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Abstract

The financial crisis which erupted in 2007-8 has illustrated the disruptive effects of procyclicality. The phenomenon of procyclicality refers to the mutually reinforcing interactions between the financial system and the real economy that tend to amplify business cycle fluctuations. These fluctuations can cause or exacerbate turbulences in the financial system and this explains why supervisory and regulatory authorities are so much concerned in mitigating the degree of procyclicality. In this study, we focus on the ratings system of the U.S. banking institutions and test how these are linked to the phenomenon of procyclicality. More concretely, we empirically investigate the sensitivity of CAMEL ratings system, which is used by the U.S. authorities to monitor the conditions in the banking market, to the fluctuations of economic cycle. Our results reveal that the overall state of the U.S. economy and CAMEL ratings are positively correlated. We find that CAMEL ratings largely depend on the course of the business cycle as they are lower during economic upturns and higher during economic downturns. This is to say that the performance and risk-taking behaviour of banks is rated higher when the conditions in the economy are favourable and lower when the economic environment is weak. This very important and rather unknown source of procyclicality should be taken into serious consideration by authorities.

JEL Classification: C13, C20, C50, D02, G21 and G28
Keywords: CAMELS ratings, financial crisis, financial stability and procyclicality

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1. Introduction

The concern about procyclicality has been revived after the eruption of the global financial crisis in 2007-8. In broad terms, procyclicality is related to the mutually reinforcing interactions between the financial system and the real economy that tend to amplify business cycle fluctuations. These fluctuations can cause or exacerbate turbulences in the financial system and this explains why supervisory and regulatory authorities are so much concerned in mitigating the degree of procyclicality of the system.

The key sources of procyclicality in the financial sector are related to the distortions in incentives. To provide an example, financial contracts that establish a direct link between asset valuations and funding do not capture the conflicts of interest between lenders and borrowers. A second example of incentives' distortions involves actions by individual agents that may be rational from the agents' perspective, but may result in unfavourable outcomes for the system as a whole. This happens when, e.g., bank managers have strong incentives to take excessive risk with the purpose to increase the short-term profits of their banks and also their bonuses. Excessive risk, however, has been proved to be harmful for the stability of the financial system and detrimental for the entire economy in the medium to long-run.

The procyclical tendency of the financial systems worldwide towards boom-bust cycles goes back to the work of Minsky (1977). Nevertheless, the impact of procyclicality on the smooth functioning of the economic and financial activities had only recently confirmed in the relevant empirical literature. Indeed, bank capital adequacy requirements, risk and profit measurements, and credit supply have all been lately found to be amongst the fundamental factors which foster the positive feedback mechanisms between the financial and the real sectors of the economy. Moreover, some recent studies have provided strong support to the view that the lending behaviour of banks is significantly affected by business cycle waves. Along the same lines, bank leverage has been also lately found to follow a procyclical pattern.

Even though the procyclicality literature has advanced sufficiently over the last decade or so, little attention has been paid on the ratings of banking institutions and how these are linked to the phenomenon of procyclicality. In this paper, we make an effort to fill part of this literature gap by examining the sensitivity of CAMEL ratings system, which is used by the U.S. authorities to monitor the conditions in the banking market, to the fluctuations of economic cycle. The Uniform Financial Rating System, informally known as the CAMEL ratings system, was introduced by the

U.S. regulatory authorities in November 1979 to assess the health of individual banking firms. According to this system, bank examiners assign a score on a scale of 1 (best) to 5 (worst) for each of the five CAMEL components; they also assign a single summary measure, known as the 'composite rating'. In 1996, CAMEL evolved into CAMELS, with the addition of a sixth component ('S') to summarise Sensitivity to market risk. Following the Federal Deposit Insurance Corporation (FDIC) Improvement Act of 1991, U.S. regulators resort to the CAMEL rating system every 12 to 18 months to conduct on-site examinations of bank safety and soundness.

The results of our empirical analysis reveal that the overall state of the U.S. economy and CAMEL ratings are positively correlated. More concretely, we find that CAMEL largely depends on the course of the business cycle as they are lower during economic upturns and higher during economic downturns. This is to say that the performance and risk-taking behaviour of banks is rated higher when the conditions in the economy are favourable, and lower when the economic environment is weak.

