Elsevier Editorial System(tm) for The British Accounting Review

Manuscript Draft

Manuscript Number: BAR-D-15-00246

Title: Financial crisis and international supervision: new evidence on the discretionary use of loan loss provisions at Euro Area commercial banks

Article Type: SI: Issues in banking

Keywords: capital management; income smoothing; supervisory stress testing

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Financial crisis and international supervision: new evidence on the discretionary use of loan loss provisions at Euro Area commercial banks

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1. Introduction

Together with prudential capital requirements, loan loss provisions (LLPs) are crucial to transmit macroeconomic conditions to real economy as they affect bank performance and incentives to issue new loans. How bank managers decide their provisioning policies has attracted many researchers in the banking field especially because they merge different information and behaviors. LLPs are usually classified as either specific or general. The former, also known as non-discretionary provisions, depend on expected future losses and are added to specific reserves (Whalen, 1994; Beaver & Engle, 1996). General provisions, also called discretionary, increase generic reserves to protect the bank against not yet unidentified losses. General provisions are judgmental and can be used to pursue different management objectives. In particular, LLPs can be manipulated to meet minimum capital requirements and/or to improve the market's perception by stabilizing their banks' income (income smoothing).

Recent literature has emphasized the relationship between LLPs and bank capital requirements with the credit cycle. Low specific provisions during expansion periods push banks to grant new loans while their incentives to supply new credits decrease during downturns, when banks are constrained to set aside a larger amount of provisions. Furthermore, it becomes harder to meet prudential capital requirements and banks become more likely to reduce their lending activity. The pro-cyclical nature of both capital requirements and provisioning rules calls for greater collaboration between accounting setters and banking regulators and supervisors, especially after the 2007 crisis.

Based on these issues and motivated by the debate on the opportunity of a stricter banking regulation (i.e., Basel III counter-cyclical buffer) and supervision (i.e., European Banking Authority (EBA) stress tests), this research investigates whether bank managers' incentives to discretionally use LLPs have been affected by the crisis erupted in 2007. In particular, we analyze during the period 2005-2011 a representative sample of Euro Area banks, by detecting potentially different

behaviors of listed banks and of banks subject to the EBA 2010 and 2011 stress tests. The consequences of the crisis on US bank managers' provisioning policies have been recently investigated by El Sood (2012), whereas, to the best of our knowledge, the effects on European banks have not been investigated yet. Overall, our purpose is twofold: first, to provide new evidence to the conflicting results of previous literature, by focusing on provisioning policies during stressed market conditions; second, to investigate whether a completely new form of stricter supervision (i.e., the EBA stress tests) during the crisis period may also affect the discretionary use of LLPs. To date, this latter issue in particular has never been studied before. The crisis severely affected loan portfolio quality and earnings of Euro Area banks and might have reduced the incentives to manage income and regulatory capital via LLPs, due to the increase of specific/non-discretionary provisions as they are inversely correlated with bank loans quality. Nevertheless, because of the decline in their credit portfolio quality and higher incentives to shift risk (Fonseca & Gonzales, 2008), banks' regulatory capital ratios decreased during the crisis. Moreover, a stricter supervision, as that imposed by EBA amidst the crisis through the 2010 and 2011 stress testing exercises, required banks to be resilient to stressed scenarios and imposed more pressure on bank managers' decisions.

Based on a panel data analysis, our empirical evidence shows that banks tended to smooth income but not to influence regulatory capital via LLPs. In particular, incentives to smooth income increased after the crisis, irrespective of the different nature of public and private.

As to the behavior of banks that underwent the EBA stress tests, we observe that the disclosure of the 2011 test results together with the release of a detailed set of sensitive information is associated with more income smoothing by tested banks, as they need to stabilize their income in order to improve the market's perception of their risk. This may be interpreted as an unwilled side effect that both accounting and banking regulators and supervisors should carefully take into account. To mitigate possible concerns about endogeneity issues, we also run a GMM estimation and find that our results are qualitatively unchanged. As robustness checks, we test our hypotheses excluding Spanish and Greek banks due to the specific provisioning mechanism adopted in Spain

and the extremely difficult financial and economic conditions in Greece during our investigation period. Overall, this research confirms the need for a better coordination of accounting setters and supervisory authorities' actions. Our findings can contribute to set accounting and prudential regulations that can more effectively pursue their specific objectives.

This paper proceeds as follows. In section 2, we analyze the rationale for discretionary use of LLPs and develop our research hypotheses. Section 3 describes our data, sample selection and outlines methodological aspects of this study. Section 4 provides a discussion of our findings. Section 5 checks the robustness of our results and section 6 concludes.

2. Literature review and research hypotheses

This section presents main contributions on loan loss provisioning in the banking literature, for both listed and unlisted credit institutions, and on the effect of the release of EBA stress tests results. Based on this literature, we develop our research hypotheses concerning income smoothing and capital management and also make assumptions about the impact of stricter supervision on the discretionary use of LLPs.

2.1. Income smoothing

Under ordinary economic conditions, banks can manipulate LLPs to reduce their net profit volatility, improve investors', regulators' and supervisors' risk perception and keep their compensation and the dividends flow to the shareholders stable over time. Prior studies investigating bank income smoothing via LLPs in the US, both before and after the Basel I Capital Accord came into force, find inconclusive evidence (Beatty, Chamberlain & Magliolo, 1995; Collins, Shackelford & Wahlen, 1995; Bhat, 1996; Ahmed, Takeda & Thomas, 1999). As to non-US banking systems, the empirical evidence is mixed as well. Anandarajan, Hasan, and McCarthy (2007) find that Australian commercial banks manipulate provisions to smooth their income, while Bouvatier and Lepetit (2008) show that European commercial and cooperative banks reduce their

provisions if earnings before taxes and provisions raise. Evidence from Pérez, Salas-Fumas, and Saurina (2008) and Shrieves and Dahl (2003) supports income smoothing for Spanish and Japanese commercial banks, respectively. Evidence referred to Asian emerging markets does not univocally support the earnings smoothing hypothesis as well (Laeven & Majnoni, 2003; Craig, Davis, & Pascual, 2006; Packer & Zhu, 2012).

To reduce earnings volatility and financial markets' risk perception, publicly traded banks might have stronger incentives in smoothing their income, if compared to unlisted banks (Nichols, Wahlen, & Wieland, 2009). Accordingly, Beatty, Ke and Petroni (2002) show that a higher number of stakeholders makes listed banks more engaged in income smoothing. According to Anandarajan *et al.* (2007), publicly traded banks use income to signal success and strength to their shareholders, since they raise funds in the stock market. However, Fonseca and Gonzales (2008) suggest that listed banks are less likely to smooth income because they are subject to a stricter supervision because of their larger size and greater impact in the case of a banking crisis.

