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Abstract

Using an unbalanced panel of accounting data from 1997 to 2004 and controlling for individual bank costs and risk, we find capital buffers of the banks in the in the EU15 have a significant negative co-movement with the cycle. For banks in the accession countries there is significant positive co-movement. Capital buffers of commercial and savings banks, and of large banks, exhibit negative co-movement. Those of co-operative and smaller banks exhibit positive co-movement. Speeds of adjustment are fairly slow. We interpret these results and discuss policy implications, noting that negative co-movement of capital buffers will exacerbate the procyclical impact of Basel II.

Key words: Bank Capital, Bank Regulation, Business Cycle Fluctuations
JEL classification numbers: G21, G28

1. Introduction

Much debate surrounding the new Accord (Basel II) on bank capital requirements, due to come into force in 2007, has centred on its potential 'pro-cyclicality'. One of the primary aims of Basel II is to create a closer link between capital requirements and risks, so it is clear that these requirements will become more dependent on the business cycle. In a cyclical downturn, when counterparties are more likely to be

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downgraded than upgraded, the resultant effect could be a significant increase in the capital requirements to account for increased counterparty risk. Similarly, during an economic upturn, the amount of capital required would be reduced. Since raising capital is costly, especially during an economic recession when profits are decreasing, banks might be forced to reduce their loan portfolio in a recession, so as to meet rising capital requirements. Thus many have argued that the new Accord will make it much harder for policy makers to maintain macroeconomic stability.

The growing literature on the potential pro-cyclicality of Basel II has largely focussed on quantifying the likely range of variation in ‘Pillar 1’ capital requirements through the business cycle.[1] In practice, well-functioning banks hold capital well in excess of the minimum requirements, which will reduce the impact of Pillar 1 regulatory capital requirements on loan portfolios. Moreover, the supervisory review powers granted to regulators under Pillar 2, allowing them to demand a buffer of additional capital during a business cycle expansion, provide policy makers with a tool to counter the potential pro-cyclicality effect of the new accord. All this implies that the management of bank capital buffers over the course of the business cycle will be as important, or even more important, than the ‘Pillar 1’ requirements as a determinant of the cyclical impact of the new accord.

With this policy concern in mind, we investigate the cyclical behaviour of bank capital buffers of European banks, under the old Basel 1988 accord on capital regulation. By ‘capital buffer’ we mean the amount of capital banks hold in excess of that required of them by national regulators. The main objective of our paper is to establish the extent of co-movement between this buffer and the cycle, and to determine whether such co-movement is country, bank type or bank size specific. We also analyse the impact of various cost and revenue variables on the behaviour of bank capital buffers.

Our estimation results reveal substantial differences in the cyclical behaviour of capital buffers. We find that capital buffers of RAM (10 countries that joined the EU in May 2004) banks move together with the business cycle while those of banks in the Denmark, Sweden and the United Kingdom (DK-SE-UK) and EA sub-samples exhibit negative co-movement.[2] We also find additional distinctions by size and type of bank.. Capital buffers of commercial and savings banks, as well as those of larger banks have a negative relationship with the cycle while those of co-operative banks and of smaller banks move together with the cycle. In almost all cases we find a fairly slow speed of adjustment towards desired capital buffers. These results pro-

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[1] Basel II is based on three complementary pillars. Pillar 1 consists of the regulatory calculations of capital requirements for market, credit, and operational risk. Pillar 2 is the supervisory review process, where supervisors assess both the bank’s total capital adequacy for the full range of risks including those not covered by Pillar 1 and the bank’s management of capital. Pillar 3 is market discipline. In order to improve transparency of banks to counterparties and investors, banks will be required to disclose detailed information on their risk profile and capital adequacy.

[2] The latter finding is broadly in line with most of the individual country studies that analyse the determinants of excess capital and their relationship to the cycle (see among others Ediz et al., 1998; Rime, 2001; Ayuso et al., 2004; Lindqvist, 2004; Stoltz and Wedow, 2005).

vide a benchmark from which inferences relating to the introduction of Basel II and its effect on capital buffer management can be made. In particular, they shed some light on how capital management decision may need to be adjusted through Pillar II and III of Basel II in order to offset the potential cyclical effects of the new accord.

The paper is organized as follows. Section 2 discusses the motivation for holding excess capital, sets out the hypotheses we test, and describes our data including the various controls we introduce for bank specific determinants of bank capital. Section 3 presents our specification and empirical results and summarises some robustness checks. Section 4 concludes.

2. Hypotheses and Data Description

Our data, for the years 1997-2004, indicates that banks hold far more prudential capital than that required by the regulators (see Table 1).[3] Total capital buffers (tier 1 plus tier 2) of banks within the EU15 vary from 1.87 percent of risk-weighted assets in Portugal to 4.79 percent in Finland with an average across the EU15 of 2.93 percent. Buffers are also substantial in the accession countries, ranging between 2.64 percent in Cyprus and 6.99 in Malta. The average buffer for the RAM10 is around 5.14 percent which is considerably larger than in the EU15.

Several reasons have been put forward to explain why banks hold excess capital (see amongst other studies Marcus, 1984; Berger et al., 1995; Jackson et. al., 1999; Milne and Whalley, 2001; Estrella, 2004; Milne, 2004). Banks generally will tend to assess their risks differently than regulators, for instance using their own internal economic capital models. Appropriate bank-specific capital levels will therefore be set according to their own assumptions and risk appetites. Banks may also need to hold excess capital in order to signal soundness to the market and satisfy the expectations of rating agencies (Jackson et. al., 1999). These ‘market disciplines’ may lead banks to holding more capital required by regulators.

Banks may also hold a buffer of capital as a protection against the violation of the regulatory minimum requirements (Marcus, 1984; Milne and Whalley, 2001; Milne, 2004). By holding capital as a buffer, banks insure themselves against costs arising from a supervisory intervention in response to a violation of the requirements.

A further reason for holding a capital buffer is to take advantage of future 'growth opportunities', putting banks in a position to obtain wholesale funds quickly and at a competitive rate of interest in the event of unexpected profitable investment opportunities. In the event of a substantial increase in loan demand, banks with relatively little capital may lose market share to those that are well capitalised.

[3] Similarly large capital buffers are also held by US and Asian banks. See for example Peura and Jokivuolle (2004) for a tabulation of US capital buffers.

It is difficult to empirically distinguish these different underlying determinants of bank capital buffers: for example higher portfolio volatility can be expected to increase capital buffers, whether these are the result of market disciplines or of a desire to avoid supervisory interventions. Our paper has a more limited objective, to investigate how capital buffers of European banks behave over the business cycle, and in particular whether capital buffers are higher in business upturns and lower in business downturns (positive co-movement) or the reverse (negative co-movement), controlling as far as we can for various bank specific determinants of capital buffers..

We thus test the following null hypothesis: H_0 ***Under the Basel I Accord, business cycle fluctuations do not have an impact on the capital buffers of European banks***; against two alternatives: $H_1(a)$ ***Capital buffers co-move positively with the business cycle i.e. banks tend to increase capital in business cycle expansions and reduce capital in recessions***; and $H_1(b)$ ***Capital buffers co-move negatively with the business cycle*** **i.e.** ***banks tend to reduce capital in business cycle expansions and increase capital in recessions***.