The structure of the paper is as follows. Section 2 reviews the relevant literature. Section 3 presents the data set, the variables, and the econometric model which are employed in our analysis, and discusses the empirical results. Section 4 is devoted to robustness checks, whereas Section 5 concludes.

2. Literature review

The research on procyclicality has been particularly focused on the importance of banks' capital cushion in the system's procyclicality both under Basel I and Basel II Agreements. A number of studies have indeed analysed the operation of bank capital buffers within the context of Basel I (Rime, 2001; Ayuso et al., 2004; Estrella, 2004; Lindquist, 2004; Bikker and Metzemakers, 2005, and Jokopii and Milne, 2006 among others). Though the majority of these studies focuses on different banking sectors and relies on various econometric techniques, they share a common feature: they all provide strong empirical evidence that the Basel I capital buffers exhibit significant cyclical patterns in the sense that buffers tend to increase during economic downturns and decrease during upturns.

Several other studies have evaluated the cyclicality character of capital charges under Basel II before its implementation by employing numerical simulations on hypothetical or real world portfolios. For example, Kashyap and Stein (2004) make a simulation exercise to show that the

increase in capital charges under Basel II for the average virtual portfolio of borrowers is in the range of 30%-45%. Along the same lines, Ervin and Wilde (2001) assume a portfolio of BBB-rated borrowers and demonstrate that a bank with an initial capital ratio of 8% in 1990 would have experienced a decrease in regulatory capital requirements of 6.8% under the Internal Ratings Based (IRB) capital requirements of Basel II.

Furthermore, Rösch (2002) relies on a broad set of S&P's transition and default rates for a period covering 19 years (1982-2000) and finds that these two effects is likely to offset capital requirements, which means that Basel II might be less cyclical compared to its predecessor. In contrast to the results of Rösch (2002), Jokivuolle and Peura (2004) and Zicchino (2005) find that capital buffers do dampen the cyclical effects of Basel II. In a different setting, Repullo and Suarez (2009) construct a dynamic general equilibrium model that highlights the cyclical behaviour of the Basel II capital buffers. They show that the probabilities of bank failures are much lower under the Basel II regime than under Basel I or in a situation with no capital requirements. This is to say, the side effects of Basel II are basically consist of a pay-off in terms of the long-term solvency of banking organisations.

After the onset of the late 2000s crisis, the relevant literature has documented that during boom phases where the financial sector rises and economy grows, banks are very optimistic regarding near future economic trends (*i.e.*, a general euphoria prevails in the economy) thus utilising downward biased information sets to evaluate risk. As a consequence, risk tends to be underestimated making the (risk-based) Basel II capital requirements to shrink in the expansion phase of the business cycle when risk is measured to be low. At the same time, banks expand their lending activity which, in turn, inflates asset prices. Collateral values also rise justifying even more lending and this perpetuates the endogenous cycle.

The opposite with what we describe above occurs in economic downturns like in the period that followed the years 2007-8. On the one hand, banks are particularly fragile in this phase of the business cycle which renders them very cautious in extending credit, whereas on the other hand market expectations on future economic activity and future economic fundamentals are very low. Hence, in such periods, risk is measured to be high feeding further the inclination of financial institutions to strengthen their capital base by holding capital well in excess of the minimum requirements. The increase in capital requirements during downswings reduces credit availability

and asset prices and is highly likely to result in a credit crunch that deteriorates the already adverse economic conditions.

To move further in the analysis of the bank procyclicality literature, Gordy and Howells (2006) examine the procyclicality problem by focusing on the Third Pillar of Basel II, which concerns market discipline via public disclosure practices. Their study investigates whether and to what extent the enforcement of banks to disclose detailed information on their risk profile and capital adequacy to the public has a procyclical impact on banks' lending activity. Their simulation-based empirical approach indicates that the extent of cyclicality in capital requirements depends largely on how market discipline makes banks to vary their fresh loans according to macroeconomic conditions. By the same token, Peek et al. (2003) and Lown and Morgan (2006) show that the supply of credit increases during cycle upturns and shrinks in contraction phases.