To the best of our knowledge, banks' income smoothing during adverse financial market conditions has not been fully investigated yet. El Sood (2012) finds that during the crisis US banks use provisions to smooth income upward. According to Packer and Zhu (2012) the global financial crisis has significantly increased income smoothing practice only for Indian banks, but not for the rest of the Asian banking systems that they take into account. Multiple factors might affect bank managers' provisioning decisions under stressed economic conditions. The crisis might limit the scope for a discretionary use of banks' provisions because of the increasing and massive deterioration in the quality of their loans and the associated increase in the share of specific LLPs. Nevertheless, the peculiar features of the turmoil originated by a toxic assets contagion in the financial markets in the 2007 might have created incentives to shift risk and consequently smooth income, for both private and listed banks. As a result, during the crisis banks might be more engaged in income smoothing relative to the pre-crisis period (Hypothesis 1), especially if they are

publicly traded as they have higher incentives in reporting stable income numbers, especially during extremely volatile periods (Hypothesis 2).

H1: The relationship between loan loss provisions and earnings before provisions and taxes is more positive during the crisis.

H2: The relationship between loan loss provisions and earnings before provisions and taxes is more positive for listed banks than private banks during the crisis.

2.2. Capital management

By manipulating LLPs bank managers can avoid the cost of violating prudential regulation on bank capital adequacy. According to the Basel II Capital Accord, which was in force during the investigation period, the Tier1 capital includes retained earnings, implying that banks characterized by a low capital endowment might have more incentives to make lower LLPs. Nevertheless, if banks' loan loss reserves are lower than 1.25% of risk-weighted assets (RWAs), an increase in provisions raises the Tier2 capital and, overall, the total regulatory capital ratio (BCBS, 2006). The sign of the relation between provisions and regulatory capital will derive from which of these two effects predominates and empirical evidence is not conclusive (Ahmed *et al.*, 1999; Pérez *et al.*, 2008; Craig *et al.*, 2006; Anandarajan *et al.*, 2007; Bouvatier and Lepetit, 2008; Leventis, Dimitropoulos & Anandarajan, 2011).

We expect low-capital banks to be characterized by higher incentives to use LLPs to manage their capital after the crisis broke out (Hypothesis 3), because both the worsening macroeconomic scenario and the rising counterparty risk exposures have increased banks probability of default. Furthermore, the associated costs of violating capital requirements increase in distressed economic conditions because raising capital is more expensive and reducing the risk weighted assets could force them to close profitable customer relationships and/or sell assets at unfavourable conditions. Because of the greater use of the stock market as source of funds, listed banks are expected to be

more willing to meet capital requirements and are more likely to manage their capital ratios (Hypothesis 4).

H3: The relationship between loan loss provisions and primary capital (Tier1 capital) is y more positive during the crisis

H4: The relation between loan loss provisions and primary capital (Tier1 capital) is more positive for listed banks than private banks during the crisis.

2.3. Supervisory stress testing and discretionary use of LLPs

The effectiveness of banking regulation and supervision in preventing managers from excessive risk-taking behaviour might create incentives to use LLPs for income smoothing and capital management purposes (Fonseca & Gonzales, 2008). In this regard, EBA 2010 and 2011 stress tests offer a privileged context to investigate these issues. By assuming EBA stress tests are an example of supervisory intervention that can severely affect managerial discretion in making provisions, we use them as an empirical experiment to detect whether stricter supervision during the crisis provides a disciplining effect on managers' decisions and makes bank provisioning policies less prone to pursue discretionary objectives.

Additionally, from a disclosure perspective, we also might expect banks that underwent EBA stress testing exercises to be more constrained in manipulating LLPs, due to the greater release of bank-specific information that stress tests both require and make public. In fact, on the one hand, sensitive data are needed by the national authorities responsible to feed the what-if scenarios generation process and, on the other hand, results of stress tests are published on an aggregated basis, as in 2010, or referred to each single bank, as in 2011.

Therefore, we expect EBA exercises to make banks less likely to use LLPs to smooth their income (Hypothesis 5). As for the capital management hypothesis, we suggest that another effect can prevail over the disciplining effect: since the EBA exercises focus on capital adequacy under

stressed macroeconomic scenarios, tested banks might have more pronounced incentives to manipulate LLPs to avoid the costs associated with failing the supervisory assessment (Hypothesis 6).

H5: The relationship between loan loss provisions and earnings before taxes and provisions is less positive for banks under supervisory stress test than for un-tested banks.

H6: The relationship between loan loss provisions and Tier1 capital is more positive for banks under supervisory stress test than for un-tested banks.

A main assumption behind these hypotheses is that banks' managers care about the results of the EBA tests. Some recent research papers have investigated the informative content of the stress testing exercises, particularly focusing on their impact on banks' stock price. Beltratti (2011) finds that, by making public details about each bank capital shortfall, the 2011 EBA stress test provided sensitive information to the market. Based on the analysis of market reaction on the stress tests' announcement dates, Cardinali and Nordmark (2011) show that investors cared little for the 2010 stress test, whereas they had a negative reaction to the release of the 2011 methodology, with no effect on on un-tested credit institutions. By focusing on price changes upon the disclosure of the 2011 results, Petrella and Resti (2013) show that on the results date the market reacted strongly to the disclosure of detailed information, thus corroborating the hypothesis that the stress test exercise mitigates bank opaqueness. Goldstein and Sapra (2011) find that the higher disclosure of the 2011 exercise results led to different market reactions relative to the release of aggregate information following the 2010 exercise because market participants had also information on the related drivers. The different informative content of the two stress tests might also lead to different results in terms of their impact on the discretionary use of LLPs. Particularly, due to the larger market reaction to the results of the 2011 stress test, bank managers might have had more incentives to smooth income to improve market perception of their banks' risk. This would have been crucial to raise new capital during the turbulent next years and might have led, contrary to what stated in Hypothesis 5, to a

more positive relationship between loan loss provisions and earnings before taxes and provisions in 2011.

