



Asymmetric effects of the business cycle on bank credit risk

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ABSTRACT

Prior empirical research on the relation between credit risk and the business cycle has failed to properly investigate the presence of asymmetric effects. To fill this gap, we examine this relation both at the aggregate and the bank level exploiting a unique dataset on Italian banks' borrowers' default rates. We employ threshold regression models that allow to endogenously establish different regimes identified by the thresholds over/below which credit risk is more/less cyclical. We find that not only are the effects of the business cycle on credit risk more pronounced during downturns but cyclicality is also higher for those banks with riskier portfolios.

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1. Introduction

In the recent banking literature, the relation between credit risk and the business cycle (so-called cyclicality of credit risk) has been analyzed for both macro financial stability and micro risk management purposes. Indeed, the potential impact of economic developments on banks' portfolios is relevant for both policy makers, interested in forecasting and preventing banks' instability due to unfavorable economic conditions, and risk managers, who pay attention to the robustness of their capital allocation plans under alternative scenarios. These different perspectives are not mutually exclusive. In fact, the reform of the Basel Accord on banks' capital requirements made it clear the need to match the micro and macro dimensions.

Focusing on the latter, this paper analyzes the relation between credit risk and the business cycle allowing explicitly for asymmetries, which have been almost always neglected so far. In fact, we seek empirical evidence for the asymmetric behavior of credit risk

cyclicality not only through the business cycle but also across different credit risk regimes, a completely unexplored issue so far.

Previous work on this topic has focused on the macro prudential perspective trying to quantify the effects of macroeconomic conditions on banks' asset quality in some countries. For example, [Pesola \(2001\)](#) shows that shortfalls of GDP growth below forecast contributed to the banking crises in the Nordic countries, while [Salas and Saurina \(2002\)](#) demonstrate that macroeconomic shocks are quickly transmitted to Spanish banks' portfolio riskiness. Similarly, [Meyer and Yeager \(2001\)](#) and [Gambera \(2000\)](#) argue that a small number of macroeconomic variables are good predictors for the share of non-performing loans in the US, while [Marcucci and Quagliariello \(2008b\)](#) find that Italian banks' borrowers' default rates increase in downturns. Likewise, [Hoggarth et al. \(2005\)](#) provide evidence for the UK of a direct link between the state of the business cycle and banks' write-offs. Analogous evidence is provided in cross-country comparisons by [Bikker and Hu \(2002\)](#), [Laeven and Majoni \(2003\)](#) and [Valckx \(2003\)](#).

However, researchers have not explored the possibility of asymmetric effects, for which the impact of macroeconomic conditions on banks' portfolio riskiness is dissimilar in different phases of the business cycle. This is very important since bank supervisors are inherently more concerned about downturns rather than

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expansions. Also, assuming linear relationships may hinder some important characteristics of banks' riskiness. To the best of our knowledge, the only exception is the paper by Gasha and Morales (2004) who apply a self-exciting threshold autoregressive (SETAR) model to country-level data showing that GDP growth affects non-performing loans only below a certain threshold in a group of Latin American countries.

Asymmetries are somehow taken into account in a related strand of literature on credit risk management and structural credit risk models. In particular, some studies on the properties of credit rating transition matrices over the cycle have analyzed whether transition probabilities are affected to a larger (smaller) extent by recessionary (expansionary) conditions. Quite often regime-switching models are used for this kind of investigations. For example, on the basis of GDP growth, Nickell et al. (2000) divide the business cycle into three categories (peaks, normal times and troughs) finding that in peaks low-rated bonds are less prone to downgrades. The impact of the business cycle appears therefore to be asymmetric and dependent on borrowers' creditworthiness. Likewise, in their analysis of the linkage between macroeconomic conditions and migration matrices, Bangia et al. (2002) find that downgrading probabilities, particularly in the extreme classes, increase significantly in recessions. Pederzoli and Torricelli (2005) adopt a similar framework to assess the impact of the business cycle on capital requirements under Basel 2.

However, in this line of research the identification of expansions/recessions is based on some external sources. Most studies in this field employ the NBER business cycle classifications, but some authors like Lucas and Klaassen (2006) cast serious doubts on their use. A further shortcoming of this approach is that it completely ignores the possibility that asymmetries might also depend on the severity of the recession, rather than on the dichotomy expansion/recession. Finally, another gap in this literature is that it does not test the hypothesis that the effects of the business cycle on credit risk are different depending on banks' portfolios riskiness.

