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Short-run dynamics in bank credit: Assessing nonlinearities in cyclicality

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ABSTRACT

This paper explores whether the procyclicality of private credit changes during the business cycle. To this end, we rely on the estimation of smooth transition regression models for a sample of 17 OECD countries over the 1986–2010 period. Our findings show that credit procyclicality is nonlinear, depending on economic conditions. More specifically, credit is highly procyclical in extreme – booms and busts – regimes in Canada, the UK and the US, while procyclicality is less pronounced in one or both extreme regimes in Australia, Belgium, France, Finland, the Netherlands, Norway, and Spain. Our results also emphasize the importance of financial factors in explaining the short-run behavior of private credit.

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1. Introduction

The linkage between credit and the business cycle has been widely discussed in the literature, which generally emphasizes that the credit market is highly procyclical.[1] Indeed, a well established fact is that lending often increases significantly during business cycle expansions, and then falls considerably during subsequent downturns. The question of credit procyclicality has recently become even more important since there is now some consensus that the period leading up to the recent crisis was preceded by strong credit growth, combined with a speculative asset price bubble (Borio and Drehmann, 2009). When this bubble burst, it gave place to a deep banking crisis, accompanied by a severe economic recession.

Even though the specific causes explaining credit procyclicality – among supply-side, demand-side or regulatory-side factors – are still a subject of considerable debate,[2] the overall consideration of credit procyclicality is implicitly based on the hypothesis that both expansion and recession phases have the same effect (in absolute value) on the credit cycle. This symmetry implies that a change in the output gap of a given magnitude will therefore have the same impact regardless of whether it occurs during a recession or during an expansion.

In this paper, we investigate whether the effect of business cycle on credit cycle – i.e. credit procyclicality – is stable over time. Nonlinearities or asymmetries in this relationship could indicate that the strength of credit cycle determinants varies over the phases of the business cycle, a characteristic that would have important implications in terms of banking regulation.

Indeed, the credit cycle is mainly driven by the business cycle, but the stability over time of this relationship can be questioned. Credit cyclicality could be more or less pronounced according to economic conditions leading to different short-run dynamics between boom and bust periods and/or between countries. Furthermore, the general conception that recession phases develop rapidly and are short-lived while expansion phases develop slowly and are more prolonged calls into question the linearity assumption of credit cyclicality.

Assessing this asymmetry allows us therefore to identify more accurately the main determinants of expansionary and contraction phases in bank credit. This point could be relevant for the banking regulator – or the macro-prudential regulator – to detect the emergence of boom periods and to identify which regulatory instrument is appropriate to curb bank lending. For example, a loan-to-value ratio regulation (Borio et al., 2001) could be an appropriate regulatory instrument to curb bank lending if boom periods are more driven by property prices than by the business cycle. Similarly, government interventions to

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[1] Regarding empirical contributions, see e.g., Borio et al. (2001), Goodhart et al. (2004), White (2006), Jiménez and Saurina (2006), Goodhart and Hofmann (2008), Bouvatier et al. (2012), and the references therein. For theoretical considerations, see Gorton and He (2008) and Aikman et al. (2011) among others.

[2] See Aikman et al. (2011) for a survey.

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support the financial sector during recessions – as recapitalization, guarantees, asset purchases, and liquidity support – could be particularly appropriate if credit cyclicality is magnified during downturns.[3]

Remarkably, the empirical literature on bank credit is mainly based on linear estimations and focus on long-term determinants.[4] Only a few studies have investigated potential nonlinearities in the bank credit dynamics. For instance, Gambacorta and Rossi (2010) show that the effect on credit, GDP and prices of monetary policy tightening is larger than the effect of monetary policy easing in the euro area. Relying on Markov-switching models, Kakes (2000) finds that interest rate shocks have an asymmetric effect on credit, depending on the business cycle phase, for the US, Germany, Belgium and the UK, but not for the Netherlands. Markov-switching models have also been used to identify instabilities in short-run dynamics. Frömmel and Schmidt (2006) find evidence of unstable regimes for several European countries during which bank credit does not return to its long-run trend. In addition, stock market conditions seem important to explain credit fluctuations during these less stable regimes. With a similar methodology, Eller et al. (2010) examine Central, Eastern and Southeastern European (CESEE) countries and show that the short-run credit dynamics is characterized by a regime switching mainly driven by credit supply factors.

As a result, the empirical literature that studies credit procyclicality did not, to the best of our knowledge, investigate potential nonlinearities in the impact of the business cycle on the credit cycle. We aim at filling this gap by focusing on bank credit short-run fluctuations, and paying special attention to credit market asymmetries in relation to the business cycle in 17 OECD countries over the 1986–2010 period. To this end, we start by testing if the relationship between credit and GDP cycles is linear, i.e. whether credit is linearly procyclical. For those countries for which the linearity hypothesis is rejected, the asymmetry is captured through the estimation of smooth transition regression (STR) models. These models allow us to distinguish the effects of GDP on credit, depending on a transition variable. More specifically, in the STR specification, two extreme regimes – "booms" and "busts" – corresponding to two distinct credit equations, are endogenously determined. The transition from one regime to the other is smooth and governed by the transition variable. A large set of transition variables is considered in order to capture differences between countries. Indeed, depending on the country, nonlinearities in procyclicality could rather be related to conditions in credit market, stock market or property market rather than being associated with the business cycle phases.