3. Empirical analysis

3.1 Sample selection

We collect Euro Area banks' IAS-compliant balance-sheet data referred to the 2005 – 2011 period from Bankscope. To build our sample we adopt the following constraints. First, we focus on banks that are significantly involved in traditional lending activity, i.e. with customer loans higher than 50% of total assets over the sample period. To reduce size-related bias, we do not consider banks whose average asset value over the entire sample period is lower than the second quartile of the average asset distribution of the entire sample. Our initial sample is made up of banks that are from the 21 European countries included in the 2010 and 2011 EBA stress tests. To ensure consistency in our analyses, we only keep banks with data available for more than five. Finally, to address potential issues with outliers, we eliminate the extreme bank/year observations (i.e., observations for which a variable presents values lower than the 1st percentile and higher than the 99th percentile).

The final sample is an unbalanced panel of annual data of 1,232 bank-year observations. and comprises a number of banks ranging from 114 in 2005 to 205 in 2007, 2008 and 2009. Among them, the number of listed banks goes from 35 in the first and the last year of the observation period to 42 in 2007, 2008 and 2009. In order to avoid potential biases related to listing or delisting decisions, we delete banks whose stocks were delisted or began to trade during the sample period. Our sample includes 30 out of 91 credit institutions that were subject to the 2010 stress test exercise, of which 28 were tested in the 2011 stress test as well.

3.2. Methodology

3.2.1. Testing for the discretionary use of LLPs during the crisis

The first objective of this research is to test whether the financial crisis affected banks' discretionary use of LLPs with regards to the hypotheses of income smoothing practice and capital management. Our analysis is close to El Sood (2012), even if we focus on the potentially different behavior of both listed and stress tested banks' behavior and adopt estimation techniques that better account for the dataset dynamic nature. To test our H1 and H3 hypotheses, we use the following model:

$$LLP_{i,t} = a_0 + a_1 NPL_{i,t} + a_2 LOAN_{i,t} + a_3 GDPGR_{j,t} + a_4 EBTP_{i,t} + a_5 TIER1_{i,t} + a_6 CRISIS \bullet EBTP_{i,t} + a_7 CRISIS \bullet TIER1_{i,t} + \varepsilon_{i,t} \quad (1)$$

$LLP_{i,t}$, is the ratio of loan loss provisions to total assets for bank *i* at time *t*. The variables employed as predictors have been largely used to test for the discretionary use of LLPs. Prior research captures the non-discretionary component of LLPs using variables reflecting both the level and the dynamics of loan portfolio losses (see, among others, Bouvatier & Lepetit 2008; Fonseca & Gonzàles 2008; Anandarajan *et al.* 2007; Ahmed *et al.* 1999). Particularly, we use the variable $NPL_{i,t}$, the ratio of non-performing loans divided by total assets . This variable is positively related to loan loss provisions. Our proxy for the discretionary component of LLPs is the variable $LOAN_{i,t}$, which is equal to customer loans divided by total assets. The variable $GDPGR_{j,t}$ corresponds to the annual growth rate of the gross domestic product at constant prices for the country *j* at year *t* and is expected to capture the pro-cyclicality in LLPs due to macroeconomic conditions (Fonseca & Gonzàlez 2008; Anandarajan *et al.* 2007; Anandarajan *et al.* 2007; Bikker & Metzemakers 2005; Laeven & Majnoni 2003). Since banks are expected to reduce provisions to increase their income and/or capital during worsening macroeconomic conditions, we hypothesize a negative coefficient of the variable $GDPGR_{j,t}$.

Based on prior literature (see, among others, Leventis *et al.* 2011; Bouvatier & Lepetit 2008; Anandarajan *et al.* 2007; Ahmed *et al.* 1999), to detect income smoothing, we use the variable $EBTP_{i,t}$, defined as the ratio of earnings before taxes and loan loss provisions for bank *i* at time *t*

divided by total assets. Should the coefficient of $EBTP_{i,t}$ be positive, low- (high-) income banks would decrease (increase) provisions.

To test for the use of LLPs for capital management purpose, prior research focuses on the ratio of actual regulatory capital divided by the regulatory minimum capital (see Ahmed *et al.*1999; Beatty *et al.* 1995;, Leventis *et al.* 2011), or (as Bouvatier and Lepetit, 2008) on a variable based on the quartiles of the total capital ratio distribution. We opt for the ratio of Tier1 capital to risk weighted assets ($TIER1_{i,t}$), for two main reasons. First, it does not suffer from the influence of accounting relations on the link between bank capital and LLPs, that is due to the negative correlation between provisions and Tier1 capital and to the positive correlation between provisions and Tier 2. Secondly, relative to Tier 2, the definition of Tier1 capital measure is more homogeneous across the national supervisory standards. We argue that banks with less capital may have lower incentives to set provisions aside in order to increase their primary regulatory capital endowment via retained earnings. Hence, the capital management hypothesis is supported if the coefficient of $TIER1_{i,t}$ is positive.

Finally, we consider an indicator variable, CRISIS, equal to 1 for the period 2008-2011, and 0 otherwise. Thus, we can generate two interaction terms CRISIS●$EBTP_{i,t}$ and CRISIS●$TIER1_{i,t}$. to investigate differences in banks' use of LLPs in the two periods. Based on the Hypotheses 1 and 3, these variables coefficients are expected to be both positive.

3.2.2. Testing for LLPs discretionary use by listed banks

Potential differences in listed banks' behaviour relative to unlisted credit institutions are estimated through the model presented in the following equation (2), where, relative to equation (1), we add four interaction terms:

$$LLP_{i,t} = a_0 + a_1 NPL_{i,t} + a_2 LOAN_{i,t} + a_3 GDPGR_{j,t} + a_4 EBTP_{i,t} + a_5 TIER1_{i,t} + a_6 CRISIS \bullet EBTP_{i,t} + \\ + a_7 CRISIS \bullet TIER1_{i,t} + a_8 LISTED \bullet EBTP_{i,t} + a_9 LISTED \bullet EBTP_{i,t} \bullet CRISIS + a_{10} LISTED \bullet TIER1_{i,t} + \\ + a_{11} LISTED \bullet TIER1_{i,t} \bullet CRISIS + \varepsilon_{i,t} \quad (2)$$

First, the two interaction terms LISTED●EBTP$_{i,t}$ and LISTED●TIER1$_{i,t}$ are generated by interacting our key variables with an indicator variable, LISTED, equal to 1 for listed banks and 0 otherwise. These interaction terms allow us to examine whether, overall, listed credit institutions use LLPs to smooth income and manage capital at a larger extent than unlisted banks. If coefficients α_8 and α_{10} of equation (2) were positive, that would be the case. Furthermore, to specifically test for the Hypotheses 2 and 4, according to which, listed banks are even more willing to report stable income numbers and more likely to be engaged in capital management practice during the crisis, we generate the two two-way interaction variables, LISTED●EBTP$_{i,t}$●CRISIS and LISTED●TIER1$_{i,t}$●CRISIS. Should their coefficients α_9 and α_{11} be positive, Hypotheses 2 and 4 would be confirmed.