The debate over the procyclicality of the financial system has also turned to focus on the impact that the loan loss provisioning system of banking institutions has on credit cycles. There are two different aspects for such kind of analysis depending on how Loan Loss Provisions (LLPs) are treated. On the one hand, we have the so-called 'risk-management hypothesis' that emphasises the interest of regulatory and supervisory authorities to reduce procyclicality of both LLPs and bank capital. Risk management links provisioning rules to the capital requirements through the coverage of credit risk. Specifically, expected future credit losses are covered by loan loss reserves whereas unexpected losses are covered by capital reserves. The component of LLPs which covers expected losses is called non-discretionary. There is, however, one more component, the discretionary component, which is linked to the 'capital management hypothesis' according to which provisions are used for bank management purposes like income smoothing, capital management, or for the signaling of bank financial strength to investors and their counterparts.

Based on the analysis above, Bouvatier and Lepetit (2008) use a sample of 184 European banks over the period 1992-2004 to examine how LLPs affect the procyclicality of the financial system by differentiating the discretionary component of LLPs from the non-discretionary component. They conclude that the former one has no considerable impact on credit cycles, in contrast to the latter one which amplifies system's procyclicality. In more details, their results show that banks are capable of identifying only a small number of problem loans in periods of economic upsurges, whereas provisions for bad loans increase by a lot when economy slows down. The procyclical effect of the non-discretionary component of LLPs is also reported in the studies of Laeven and

Majnoni (2003) and Bikker and Metzemakers (2005) and, more recently, in that of Fonseca and Gonzalez (2008).

Another aspect of procyclicality is the one related to the leverage of financial institutions. Adrian and Shin (2010) investigate the leverage behaviour of the five largest US investment banks before the crisis finding strong evidence of procyclicality. They show that in the economic upsurge that preceded the crisis, the market value of assets moved upwards and investment banks exploited this trend to increase their leverage. Such increase was attained mainly through the increase in overnight inexpensive repurchase agreements (repos).

Notwithstanding the fact that the procyclicality of leverage is more pronounced for non-depository institutions like the investment banks whose assets and liabilities are more exposed to market conditions, the reliance of commercial banks on short-term funding through securitised activities made the typical retail depository institutions also prone to procyclicality. In fact, IMF World Economic Outlook (2008) provides strong evidence of procyclical leverage by commercial banks in arm's-length financial systems, *i.e.*, systems where intermediation relies more on financial markets and not so much on traditional bank-based activities. Therefore, the leverage-taking behavior of US commercial banks is also examined in terms of procyclicality.

Procyclicality can also be traced in the rating scores assigned to financial institutions by the international credit rating agencies. Indeed, Pagratis and Stringa (2009) provide significant evidence of a positive relationship between bank ratings and economic activity. Following the relevant corporate finance literature (see, e.g., Amato and Furfine, 2004) and using a sample of 293 banks from 33 countries over the period 1999-2006, they show that senior unsecured ratings assigned to banks by Moody's tend to be lower in economic slowdowns and higher in economic upturns.

Albertazzi and Cambacorta (2009) empirically examine the relationship between bank profitability and business cycle fluctuations focusing on a set of 10 industrialised economies. Profits are calculated using interest and non-interest income together with operating expenses, and LLPs. Their findings suggest that interest income and provisions are strongly affected by changes in economic growth in contrast to noninterest income which remains rather unaltered. Since banks rely more and more on modern financial products that produce noninterest income, they argue that bank profits have turned to be less procyclical nowadays.

3. Empirical analysis

3.1. Description of the data set

The U.S. bank balance sheet data that we employ in our empirical analysis are of quarterly frequency and can be found in machine-readable form at the website of the Federal Reserve Bank of Chicago. We begin with a total of 8,905 commercial and savings banking institutions that filed a Report on Condition and Income (more widely known as Call Report) in the first quarter of 2002, that is, in 2002q1. Due to failures, mergers and acquisitions (M&As) that took place during the sample period, the total number of active banks was reduced to 7,072 in 2012q4. We do not consider any savings associations (*i.e.*, thrifts) in our analysis as they file different regulatory reports compared to those filed by their commercial and savings counterparts.