The rest of the paper is organized as follows. Section 2 is devoted to the presentation of the retained methodology. Section 3 describes the data and provides some stylized facts concerning credit cycles and credit procyclicality. Estimation results are displayed in Section 4, and Section 5 concludes the article.

2. Methodology

As a first step, the procyclical character of credit can be analyzed relying on the simple following relationship:

$$\hat{l}_t = \phi_0 + \phi_l \hat{l}_{t-1} + \phi_y \hat{y}_{t-1} + \epsilon_t \tag{1}$$

with $\hat{l}$ representing the credit cycle and $\hat{y}$ the business cycle.

We consider the lagged output gap $\hat{y}_{t-1}$ to tackle the endogeneity problem between the credit cycle and the business cycle, as well as the lagged endogenous variable to allow for a dynamic adjustment.[5] However, since credit market conditions are affected by asset prices and interest rates (see Goodhart and Hofmann (2004), Goodhart and Hofmann (2008), and Bouvatier et al. (2012) among others), credit procyclicality might be overestimated in this specification. From this perspective, Eq. (1) can be augmented by the interest rate, as it is standard in the monetary policy literature. We also introduce house and share prices, since there is an obvious link between asset prices dynamics and financial (in)stability: as recalled by Goodhart and Hofmann (2008) among others, booming asset prices episodes are frequently viewed as announcing future sharp correction of prices, generating instability of the financial and banking sector. In addition, regarding the interplay between financial constraints and entrepreneurship, both private credit and stock market capitalization can be seen as supplementary (or complementary) sources of financialization. Thus, the linear relationship between aggregate private credit, aggregate economic activity, interest rates and aggregate asset prices can be expressed as follows:

$$\hat{l}_t = \phi_0 + \phi_l \hat{l}_{t-1} + \phi_y \hat{y}_{t-1} + \phi_h \hat{h}_{t-1} + \phi_s \hat{s}_{t-1} + \phi_r \hat{r}_{t-1} + \epsilon_t \tag{2}$$

where $\hat{h}, \hat{s}$ and $\hat{r}$ respectively represent the cycle in the house market, the stock market and the interest rate.[6] A potential drawback of the previous equation is that it assumes that both economic expansions and recessions have the same effect (in absolute value) on the credit cycle. Furthermore, a change in output gap of a given magnitude will have the same effect regardless of whether it occurs in a recession or in an expansion state.

To overcome this limit, and in order to investigate potential nonlinearities in the relationship between credit and business cycles, we rely on the STR models developed by Granger and Teräsvirta (1993) and Teräsvirta (1994). These models have several interesting features that make them suitable for our purpose. First, regression coefficients can take different values, depending on the value of another observable variable—namely, the threshold or transition variable. In other words, the observations are divided into a small number of homogenous groups or "regimes", with different coefficients depending on the regimes. Second, regression coefficients are allowed to change gradually when moving from one group to another: STR is a regime-switching model where the transition from one regime to the other is smooth rather than discrete. Finally, countries are allowed to switch between regimes over time according to changes in the threshold variable.

More specifically, the STR model can be expressed as follows:[7]

$$\begin{aligned}\hat{l}_t = {} & \phi_0 + \phi_l \hat{l}_{t-1} + \phi_y \hat{y}_{t-1} + \phi_h \hat{h}_{t-1} + \phi_s \hat{s}_{t-1} + \phi_r \hat{r}_{t-1} \\ & + \left[\theta_0 + \theta_y \hat{y}_{t-1}\right] \times G(\hat{e}_t; \gamma, \mathbf{c}) + \epsilon_t\end{aligned} \tag{3}$$

Eq. (3) is enlarged with respect to Eq. (2) by a transition function, $G(\hat{e}_t; \gamma, c)$, which, in turn, depends on $\hat{e}_t$, an observable transition variable, that governs the regime switching. Note that since our focus is on the effects of booms and busts on the credit cycle, we restrict nonlinearity to the (lagged) output gap (y_{t-1}). This choice has also the advantage of not imposing the same speeds of transition and thresholds to all the variables in Eq. (2), an assumption that would be misleading. The transition function can be either a logistic function or a quadratic logistic function and is defined as:

$$G(\hat{e}_t; \gamma, c) = \left[1 + exp\left(-\gamma \prod_{j=1}^{m} \left(\hat{e}_t - c_j\right)\right)\right]^{-1}, \qquad \gamma > 0. \tag{4}$$

The transition function is continuous, normalized and bounded between 0 and 1, γ is the slope parameter that determines the smoothness of the transition from one regime to the other, and c denotes the threshold parameter ($c_1 \leq c_2 \leq \ldots \leq c_m$). Depending on the realization of the

[3] See Laeven and Valencia (2011) concerning government intervention packages and the effects during the recent financial crisis.

[4] See for example Calza et al. (2003), Hofmann (2004) or Calza et al. (2006).

[5] A second lag on the credit variable is included in the right-hand side of Eq. (1) in case of autocorrelation (see below).

[6] Note that all variables in Eqs. (1) and (2) are obviously stationary.

[7] The specification is presented with one lag, but the choice of the autoregressive lag is made using information criteria (see below).

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