These descriptive hypotheses are consistent with a number of different underlying structural models of bank capital dynamics. Estrella (2004) examines the relationship between optimal forward looking capital buffers and deterministic cycles of loan losses. He finds that banks, subject to costs of capital adjustment, will build up capital buffers in anticipation of loan losses. Since loan losses themselves tend to lag the business cycle, this suggests that actual capital buffers will rise during cyclical downturns, i.e. negative cyclical co-movement.

It is also argued (see amongst others Rajan, 1994; Borio et al., 2001; Crockett, 2001) that portfolio risks actually increase during an economic upturn. During an economic boom, lenders provide large amounts of credit while imbalances that will become responsible for the following recession continue to build up, increasing the possibility of unusually large losses during a cyclical downturn. Under this interpretation rational forward looking banks may build up capital buffers during cyclical upturns, i.e. positive co-movement.

Both positive and negative co-movement may also arise as a consequence of myopic bank behaviour. For example during an economic upturn, when risks are less likely to immediately materialise, banks may underestimate risks and as a result expand their loan portfolios and lower their capital ratios (negative co-movement). On the other hand unanticipatedly high levels of loan-loss provisions in an extended cyclical downturn may lead to lower capital ratios in a deep recession (positive co-movement)

While we cannot distinguish these different structural models of bank capital buffers, or distinguish myopic from forward looking expectations, we can control for institution specific factors that influence the banks desired level of capital. A large body of literature examines variations in risk profile and portfolio and capital structure decisions between different types of banks (see among others, Saunders et al., 1990; Gorton and Rosen, 1995; Esty, 1997; Salas and Saurina, 2002b). Differences in capital buffers can arise because of variations, in portfolio risks, in ownership structures and in access to the capital market.

The clearest prediction of this literature is that larger banks will hold smaller average capital buffers. Most obviously, large geographically diversified banks will have a much smaller probability of experiencing a large decline in their capital ratios, a diversification effect increasing with size. This effect is reinforced by asymmetric information between lenders and borrowers and by government support for banks that are 'too big to fail'. Banks help overcome information asymmetries by screening and monitoring borrowers, but these are costly activities and banks are likely to balance the cost of (and gain from) these activities against the cost of excess capital. To the extent that large banks enjoy economies of scale in screening and monitoring they will require less capital relative to the size of their loan assets. Large banks may also expect a greater degree of support than small banks from the government in the event of difficulties, further reducing capital buffers.

Sample selection

We build an unbalanced panel data set with eight years of annual bank balance sheet data obtained from the Bureau Van Dyck *Bankscope* database. Our sample includes data for commercial, savings and co-operative banks. In total, 468 banks are included in the sample, made up of 364 EA banks, 427 EU15 banks and 41 banks for the RAM10 (the 10 accession countries that joined the European Union in 2005). All 25 European Union countries are represented in the sample. As is usual in panel studies using accounting data, we remove some extreme outlier observations of changes in capital buffers.[4]

We have to consider carefully the timing of accounting years. The majority of bank accounting years end in the December of the calendar year (this applies to around 80 percent of our observations. However some 20 percent of our observations are for accounting years ending between January and March. Since capital buffers in the first quarter of the calendar year are determined by economic conditions in the previous year, we have transferred all accounting years ending between January and March back one year, so for example an end-March 2004 year we classify as an 2003 observation.)

The largest bank in the samples is *BNP Paribas,* with total assets of around €906 bln at the end of 2004. The smallest bank, *Budapest Bank* in Hungary, has total assets amounting to just around €1.5 million at the end of 2004. The largest number of banks are in France (103 banks) and Spain (70 banks) from the EU15 and in Poland (10 banks) for the RAM10.

[4] Data errors lead to occasional very large movements in reported capital buffers. Of the total 3736 observations available to us, we dropped 21 in the extreme tails of the cross sectional distribution of capital buffers, with a much larger number of standard deviations from the mean than the bulk of observations, on the assumption that these are reporting errors.

Our sample is further broken down by bank type distinguishing between commercial, co-operative and savings banks. We additionally differentiate between 'small' and 'large' banks, defining large banks as those with total assets exceeding the 2004 median of €37 billion in 2004. The sample distribution across sub-samples, by type and size of bank, is presented in Table 3. The RAM10 sub-sample is made up of small commercial banks, with the exception of a small Polish savings bank, *Powszechna Kasa Oszczednosci Bank*. We divide the EU15 into two further sub-samples, the Euro area (EA) and Denmark, Sweden, and UK (DK-SE-UK). The two sub-samples and the total EU15 contain a similar breakdown of banks, with 19 percent of banks large and with 65 percent commercial banks, 15 percent co-operative banks and around 20 percent savings banks. Across the entire data set Sweden has the largest percentage of 'large' banks (around 50 percent), followed by Ireland (around 35 percent).

Dependent and explanatory variables

Table 1 tabulates average capital buffers in our sample, by time and by country. Here the capital buffer is measured as the institutions' total Tier 1 plus Tier 2 capital Basel 1 risk-weighted capital ratio less its regulatory minimum requirements.[5] These requirements vary slightly from one country to another, as summarised in Table 2, sometimes exceeding the Basel minimum of 8 percent. The individual country averages are averages weighted by the market share (total assets) of the individual banks. There are several differences in the buffer sizes between countries. Many of the smaller countries such as Finland, Belgium and Ireland have large buffers of around 4 percent when compared to banks in larger countries such as France and Italy and the UK, where the buffers are around two percent above the required minimum.

On average over our sample period RAM10 banks held far more capital than banks in the EU15 countries (see the averages of the composite countries at the bottom of Table 1). However this gap has declined over time. Figure 1 plots the evolution of our individual sub-sample capital buffers. In the EU15 capital buffers rose slightly between 1998 and 1999, but then increased substantially between 2002 and 2003. In the RAM10 countries capital buffers have behaved very differently, rising steadily from 1997 to 1998 before falling sharply between 2000 and 2001. Thereafter, the RAM10 buffer level continues on a slight downward trend and by 2004 is at a similar level to the EU15.

Figure 1 also distinguishes between different bank types and bank sizes, for the EU25 and for our three sub-samples (EA, DK-SE-UK and RAM10), and compares these buffers with our principal explanatory variable, the output gap. The capital

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[5] We study only the total capital buffer not the Tier 1 buffer. There are two reasons for this. We need to take account of variations in the minimum level of required capital between jurisdictions (Table 2). As summarized in Table2 these differences are in total not Tier 1 capital requirements. Also the main source of capital fluctuation e.g. equity and loan loss reserves, affect both Tier 1 and total capital buffers.

buffers of co-operative banks behave very differently than those of commercial and savings banks, possibly reflecting the differences in ownership structure and objectives of co-operative banks.[6] This figure also confirms that small banks hold much higher average capital buffers than large banks.

