




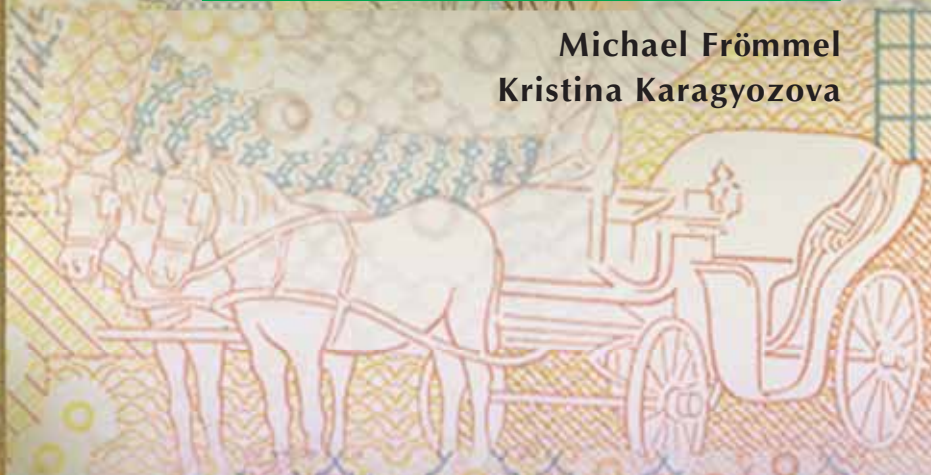
DISCUSSION PAPERS

DP/65/2008



Bank Lending and Asset Prices: Evidence from Bulgaria

Michael Frömmel
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**Michael Frömmel
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March 2008

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SUMMARY. We examine the dynamics of bank lending to companies and private households in Bulgaria by applying a non-linear Markov switching error correction model (MS-ECM). The MS-ECM provides evidence for multiple structural breaks and improves the estimation results compared to a linear model. In particular we find a more or less pronounced, time-varying relation between bank lending and asset prices. We identify periods when corporate and household loans were driven to a greater extent by supply-side rather than long-run demand-side factors. We also find evidence for a regime switch due to the introduction of administrative measures to curb the credit expansion in early 2005.

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1. Introduction

Bank lending in Central and Eastern European Countries (CEEC) is an important issue for three main reasons. First, most economies in transition are experiencing a substantial increase in productivity. This catching up process requires huge investments by private companies for modernizing production. However, mainly small- and medium-sized firms may be constrained in borrowing (see for instance Pissarides et al., 2000; Konings et al., 2003). In particular this is the case for Bulgaria, joining the European Union in 2007. According to the EBRD it is one of the major challenges to "improve the country's investment climate" (EBRD, 2005a), and Bulgaria's financial system is regarded as less strong than those of the countries which have recently joined the European Union (EBRD, 2005b). Second, bank lending is of crucial importance for the transmission of monetary impulses. It is therefore of high relevance for monetary policy to learn about the determinants of bank lending. Third, CEEC are very different in terms of ownership in the banking sector. As for most European transition economies (except Belarus, Russia and the Ukraine) Bulgaria's banking sector is dominated by foreign banks. Out of the 34 banks operating in Bulgaria, 25 are owned by foreigners, providing 88 per cent of the total credit volume (Q1:2006).

Whereas most studies focus on those economies in transition which have joined the European Union in 2004, little work has been done on the new Member States Bulgaria and Romania and the countries to join EU in the future. Bulgaria is, however, different from many other countries. First, Bulgaria's financial sector shows a much lower degree of financial deepness than the transition economies which have recently joined the European Union. The share of banks' total assets in GDP was only 79.7 per cent at the end of 2005 compared to 282 per cent in the Euro area and 93 per cent in the eight new Central and Eastern European member countries (Backe and Walko, 2006). Furthermore the markets for corporate bonds and stocks are in particular in contrast to the Czech Republic, Hungary and Poland – they are very small and do not significantly contribute to private companies liabilities nor do they to banks' assets. A second remarkable characteristics of Bulgaria making it different from the new EU member states is the existence of a currency board, which was introduced in 1997 (see Section 3).

Our contribution to the literature is threefold: Firstly, we provide empirical evidence for the asset price/bank lending relation for Bulgaria as a small transition economy with some particular characteristics (as mentioned above). We extend the existing literature on the Bulgarian credit market to the most recent years and focus on the post crisis period. Second, we use an econometric model which explicitly allows for structural change in terms of a

Markov switching error correction model. This technique allows us to evaluate whether the administrative measures for curbing credit expansion, introduced by BNB in 2005, may have provoked a regime switch. Third, in contrast to the existing literature we analyse loans to non-financial corporations and households separately (see Section 3).