3.2.3. Testing for LLPs discretionary use by EBA stress tested banks

According to the Hypotheses 5 and 6, we expect banks that underwent the EBA's stress tests to be less involved in the income smoothing practice but more engaged in manipulating capital. To test for these hypotheses, we estimate the following model:

$$\begin{aligned} LLP_{i,t} &= a_0 + a_1 NPL_{i,t} + a_2 LOAN_{i,t} + a_3 GDPGR_{j,t} + a_4 EBTP_{i,t} + a_5 TIER1_{i,t} + a_6 CRISIS \bullet EBTP_{i,t} + \\ &+ a_7 CRISIS \bullet TIER1_{i,t} + a_8 LISTED \bullet EBTP_{i,t} + a_9 LISTED \bullet EBTP_{i,t} \bullet CRISIS + a_{10} LISTED \bullet TIER1_{i,t} + \\ &+ a_{11} LISTED \bullet TIER1_{i,t} \bullet CRISIS + a_{12} EBA\_TESTED \bullet DY2010 + a_{13} EBA\_TESTED \bullet DY2011 + \\ &+ a_{14} EBA\_TESTED \bullet EBTP_{i,t} \bullet DY2010 + a_{15} EBA\_TESTED \bullet EBTP_{i,t} \bullet DY2011 + \\ &+ a_{16} EBA\_TESTED \bullet TIER1_{i,t} \bullet DY2010 + a_{17} EBA\_TESTED \bullet TIER1_{i,t} \bullet DY2010 + \varepsilon_{i,t} \end{aligned} \quad (3)$$

Relative to equation (2), we first interact the sample binary variable EBA_TESTED, that equals 1 if bank *i* participated in at least one of the two EBA stress tests and 0 otherwise, with the two dummies DY2010 and DY2011, equal to 1 if the observation year is 2010 and 2011, respectively, and 0 otherwise. A positive (negative) sign for their coefficients α_{12} and α_{13} in equation (3) would entail that, compared to banks that were not subject to EBA stress tests, tested banks set a greater (smaller) amount of provisions aside at the end of the year in which they were included in the EBA stress test exercise, relative to the rest of the years included in the sample

period. Furthermore, we generate other two-way interaction variables, EBA_TESTED●EBTP$_{i,t}$●DY2010, EBA_TESTED●EBTP$_{i,t}$●DY2011, EBA_TESTED●TIER1$_{i,t}$●DY2010, and EBA_TESTED●TIER1$_{i,t}$●DY2011, to investigate differences between tested and untested banks for each of the years of the EBA stress tests. Particularly, the Hypothesis 5, according to which tested banks are expected to be less involved in income smoothing, would be confirmed for 2010 and/or 2011 if coefficients α_{14} and/or α_{15} in equation (3) were negative. The assumption of a more aggressive involvement in capital management practices, which is stated in Hypothesis 6, would be supported by the empirical evidence referred to 2010 and/or 2011 if coefficients α_{16} and/or α_{17} in equation (3) were positive. Based on the variables formerly included in equation (2), we also control for the evidence on tested banks being driven by the public nature of most of them. The following Table 1 summarizes labels, name and description of the variables used to test our hypotheses.

[Table 1 here]

3.3. Descriptive statistics

Main descriptive statistics referred to our sample banks are shown in Table 2. The average value of the variable LLP is slightly higher than 0.43%, confirming that provisions for loan losses are a relatively important bank accrual. On average, NPL is 3.46% and, as expected, experiences an increasing trend over the analysis time period. Customer loans are almost 72% of total assets, confirming the traditional nature of the business that our sample banks run and remains quite stable over time. EBTP is on average 3.17% and it shows a markedly decreasing trend over the six-year time horizon we take into account. The variable measuring banks' endowment of primary regulatory capital divided by risk-weighted assets, is almost 10.6, well above the minimum required by both the Basel 2 Capital Accord in force during the investigation period, and the incoming Basel 3 new set of rules. In particular, it shows an increasing trend that reflects banks' efforts to improve

the quality of their regulatory capital, both in line with national and international authorities' responses to the crisis, and also anticipates the new Basel III framework that the BCBS was setting just in those years.

We detect differences between listed and unlisted banks and stress-tested and untested banks and show that the respective means are statistically different for all the variables. Particularly, as expected, on average, publicly traded banks are larger than private ones and are less involved in lending activity. Even if they are characterized by a better credit quality, which may be largely explained by the greater diversification opportunities due to their larger size, listed banks tend to set a greater amount of loan loss provisions aside, entailing a more prudent approach to credit risk management. These results are probably due to the market disciplining effect. Publicly traded banks are less profitable than private banks. This can be the consequence of the higher customer loans share of total assets of the latter. In fact, if issued to sufficiently risky counterparties, customer loans can be much more profitable than other bank assets. This would also be consistent with the higher average value of TIER1 for unlisted banks: a larger amount of primary regulatory capital endowment has to protect them against a greater risk exposure.

Our main variables show statistically different means even when tested banks are compared to untested banks. Particularly, the former are less profitable, less involved in the traditional lending activity, are characterized by both lower Tier1 capital ratios and a less non-performing loans. Not surprisingly, these results are similar to those highlighted before in comparing listed and unlisted banks and can be mainly explained by the larger average size of tested banks. Nevertheless, contrary to what found in the comparison between listed and unlisted banks, the difference in the mean values of LLP between tested and untested banks is not statistically significant.

[Table 2 here]

Descriptive statistics reported in Table 3 are calculated by distinguishing between the years preceding the 2008 (pre-crisis years) and the period 2008 – 2011 (crisis years). As expected, the entire sample and the two groups of listed and tested banks set a greater amount of loan loss provisions aside after the crisis broke out, with statistically significant differences in means. This is consistent with the statistically significant increase in the average value of NPL for, again, the whole sample, publicly traded and tested banks. Mainly due to the greater amount of provisions made after the eruption of the crisis, we find a statistically significant decline in EBTP for both the whole sample and the group of listed banks. EBTP decreased also for tested banks, but the mean value referred to the pre-crisis period is not statistically different from the value of the crisis period. The average LOAN systematically increased, though the difference in means between the two periods is statistically significant only when we consider the entire sample banks. Consistently with the increasing risk in banks' credit portfolio, the average value of TIER1 went up for the entire sample, listed and tested banks, being in all the three cases above the minimum prudential requirement in force during the investigation period. The differences in means between the two periods is always statistically significant. The variable measuring bank size increased not only for the total sample, but also for listed and tested bank in the crisis period, though the difference in means is statistically significant only for listed banks.