Table 4 provides definitions of the variables used in our estimation. Our cyclical indicator is real GDP growth calculated from *Eurostat* data for each of the 25 countries and for the different sub-sample country groupings.[7] Our basic specification (model 1) includes three additional variables (ROE , $RISK$ and $SIZE$) as controls for various determinants of individual capital buffers as discussed by (Estrella, 2004). The first of these determinants is the *greater cost of* e*quity capital funding*, relative to deposits or debt. Theoretical analysis (see Myers and Majluf, 1984; Campbell, 1979) suggests that in the context of information asymmetries, equity is a more costly alternative to other bank liabilities. Equity may also be disadvantaged because interest payments on debt are deducted from earnings before tax.

Direct measurement of this cost is difficult. Previous studies (see among others Ayuso et al. 2004; Bikker and Metzemakers, 2004; Stoltz and Wedow, 2005) have included the banks return on equity (ROE), the ratio of post-tax earnings to book equity, as a proxy for the direct costs of remunerating excess capital. However ROE may well exceed the remuneration demanded by shareholders and to this extent is a measure of revenue rather than cost. For comparability with previous studies we include ROE as a control variable, but we acknowledge that this reflects both revenue and cost. The buffer capital model of Milne (2004) suggests that for financially strong banks the revenue impact will generate a negative relationship between ROE and capital buffers, because a high level of earnings substitutes for capital as a buffer against unexpected shocks i.e. under both cost and revenue interpretations we expect to observe a negative relationship between the capital buffer and the ROE variable.

The second determinant identified by Estrella is the *expected cost of failure* equal to the deadweight cost carried by shareholders times the probability of failure.[8] Since a bank's probability of failure is dependent on its risk profile, we proxy the cost of failure by adopting various measures of risk. As a first measure, we consider the ratio of non-performing loans to total loans $(RISK)$ as in Ayuso et. al (2004). This is an *ex post* measure of the risks assumed by banks and is comparable to other measures adopted in the literature since banks with non-performing loans are obliged to make provisions for loan losses. If banks set their capital in line with the true riskiness of their portfolios, then we would expect the relationship here to be

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[6] Co-operative banks cannot easily issue new shares and members prefer cash payments over retained earnings because there is no market for their ownership claims.

[7] We also investigated the use of the output gap which we obtained by applying the Hodrick-Prescott filter to the real GDP series. Estimates substituting this gap differed to only a minor extent and are therefore not presented here.

[8] An alternative framework for modelling these costs is Milne, 2004 and Milne and Whalley, 2001.

positive.[9] As discussed above there are several reasons, most notably greater portfolio diversification, for expecting a negative relationship between bank size and the level of capital buffers. Furthermore, we include dummy variables denoted *BIG* and *SMALL* to capture differences in buffer movements varying with the size of the institution. *BIG* equals one for banks in the highest decile of the size distribution of assets and otherwise equals zero. Similarly *SMALL* equals one for banks in the lowest thirty percentile of the size distribution of assets. These dummy variables are recomputed for each time period and for each sub-sample.

In a further specification (model 2) we include three additional balance sheet variables to control for the determinants of bank capital. Our *PROFIT* variable capturing post tax profits over total assets has an ambiguous anticipated sign. Higher retained earnings can be expected to increase capital buffers, but also higher expected earnings can be expected to reduce desired capital buffers. The ratio of bank loans to total assets $(NET\ LOANS)$ suggests a riskier profile so the expected sign is therefore positive. Annual loan growth $(\Delta LOAN)$ is a proxy for credit demand (this variable is also used by Ayuso et al., 2004) and should be expected to increase assets relative to capital and hence lower capital buffers.

3. Estimation Results

Following previous literature (Ayuso et al., 2004, Estrella, 2004) we use a partial adjustment framework with quadratic costs of adjusting capital.[10] Lower adjustment costs result in a faster speed of adjustment (δ):

$$\Delta BUF_{ijt} = \delta(BUF_{ijt}^{*} - BUF_{ijt-1}) + u_{ijt} \qquad (1a)$$

Here BUF_{ijt} and BUF_{ijt}^{*} are the actual and the optimum capital buffer respectively, of bank i in country j at time t. The proportionate adjustment towards the desired capital buffer in each period is δ. u_{ijt} is the error term that can be decomposed as the sum of two components, a random country specific component μ_i, plus a pure bank idiosyncratic component ε_{ijt}.

The desired capital stock BUF_{ijt}^{*} however cannot be observed, and is therefore approximated by the various cost and revenue variables discussed in the previous section.[11] The estimated version (our model 1) including these variables is therefore:

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[9] Banks may vary significantly in their willingness to take risk. This measure therefore can be assumed to uncover information on bank type. Any further idiosyncratic time-invariant component in the banks risk profile would be captured by the μ_i component of the residual term of Equation 2.

[10] We do not investigate the possibility of asymmetries in these costs, since it may be easier to reduce capital, e.g. by paying dividends or buying back equity, than it is to increase capital.

[11] For a theoretical derivation and explanation of linear-quadratic partial adjustment in models of bank capital see Ayuso et al. 2004 or Estrella, 2004.

$$BUF_{ijt} = \alpha \text{ROE}_{ijt} + \gamma \text{RISK}_{ijt} + \varepsilon \text{B}IG_{\text{ijt}} + \phi SMALL_{\text{ijt}} + (1-\delta) BUF_{ijt-1} + \beta CYCLE_t + u_{ijt} \quad (1b)$$

All of the variables defined in (1b) are defined in levels and so as is common with panel data analysis, we proceed to transform (1b) into first differences in order to obtain unbiased estimates. Since the model includes the lagged endogenous variable among the regressors and, since some of our other explanatory variables are likely to be endogenous, we employ the two-step generalized method of moments (GMM) procedure of Arellano and Bond (1991)[12]. The instruments chosen include the full set of lags of the dependent variable (BUF) together with two to four lags of both $RISK$ and ROE. In each case, the number of lags was chosen to avoid correlation with the error term u_{ijt} (which now appears in first differences) while simultaneously minimising the number of observations lost.

Estimation results for country groups.

The results for both model 1 and model 2 are presented in Table 5 for the total EU25 sample and our four sub-sample country groups. Estimation results are presented with both the domestic and the broad (EU25) measures of the cycle (real GDP growth).

For the EU25 and the EU15, EA and DK-SE-UK sub-samples, we find a negative significant relationship between the capital buffer and each of the cycle variables, consistent with our $H_1(a)$ hypothesis. In the Euro Area (EA) sub-samples a one-percentage rise in the growth rate of domestic GDP is associated with a 0.13 percent fall in the capital buffer. The positive 0.12 coefficient on the lagged dependent variable indicates that this cyclical impact increases after one year. A larger impact effect is seen for the DK-SE-UK sample, where the capital buffer decreases on average around 0.46 percentage points on a one percentage point rise in the domestic cyclical variable, however this is offset by a negative coefficient on the lagged dependent variable. These effects – a positive coefficient on the lagged dependent variable and a negative coefficient on the growth rate of domestic GDP – carry through to the EU15 and EU25 aggregated samples.