The structure of the paper is as follows: Section 1 introduces the research topic. Section 2 stresses the relevance of asset prices for bank lending and motivates the use of regime switching models. Section 3 describes the evolution of Bulgaria's banking system between 1997 and 2006, thus highlighting the economic background of our analysis. Section 4 introduces the Markov switching error correction model, whereas Section 5 presents the data. The estimation results are described in Section 6, and Section 7 is a summary.

2. The Link Between Asset Prices and Bank Lending

Traditional theories of monetary policy transmission argue that bank lending mainly depends on economic activity and the interest rate. Their relation to bank lending stems from the need of money – loans – for transactions of economic activity and from the interest rate's role as the price of loans. Both variables can be interpreted as credit demand factors (Barajas, Steiner 2002; Calza et al. 2003; Ghosh, Ghosh 1999; Pazarbasioglu 1997). There are, however, more determinants of bank lending, both on the side of supply and demand. Asset prices are of particular interest among these and empirically confirmed for a number of countries (Hofmann 2004). The relation between bank lending and asset prices is usually seen in the context of the bank lending channel, stressing the particular role of banks in the monetary transmission process. The relation between asset prices and bank lending may stem from different sources. Seen from the demand side, the wealth effect should be mentioned first, i.e. the increase in asset prices affects agents' wealth portfolios and therefore triggers consumption and credit demand. Besides this view, a relation may be caused by the interaction between banks and borrowers. This interaction has been analysed in theoretical studies, for example, in Kiyotaki and Moore (1997) or in Chen (2001). The rationale is that the borrower's net worth serves as a collateral for lending. This net worth is highly affected by the value of the borrower's assets. If therefore the price of assets rises (falls), the borrower's capacity for lending will rise (fall), too. Other models, which explicitly lead to switches between different equilibria in the credit market, are those of Scheinkman and Weiss (1986) or Azariadis and Smith (1998). The latter is based on constraints in borrowing and asymmetric information and leads to transitions between a

Walrasian regime and a regime of credit rationing with slowing economic activity, falling interest rates and binding credit constraints. This model therefore links theoretical models of credit markets and empirical studies on credit markets, thus serving as a theoretical foundation for the use of Markov switching models.

The increased interest in the relation between asset prices and bank lending during recent years is mainly motivated by the fact that strong declines in asset prices are often accompanied by a decrease in bank lending. Thus many studies analyze the credit market in presence of an asset price bust, such as the great depression at the end of the 1920s (Bernanke 1995, Eichengreen and Mitchener 2003), the decline of asset prices in Japan in the 1990s (Kim and Moreno 1994, Brunner and Kamin 1998), the Asian crisis at the end of the 1990s (Stiglitz and Greenwald 2003, Caporale and Spagnolo 2003) or the bust of stock prices after 2000 (Frömmel and Schmidt 2006). A decline in asset prices, however, will not necessarily lead to a severe crisis and a decline in credit growth. There may also be a dampening effect on credit and investment, without leading to a real recession.

In what follows we investigate deviations of Bulgarian credits to non-financial corporations and households from their longrun evolution and whether these deviations are related to different demand and supply side factors of bank lending, in particular the evolution of real estate prices.

3. Bulgaria's Banking System

Since the introduction of the Currency Board Regime in 1997, Bulgaria's banking system has changed considerably not only in terms of the dynamics and structure of bank lending, but also in terms of ownership structure and competition. Apart from the supply factors, there were also many changes in the structure of the economy, affecting corporate credit in particular. Taking into consideration both supply and demand variables, one may easily distinguish three distinct subperiods in the years 1997–2006 – a credit crunch period until 2001, credit expansion in the years 2002–2005, and a period of more moderate growth after BNB has introduced administrative measures to curb the lending boom.