Since our focus is on the late 2000s crisis, we do not examine the years before 2002. We chose the year 2002 and not any other previous year for two main reasons. First, the two international financial crises that erupted in East Asia and in Russia at the end of the 90s together with the Long Term Capital Management (LTCM) crisis of 1998 both had a destabilising impact on the U.S. banking system. Second, no considerable regulatory or other similar reforms occurred in the U.S. banking market after 2002, meaning that the operation of banks remained largely unaffected by exogenous factors throughout the examined period. In fact, the latest legislative activity in the U.S. that largely influenced the operation of the entire banking sector was the Gramm-Leach-Bliley Act of 1999, which opened up the local market allowing commercial and investment banks, securities firms and insurance companies to merge their activities. If any additional reforms had taken place in the banking regulatory environment after 2002, it would be very likely to have exerted an impact on the leverage decisions of banks and, hence, to have biased our results as it is well established in the relevant literature that regulation strongly affects industry structure and alters the behaviour of banks in terms of performance and risk-taking (see, e.g., Brissimis et al., 2008).[1]

3.2. The CAMEL ratings system

Following the bank failure literature (Lane et al, 1986; Cole and Gunther, 1995; Ioannidis et al., 2010), we construct a set of financial variables that largely resembles the original CAMEL system,

[1] It has to be mentioned here that the U.S. government enacted the Sarbanes-Oxley Act in mid-2002 with the purpose to set new or enhanced disclosure standards for all U.S. public company boards including those of banking firms. However, the Act had a partial effect on the operation of the banking industry as it only targeted the listed banks; further, it was introduced in the very beginning of our sample period and not somewhen in the middle of it implying that its overall impact is reflected in our data.

which is used by U.S. authorities to monitor banking conditions. Under the CAMEL rating system, banking firms are rated from 1 (best) to 5 (worst). Banks with a composite rating of 4 or 5 are considered problem banks. Banks with ratings of 1 or 2 are considered to present few, if any, supervisory concerns, while banks with ratings of 3, 4, or 5 present moderate to extreme degrees of supervisory concern.

Hence, the dependent variable in our model (*CAMEL*) is a vector of several different measures of Capital adequacy, Asset quality, Management expertise, Earnings strength, and Liquidity. We use the equity to assets ratio as an indicator of bank capital strength (*CAP1*); asset quality is measured with provisions for credit losses divided by total loans and leases (*ASSETQLT1*); the quality of bank management is proxied by total operating income as a fraction of income generating assets (*MNGEXP*), which is a typical measure of operating efficiency in the banking literature (see, e.g., Lane et al., 1986); the return on assets (*ROA*) is applied as a measure of earnings strength, whereas the ratio of cash & cash equivalents and federal funds sold and securities purchased under agreements to repurchase to total assets reflects the degree of bank liquidity (*LQDT1*). To develop all the aforementioned ratios, we use bank balance sheet data which have been hand-collected from Call Reports. Appendix A summarises the *CAMEL* components and their data sources.

3.3. The econometric model

The model we employ in our empirical analysis relies on a data set which, as earlier described, consists of the universe of the 7,072 U.S. commercial and savings banks and extends from 2002q1 to 2012q4, where *q=2002q1, 2002q2,…, 2012q4.* Our model takes the following form:

$$\overline{CAMEL}_{iq} = \alpha_{iq} + \beta_{1,q}GDP_q + \beta_{2,q}CPI_q + \beta_{3,q}UNEM_q + \beta_{4,q}Z_q + \gamma_{1,qk}d_k^{size} + \gamma_{2,iq}MA_{iq} + \gamma_{3,q}HHI_q + +\gamma_{4,q}CR1_q + \varepsilon_{iq} \qquad \text{Eq. 1}$$

The bar above the dependent variable of eq. 1 means that we average *CAMEL* ratings over each sample quarter *q*; that is, we use the time-averaged values of *CAMEL*. Turning to the left-hand side variables of eq. 1, we measure the main economic fundamentals with the following three variables: the GDP output gap (*GDP*) which is obtained from the Bureau of Economic Analysis of the U.S. Department of Commerce; the change in the U.S. Consumer Price Index (*CPI*) to

control for variations in the level of prices; and the unemployment rate (*UNEM*). Both inflation and unemployment data are obtained from the Bureau of Labor Statistics of the U.S. Department of Labor.