These findings are broadly in line with previous literature. (Ayuso et al., 2004) (Lindqvist, 2004) and (Stoltz and Wedow, 2005) find a similar negative relationship between bank buffers and the cycle variables for German, Spanish and Norwegian banks respectively. These findings can additionally be compared to those of Bikker and Metzemakers (2004) who conduct a cross-country analysis of bank capital buffers for 29 OECD countries. Using the aggregate OECD database they find a negative relationship between capital buffers and the cycle. Their finding however is only marginally statistically significant. They consequently conclude that while the rela-

[12] The GMM estimator is particularly useful in obtaining unbiased and efficient estimates in dynamic models with lagged endogenous variables as regressors.

tionship appears to be negative, cyclical effects on buffer movements are fairly limited.

The RAM10 sample returns opposite results. Here we find a significant positive relationship between the buffer and the cycle variables, in line with our $H_1(b)$ hypothesis. Here we see a significant increase in the capital buffer variable of 0.10 and 0.25 percentage points for a one percentage point rise in the rate of GDP growth.

Table 5 also reports results using a broader cyclical measure (GDP growth for the EU15, or EU25, as a whole) instead of domestic GDP growth. This makes little difference to the results, aside from a slightly smaller coefficient on the lagged dependent variable for the DK-SE-UK sub-sample.

Turning to the bank specific variables, the coefficient on *ROE* is significant with the expected negative coefficient in each of the sub-sample estimations, but the coefficient size is fairly small: -0.03 in the EA and RAM10 and slightly larger -0.09 in DK-SE-UK. The signs of the *BIG* coefficients are negative, consistent with the notion that big banks keep lower levels of capital in the expecation that in the event of difficulties, they will be bailed out. The sign of the *SMALL* coefficient is positive, suggesting that these banks hold larger capital buffers. These size coefficient are however only significant in some sub-samples.

RISK (non performing loans over total lending) is highly significant and positive for four of the five sub-samples. This suggests that banks with relatively risky portfolios generally do hold more capital. For the case of DK-SE-UK, the *RISK* coefficients are negative and significant.

Finally, the cost of adjusting capital, captured by the lagged endogenous variable, is positive and significant in almost all cases. This finding is in line with the view that the costs of capital adjustment are an important explanation of the holding of large capital buffers. The coefficients are largely uniform across sub-samples, which would indicate that the costs of adjustment are largely consistent between countries, corresponding to a rate of adjustment towards desired capital of around 66 percent per annum. However we find that the coefficients are negative for the DK, SE, UK sub-sample, which is inconsistent with a costly adjustment model of bank capital management.

Table 6 presents further estimation results for a second model (model specification 2), adding several further balance sheet variables to our baseline model (model specification 1). The sign of the relationship between GDP growth and bank capital buffers is unchanged. In EA and DK-SE-UK sub-samples the magnitude remains negative but is smaller (the decline is more marked when using the domestic measure of the cycle). In the RAM10 the magnitude remains positive and is now larger. The additional variables in this second model are themselves cyclically varying, so some change in the estimated co-movement is unsurprising. Overall we conclude from this second specification that considerable cyclical co-movement and that this movement is very different in RAM10 than in the rest of the EU .

The coefficient on the proxy for the cost of holding capital (*ROE*) and the speed of adjustment (the coefficient on the lagged dependent variable) are broadly unchanged from those reported for model specification 1. The coefficients for the *RISK* proxies are now larger while the coefficients on the *BIG* and *SMALL* variables are almost the same as in the previous model specification.

The new *PROFIT* variable for all sub-samples is positive and highly significant; indicating that retained earnings seem to be used to increase the capital cushion. The effect is noticeably larger for the EA sample when compared to the other sub-samples. The expected negative sign for the *NET LOANS* variable is found for the EU15, EA and RAM10 sub-samples, however the coefficients are broadly insignificant. The DK-SE-UK sample returns a highly significant positive coefficient. Considering the $\Delta LOAN$ variable, for all sub-samples, we find the parameter to be highly significant, with a negative sign as expected. This finding suggests that a contemporaneous increase in loan demand substantially reduces the capital buffer.

Estimation results for sub-groups of types and sizes of banks.

Table 7 reports further versions of these estimation results, for sub-groups of banks, distinguishing commercial, savings and co-operative banks and also large and small banks. We report estimates using only for the EA15. Here we wish to determine the effect that special bank specific features can have on capital buffer movements. We find this particularly useful for our estimations since the RAM10 sub-sample consists only of small commercial banks and RAM10 banks appear to behave so differently from those in the EA15. Considering commercial and savings banks, we find that for savings banks the co-movement with the cycle remains negative, but for co-operative banks the relationship is very different with a positive relationship evident between the cycle and capital buffers. The results for savings banks are more significant than for commercial banks, suggesting that the negative relationship reported in Table 5 is largely driven by savings banks.

This finding can help explain the relationship between our results and those of other researchers. (Stoltz and Wedow, 2005) present evidence for German banks showing that the relationship between the buffer and the cycle variable is stronger for savings banks than it is for co-operatives. The cross-country study of (Bikker and Metzemakers, 2004) finds that the cyclical effects appear to be limited. This finding is in line with our results since they focus their estimations on commercial banks only. (Ayuso et al., 2004) consider only savings and commercial banks in their study and find a robustly significant negative relationship. Their study does not however analyse bank type effects separately.

The *ROE* variable coefficients are very similar to those reported in Table 5. The coefficient is noticeably more significant amongst savings banks than it is for co-operative or commercial banks. This finding tends to indicate that the cost of holding excess capital appears to be most significant for co-operative banks when compared to savings and commercial banks.

The *RISK* coefficient remains positive and significant for both commercial and co-operative banks in all three sub-samples, while it is negative for savings banks. The impact of bank size (the *BIG* and *SMALL* variables) is similar to that reported in Tables 5 and 6, but only statistically significant for small savings banks.

For all three sub-samples, the BUF_{t-1} variable is positive and highly significant for commercial banks, while it is much smaller (and significant) for savings banks and insignificant for co-operative banks. This suggests that adjustment costs are more important for commercial banks.

Table 7 also reports a comparison by bank size. Here small banks are as defined in Table 3, with total assets less than €37bn in 2004. The dummy variables *BIG* and *SMALL* are dropped from these estimates. We find a positive and significant relationship between the capital buffers of small banks and output gap variables, while the relationship is negative and significant for large banks. The coefficients on the *ROE* variable are little changed from those obtained for the initial total sample estimations, negative and significant for both small and large banks. The *RISK* coefficients remain positive and significant for both small and large banks. The estimated cost of adjusting capital (the coefficient on BUF_{t-1}) is significant for both large and small banks. The coefficient is somewhat lower for small banks suggesting that adjustment costs play a larger role in the case of large banks.

To summarise, our estimations by both size and type of bank provide evidence that the capital buffers of both small and co-operative banks have a positive relationship with the output gap variables. On the other hand we find negative co-movement with the cycle for commercial banks, savings banks, and large banks. These differential results might be due to different access to capital markets or due to the fact both smaller banks as well as cooperative banks are more reliant on retained earnings than other banks in the sample hence building up capital during the economic upturn.