In the first five years after the monetary regime change, a lot of restructuring in both the financial and corporate sector has taken place. In addition, a new legal framework was introduced for the banking sector, imposing quite conservative requirements on capital adequacy and liquidity. While a considerable improvement has been achieved in respect to commercial law, its implementation and enforcement was unsatisfactory and the associated credit risks remained high (see Nenovsky et al. 2002). All these

factors could explain the low demand and at the same time the reduced capacity and the unwillingness of the banks to lend, which contributed to the shrinking of bank lending in the post crisis years. There has been a wide dispute in the literature whether the demand or the supply side constraints had a stronger impact on bank lending in Bulgaria. Hristov and Mihaylov (2002) utilize interviews with banks' officers and a disequilibrium corporate credit model to test the relative importance of these factors and find that until 2000, there was insufficient demand while in the period 2000–2001 lending was rather supply-constrained. Studies, based on interviews with companies' manager, reflect that supply of credit was considered insufficient even earlier than the model predicts – in as early as 1999 (a review of these surveys can be found in Nenovsky et al. 2002). A study by Dobrinsky et al. (2003), incorporating panel data on companies' balance sheets, also supports the hypothesis that the changes in corporate credit in the period 1997–1999 were mostly driven by supply side factors and there is a strong evidence for a credit crunch right after the introduction of the CBA. Nenovsky et al. (2002) also test whether the capacity or the willingness to lend determines the supply of credit by relying on both individual companies and commercial banks data for the years 1998–2001. The authors confirm that it was not the availability of resources but rather the institutional environment that affected bank decisions. Indeed, banks were overcapitalized, with capital adequacy and liquidity ratios far above the minimum requirements, but nevertheless preferred to allocate their resources abroad.

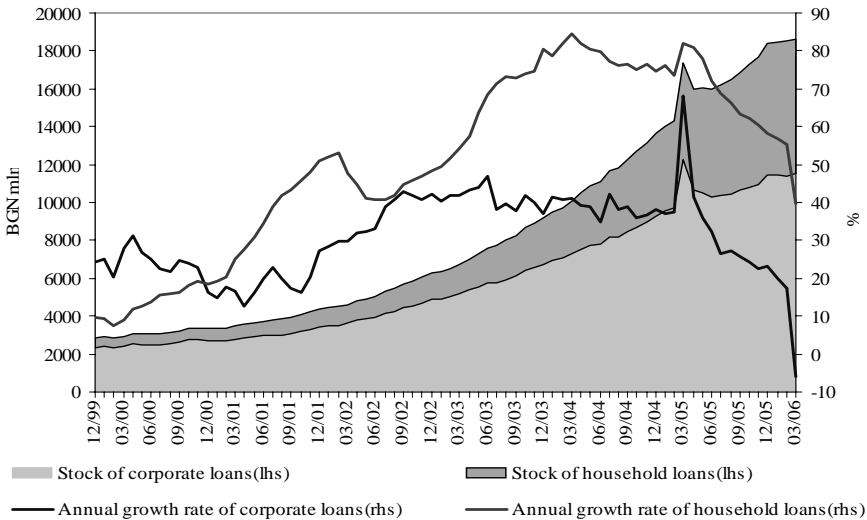
Not surprisingly, all the above-mentioned studies on the Bulgarian banking system in that period dealt only with corporate credit. At that time, lending to households was rather underdeveloped and accounted for less than 22 per cent of all loans to the non-financial sector. On one hand, banks were facing much higher monitoring and agency costs in respect to households due to the relatively small size of the consumer loans and the lack of credit history records. There was no centralized information on consumer loans before 2004, when the BNB Central Credit Register was amended to cover all loans. On the other hand, the household sector was extremely concentrated, with one single bank (DSK, former State Savings Bank) holding more than 90 per cent of consumer credit in 1999. This bank was not privatized until 2003, and prior to restructuring it had neither the capacity nor the know-how to take advantage of its customer base.

After the privatization of all commercial banks was virtually completed in 2001–2002, domestic credit began to recover. As in many other transition countries, this period of credit expansion was associated with the change of ownership, enhanced competition, high profit appetites, strong capital inflows, reduced credit risk and improvements in the legal and institutional

framework. Indeed, the share of foreign banks increased from 37 per cent in 1999 to 79 per cent at the end of 2005. As foreign banks saw the high profit potential of the Bulgarian credit market, competition increased considerably and market players began to explore also the retail market, its share reaching 38 per cent of all loans in 2005. Mortgage loans were the fastest growing segment of consumer loans and grew by more than 70 per cent per annum from 2003 onwards. This remarkable growth was associated with the dynamic development of the real estate market, where prices increased by more than 40 per cent per annum in 2004 and in the first half of 2005.

FIGURE 1

**STOCK AND ANNUAL GROWTH RATE OF CORPORATE AND
HOUSEHOLD LOANS**



Source: BNB

In this second period, banks began to utilize all available funds not only to meet the strong current demand, but also to ensure a market share that would enable them to explore the profit potential of the domestic market in the future. Hence, one should expect much stronger relation between the resource capacity of the banks and lending dynamics, not only in terms of deposits but also in terms of foreign liabilities, attracted to finance the strong credit demand.