We further employ the vector *Z* in our model to capture all the financial and macroeconomic state variables that influence bank performance and risk-taking as captured in *CAMEL*. These variables are the following: i) the market return volatility measured with the Implied Volatility Index (VIX) found in the Chicago Board Options Exchange Market, ii) the liquidity risk spread given by the quarterly difference between the 3-month LIBOR rate and the 3-month U.S. T-bill rate, iii) the change in the slope of the yield curve given by the change in the quarterly difference between the 10-year U.S. T-bill rate and the 3-month U.S. T-bill rate, iv) the interest rate risk defined as the quarterly standard deviation of the day-to-day 3-month U.S. T-bill rate,[2] and v) the credit risk, measured by the quarterly change in the credit spread between the 10-year BAA-rated bonds and the 10-year U.S. T-bill rate.

Turning to the control variables of our empirical analysis, these are described as follows: d_k^{size} is a dummy for the size class *k* (*k* = 1, 2, 3, 4); to be more specific, we follow Berger and Bouwman (2013) to split our sample banks into four separate size categories denoted by the lower-case letter *k*. We define small banks as those banks with total assets up to $1 billion (*k* = 1). This definition of small banks conforms to the usual notion of community banks in U.S. We further define medium-sized banks with total assets between $1 billion and $3 billion (*k* = 2), large banks with total assets from $3 billion to $10 billion (*k* = 3), and, lastly, extra-large banks which are all those banking firms with more than $10 billion in total assets (*k* = 4).

We also control for the possible impact of M&As by introducing a dummy variable in our model (*MA*), which is equal to unity in the quarter *q* that bank *i* has been involved in some M&A transaction. For example, if a transaction has occurred on, say, 15/04/2008, then this transaction is recorded in the second quarter of 2008, meaning that the binary variable *MA* will take the value of one for 2008q2. To construct *MA*, we resort to the relevant information provided by National Information Center of the Federal Financial Institutions Examination Council (NIC/FFIEC).

[2] This measure describes the changes in interest rates and/or security prices that are expected to have an effect on bank income and on market value of bank equity. To be more specific, interest rate risk arises predominantly from mismatches in the durations of assets and liabilities. It, therefore, reveals the interest rate cycle movements that influence the deposit-taking and lending activities of banks.

Moreover, we measure the degree of market concentration with the Herfindahl-Hirschman Index (*HHI*) using bank total deposits as the input variable. *HHI* is calculated as the sum of squares of the market share of each bank included in our sample:

$$HHI_t = \sum_{i=1}^{n} (market\ share)_{iq}^2 \qquad \text{(Eq. 2)}$$

Eq. (2) relies on the market share of bank *i* at quarter *q* where *n* is the total number of banks in the examined market. The index ranges from 0 to 10,000, where zero reveals a market with an infinite number of banks and 10,000 shows a market with just a single banking firm. *HHI* is a static measure in the sense that it estimates market concentration at some particular point in time *q*.

We further introduce a crisis dummy (*CR1*) to capture the impact of crisis on the operation of the banking firms. This dummy is set equal to 1 in 2007q3. Indeed, in August 2007, the difference between the interest rates on interbank loans and short-term U.S. government bills (the so-called TED spread) widened to 150-200 basis points relative to a historically stable range of 10-50 basis points.[3]

Lastly, to control for the differences in the banking environments amongst U.S. states, we incorporate state fixed effects in our regression. All variables we employ in eq. 1and the sources utilised to construct them are summarised in Appendix A.

3.4. Discussion of the empirical results

The regression results are presented in the Table 1 that follows. As we can see, the overall state of the U.S. economy and *CAMEL* ratings are positively correlated. Indeed, we find that the variable *CAMEL* largely depends on the course of the business cycle: the coefficients of *GDP* and *CPI* turn out to be significantly negative, while that of *UNEM* is found to be significantly positive, implying that *CAMEL* ratings are lower during economic upturns and higher during economic downturns. Put differently, the performance of banks is rated higher when the conditions in the economy are favourable, and lower when the economic environment is weak.