Robustness tests.[13]

We investigated a large variety of alternative specifications as a check on the robustness of our main findings, including subsets of the explanatory variables reported in Tables 5 and 6. In all cases the relationship between the capital buffer and the output gap is very similar to that which we report here.

A major concern is endogeneity, leading us to investigate whether the relationships that we report between capital buffers and the business cycle is robust to alternative dynamic specifications. We estimate a static version of the model where we omit the lagged dependent variable BUF_{t-1}. We also experimented with varying lag lengths for the explanatory variables, and by dropping the *ROE* variable from the estimations (since this is itself a cyclically varying variable). Finally we estimated a

[13] The analysis underlying these robustness tests is reported in Appendices 2 and 3 of the SSRN working paper version of this paper, Jokipii and Milne (2006).

'fixed effects' version of the model, in which all the bank specific variables were omitted $(RISK, ROE, BIG, SMALL)$ but in which we introduce a dummy (fixed effect) for each bank in the sample. In all these cases the coefficients on the business cycle variables remain fairly close to our reported results, indicating that these estimates are reasonably robust to dynamic re-specification.

There are potentially individual national effects that could arise from various country-specific characteristics relating to the legal, regulatory, structural, or tax and accounting framework. A simple way to test, and control for these conditions, is to create a country-specific dummy variable (D_i) for each country. As it turns out, there are no significant fixed country dummy variables in our regressions, indicating that all the national effects are already captured by our chosen specifications.

We also re-estimated our model 2, including in the explanatory variables both the broad cycle and the difference between the broad EU-25 cycle and the domestic cycle. In the case of the DK-SE-UK and the RAM10 country grouping, we find that both the domestic cycle and the additional impact of the broad cycle are significant at the five or ten percent level. In the other sub-samples and the EU25 there is no significant additional effect. Very similar results emerged when re-estimating model 1. This indicates that, while there is collinearity between the broad and domestic cycle, the domestic cycle is the slightly better measure. It does better than the broad cycle for DK-SE-UK and the RAM10, while the choice of cycle measure is immaterial for the other groupings.

Finally we have been concerned with a further econometric problem affecting all studies, such as our own, that combine macro-level and micro-data, whether in panel or cross-section. This problem, originally highlighted by Moulton (1990), is the possibility of a substantial downward bias on standard errors for macro-economic variables, when there is clustering of unobserved random variables. This possibility cannot be ignored in any study such as our own, using micro-level data to investigate macro-economic relationships, since any omitted macro-economic variables will lead to such clustering. The example presented by Moulton (1990) the corrected standard errors are three times as large as those obtained without correct. Our analysis of this problem suggests that standard errors on our cycle variables should be increased by around 20 per cent to allow for clustering. This reduces but does not overturn the significance of our results.

4. Conclusions

This paper examines the relationship between European bank capital buffers and the business cycle. Much of the empirical literature in this field has focussed on examining the determinants of bank capitalization within a single country. Our research is cross-country, comparing behaviour in different sub-sample groups of countries and for different groups of banks.

We build an unbalanced panel of 486 banks, using annual balance sheet data between 1997 and 2004. Controlling for various determinants of capital buffers, we analyse the remaining impact of the business cycle. We find a significant negative relationship between the capital buffers of banks and the rate of GDP growth, for EU25, EU15, EA and DK-SE-UK sub-samples. For the RAM10 banks i.e. those in the 10 accession countries that joined the EU in 2004, our results indicate that capital buffers co-move positively with the output gap.

We distinguish further between both type and size of bank. Our findings indicate that capital buffers of large banks, and of commercial and savings banks, appear to behave in a similar fashion to the sample as a whole, co-moving negatively with the output gap i.e. declining in recession. On the other hand the capital buffers of small banks and of co-operative banks co-move positively with the cycle, rising in recession.

Our results complement and extend the findings of previous researchers. Negative co-movement of capital buffers with the cycle has been reported before for banks in individual countries (Ayuso et al., 2004, Lindqvist, 2004, and Stoltz and Wedow, 2005). The only previous cross-country study, that of (Bikker and Metzemakers, 2004) finds rather smaller degree of negative co-movement than us, using a longer time period of aggregated OECD bank data. However their data covers only commercial banks. Our investigation of different bank types reveals a more pronounced negative co-movement for savings banks than commercial banks, which may help to explain the difference in our finding.

Our results are essentially descriptive. This raises the question as to why small banks and co-operative banks as well as those in accession countries exhibit positive co-movement while the other banks that dominate our sample exhibit negative co-movement. In the case of the accession countries, this may be due to ongoing structural changes. As indicated in Figure 2, RAM10 capital buffers have been converging on those in the rest of the EU, and it is possible that negative co-movement may be observed once this convergence is complete.

For co-operative banks and smaller commercial banks the most likely reason is capital market frictions. Small banks find it relatively costly to raise new equity capital while co-operative banks are unable to make such issues at all. These banks are thus reliant on retained earnings as a protection against insolvency and this can explain a preference for building up capital during economic upturns. With the exception of the very largest co-operative banks, such banks also find it costly to borrow on wholesale debt markets and are thus relatively dependent on retail deposits as a source of funding. This makes it difficult for smaller and co-operative banks to respond as much to cyclical increases in loan demand as other banks. Because their loan assets rise more slowly, this mechanism will also increase their capital buffers during cyclical upturns, relative to those of other banks. Further research may elucidate these relationships.

Negative co-movement suggests additional reasons for concern about the potential 'pro-cyclical' impact of the introduction of the new Basel II accord on bank capital adequacy. Larger banks, notably the commercial and savings banks, have in our sample period reduced capital buffers in the economic downturn. Under the new accord Pillar 1 capital requirements will be increased in the economic downturn as bank exposures are downgraded, whether by external rating agencies or in internal rating systems. This suggests that capital management will especially challenging under the new accord because it will lead to higher capital requirements precisely at the time (the trough of the business cycle) when most of the banks are seeking to reduce their capital levels.

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Table 1: Total Capital Buffers by Country (weighted by total assets)