The credit expansion, observed in the years 2002–2004, has raised concerns about the overall stability of the banking sector. Once being blamed for non-performing its efficient allocation of resources function, Bulgarian banks soon began to be criticized for expanding their credit portfolios too fast. While the strong growth reflected the natural deepening of the financial sector and improved economic prospects, i.e. an increase in the demand for loans, it also raised concerns whether the banks have the institutional capacity to meet this intensive demand and whether this was accompanied by a fragility of the financial sector. These concerns led to the introduction of various administrative measures, aiming to slow down the growth of credit. In 2004, attempts were made to withdraw liquidity from the banking sector, by transferring the government deposits from commercial banks to the BNB and by broadening the reserve requirements base. In the beginning of 2005, more decisive steps were taken and additional reserves requirements were imposed for those banks exceeding a certain level of credit growth.¹ These measures were supplemented by stricter requirements on capital adequacy, loans classification and provisioning. The broad range of administrative measures imposed is very likely to have caused a switch from demand-restrained to supply-restrained regime of bank credit determination, with a share of the bank credit and corporate loans in particular transferred into the external sector or non-bank credit institutions.

4. Markov Switching Error Correction

For our analysis we apply a Markov switching error correction model (MS–ECM).² The MS–ECM is based on the assumption that a cointegration relation may work in the long run, whereas in the short run the dynamics may change from time to time. An extreme case would be that the variables are 'globally stationary', whereas they are 'locally non-stationary' during particular periods. As Psaradakis et al. (2004) point out it is no contradiction that one finds cointegration in the long run, whereas locally the connection between the variables may get temporarily lost as if cointegration had been 'switched off' and there was no disequilibrium adjustment (Psaradakis et al. 2004).³

¹The additional reserves requirements were phased out in the end of 2006, but BNB reserved "its right to adopt, if circumstances necessitate it, additional measures in order to guarantee a moderate bank credit growth and stability of the system" (BNB 2007).

²For a general introduction to Markov switching models see, *inter alia* Hamilton (1993) or Kim and Nelson (1999). For the properties of MS–ECM see Psaradakis et al. (2004).

³This can be seen as a nice extension of the 'drunk and her dog' illustration of cointegration (Murray, 1994): The drunk follows his zig-zag walk, the dog goes his own way, representing random walks. Both are connected via the leash, correcting for 'errors'. From time to time the leash falls down and they get disconnected, but the drunk picks up the leash again after some time. Thus, in the long run they walk together, although being temporarily disconnected.

They suggest proceeding in two steps, first checking the long term relation for cointegration, after this investigating the short term dynamics for Markov switching. As a result, one may find a stable long-term equation, but in the short-run a more complex dynamics. In the model there will, however, not necessarily be a non-stationary state in the error correction equation. The setting also includes the cases of a fast versus a slow adjustment to the long-term relation or a switch between different short term influences. The model has not been extensively used in the literature. Hall et al. (1997) use the model for detecting bubbles in UK house prices, Hall et al. (1998) use a similar model for the Japanese consumption function. Bessec (2002) applies a model with two different long-term equilibria between exchange rates in the European Monetary System switch. Frömmel and Schmidt (2006), which are closest to our work, seek for bubbles in bank lending in countries of the Euro area.

In our analysis we use as the long-term relation a credit demand equation. It takes the form

$$l_t = \omega + \alpha y_t + \beta i_t + \varepsilon_t \quad (1)$$

where l_t is the log of the bank lending, y_t and the log of GDP, i_t the lending rate. This specification of a demand function is in line with the literature (Pazarbasioglu 1997, Ghosh and Ghosh 1999, Barajas and Steiner 2002, Calza et al. 2003). We also estimated credit demand functions which include the prices for real estate. There is no substantial change in the results. As the series for real estate prices, as pointed in out in the following section, shows a severe structural break in 2003 we decided to work with the simpler demand function as given in (1) to avoid possible methodological pitfalls. The assumption that in the long run bank lending is determined by the demand for credit is common in the empirical literature (see Bernanke and Blinder 1988, Fase 1995, Deutsche Bundesbank 2002, Calza et al. 2003, Frömmel and Schmidt 2006).