The aforementioned results can be verified by the positive and statistically significant coefficient of the vector *Z*, which shows that the increased market volatility combined with lower

[3] Other recent studies -like that of Cornett et al. (2011)- also use the third quarter of 2007 as the starting point of the crisis.

yields, higher credit risk, liquidity risk, and interest rate risk are related with higher *CAMEL* scores, *i.e.* with lower bank performance. It can thus be argued that *CAMEL* ratings follow a clearly procyclical pattern.

As regards bank size, the negative links of size dummies with *CAMEL* reveal large-scale diversification, economies of scale and scope, better access to capital markets, and, more generally, a source of support for the operation of the entire organisation, or the entire banking system.[4] These findings provide strong evidence for the Too-Big-To-Fail (TBTF) strategies that many banks follow in order to improve their performance and risk profile.

Further, market concentration has a negative impact on the performance and risk-taking behaviour of banks since *HHI* increases *CAMEL*. This is to say, a more competitive market structure is more beneficial for the operation of the banking industry. We also find that M&As do not significantly affect bank performance and risk-taking, even though we would expect to report a negative and statistically significant relationship, which would imply that M&As are beneficial for bank performance. Last, as expected, the impact of the late 2000s financial crisis on bank performance is clearly negative as given by the positive sign of the coefficient of *CR1*.

Table 1

Variables	Coef. value	*t*-stat
constant	0.05	0.88
GDP	-0.13	-2.76***
CPI	-0.16	-2.32***

[4] As is obvious from the results in Table 1, one of the coefficients of the four size class dummies and, more specifically, that of *Medium* is normalised to zero in order to avoid the existence of multicollinearity

UNEM	0.09	1.87**
Z	0.32	1.76**
Small	-0.42	-1.69**
Medium	0.00	
Large	-0.63	-1.78**
Extra-large	-0.87	-1.76**
MA	-0.33	-1.04
HHI	0.94	3.41***
CR1	1.42	3.00***
Fixed effects	Yes	
R^2	0.23	
F-test	11.04	
D-W	1.16	

***, **, * correspond to 1%, 5%, and 10% level of significance respectively for a two-tailed distribution

4. Robustness analysis

We perform an analysis to test the robustness of our main findings. To achieve this, we use a series of alternative variables to construct CAMEL ratings. Capital adequacy is measured by the ratio of Tier 1&2 regulatory bank capital to risk-based assets (*CAP2*); asset quality is proxied by loan loss reserves and loan charge-offs divided by total loans (*ASSETQLT2*); the returns on equity are utilised to proxy banks' earnings (*ROE*); and the ratio of liquid deposits to total deposits (*LQDT2*) is employed in our robustness analysis to measure the degree of liquidity of the sample banking firms. Lastly, we replace *CR1* with *CR2*, which is equal to 1 in 2008q3 when the Lehman Brothers collapsed. All variables employed in the robustness analysis as well as the sources used to construct these variables are summarised in Appendix A.

We rerun our baseline model (eq. 1) and we obtain the results which are reported in Table 2 and which corroborate our conclusions reached in our baseline analysis.

Table 2

Variables	Coef. value	*t*-stat
constant	0.07	0.81
GDP	-0.11	-2.69***
CPI	-0.18	-2.38***
UNEM	0.11	1.96***
Z	0.29	1.85**
Small	-0.39	-1.72**
Medium	0.00	
Large	-0.61	-1.84**
Extra-large	-0.82	-1.71**
MA	-0.29	-1.18
HHI	0.90	3.32***
CR1	1.37	2.88***
Fixed effects	Yes	
R^2	0.21	
F-test	12.45	
D-W	1.21	

***, **, * correspond to 1%, 5%, and 10% level of significance respectively for a two-tailed distribution

5. Concluding remarks

The financial crisis which erupted in 2007-8 has illustrated the disruptive effects of procyclicality, which refers to the amplification of the effects of the business cycle, and of the risk that can build up when financial institutions acting in an individually imprudent manner collectively create

systemic problems. There is now broad consensus among regulators and supervisors that the microprudential regulatory framework needs to be complemented by macroprudential principles that can smooth the effects of the credit cycle. This has led to proposals for countercyclical capital requirements and loan loss provisions that would be higher in good times and lower in bad times.