[Table 3 here]

Table 4 provides correlations of our variables. NPL, LOAN, and EBTP have a significant and positive association with LLP for the entire sample, listed and tested banks. The correlations of GDPGR and TA with LLP are both negative and statistically significant. Finally, as concerns the correlation between TIER1 and LLP, it is negative and significant for the whole sample, positive for both listed and tested banks, but significant only for the latter. Overall, based on the low correlations between the regressors, we can exclude cases of multicollinearity.

[Table 4 here]

4. Results

Panel data analysis is a very efficient tool and allows us to consider the unobservable and constant heterogeneity, i.e. each bank specific characteristics. Based on the Hausman test, we adopt fixed effects to estimate equations (1), (2) and (3). Our results are presented in Table 5.

Evidence from equation (1) in Table 5 suggests that banks smooth their income via LLPs more intensively during the crisis (a_4 is positive and statistically significant). This result supports our H1 hypothesis and is consistent with the evidence reported in El Sood (2012) for a sample of US banks. We do not find any significant difference in our banks' behavior in terms of capital management (hypothesis H3) during the period 2008 – 2011 (the coefficient of CRISIS●TIER1 is not statistically significant). These findings are confirmed in the specifications of equations (2) and (3).

None of the terms interacting the dummy LISTED with our key variables is statistically significant. Therefore, listed banks do not appear to behave differently from private banks during the crisis. The absence of differences in income smoothing practice is not in line with Anandarajan *et al.* (2007), whose evidence is referred to Australian banks over the period 1991 – 2001.

Since prior literature has argued about the differences, in terms of informative content and market reaction, between the two EBA exercises, in equation (3) we test for our hypotheses in the 2010 and 2011 separately. First, we find that banks subject to stress tests make significantly less provisions in 2011 relative to untested institutions (EBA_TESTED●DY2011 is negative and statistically significant). Secondly, tested banks engaged more in income smoothing in 2011 (EBA_TESTED●EBTP●DY2011 is positive and statistically significant). The coefficients of the variables referred to the year 2010 (EBA_TESTED●DY2010 and EBA_TESTED●EBTP●DY2010) and those of the variables used to test for the capital management

hypothesis for both 2010 and 2011 (EBA_TESTED●TIER1●DY2010 and EBA_TESTED●TIER1●DY2011) are not statistically significant. Overall, based on these results, neither of the two Hypotheses 5 and 6 is supported. Particularly, the evidence of more income smoothing by tested banks in 2011 is in contrast with our Hypothesis 5, according to which the disciplining effect of the stress tests should lower incentives to manage income via LLPs. Nevertheless, it can be interpreted based on the impact that the different types of release of the stress tests results had on the market and on managers' behavior. Contrary to what occurred for the publication of the results in 2010, market response to the publication of the 2011 stress test results was large and led managers to use LLPs to smooth income in order to ultimately improve market perception of their banks' risk. Furthermore, the more aggressive income smoothing that we observe for the year 2011 might also be due to perceived bankruptcy concerns for some of the tested banks.

Overall, our results support the income smoothing hypothesis at the 1% confidence level. However, contrary to what is required for the capital management hypothesis to be confirmed, the coefficient of the Tier1 capital ratio is always negative and economically not relevant, being also marginally significant at the 10% confidence level only for equations 1 and 2.

As to the control variables used in our models, we find that the l GDPGR is negatively and significantly associated with the LLP at 1% confidence level, for all the three estimated equations. This suggests that banks make provisions during and not before economic recessions. The pro-cyclical nature of our banks' behavior is consistent with previous empirical research. The coefficient of NPL is positive and statistically significant for all the equations shown in Table 5 at the 1% confidence level, confirming the direct relation between LLPs and credit quality. Customer loans are negatively correlated with loan loss provisions but the coefficient of the variable LOAN is neither statistically nor economically significant.

[Table 5 here]

5. Robustness checks

The robustness of our results is tested through the following checks. First, banks from Spain and Greece are removed from the sample, because of the especially distressed situation of these two countries' banking sectors during the investigation period. Among the eight banks that failed the 2011 stress test, five were from Spain and two from Greece, and many other intermediaries in these two countries were very close to fail the test. Since these banks might have behaved on the basis of peculiar incentives, we decide to remove them from the sample to test if our results are biased by their inclusion. Furthermore, we eliminate Spanish banks also because of the specific regulatory constraints imposed on their provisioning policies by the Banco de España since 2000, i.e., the dynamic provisioning system. Based on dynamic provisioning requirements, Spanish banks are required to make provisions in periods of economic expansions so that they can be used during economic downturns. It is worth highlighting that this mechanism automatically implies income smoothing and aims to induce banks' countercyclical behavior in their provisioning practice, by also generally reducing managerial discretion.

Table 6 shows the results obtained after dropping Spanish and Greek banks from the sample. The variable CRISIS●EBTP is marginally significant at the 10% confidence level, showing a decrease in its statistical significance if compared to the analysis of the whole sample (see Table 5). By dropping Spanish banks, therefore, we get rid of banks that can significantly contribute to the result of more income smoothing during the crisis, since they are forced by law to smooth their income over time. The capital management hypothesis is still not confirmed: the coefficient of the variable TIER1 is again negative and not economically significant, even if statistically significant. The empirical evidence referred to listed banks does not support the hypothesis of a different behavior, if compared to private intermediaries, neither for the income smoothing nor for the capital management hypothesis, for both the overall period (LISTED●EBTP and LISTED●TIER1 are not

statistically significant) and during the crisis (LISTED●EBTP●CRISIS and LISTED●TIER1●CRISIS continue to be statistically not significant). Finally, the coefficient of EBA_TESTED●EBTP●DY2011 in equation (3) is statistically significant at the 10% confidence level, whereas it was at the 5% for the overall sample. Consistently with what highlighted before, dropping Spanish banks makes its coefficient less statistically significant. As expected, and already shown in Table 5, LLP is again positively and significantly correlated with the variables NPL and EBTP at the 1% confidence level, and negatively and significantly at the 1% confidence level with the annual real GDP growth rate.