If the variables from equation (1) are cointegrated one may model the short run dynamics as an error correction equation:

$$\Delta l_t = a_1 + a_2 \varepsilon_{t-1} + a_3' X_t + u_t \quad (2)$$

with ε_{t-1} the error term from the long run equation (1), a_2 the error correction coefficient, thus governing the speed of adjustment to the long-term equation, X_t a set of possible explanatory variables, which have to be specified from theory, and a_3 a vector of coefficients. In the MS-ECM framework we do no longer assume in equation (2) that the short term dynamics are time-invariant, but let them switch to states, depending on a non-observable state variable s_t . Thus there is no single error correction equation and in this case equation (2) evolves to:

$$\Delta I_t = a_1 + a_2 \varepsilon_{t-1} + a_1 \cdot X_t + u_t \text{ if } s_t = 1, \quad (3a)$$

$$\Delta I_t = b_1 + b_2 \varepsilon_{t-1} + b_3 \cdot X_t + u_t \text{ if } s_t = 2, \quad (3b)$$

for a non-observable regime variable s_t which follows a first-order Markov process with 2 states, characterized by the transition probabilities

$$\begin{aligned} p &= P(s_t=1 \mid s_{t-1}=1) \\ 1-p &= P(s_t=2 \mid s_{t-1}=1) \\ q &= P(s_t=2 \mid s_{t-1}=2) \\ 1-q &= P(s_t=1 \mid s_{t-1}=2) \end{aligned} \quad (4)$$

Thus our model extends the standard (linear) error correction model by allowing the parameters in the error correction equation to depend on the stochastic outcome of the unobserved Markov process. The main advantages of this approach are the ability to capture different kinds of adjustment processes including temporary non-stationarity and the estimation of the break points from the data, making a priori assumptions of the date on which regime changes appear obsolete. Although the Markov switching model is usually regarded as a model of multiple break points, the setting of the model includes the existence of one single regime switch, i.e. an absorbing state, as a special case.⁴ Thus the model is a very flexible one in terms of the cases included.

The probabilities of being in a particular regime at time t are of high importance for interpreting the results. From the estimation procedure we directly receive the *ex ante-probabilities* $Pr(s_t=i \mid \Phi_{t-1})$ and the *filter probabilities* $Pr(st=i \mid \Phi_t)$, i.e. the probabilities of being in a particular regime at time t based on all information up to time $t-1$ or to time t respectively. For an *ex post* analysis, however, it is more appropriate to rely on the *smoothed* probability $Pr(st=i \mid \Phi_T)$, where T is the set of all available information up to time T , i.e. for the whole sample period. The smoothed probability requires an additional filter algorithm to the estimation procedure. Alternative algorithms have been proposed in the literature, we use the one by Kim (1994), which is easy to implement and commonly used in the literature. For a detailed description of the smoothing algorithm see Kim and Nelson (1999).

All calculations have been performed as maximum likelihood estimations programmed in GAUSS.

⁴Hamilton, (1993) p. 235 states: "Some might object that a change in regime could be represented as permanent change...) rather than the cycling back and forth between states 1 and 2... However, the specification allows the possibility of a permanent change as a special case, if $p_{21}=0$." and advises on the use of the Markov switching model even in this case of capturing uncertainty about the regime switch (p.695).

5. Data Description

For our analysis we use quarterly time series provided by the Bulgarian National Bank. They cover the period from the first quarter 2000 to the first quarter 2006, including 25 observations. The reason is that the series for the real estate prices are available only since the first quarter of 2000. Only data on housing prices are available, but we can expect a strong co-movement in housing and retail real estate prices as there were many common factors, driving both prices up (strong demand, poor quality and insufficient volume of the existing estates). This is especially true for office spaces and commercial areas, which constitute a major share of the retail real estates.⁵

We use series for the bank lending to domestic non-financial corporations, bank lending to domestic private households, GDP,⁶ the lending rate, net foreign assets of the banking sector, banks' deposits and the real estate prices in BGL per square meter. The role of net foreign assets is twofold: Banks may increase their supply of loans by attracting additional deposits of domestic non-financial institutions or by borrowing abroad, thus worsening their position in net foreign assets. Both measures have the same effect. On the other hand, the net foreign assets may also be a substitute to lending to domestic customers. Whereas deposits are therefore restricting the bank lending and thus in any case a supply factor, net foreign assets may be driven by demand (capital import for serving credit demand) or by supply (capital export as a substitute to domestic lending).

Following Psaradakis et al. (2004) we first check the variables for our long run relation for cointegration. Table 1 shows the results of standard ADF unit root tests for the original time series. Except for the lending rate we use logs of the variables. Obviously all series are non-stationary in levels. The first differences, in contrast, are stationary except for the real estate prices.⁷ Due to the ambiguous evidence on the real estate prices' stationarity we exclude it from the long run equation and use it for the short-run error correction equation only.