One very important aspect which should also be seriously considered from authorities is the procyclicality of performance ratings system of banking institutions, which is the main topic of analysis of the current study. Indeed, in this study, we focus on the ratings of the U.S. banking institutions and how these are linked to the phenomenon of procyclicality. Towards this, we empirically investigate the sensitivity of CAMEL ratings system, which is used by the U.S. authorities to monitor the conditions in the banking market, to the fluctuations of economic cycle. The results of our empirical analysis reveal that the overall state of the U.S. economy and CAMEL ratings are positively correlated. More concretely, we find that the CAMEL ratings largely depend on the course of the business cycle as they are lower during economic upturns and higher during economic downturns. This is to say that the performance and risk-taking behaviour of banks is rated higher when the conditions in the economy are favourable, and lower when the economic environment is weak.

References

Adrian, T., Shin, H.S., 2010. Liquidity and leverage. Journal of Financial Intermediation 19, 418-437.

Albertazzi, U., Gambacorta, L., 2009. Bank profitability and the business cycle. Journal of Financial Stability 5, 393-409.

Amato, J. D., Furfine C. H., 2004. Are Credit Ratings Procyclical? Journal of Banking and Finance 28, 2641-2677.

Ayuso, J., Pérez, D., Saurina, J., 2004. Are capital buffers pro-cyclical? Evidence from Spanish panel data. Journal of Financial Intermediation 13, 249-264.

Berger, A.N., Bouwman, C.H.S., 2013. How does capital affect bank performance during financial crises? Journal of Financial Economics, *forthcoming*.

Bikker, J.A., Metzemakers, P., 2005. Bank provisioning behavior and procyclicality. Journal of International Financial Markets, Institutions and Money 15, 141-157.

Bouvatier, V., Lepetit, L., 2008. Banks' procyclical behavior: Does provisioning matter? Journal of International Financial Markets, Institutions and Money 18, 513-526.

Brissimis, S.N., Delis, M.D., Papanikolaou, N.I., 2008. Exploring the nexus between banking sector reform and performance: Evidence from newly acceded EU countries. Journal of Banking and Finance 32, 2674-2683.

Cole, R., Gunther, J., 1995. Separating the likelihood and timing of bank failure. Journal of Banking and Finance 19, 1073-1089.

Cornett, M.M, McNutt, J.J., Strahan, P.E., Tehranian, H., 2011. Liquidity risk management and credit supply in the financial crisis. Journal of Financial Economics 101, 297-312.

Ervin, D.W., Wilde, T., 2001. Pro-cyclicality in the new Basel accord. Risk 14, 28-32.

Estrella, A., 2004. The cyclical behavior of optimal bank capital. Journal of Banking and Finance 28, 1469-1498.

Fonseca, A.R., Gonzalez, F., 2008. Cross-country determinants of bank income smoothing by managing loan-loss provisions. Journal of Banking and Finance 32, 217-228.

Gordy, M.B., Howells, B., 2006. Procyclicality in Basel II: Can we treat the disease without killing the patient? Journal of Financial Intermediation 15, 395-417.

IMF World Economic Outlook, 2008. Financial Stress, downturns, and recoveries. International Monetary Fund, Washington D.C.

Ioannidis, C., Pasiouras, F., Zopounidis, C., 2010. Assessing bank soundness with classification techniques. Omega 38, 345-357.

Jokipii, T., Milne, A., 2006. The cyclical behavior of European bank capital buffers. Bank of Finland Research Discussion Papers 17.

Jokivuolle, E., Peura, S., 2004. Simulation based stress tests of banks' regulatory capital adequacy. Journal of Banking and Finance 28, 1801-1824.

Kashyap, A.K., Stein, J.C., 2004. Cyclical implications of the Basel II capital standard. Economic Perspectives, Federal Reserve Bank of Chicago.

Laeven, L., Majnoni, G., 2003. Loan loss provisioning and economic slowdowns: Too much, too late? Journal of Financial Intermediation 12, 178-197.

Lane, W., Looney, S., Wansley, J., 1986. An application of the Cox proportional hazards model to bank failure. Journal of Banking and Finance 10, 511-531.

Lindquist, K.G., 2004. Banks' buffer capital. How important is risk? Journal of International Money and Finance 23, 493-513.