[Table 6 here]

The second robustness check is based on the use of the two-step system GMM estimation technique for dynamic models (Blundell and Bond, 1998; Arellano and Bover, 1995). We adopt this technique to deal with a potential simultaneity issue affecting the determination of both some independent variables and LLP. In order to control for unobserved heterogeneity, simultaneity and dynamic endogeneity (if any), first-differences of the variables are used as instruments for the equations in levels. Results are presented in Table 7[1]. We implement a finite sample correction following Windmeijer (2005), as suggested by Blundell and Bond (1998). Based on Hansens' test and Arellano and Bond (1991), respectively, we do not have issues concerning instrument validity and serially uncorrelated error terms.

Overall, the two-step system GMM estimates show that our main results are confirmed at the usual confidence levels. All the control variables have the expected sign as in the GLS fixed effects analysis but LOAN is negatively and significantly related to LLP, suggesting that banks with larger credit portfolio make less provisions.

[1] We use the Roodman 'xtabond2' module in Stata to obtain the system GMM estimates. Please refer to Roodman (2009).

[Table 7 here]

6. Conclusions

We investigate the discretionary use of LLPs by Euro Area commercial banks over the 2005-2011 time period. In particular, we examine banks' behavior in relation to: i) the distressed economic and financial conditions experienced during the crisis and ii) the two stress test exercises that the European Banking Authority run in 2010 and 2011. Studying banks managers' decisions under such extraordinary conditions can give useful insights for a deeper understanding of actual provisioning practices.

Overall, Euro Area banks used provisions to smooth income, but not to manage their capital for regulatory purpose, and were more aggressively involved in income smoothing after the financial crisis broke out. This can reasonably be due to more pronounced incentives to enhance investors' perception. Moreover, we analyze banks' behavior by separately testing for the discretionary use of LLPs for each of the two years of the stress tests (2010 and 2011) since prior literature pointed out significant differences between the two exercises in terms of their informative content and market response.

Contrary to our initial expectations, the capital management hypothesis is supported for neither 2010 nor 2011. As to the earnings management, we observe that tested banks make significantly less provisions and are more involved in income smoothing, relative to untested institutions only in 2011. We argue that the results may be due to the different type of release of the stress tests results. The strong market response to the 2011 test results might have led banks to manage income via loan loss provisions, balancing the presumed disciplining effect of the tests, because of higher incentives to increase the market's confidence, if compared to untested intermediaries. Our results on this specific issue contribute to the debate on the opportunity to

disclose stress tests results, by providing evidence of an unwilled side effect that regulators and supervisors, as well as accounting setters, should carefully take into account.

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Tables

Table 1
Variables definitions.

Notation	Variable name	Description
Panel A: Dependent variable		
LLP	Loan loss provisions	The ratio of loan loss provision to total assets
Panel B: Income smoothing and capital management variables		
EBTP	Earnings before taxes and provisions	The ratio of earnings before taxes and provisions to total assets
TIER1	Basel II Tier1 capital ratio	Tier1 capital divided by risk weighted assets
Panel C: Control variables		
GDPGR	GDP growth rate	The GDP growth rate on a year-to-year basis
LOAN	Customer loans	Customer loans divided by total assets
NPL	Non-performing loans	Non-performing loans divided by total assets
TA	Total asset	Natural logarithm of total asset
Panel D: Dummy variables		
DY	Year dummies	Six dummy variables which equal either one or zero for each year from 2006 to 2011, excluding the year 2005
CRISIS	Crisis dummy	An indicator variable that is 1 for years 2008 – 2011 and 0 otherwise
LISTED	Listed banks dummy	An indicator variable that is one for listed banks and 0 otherwise
EBA_TESTED	Tested banks dummy	An indicator variable that is 1 for banks that underwent EBA stress tests and 0 otherwise

Table 2
Descriptive statistics – Part 1.

	Whole sample	Listed	Unlisted	Listed vs. Unlisted	EBA_tested	EBA_untested	EBA_tested vs. EBA_untested
	Mean (sd)	Mean (sd)	Mean (sd)	Difference in means (*p*-value)	Mean (sd)	Mean (sd)	Difference in means (*p*-value)
LLP	0.004323	0.005182	0.004076	0.001106***	0.0046728	0.004255	0.000417
	(0.003052)	(0.003681)	(0.002799)	(0.0000)	(0.0039108)	(0.002855)	(0.7725)
NPL	0.034565	0.031564	0.035427	-0.003862***	0.0256079	0.036279	-0.010671***
	(0.023739)	(0.025019)	(0.023301)	(0.0014)	(0.0227986)	(0.023539)	(0.0000)
LOAN	0.716611	0.664797	0.731501	-0.066704***	0.6641996	0.726647	-0.062448***
	(0.139868)	(0.139993)	(0.136306)	(0.0000)	(0.1233164)	(0.140660)	(0.0000)
EBTP	0.031737	0.029350	0.032423	-0.003073***	0.0257899	0.032875	-0.007086***
	(0.009517)	(0.008581)	(0.009665)	(0.0000)	(0.007839)	(0.009387)	(0.0000)
TIER1 (%)	10.581780	8.822800	11.087230	-2.26443***	9.485253	10.79175	-1.306497***
	(3.541986)	(2.055214)	(3.714584)	(0.0000)	(2.190063)	(3.70959)	(0.0001)
TA	15.977610	17.85547	15.438	2.41747***	18.74594	15.44751	3.29843***
	(2.051677)	(1.624509)	(1.832486)	(0.0000)	(1.419729)	(1.697532)	(0.0000)
N. obs.	1,232	275	957	-	198	1,034	-

This table reports descriptive statistics, referred to the period 2005 – 2011, for all sample banks (column 2), listed vs. unlisted banks (columns 3 and 4, respectively), EBA tested vs. untested banks (columns 6 and 7, respectively). The p-values of the two-sample Wilcoxon rank-sum tests are reported. ∗∗∗, ∗∗ and ∗ express significance at 1, 5 and 10%. See Table 1 for the variables definitions.

Table 3
Descriptive statistics – Part 2.