⁵According to a survey of the Bulgarian real estate company ADIS Ltd, which is available on <http://www.adis.bg/en/news.php?id=4802>, in the first three quarters of 2004, the commercial and office areas represented around 56% of all newly build retail spaces in terms of gross external area.

⁶We also used components of GDP in terms of the gross fixed capital formation for the corporations and household expenditure for the households instead of GDP. This did, however, not improve the results.

⁷Perron's (1989) unit root test taking a structural break into account, however, rejects the unit root hypothesis for the changes in real estate prices at least on the ten per cent level. As we do not include real estate prices in the long term equation, the results are not given here but available from the authors on request.

Another structural break occurs for the credit series: In May 2005 the BNB introduced additional minimum reserve requirements for limiting growth of loans to the non-government sector (BNB 2005). Due to the design and the early announcement of the measures, commercial banks increased their lending prior to the introduction of the measures and reduced it after the introduction of the additional minimum reserves. While this obviously does not affect the results for the unit root tests, for estimating the long-run relation we use a dummy variable for the strong increase in bank lending in the first quarter of 2005. We also tested a dummy variable for the dampening effect of the measures after they were introduced. As this dummy, however, turned out to be insignificant and did not affect the results, we left it out for the estimations.

TABLE 1

UNIT ROOT TESTS OF THE LONG-RUN DETERMINANTS

	Levels	Differences
Loans to non-financial corporations	0.569 (0.987)	-5.241*** (0.000)
Loans to households	0.993 (0.995)	-3.256** (0.028)
GDP	0.332 (0.976)	-4.898*** (0.001)
Lending rate	1.528 (0.999)	-9.627*** (0.000)
Real estate prices	2.779 (1.000)	-1.696 (0.423)

Significance is given in parentheses. Asterisks refer to level of significance, ***: 1 per cent, **: 5 per cent, *: 10 per cent.

6. Empirical Results

As a first step, we estimate the long-term equation, which we interpret as the demand for credit, separately for loans to non-financial corporations and to households according to equation (1), but considering the dummy variable for the minimum reserve measures. The results are given in Table 2. The results are mostly as expected: the coefficients for GDP show the expected positive sign and are highly significant. Interestingly, the coefficient is much bigger for loans to households than to non-financial corporations, reflecting the strong increase in lending to households during recent years. Due to the catching up process, however, both coefficients are higher than reported in empirical studies for other European countries (see, e.g. Calza et al. 2003, Frömmel and Schmidt, 2006). The coefficient for the lending rate is correctly signed in both regressions but it is significant only for the households, not for the non-financial corporations.

The dummies for the measures by the BNB in the first quarter of 2005 and the subsequent period show mainly the expected results. We find a significantly positive influence on the credit volume for non-financial corporations reflecting the anticipation of the measures and expansion of the credit volume by the commercial banks. In contrast the slow-down in credit growth after the introduction of the measures is not visible: the coefficient for the second dummy is not significant. For the loans to households we do not find any significant effect of the measures, although they aimed at both, loans to non-financial corporations and households. This is puzzling only at a first glance: given that the BNB measures were preannounced, for banks was more efficiently to react in terms of corporate credit, as the volumes are bigger and corporations may more easily dispose of their liabilities than households, i.e. the transaction costs of the reaction are lower for corporate loans.

TABLE 2

ESTIMATION OF LONG-TERM LOAN EQUATIONS

Non-financial corporations	Households	
Constant	-28.553*** (0.000)	-45.116*** (0.000)
GDP	2.792*** (0.000)	3.836*** (0.000)
Lending rate	-0.039 (0.202)	-0.126*** (0.004)
Real estate prices		
Dummy 2005:1	0.191*** (0.001)	0.167 (0.213)
Dummy 2005:2-3	0.018 (0.754)	0.095 (0.351)
Cointegration tests ¹ :		
Trace statistic		
(no cointegration equation)	125.290*** (0.000)	116.276*** (0.000)
(at most 1 cointegration eq.)	55.025 (0.221)	64.495** (0.044)
(at most 2 cointegration eq.)	31.764 (0.401)	34.473 (0.267)
Max. eigenvalue statistic		
(no cointegration equation)	70.265*** (0.000)	51.780*** (0.001)
(at most 1 cointegration eq.)	23.261 (0.399)	30.023* (0.088)
(at most 2 cointegration eq.)	15.856 (0.558)	15.991 (0.546)

Significance is given in parentheses. Asterisks refer to level of significance, ***: 1 per cent, **: 5 per cent, *: 10 per cent.