	1997	1998	1999	2000	2001	2002	2003	2004	avg
AT	0.72	2.09	2.09	1.96	2.89	2.63	3.08	3.10	2.32
BE	3.43	3.45	4.37	5.75	5.31	5.06	4.66	4.45	4.56
FI	4.03	2.49	4.01	1.38	1.68	2.53	10.97	11.20	4.79
FR	2.24	2.31	2.13	1.80	1.78	1.67	1.84	1.49	1.91
DE	1.96	1.89	2.46	3.00	2.79	2.85	4.41	4.37	2.97
GR	1.73	1.67	6.21	4.51	2.83	2.24	3.42	4.57	3.40
IE	3.02	3.54	3.23	3.05	3.05	4.95	6.82	5.54	4.15
IT	1.49	1.81	1.46	1.61	1.34	2.32	2.42	2.87	1.92
LU	4.87	4.07	4.26	4.07	3.94	3.75	4.88	2.47	4.04
NL	2.96	2.84	2.71	2.69	2.80	3.23	3.56	3.50	3.04
PT	2.66	1.86	2.35	0.98	1.23	1.62	2.04	2.21	1.87
ES	1.93	2.75	2.39	2.50	3.20	2.82	2.63	2.51	2.59
DK	2.29	2.22	2.62	1.75	2.24	2.43	2.79	2.23	2.32
SE	2.55	2.73	3.23	2.46	2.70	2.29	2.53	2.68	2.65
UK	1.70	1.47	1.89	2.37	1.50	0.96	0.92	0.85	1.46
CY	2.13	1.34	3.94	4.63	3.24	1.52	1.48	2.83	2.64
CZ	2.09	3.79	4.81	6.13	4.03	3.94	4.43	2.74	4.00
EE	3.23	8.57	10.55	7.53	6.84	6.55	5.18	4.01	6.56
HU	4.51	4.73	7.32	6.88	3.27	4.68	2.27	1.96	4.45
LAT	8.10	1.60	4.78	3.00	2.74	2.42	2.33	4.14	3.64
LIT	2.23	15.40	3.12	3.79	4.49	4.81	1.97	2.28	4.76
MAL	6.57	8.46	8.06	8.27	6.65	7.19	7.71	3.01	6.99
PL	2.32	2.18	4.84	5.36	6.33	5.67	5.76	7.67	5.02
SLK						5.36	10.14	12.05	9.18
SLV	8.06	6.10	5.49	6.71	6.03	8.09	6.29	6.04	6.60
EU25	3.20	3.72	4.10	3.84	3.45	3.66	4.18	4.03	3.77
EU15	2.51	2.48	3.03	2.66	2.62	2.76	3.80	3.60	2.93
EA	2.59	2.56	3.14	2.77	2.74	2.97	4.23	4.02	3.13
DK-SE-UK	2.18	2.14	2.58	2.19	2.15	1.90	2.08	1.92	2.14
RAM10	4.36	5.80	5.88	5.81	4.85	5.02	4.75	4.67	5.14

Note: AT= Austria, BE= Belgium, DE= Germany, ES= Spain, FI= Finland, FR= France, GR= Greece, IE= Ireland, IT= Italy, LU= Luxembourg, NL= Netherlands, PT= Portugal, DK= Denmark, SE= Sweden, UK= United Kingdom,CY= Cyprus, CZ= Czech Republic, EE= Estonia, HU= Hungary,LAT=Latvia, LIT=Lithuania, MAL= Malta, PL= Poland, SK= Slovakia, SL=Slovenia.

** denotes figures equal to the un-weighted average of composite countries.*

Capital buffer is defined as the institutions total risk weighted capital (Tier 1 + Tier 2) capital less the required minimum (8% or the higher value in Table 2). Within each country average bank capital buffers weighted by bank market share.

Table 2: National Total (Tier 1 + Tier 2) Capital Requirements

	minimum required ratio	*year of implementation*
UK	9%	1979
CY	8 %	1997
	10 %	2001
EE	10 %	1997
LAT	10 %	1997
	8 %	2004
LIT	10 %	1997
	8 %	2005
SL	8 %	2002

Note:The FSA sets additional unpublished 'trigger' and 'higher target' ratio for UK banks resulting in higher levels of capital required by the regulators.To allow for this apply a 9% requirement to UK banks active in the sample and calculate the buffer as capital above this level. RAM countries have followed UK practice, setting higher capital requirements than 8%.. Further discussion of individual country capital requirements is reported in Appendix 1 of Jokipii and Milne (2006)

Table 3: Distribution of the Sample

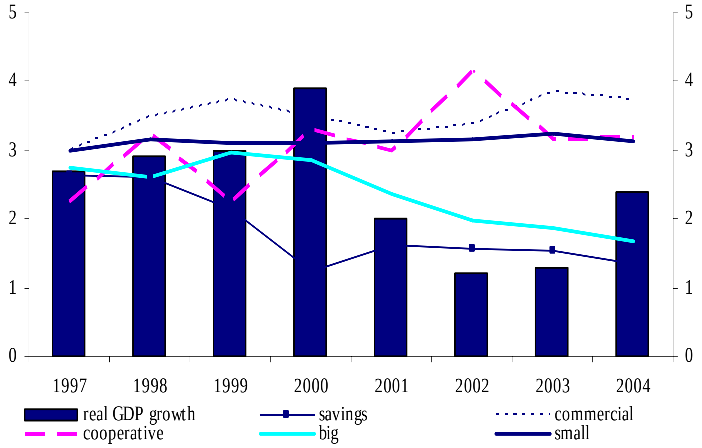
	commercial banks	**co-operative banks**	**savings banks**	**big banks** *(total assets> €37 billion in 2004)*	**small banks** *(total assets< €37 billion in 2004)*	**total**
EU25	311	77	80	85	383	468
EU15	271	77	79	79	348	427
EA	214	76	74	59	305	364
DK-SE-UK	57	1	5	20	43	63
RAM10	40	0	1	6	35	41

Table 4: Description of Variables Adopted

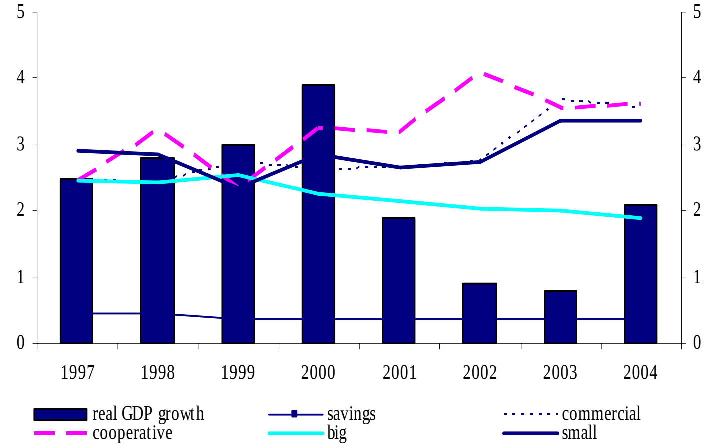
Variable	**Description**
BUF	total capital-national regulatory minimum (%)
ROE	return on equity (%)
RISK	ratio of non-performing loans to total loans (%)
BIG	dummy variable : value 1 for banks in highest size decile of country sub-sample at time t
SMALL	dummy variable : value 1 for banks in lowest thirty per-centile of sub-sample at time t
PROFIT	post-tax profit over total assets
ΔLOAN	annual loan growth (%)
NET LOANS	loans over total assets
CYCLE	domestic and sub-sample GDP growth

