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# Identifying multiple regimes in the model of credit to households

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ABSTRACT

This research proposes a new method to identify the differing states of the market with respect to lending to households. We use an econometric multi-regime regression model where each regime is associated with a different economic state of the credit market (i.e. a normal regime or a boom regime). The credit market alternates between regimes when some specific variable increases above or falls below the estimated threshold level. A novel method for estimating multi-regime threshold regression models for dynamic panel data is also employed.



## 1. Introduction

Credit booms and busts have been responsible for much of the macroeconomic turbulence in emerging and developed markets. Lending booms are also known to be good predictors of banking and other financial crises (Gourinchas, Valdés, & Landerrechte, 2001; Kaminsky & Reinhart, 1999; Laeven & Valencia, 2008; Roy & Kemme, 2012; Tornell & Westermann, 2002). Economists and policy makers often ask if credit grows too rapidly or too slowly given the actual state of the economy (Backé & Wójcik, 2008). Special attention is also paid to household loans that often initiate consumption, investment and production booms (Coricelli, Mucci, & Revoltella, 2006; Kiss, Nagy, & Vonnák, 2006; Mendoza & Terrones, 2008).

Several studies aim to identify periods where credit was booming in different markets. For example, deviations from the long-run trend were used as a measure of the credit boom in some analyses (Mendoza & Terrones, 2008). Econometric error correction models were also employed to estimate the equilibrium level of credit and to assess possible divergence of credit levels from this equilibrium (Égert, Backé, & Zumer, 2006; Kiss et al., 2006, and references therein). However, the purely statistical methods used to calculate the long-run trend of credit (the Hodrick–Prescott (HP) filter) do not consider the link between credit and macroeconomic fundamentals and therefore may fail to distinguish booms from normal credit growth in many emerging (catching-up) economies (see also arguments in Coudert & Pouvelle, 2010; Geršl & Seidler, 2011).

Error correction models do in fact take into account the economic long-run relationship between lending to households as well as other macroeconomic factors. The situation where credit deviates from this relationship is often regarded as evidence of a credit boom. However, some divergence from the equilibrium may be caused by some specific economic condition, policy, regulatory or accounting reform. An observation of credit over longer periods of time may reveal that although credit exceeds the

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sustainable level it follows the error correction mechanism and eventually returns to the equilibrium state (Kiss et al., 2006). The movement of credit to households toward the long-run equilibrium should not be treated as a boom. Standard calculations will tend to overstate the number of boom periods where such return processes are not discarded.

On the other hand, the estimation of error correction parameters will be downward biased in the presence of prolonged booms because many observations will constitute upward deviations from the error correction mechanism. These biases will tend to understate the true number of booms in favor of returns to the equilibrium.

A suitable procedure is clearly needed to distinguish true booms from incidental deviations, returns, and catching-up processes as well as to eliminate the biases in the selection of boom regimes. In this paper we propose a new method to identify possible boom and bust regimes in the credit to households market. This new method deals with the problem of imprecise identification of boom episodes encountered in earlier studies by accounting for changing regimes in the credit market during different periods. Our approach relies on the economic interpretation of these regimes rather than on using estimates of deviations from long-run trends to detect periods of credit boom.

We assume that potential normal, boom, and bust periods can be identified as separate economic regimes. In normal times credit moves along the equilibrium path and deviates only slightly after minor disturbances. In turn, a credit boom is identified as a period (or regime) where credit grows rapidly and departs from the long-run equilibrium. Booms may be associated with periods of economic expansion, rising asset prices, widening external deficits, or real appreciation. They can also result from competition between banks (possibly independent from economic cycles) and from financial liberalization (e.g. Cotarelli et al., 2003; Gorton & He, 2008; Lorenzoni, 2008; Mendoza & Terrones, 2008). In the bust regime, credit falls back quickly to its equilibrium level.

We have constructed an econometric model where the impact of the explanatory variables on the growth rate of credit depends on the regime the model enters in a given period. This model is a multi-regime threshold regression where changes of regimes are governed by an exogenous threshold variable. When the threshold variable increases above or decreases below a predetermined level the model switches regimes. Statistical tests are then used to verify the number of regimes in the econometric model and each regime is identified as a normal state, state of boom, or a state of bust.

Our approach to identifying various credit regimes requires application of a novel econometric method. Given the short time-series data related to credit markets for individual countries and a limited number of countries with longer time-series data, we found it necessary to conduct estimation methods for panel data using a limited number of observations. The recently introduced methods for estimating dynamic threshold models for panel data rely on the instrumental variable approach (Caner & Hansen, 2004; Kremer, Bick, & Nautz, 2011). They are not explicitly designed for small samples and therefore may provide imprecise estimates of regression parameters.

We estimate the dynamic panel data models using the bootstrap-corrected LSDV (least squares dummy variable) method of Everaert and Pozzi (2007). This method produces more precise and less biased estimates in small samples than other estimation methods. Our analysis is one of the first applications of this method to dynamic threshold regressions for panel data.[1] Using this approach we are able to identify normal and boom regimes in the models of credit to households.

In the next section we describe the method used to identify normal and boom regimes within the credit market. The data involved in this and selection of variables is described in Section 3. Empirical results are presented in Section 4 and the final section will share our conclusions.

## 2. Identification of multiple regimes for credit growth

Several studies analyze multiple states (or regimes) occurring within credit markets. The most common distinction that exists within the literature is between the credit-rationing regime and the “normal” (demand-driven) regime (Azariadis & Smith, 1998; Balke, 2000; Blinder, 1987). In the former regime the amount of loans distributed to firms and households depends on the supply-side which includes factors related to restrictive lending policies of banks, the interest rate spread, minimum loan to value ratios, and other measures of credit rationing. In the latter regime various demand factors including the lending interest rate, profits of companies, wages, and price of goods all affect the level of credit in the economy.

Another possible regime considered in economic studies is the state of boom. Markets for goods are vulnerable to booms that are driven by rapid and often prolonged growth in demand. Capital markets are afflicted by asset booms or bubbles when investor expectations move stock prices up and away from fundamentals. Similarly, boom periods in the credit market are observed when the demand for loans raises the level of credit beyond the sustainable equilibrium. Credit booms are modeled not only as deviations from that equilibrium but also as separate regimes that can last for some time (e.g., Backé & Wójcik, 2008; Lorenzoni, 2008; Martín, 2011). Such boom regimes end either with a bust or a soft landing after which credit returns to the long-run equilibrium.

The presence of credit-rationing, sustainable and unsustainable (boom and bust) states provides the rationale for using a multi-regime econometric model to explain the changes in credit to households. The statistical method to test for the presence of two, three or more states of the lending market is discussed below followed by a description of the procedure with which to identify each regime, including the boom regime.

[1] Shin and Kim (2011) analyzed a threshold model of Tobin's Q investment function with the same estimation technique. These authors also investigated the finite sample properties of this estimation method. However, their model assumes only two regimes and does not explicitly control for changes in the constant term between regimes.