¹MacKinnon, Haug and Michelis (1999) *p*-values.

Again following the sequential procedure suggested in Psaradakis (2004) we check the variables for cointegration first. We do this by applying Johansen's (1991) test for cointegration. The results can be found for comparison in the lower part of Table 2. For both, loans to non-financial corporations and to households, we find evidence for one or two cointegration relations, for the trace as well as for the max. eigenvalue statistics.

It is therefore straightforward to start with a linear error correction model. Based on the long-term relations given in table 2 we estimate the following error correction equation for the non-financial corporations C (analogously for the households H):

$$\Delta l_t^C = a_1 + a_2 \varepsilon_{t-1} + a_3 \Delta NFA_t + a_4 \Delta dep_t + a_5 \Delta l_t^H + a_6 \Delta RE_t + a_7 \Delta l_{t-1}^C + v_t \quad (5)$$

where ε_{t-1} is the residual from equation (1) and the short term determinants are changes in the net foreign assets (ΔNFA_t), changes in the deposits (Δdep_t), the changes in credits to households (Δl_t^H) and changes in the real estate prices (ΔRE_t). Changes in credit to households are included as it is often argued that banks expand lending to households when lending to corporations is slowing down. From this consideration in the short run a negative relation between corporate and household loans would follow. But one may also expect strong co-movements in dynamically growing markets, when both credit sectors are expanding at the same time. All variables but the changes in the real estate price capture the behavior of the supply side of the credit market, whereas changes in real estate prices may influence bank lending *via* the supply as well as *via* the demand side (see the discussion in Section 2). The linear error correction model performs poorly especially in respect to credits to non-financial corporations. All coefficients but the constant are insignificant. In contrast, for credits to households most of the coefficients are significant. The error correction coefficient a_2 is correctly signed in both equations (albeit significant only for household loans). The remaining significant coefficients in the error correction equation for household loans, however, are only partly correctly signed: while there is no clear-cut expectation for net foreign assets due to its ambiguous role (see the discussion in Section 5) one would expect a positive sign for the deposits (reflecting that higher deposits allow banks to expand their loans, too). The coefficients for the real estate prices, however, are correctly signed. Furthermore it intuitively makes sense, that this coefficient is only significant for the household loans, since households' real estate serves as collateral for loans to a higher extent than it does for corporate loan.

TABLE 3

**ESTIMATIONS OF THE LINEAR ERROR CORRECTION MODEL
(2000:1 TO 2005:4)**

	Non-financial corporations	Households
constant	0.035 (0.128)	0.029 (0.164)
ε_{t-1}	0.033 (0.755)	-0.137*** (0.017)
ΔNFA_t	-0.025 (0.150)	0.029* (0.571)
$\Delta spread_t$	0.013 (0.143)	-0.005 (0.571)
Δdep_t	0.640 (0.330)	-1.251* (0.064)
ΔI_t^{HH} resp. ΔI_t^{NF}	0.271 (0.147)	0.395* (0.061)
ΔRE_t	-0.014 (0.961)	0.537** (0.023)
ΔI_{t-1}	-0.026 (0.897)	0.452** (0.011)

Significance is given in parentheses. Asterisks refer to level of significance, ***: 1 per cent, **: 5 per cent, *: 10 per cent.

In the next step we model the error correction equation (5) as a Markov switch-ing regression, allowing the coefficients from eq. (5) to switch between the regimes. Equation (5) therefore evolves to (again for corporate loans):

$$\Delta I_t^C = a_1 + a_2 \varepsilon_{t-1} + a_3 \Delta NFA_t + a_4 \Delta dep_t + a_5 \Delta I_t^{HH} + a_6 \Delta RE_t + a_7 \Delta I_{t-1}^C + v_t \quad (6a)$$

$$\Delta I_t^C = b_1 + b_2 \varepsilon_{t-1} + b_3 \Delta NFA_t + b_4 \Delta dep_t + b_5 \Delta I_t^{HH} + b_6 \Delta RE_t + b_7 \Delta I_{t-1}^C + v_t \quad (6b)$$