In this paper, we address all these issues of asymmetries in credit risk cyclicity. Using threshold regression models and both aggregate and bank level data, we test whether banks which are more exposed to credit risk are affected by the business cycle to a greater extent than those with less-risky portfolios (i.e., whether riskier banks are more cyclical than those less-risky). We also test whether the cyclicity of credit risk is stronger in severe recessions rather than in mild recessions or, a fortiori, during expansionary phases.

We start with a standard threshold regression approach at the aggregate level on the time series of the Italian default rates. We then move ahead adopting panel threshold regression models with one threshold variable, which exploit data on borrowers' default rates at the bank level. These models can be interpreted as regime-switching panel data models where each regime is determined endogenously through one observable threshold variable. We also add to the previous literature suggesting an innovative four-regime panel approach with two threshold variables which allows us to provide a more comprehensive picture of the behavior of default rates over changing economic and credit risk conditions.

Our results show that for those banks with lower asset quality, the increase in default rates due to one percentage point decrease in the output gap (our measure of the business cycle) is almost four times higher than the effect for those banks with better portfolios. Furthermore, for models with two or more regimes with one threshold variable, we find that the impact of the business cycle on credit risk is stronger the lower banks' asset quality.

In the four-regime model, where we combine credit risk and the business cycle regimes, we find that (i) during economic slowdowns, the impact of the business cycle on portfolio riskiness for banks with lower asset quality (the a priori riskier ones) is more

than three times higher than that for less-risky banks. Also, (ii) the impact of the business cycle on credit risk for banks with lower asset quality during recessions is more than four times higher than what we have during booms. In addition, (iii) during slowdowns the impact of the business cycle on credit risk for banks with better asset quality is almost the double of that during expansions. Finally, (iv) for riskier banks the impact of the business cycle on their riskiness during expansionary phases is about 50% more than that for less-risky banks.

In sum, we conclude that riskier banks' portfolios are more cyclical (i.e., more sensitive to the business cycle) than less-risky ones and cyclicity is more pronounced in bad economic times.

Under the Basel 2 new Capital Accord, which introduces risk sensitive capital requirements, this evidence may provide some guidance to banks and supervisors in the choice of adequate capital buffers over different phases of the business cycle. Indeed, the identification of those banks that are more likely to be affected by recessionary conditions – and that therefore should build higher capital buffers in expansion – may help smooth the fluctuations of capital requirements, thus reducing Basel 2 cyclicity (Jokipii and Milne, 2008). For example, using either macroeconomic forecasts or judgmental future scenarios, supervisors may carry out stress tests in order to assess the evolution of banks' portfolio riskiness should the scenario actually materialize.

The reminder of the paper proceeds as follows. Section 2 describes the data on Italian banks' portfolios. Section 3 presents the single threshold model at the aggregate level with two regimes. In Section 4 we describe the panel data model with single threshold variable and multiple regimes (both credit risk and business cycle regimes). Section 5 delineates the panel data model with two different threshold variables and four regimes. Finally, Section 6 draws some concluding remarks and directions for further research.

2. Data

Our data set comprises both microdata on Italian banks and macroeconomic time series on a quarterly basis. Accounting ratios for the individual institutions are built up using the statistics that intermediaries are required to report to the Bank of Italy and the Central Credit Register, while the macroeconomic variables are drawn from the OECD statistics.

Since we want to analyze the evolution of banks' portfolio riskiness over the business cycle, the starting point for building up our dataset is the choice of an adequate measure of credit risk.

In Italy, banks must value loans in their portfolios at their likely realizable value. In particular, the exposures to insolvent borrowers are classified as bad loans. We compute our riskiness indicator as the ratio of the flow of loans classified as bad debts in the reference quarter to the stock of outstanding performing loans at the end of the previous one. In order to improve the reliability and timeliness of our indicator of the riskiness of banks' debtors, we use the "adjusted" bad loans as signaled by the Central Credit Register.¹ The ratio can be interpreted as the default rate of Italian banks' borrowers. With respect to other riskiness indicators, based on stock measures, such as the non-performing loan ratio, the

¹ Adjusted bad loans are those outstanding when a borrower is reported to the Central Credit Register: (a) as a bad debt by the only bank that disbursed credit; (b) as a bad debt by one bank and as having an overdraft by the only other bank exposed; (c) as a bad debt by one bank and the amount of the bad debt is at least 70% of its exposure towards the banking system or as having overdrafts equal to or more than 10% of its total loans outstanding; and (d) as a bad debt by at least two banks for amounts equal to or more than 10% of its total loans outstanding. The use of this variable ensures that there are no differences across banks due to discretionary valuations. Results provided in this paper are based on seasonally adjusted data, but we obtained similar results with the unadjusted series of the default rate.

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