Lown, C., Morgan, D.P., 2006. The credit cycle and the business cycle: New findings using the loan officer opinion survey. Journal of Money, Credit and Banking 38, 1575-1598.

Minsky, H.P, 1977. A theory of systemic fragility. In: Altman, E.D. and Sametz, A.W. (Eds.), Financial Crises: Institutions and Markets in a Fragile Environment. New York, NY: John Wiley and Sons.

Pagratis, S., Stringa, M., 2009. Modeling bank senior unsecured ratings: A reasoned structured approach to bank credit assessment. International Journal of Central Banking 5, 1-39.

Peek, J., Rosengren, E.S., Tootel, G.M.B., 2003. Identifying the macroeconomic effect of loan supply shocks. Journal of Money, Credit and Banking 35, 931-965.

Repullo, R., Suarez, J., 2009. The procyclical effects of bank capital regulation. Working Paper (presented in the Institute for Monetary and Economic Studies, Bank of Japan).

Rime, B., 2001. Capital requirements and bank behavior: Empirical evidence for Switzerland. Journal of Banking & Finance 25, 789-805.

Rösch, D., 2002. Mitigating Pro-cyclicality in Basel II. Unpublished Working Paper, Faculty of Business and Economics, University of Regensburg.

Zicchino, L., 2005. A model of bank capital, lending and the macroeconomy: Basel I versus Basel II. Bank of England Working Paper No. 270.

Appendix A: Variables and data sources

The following table presents all variables that we use in the econometric analysis. The abbreviation of each variable and the source we use to collect the data are also reported.

Variable	Abbreviation	Definition	Data source
CAMEL components			
Capital adequacy	*CAP1*	The ratio of total equity capital to total bank assets	Call Reports, Federal Reserve Bank of Chicago
	CAP2	The ratio of Tier 1 & 2 regulatory capital to risk-based assets	
Asset quality	*ASSETQLT1*	The ratio of provisions for credit losses to total loans and leases	
	ASSETQLT2	The sum of loan loss reserves and loan charge-offs divided by total loans	
Management expertise	*MNGEXP*	The ratio of total operating income to income generating assets	
Earnings strength	*ROA*	The ratio of total income to total assets	
	ROE	The ratio of total income to total equity	
Liquidity	*LQDT1*	The ratio of cash & cash equivalents and federal funds sold and securities purchased under agreements to repurchase to total assets	
	LQDT2	The ratio of liquid deposits to total deposits	
Macroeconomic conditions	*GDP*	GDP output gap	Bureau of Economic Analysis, U.S. Department of Commerce
	CPI	The quarterly change in U.S. Consumer Price Index (CPI)	Bureau of Labor Statistics, U.S. Department of Labor
	UNEM	The unemployment rate	
Z components			
Implied Volatility Index		An index of market return volatility	Chicago Board Options Exchange Market

Liquidity risk spread		The quarterly difference between the 3-month LIBOR rate and the 3-month U.S. T-bill rate	Federal Reserve Board & GFDatabase
Yield curve		The change in the quarterly difference between the 10-year U.S. T-bill rate and the 3-month US T-bill rate	Federal Reserve Board & U.S. Department of the Treasury
Interest rate risk		The quarterly standard deviation of the day-t-day 3-month U.S. T-bill rate	
Credit risk		The quarterly change in the credit spread between the 10-year BAA-rated bonds and the 10-year U.S. T-bill rate	Federal Reserve Board & Moody's
Banking market concentration	*HHI*	The sum of squares of the market share of each sample bank	Call Reports, Federal Reserve Bank of Chicago
M&A deals	*MA*	A dummy variable which is equal to unity in the quarter *q* that bank *i* has been involved in some M&A transaction	NIC/FFIEC
Crisis dummy	*CR1*	A dummy which is equal to 1 in 2007q3	
	CR2	A dummy which is equal to 1 in 2008q3	
Size dummy			
Small banks		Banks with total assets up to $1 billion	Call Reports, Federal Reserve Bank of Chicago
Medium banks		Banks with total assets between $1 billion and $3 billion	
Large banks		Banks with total assets from $3 billion to $10 billion	
Extra-large banks		Banks with total assets more than $10 billion	