Figure 1: Capital Buffers by Bank Type and Size

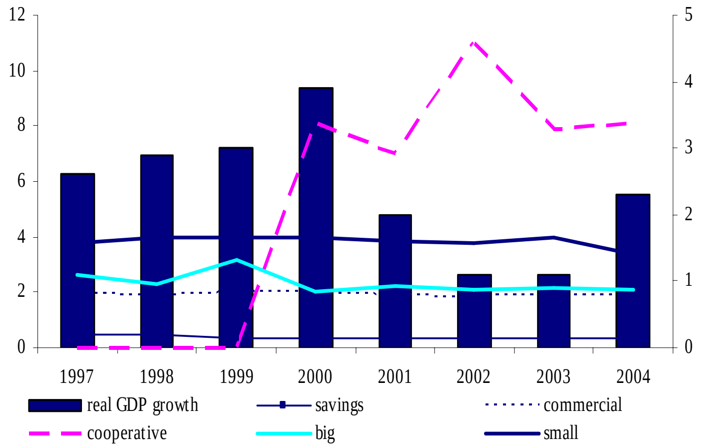
EU25



EA



DK-SE-UK



RAM10

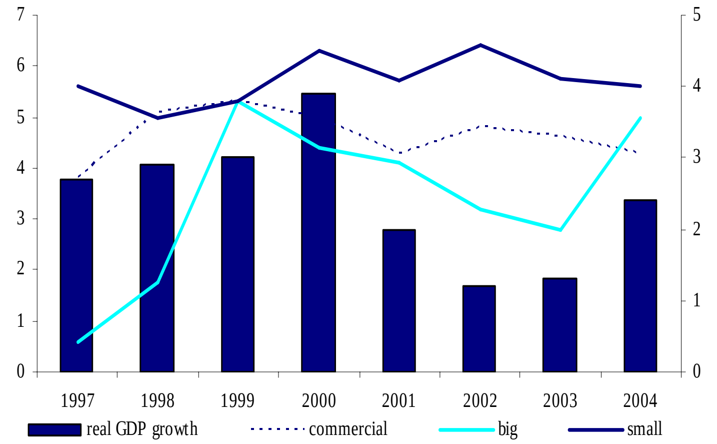


Table 5: Two-Step GMM Estimates

	EU25		***EU15***		***EA***		***DK-SE-UK***		***RAM***	
	Model Specification 1		Model Specification 1		Model Specification 1		Model Specification 1		Model Specification 1	
Cycle variable:	domestic cycle	EU25 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle
BUF_{t-1}	0.36 *(4.22)****	0.45 *(4.62)****	0.20 *(2.91)****	0.19 *(3.02)****	0.12 *(3.12)****	0.18 *(3.62)****	-0.40 *(3.02)****	-0.35 *(3.12)****	0.22 *(9.66)****	0.27 *(6.88)****
ROE	-0.03 *(1.85)**	-0.04 *(1.66)**	-0.04 *(5.41)****	-0.05 *(3.43)****	-0.03 *(1.75)***	-0.05 *(1.23)**	-0.09 *(1.66)***	-0.10 *(0.98)*	-0.03 *(1.27)**	-0.03 *(4.01)****
$RISK$	64.55 *(4.33)****	62.75 *(3.55)****	44.66 *(3.16)****	43.72 *(2.18)***	42.11 *(3.12)****	37.62 *(2.42)***	-31.69 *(4.02)****	-68.75 *(4.66)****	22.66 *(1.45)**	26.78 *(1.75)***
BIG	-14.87 *(2.13)***	-24.33 *(1.65)**	-17.25 *(0.08)*	-16.74 *(1.81)**	-19.32 *(2.01)***	-18.33 *(1.85)**	-23.67 *(0.08)*	-19.54 *(0.21)*	-11.76 *(0.06)*	-22.34 *(0.04)*
$SMALL$	21.77 *(1.92)**	18.33 *(1.99)***	22.33 *(0.17)*	16.33 *(0.33)*	19.01 *(1.90)**	23.04 *(1.66)**	13.22 *(0.08)*	12.76 *(0.66)*	23.54 *(1.94)***	20.87 *(1.46)**
$CYCLE$	-0.10 *(3.77)****	-0.09 *(3.22)***	-0.12 *(4.99)****	-0.12 *(4.65)****	-0.13 *(3.66)****	-0.15 *(5.02)****	-0.46 *(4.55)****	-0.40 *(6.33)****	0.10 *(2.02)***	0.25 *(3.97)****
Sargan	21.34 *(0.74)*	20.58 *(0.67)*	20.97 *(0.69)*	24.79 *(0.78)*	25.78 *(0.76)*	21.69 *(0.59)*	32.58 *(0.99)*	29.87 *(0.55)*	25.67 *(0.85)*	21.46 *(0.92)*
$a(1)$	-2.16 *(0.00)*	-2.78 *(0.00)*	-2.02 *(0.00)*	-2.76*(0.00)*	-2.45 *(0.00)*	-2.62 *(0.00)*	-1.44 *(0.00)*	-1.68 *(0.00)*	-1.76 *(0.00)*	-1.67 *(0.00)*
$a(2)$	-1.56 *(0.72)*	-1.69 *(0.44)*	-1.04 *(0.52)*	-1.33 *(0.96)*	-1.65 *(0.44)*	-0.95 *(0.52)*	-1.62 *(0.26)*	-1.79 *(0.71)*	-1.21 *(0.75)*	-0.99 *(0.55)*

Note: Dependent variable is BUF_{it}*. Other variables as defined in Table 3.*

T-values presented in parentheses. $a(1)$ *and* $a(2)$ *represent first and second order residual tests.*

, **, * denote significance at the ten, five and one percent levels of significance respectively.*

Cycle variable corresponds to real GDP growth. Models including the broad and the sub-group cycle are estimated separately.