	All banks			Listed banks			EBA_tested banks		
	Pre-crisis	Crisis	Difference in means	Pre-crisis	Crisis	Difference in means	Pre-EBA tests	EBA tests years	Difference in means
	Mean (sd)	Mean (sd)	(*p*-value)	Mean (sd)	Mean (sd)	(*p*-value)	Mean (sd)	Mean (sd)	(*p*-value)
LLP	0.002928	0.005310	-0.002382***	0.003231	0.006625	-0.003393***	0.003767	0.006534	-0.002766***
	(0.002030)	(0.003263)	(0.0000)	(0.002209)	(0.003887)	(0.0000)	(0.003314)	(0.004611)	(0.0000)
NPL	0.023835	0.042168	-0.0183338***	0.021682	0.038881	-0.017198***	0.017836	0.041948	-0.024112***
	(0.017828)	(0.024469)	(0.0000)	(0.020511)	(0.025591)	(0.0000)	(0.015576)	(0.028945)	(0.0000)
LOAN	0.705040	0.724811	-0.0197708***	0.653313	0.673300	-0.019987	0.66272	0.671598	-0.008879
	(0.142284)	(0.137640)	(0.0088)	(0.140752)	(0.139262)	(0.1270)	(0.129411)	(0.119825)	(0.7017)
EBTP	0.034409	0.029843	0.004565***	0.031196	0.027982	0.003213***	0.025449	0.023982	0.001468
	(0.010352)	(0.008382)	(0.0000)	(0.009254)	(0.007797)	(0.0023)	(0.007589)	(0.006195)	(0.1533)
TIER1 (%)	9.719296	11.19305	-1.473754***	8.024701	9.413797	-1.389096***	8.879154	10.78607	-1.906916***
	(3.389159)	(3.522965)	(0.0000)	(1.702401)	(2.09860)	(0.0000)	(1.994129)	(2.122556)	(0.0000)
TA	15.91552	16.02162	-0.1061	17.6016	18.04345	-0.44185**	18.7485	18.91125	-0.16275
	(2.002233)	(2.086272)	(0.3752)	(1.629461)	(1.600107)	(0.0164)	(1.448987)	(1.441306)	(0.3361)
N. obs.	511	721		117	158		130	56	

The table presents descriptive statistics of both the pre-crisis (2005 – 2008) and the crisis (2009 – 2011) periods for both all sample banks (columns 2 – 3) and listed banks (columns 5 – 6). It also shows descriptive statistics referred to both the years before the EBA stress tests and the two-year period 2010 – 2011 for tested banks (columns 8 – 9). The p-values of the two-sample Wilcoxon rank-sum tests are reported. ∗∗∗, ∗∗ and ∗ express significance at 1, 5 and 10%.
See Table 1 for the variables definitions.

Table 4
Sample correlations.

Variables	LLP	GDPGR	NPL	LOAN	EBTP	TIER1	TA
Panel A: all banks							
LLP	1						
GDPGR	-0.3955***	1					
NPL	0.5247***	-0.2999***	1				
LOAN	0.3268***	-0.1154***	0.3431***	1			
EBTP	0.1577***	0.0325	0.2473***	0.3291***	1		
TIER1	-0.0628**	-0.1300***	0.2136***	-0.0418	0.0992***	1	
TA	-0.0585**	0.0880***	-0.3019***	-0.5135***	-0.4835***	-0.3439***	1
Panel B: listed banks							
LLP	1						
GDPGR	-0.5586***	1					
NPL	0.6069***	-0.3689***	1				
LOAN	0.4095***	-0.1629***	0.3375***	1			
EBTP	0.2392***	-0.0255	0.3079***	0.4195***	1		
TIER1	0.1993***	-0.2253***	0.2147***	-0.055	0.1157*	1	
TA	-0.1661***	-0.0046	-0.2301***	-0.5168***	-0.4862***	-0.1232**	1
Panel C: EBA tested banks							
LLP	1						
GDPGR	-0.6081***	1					
NPL	0.6966***	-0.4414***	1				
LOAN	0.2656***	-0.114	0.1815**	1			
EBTP	0.3716***	-0.038	0.2030***	0.2978***	1		
TIER1	0.0628	-0.1638**	0.1143	0.0068	-0.1179	1	
TA	-0.1652**	0.0075	-0.125*	-0.7152***	-0.2095***	-0.1028	1

The table reports Pearson pair-wise correlation coefficients for whole sample banks (Panel A), listed banks (Panel B) and tested banks (Panel C).
***, ** and * denote significance at 1, 5 and 10%.
See Table 1 for the variables definitions.

Table 5
GLS fixed effect (FE) regression results of loan loss provisions.

		Equation (1)		Equation (2)		Equation (3)	
Variables/ratios	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Panel A: Coefficient estimates							
Constant		-0.000122	-0.10	0.000419	0.33	0.000585	-6.73
GDPGR	-	-0.017876***	-6.67	-0.017111***	-6.77	-0.017143***	8.38
NPL	+	0.079370***	9.54	0.077992***	9.51	0.075723***	-0.52
LOAN	±	-0.000777	-0.49	-0.000878	-0.56	-0.000817	5.10
EBTP	+	0.097247***	5.13	0.101575***	5.40	0.097310***	-1.64
TIER1	+	-0.000088*	-1.83	-0.000083*	-1.67	-0.000082	2.26
CRISIS●EBTP	+	0.030796***	2.91	0.023978**	2.18	0.025138**	-0.43
CRISIS●TIER1	+	-0.000016	-0.55	-0.000011	-0.33	-0.000014	-0.72
LISTED●EBTP	+	-	-	-0.037457	-0.74	-0.034894	-0.84
LISTED●EBTP●CRISIS	+	-	-	-0.017067	-0.56	-0.025147	-1.43
LISTED●TIER1	+	-	-	-0.000239	-1.26	-0.000259	1.83
LISTED●TIER1●CRISIS	+	-	-	0.000196	1.67	0.000208*	-0.69
EBA_TESTED●DY2010		-	-	-	-	-0.001360	-1.91
EBA_TESTED●DY2011		-	-	-	-	-0.007660**	1.03
EBA_TESTED●EBTP●DY2010	±	-	-	-	-	0.062941	2.26
EBA_TESTED●EBTP●DY2011	±	-	-	-	-	0.203738**	0.62
EBA_TESTED●TIER1●DY2010	±	-	-	-	-	0.000063	1.08
EBA_TESTED●TIER1●DY2011	±	-	-	-	-	0.000291	0.46
Panel B: Model fit							
F-statistics		84.57***		59.96***		51.21***	
Within R^2		0,4869		0.5004		0.5082	
Between R^2		0,2489		0.1105		0.1092	
Overall R^2		0,3411		0.2294		0.2336	
Number of observations		1,232		1,232		1,232	

The table reports the results of the GLS fixed effect (FE) estimates of equations (1), (2) and (3). In each regression the dependent variable is LLP. 28EBA_TESTED is an indicator variable that takes the value 1 if bank *i* is one of the 28 banks subject to both the 2010 and 2011, and 0 otherwise; DY2010 (DY2011) is an indicator variable that takes the value 1 if the observation is referred to the year 2010 (2011), and 0 otherwise. See Table 1 for the other variables definition. T-statistics are robust for heteroskedasticity. ***, ** and * express significance at 1, 5 and 10%.

