital ratio ( $TCR$ ) and 0 otherwise;  $DISC1_{it}$  and  $DISC2_{it}$ : the two specifications of the discretionary component of  $LLP$ .

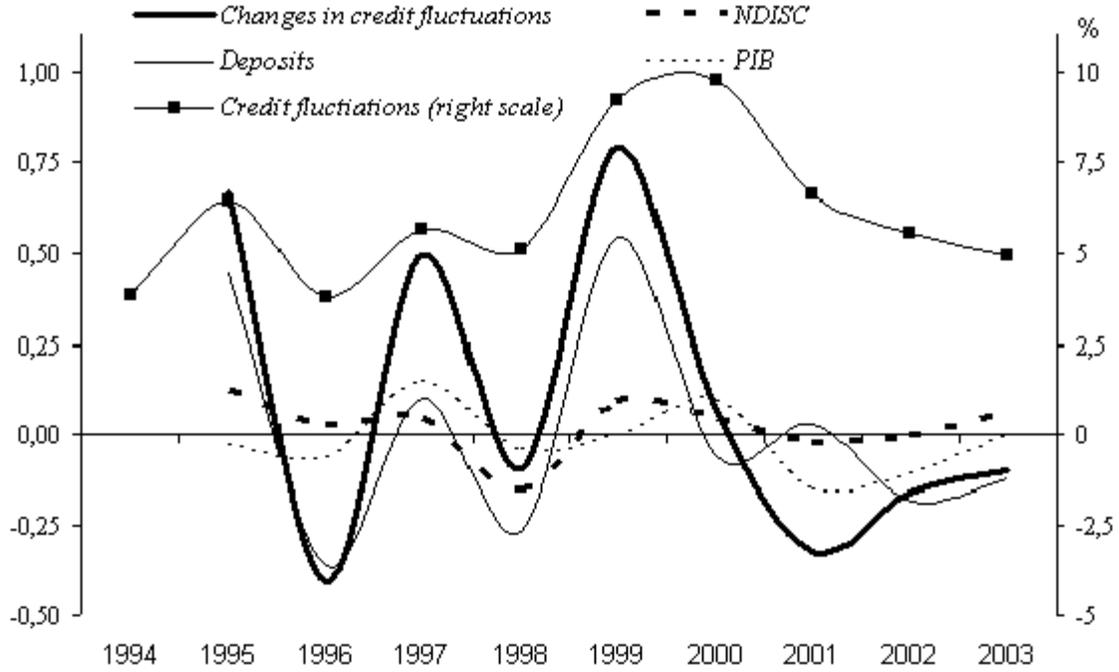
**Figure 1:** Business and credit cycles from 1980 to 2005



**Note:** Gaps are computed with EViews 5.1. We use the Christiano-Fitzgerald full sample asymmetric band-pass filter. The low value for the cycle period to be filtered is 6 quarters and the high value is 36 quarters. Data source: International Monetary Fund (IMF), International Financial Statistics (IFS).



**Figure 2:** Contributions of deposits, GDP and non discretionary provisions to changes in credit fluctuations



**Note:** This Figure uses average values of the variables and estimated coefficients of equation (7). Credit fluctuations correspond to the endogenous variable  $(\Delta_{t-1/t}L_{it})$ . Changes in credit fluctuations are defined by:  $(\Delta_{t-1/t}L_{it} - \Delta_{t-2/t-1}L_{it-1}) / \Delta_{t-2/t-1}L_{it-1}$ . NDISC, Deposits and GDP respectively represent the contribution of non discretionary provisions, deposits and GDP to changes in credit fluctuations, computed as follow:

$$\frac{\Delta_{t-1/t}L_{it} - \Delta_{t-2/t-1}L_{it-1}}{\Delta_{t-2/t-1}L_{it-1}} = \frac{\Delta_{t-1/t}D_{it} - \Delta_{t-2/t-1}D_{it-1}}{\Delta_{t-2/t-1}D_{it-1}} \times \frac{\beta_1 \Delta_{t-2/t-1}D_{it-1}}{\Delta_{t-2/t-1}L_{it-1}} + \frac{\dot{y}_{it} - \dot{y}_{it-1}}{\dot{y}_{it-1}} \times \frac{\beta_3 \dot{y}_{it-1}}{\Delta_{t-2/t-1}L_{it-1}} + \frac{NDISC_{it} - NDISC_{it-1}}{NDISC_{it-1}} \times \frac{\beta_7 NDISC_{it-1}}{\Delta_{t-2/t-1}L_{it-1}} + u_{it}$$

where  $u_{it}$  is the change in credit fluctuation explain by the other variables taken into account in equation (7).

## Appendix

**Table A1:** Descriptive statistics for European commercial and cooperative banks,  
on average over the period 1992-2004.

|      | $L$   | $\Delta L$ | $D$   | $E$   | $NPL$ | $LLP$ | $TCR$ | $ROA$ |
|------|-------|------------|-------|-------|-------|-------|-------|-------|
| Mean | 58.53 | 6.51       | 65.67 | 7.22  | 5.08  | 0.41  | 12.43 | 0.61  |
| Max  | 97.89 | 48.02      | 92.32 | 75.84 | 29.02 | 3.76  | 39.32 | 3.09  |
| Min  | 11.63 | -25.77     | 12.10 | 1.55  | 0.00  | -0.35 | 6.01  | -6.09 |
| Std  | 16.25 | 7.75       | 14.56 | 4.43  | 4.37  | 0.36  | 4.26  | 0.54  |

**Variable definitions:** all variables are in percentage.  $L$ : loans/total assets;  $\Delta L$ : loans' variation of bank  $i$  between years  $(t-1)$  and  $t / 0.5*(\text{total assets of year } (t-1) + \text{total assets of year } t)$ ;  $D$ : deposits/total assets;  $E$ : equity/total assets;  $NPL$ : non-performing loans/gross loans;  $LLP$ : loan loss provisions/total assets;  $TCR$ : total capital ratio;  $ROA$ : return on asset.