Table 6: Two-Step GMM Estimates

	EU25		***EU15***		***EA***		***DK-SE-UK***		***RAM***	
	Model Specification 2		Model Specification 2		Model Specification 2		Model Specification 2		Model Specification 2	
Cycle variable:	domestic cycle	EU25 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle
BUF_{t-1}	0.28 *(3.66)****	0.24 *(5.82)****	0.33 *(3.51)****	0.25 *(3.24)****	0.19 *(4.62)****	0.21 *(3.76)****	-0.39 *(4.01)****	-0.39 *(3.97)****	0.12 *(3.02)****	0.18 *(4.63)****
ROE	-0.03 *(1.81)***	-0.03 *(1.31)**	-0.05 *(1.97)**	-0.04 *(2.35)***	-0.04 *(1.05)*	-0.05 *(1.16)*	-0.09 *(0.23)*	-0.08 *(3..2)****	-0.03 *(0.45)*	-0.03 *(0.66)*
$RISK$	76.44 *(3.54)****	72.33 *(3.17)****	35.86 *(5.02)****	66.97 *(4.87)****	55.24 *(4.22)****	23.67 *(3.96)****	-30.06 *(2.99)****	-28.74 *(3.15)****	86.35 *(3.05)****	77.84 *(4.66)****
BIG	-24.44 *(1.44)**	-18.76 *(1.96)***	-11.99 *(0.13)*	-21.77 *(1.66)**	-12.65 *(1.45)**	-12.22 *(1.69)***	-23.65 *(0.11)*	-18.77 *(0.31)*	-23.44 *(0.15)*	-19.87 *(0.66)*
$SMALL$	19.66 *(1.47)**	22.34 *(1.52)**	12.77 *(0.99)*	13.66 *(0.77)*	18.86 *(1.84)**	15.87 *(1.92)**	20.11 *(0.16)*	13.66 *(0.22)*	12.12 *(2.01)***	15.66 *(1.99)***
$PROFIT$	180.10 *(3.56)****	175.22 *(3.02)****	165.21 *(3.99)****	135.21 *(3.42)****	152.55 *(3.11)****	164.75 *(3.75)****	66.32 *(4.02)****	78.56 *(4.51)****	82.47 *(4.66)****	90.57 *(4.06)****
$CYCLE$	-0.06 *(3.98)****	-0.02 *(3.01)****	-0.08 *(4.01)****	-0.41 *(3.33)****	-0.04 *(3.11)****	-0.10 *(2.98)****	-0.06 *(4.55)****	-0.38 *(5.78)****	0.19 *(2.55)***	0.16 *(3.11)****
$\Delta LOAN$	-0.01 *(3.06)****	-0.01 *(3.77)****	-0.01 *(3.05)****	-0.00 *(2.52)***	-0.02 *(2.06)***	-0.02 *(1.97)***	-0.02 *(3.13)****	-0.01 *(4.12)****	-0.06 *(3.11)****	-0.08 *(3.25)****
$NET\ \ LOANS$	-0.06 *(0.98)*	-0.06 *(0.76)*	-0.11 *(1.02)*	-0.01 *(0.63)*	-0.00 *(0.72)*	-0.01 *(0.99)*	0.01 *(2.99)****	0.00 *(2.87)****	-0.01 *(0.11)*	-0.02 *(0.55)*
Sargan	24.68 *(0.88)*	27.69 *(0.76)*	27.69 *(0.99)*	29.78 *(0.92)*	27.63*(0.79)*	22.46*(0.83)*	26.89 *(0.63)*	27.96 *(0.79)*	22.97 *(0.46)*	23.69 *(0.76)*
$a(1)$	-2.34 *(0.00)*	-2.65 *(0.00)*	-2.42 *(0.00)*	-2.36 *(0.00)*	-2.09 *(0.00)*	-2.11 *(0.00)*	-0.96 *(0.00)*	-1.02 *(0.00)*	-1.55 *(0.00)*	-1.67 *(0.00)*
$a(2)$	-1.11 *(0.46)*	-0.84 *(0.36)*	-1.42 *(0.45)*	-1.29 *(0.65)*	-1.08 *(0.46)*	-1.12 *(0.76)*	-1.24 *(0.82)*	-1.34 *(0.23)*	-0.92 *(0.65)*	0.76 *(0.98)*

Note: Dependent variable is BUF_{it}. *Other variables as defined in Table 3.*

T-values presented in parentheses. $a(1)$ *and* $a(2)$ *are first and second order residual tests.*

*, **, *** *denote significance at the ten, five and one percent levels of significance respectively.*

Cycle variable corresponds to real GDP growth. Models including the broad and the sub-group cycle are estimated separately.

Table 7: EU15 Two-Step GMM Estimates by Type and Size of Bank

	Commercial banks		*Co-operative banks*		*Savings banks*		*Big banks*		*Small banks*	
Cycle variable:	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle	domestic cycle	EU15 cycle
BUF_{t-1}	0.33 *(4.00)****	0.21 *(4.11)****	-0.15 *(0.60)*	0.19 *(0.77)*	-0.17 *(1.46)**	-0.16 *(3.04)****	0.44 *(6.00)****	0.30 *(4.66)****	0.25 *(3.33)****	0.15 *(3.21)****
ROE	-0.03 *(1.52)**	-0.04 *(1.33)**	-0.01 *(0.70)*	-0.02 *(1.32)**	-0.04 *(4.01)****	-0.06 *(4.66)****	-0.10 *(3.99)****	-0.7 *(3.12)****	-0.04 *(1.86)***	-0.03 *(1.97)**
$RISK$	26.55 *(2.11)***	22.46 *(2.12)***	40.55 *(3.62)****	70.44 *(3.17)****	-31.22 *(4.11)****	-22.54 *(3.66)****	40.25 *(2.25)***	69.68 *(2.52)****	29.66 *(2.23)***	55.78 *(2.09)***
BIG	-16.57 *(0.44)*	-16.33 *(0.96)*	-21.43 *(0.66)*	-20.66 *(0.68)*	-18.99 *(0.65)*	-21.34 *(0.11)*				
$SMALL$	11.22 *(0.56)*	18.76 *(0.45)*	15.66 *(0.34)*	21.23 *(0.26)*	17.43 *(1.52)**	18.75 *(1.43)**				
$PROFIT$	146.89 *(4.00)****	137.66 *(4.11)****	130.22 *(3.00)****	120.66 *(1.85)***	170.22 *(4.06)****	140.66 *(4.98)****	201.46 *(3.88)****	160.35 *(2.93)****	130.22 *(2.99)****	88.66 *(4.01)****
$CYCLE$	-0.16 *(1.25)**	-0.45 *(2.77)***	0.15 *(2.18)***	0.22 *(0.84)*	-0.10 *(3.00)****	-0.37 *(4.61)****	-0.12 *(2.53)***	-0.55 *(1.63)**	0.06 *(2.99)****	0.20 *(2.97)****
$\Delta LOAN$	-0.03 *(4.62)****	-0.02 *(3.85)****	0.00 *(3.66)****	0.03 *(4.96)****	0.01 *(0.75)*	-0.01 *(0.66)*	-0.01 *(6.33)****	-0.02 *(7.44)****	0.00 *(0.12)*	-0.00 *(0.32)*
$NET\ \ LOANS$	0.10 *(1.05)*	0.00 *(0.12)*	-0.25 *(8.53)****	-0.03 *(4.00)****	-0.09 *(1.88)**	-0.01 *(0.22)*	0.01 *(3.01)**	0.01 *(3.00)****	-0.12 *(1.97)****	-0.01 *(1.86)**
Sargan	42.44 *(0.78)*	34.66 *(0.63)*	27.89 *(0.93)*	25.67 *(0.86)*	22.97 *(0.79)*	33.79 *(0.67)*	31.75 *(0.92)*	22.97 *(0.78)*	23.67 *(0.81)*	22.75 *(0.84)*
$a(1)$	-1.66 *(0.00)*	-2.11 *(0.00)*	-1.75 *(0.00)*	-1.65 *(0.00)*	-1.88 *(0.00)*	1.35 *(0.00)*	-2.44 *(0.00)*	-3.13 *(0.00)*	-1.78 *(0.00)*	-1.44 *(0.00)*
$a(2)$	-1.21 *(0.74)*	-1.34 *(0.90)*	-1.66 *(0.96)*	-1.53 *(0.76)*	-1.57 *(0.83)*	-1.45 *(0.98)*	-1.76 *(0.80)*	1.45 *(0.76)*	-1.55 *(0.86)*	-1.63 *(0.76)*

Note: Dependent variable is BUF_{it}*. Other variables as defined in Table 3.*

T-values presented in parentheses. $a(1)$ *and* $a(2)$ *represent first and second order residual tests.*

, **, * denote significance at the ten, five and one percent levels of significance respectively.*

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