Table 6
GLS fixed effect (FE) regression results of loan loss provisions (excluding Spanish and Greek banks)

		Equation (1)		Equation (2)		Equation (3)	
Variables/ratios	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Panel A: Coefficient estimates							
Constant		-0.001380	-1.08	-0.000908	-0.70	-0.000665	-0.51
GDPGR	-	-0.015466***	-6.55	-0.015174***	-6.61	-0.015774***	-6.65
NPL	+	0.087986***	10.01	0.086954***	10.18	0.085979***	10.08
LOAN	±	-0.000237	-0.14	-0.000427	-0.25	-0.000396	-0.23
EBTP	+	0.099101***	5.63	0.102007***	5.27	0.097508***	5.00
TIER1	+	-0.000092*	-1.97	-0.000108**	-2.12	-0.000108**	-2.13
CRISIS●EBTP	+	0.019706*	1.82	0.019569*	1.76	0.020153*	1.81
CRISIS●TIER1	+	0.000002	0.07	-0.000001	-0.02	-0.000007	-0.22
LISTED●EBTP	+	-	-	-0.057119	-1.34	-0.057584	-1.30
LISTED●EBTP●CRISIS	+	-	-	-0.024340	-0.76	-0.025743	-0.86
LISTED●TIER1	+	-	-	0.000018	0.17	-0.000013	-0.13
LISTED●TIER1●CRISIS	+	-	-	0.000130	1.26	0.000130	1.35
EBA_TESTED●DY2010		-	-	-	-	0.003916	0.88
EBA_TESTED●DY2011		-	-	-	-	-0.003944*	-1.95
EBA_TESTED●EBTP●DY2010	±	-	-	-	-	-0.117659	-0.84
EBA_TESTED●EBTP●DY2011	±	-	-	-	-	0.188724*	1.86
EBA_TESTED●TIER1●DY2010	±	-	-	-	-	-0.000031	-0.21
EBA_TESTED●TIER1●DY2011	±	-	-	-	-	0.000079	0.45
Panel B: Model fit							
F-statistics		64.29***		43.78***		32.91***	
Within R^2		0.4972		0.5045		0.5118	
Between R^2		0.3695		0.3275		0.3173	
Overall R^2		0.4015		0.3736		0.3710	
Number of observations		998		998		998	

The table reports the results of the GLS fixed effect (FE) estimates of equations (1), (2) and (3). In each regression the dependent variable is LLP. 28EBA_TESTED is an indicator variable that takes the value 1 if bank *i* is one of the 28 banks subject to both the 2010 and 2011, and 0 otherwise; DY2010 (DY2011) is an indicator variable that takes the value 1 if the observation is referred to the year 2010 (2011), and 0 otherwise. See Table 1 for the other variables definition. T-statistics are robust for heteroskedasticity. ∗∗∗, ∗∗ and ∗ denote significance at 1, 5 and 10%.

Table 7
Two-step system GMM regression results for loan loss provisions.

	Equation (1)		Equation (2)		Equation (3)	
Variables/ratios	Coefficients	t-stat	Coefficients	t-stat	Coefficients	t-stat
Panel A: Coefficient estimates						
Constant	-.000935	2.01	.000345	0.62	.000191	0.40
GDPGR	-.013778***	-4.56	-.013238***	-4.87	-.012713***	-4.41
NPL	.097660***	3.47	.098048***	3.73	.098409***	3.15
LOAN	-.006410***	-2.81	-.0059698***	-2.61	-.006059***	-2.60
EBTP	.133690***	5.42	.1156504***	4.40	.113676***	4.48
TIER1	-.000046	-1.10	-.000014	-0.30	.000009	0.15
CRISIS●EBTP	.028324***	2.57	.029485**	1.96	.0298843*	1.91
CRISIS●TIER1	-.0000673*	-1.93	-.000072	-1.60	-.000073	-1.38
LISTED●EBTP	-	-	.093819	1.34	.070785	1.12
LISTED●EBTP●CRISIS	-	-	-.042031	-0.59	-.031941	-0.48
LISTED●TIER1	-	-	-.000231	-1.00	-.000147	-0.73
LISTED●TIER1●CRISIS	-	-	.000166	0.68	.0001189	0.54
EBA_TESTED●2010	-	-	-	-	-.006956**	-1.98
EBA_TESTED●2011	-	-	-	-	-.016033**	-2.20
EBA_TESTED●EBTP●2010	-	-	-	-	.131085	1.19
EBA_TESTED●EBTP●2011	-	-	-	-	.292504**	2.21
EBA_TESTED●TIER1●2010	-	-	-	-	.0000350	1.46
EBA_TESTED●TIER1●2011	-	-	-	-	.000768	1.48
Panel B: Model fit						
F-statistics	89.97***		75.31***		80.06***	
test stat AR(1)	-3.64*** (0.00)		-3.59***(0.00)		-3.57***(0.00)	
test stat AR(2)	-0.39 (0.699)		-0.08 (0.940)		-0.16(0.870)	
Hansen J-stat	186.63 (0.432)		180.76 (0.574)		182.80(0.449)	
Number of instruments	197		202		204	
Number of observations	818		818		818	

The table shows the two-step system GMM estimation of equations (1), (2) and (3). In each regression the dependent variable is LLP. 28EBA_TESTED is an indicator variable that takes the value 1 if bank *i* is one of the 28 banks subject to both the 2010 and 2011, and 0 otherwise; DY2010 (DY2011) is an indicator variable that takes the value 1 if the observation is referred to the year 2010 (2011), and 0 otherwise. See Table 1 for the other variables definition. *p*-values are in parentheses. AR(1) and AR(2) test for no serial correlation of first and second order, in the first differenced standard errors. Hansen *j-stat* tests for over-identifying restrictions. ∗∗∗, ∗∗ and ∗ express significance at 1, 5 and 10%.