The estimation results are given in Table 4. They show a substantial improvement over the single equation estimation from Table 3 and provide additional insights into the lending behavior of Bulgarian banks. We can identify significant differences between the two states for corporate as well as for household loans. The results for corporate loans, however, now show much more significant coefficients. For corporate credit both of the error correction coefficients a_1 and b_1 are significantly negative. The difference

between them, however, is not significant indicating that the adjustment process is not regime dependent. The same applies to the changes in net foreign assets: they show the expected negative sign, but there is not a significant difference between the regimes. In contrast, there is evidence that the short term dynamics of the other variables do. Regime 1 is mainly characterized by a high impact of deposits on bank lending and a co-movement between corporate and household credit, whereas the second regime does not show any further economically reasonable relation. Figure 2 shows that the probability of being in regime 1 is especially high during the credit expansion period from 2002–2005 and ends with the introduction of the BNB's administrative measures. Thus, our results confirm the distinction of three subperiods as suggested in Section 3. The significantly positive coefficient for the deposits in the second subperiod reflects the fact that during the period of credit expansion attracted resources were utilized more efficiently for providing credit as compared to the other two subperiods.

The results are slightly different for household loans. Regime 1 starts later, in 2003 (third quarter)⁸, but we find a similar swing-back to regime 2 in 2005. Thus both, corporate as well as household loans react to the BNB's measures with a regime shift. Similar to the model for the corporate credit, we find several significant coefficients. In contrast to the corporate credit, however, we find only one error correction coefficient (a_1) negatively signed, as one would expect for cointegrated time series, whereas b_1 shows a positive, albeit not significant, sign. The respective Wald test against the null hypothesis $a_1 = b_1$ indicates a significant difference between the regimes. Thus we find weak evidence for a bubble-like behavior.

Furthermore, we find the same negative influence of the developments of net foreign assets as for corporate credit only for regime 1, which is also characterized by a significantly positive relation with the deposits. The second regime is then characterized by a high impact of real estate prices and a co-movement between corporate and household loans. Summing up so far, we find regime 1, which stresses the importance of typical supplyside variables (net foreign assets and deposits, both capturing the ability of banks to lend), and a second regime, which shows a high influence of the real estate market. The differences for all coefficients are significant. According to Figure 2, regime 2 (strong impact of the real estate market) is mainly likely to have taken place between 2001 and 2003, when the real estate prices showed increasing, but moderate growth rates, and again from 2005, when the growth rates of real estate prices began to fall again.

⁸We do not refer to the smoothed probability's two short peaks prior to this as permanent regime shifts.

TABLE 4

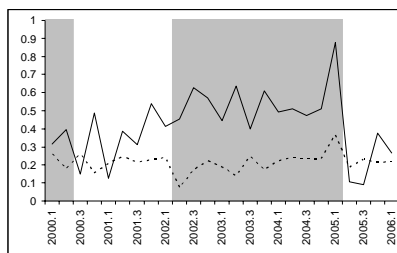
ESTIMATES OF THE MS-ECM (2000:1 TO 2005:4)

	Non-financial corporations		Households	
	Regime 1	Regime 2	Regime 1	Regime 2
ω_1, ω_2	0.047*	0.049**	0.093***	-0.004
	(0.070)	(0.012)	(0.000)	(0.385)
a_1, b_1	-0.133*	-0.158*	-0.292***	0.013
(ε_{t-1})	(0.095)	(0.099)	(0.000)	(0.396)
a_2, b_2	-0.045***	-0.041***	-0.043*	-0.007
(ΔNFA_t)	(0.005)	(0.007)	(0.064)	(0.373)
a_3, b_3	2.100***	0.619	1.030*	-0.904
(Δdep_t)	(0.000)	(0.281)	(0.096)	(0.247)
a_4, b_4	0.236*	-0.185	-0.211	0.638***
$(\Delta I_t^{HH} \text{ resp. } \Delta I_t^{NF})$	(0.069)	(0.130)	(0.224)	(0.003)
a_5, b_5	-0.203	-0.546**	0.217	0.952***
(ΔRE_t)	(0.174)	(0.038)	(0.172)	(0.000)
a_6, b_6	-0.420	-0.044	0.175	0.588***
(ΔI_{t-1})	(0.121)	(0.367)	(0.244)	(0.001)
p_{11}	0.884		0.675	
p_{22}		0.859		0.797
obs.	25		25	
Wald tests				
$p_{11}=1-p_{22}$				
$\omega_1=\omega_2$	0.005		17.290***	
$a_1=b_1$	0.044		6.664***	
$a_2=b_2$	0.039		1.724*	
$a_3=b_3$	2.946***		3.042***	
$a_4=b_4$	5.986**		8.731***	
$a_5=b_5$	1.328***		7.163***	
$a_6=b_6$	1.636*		4.314***	

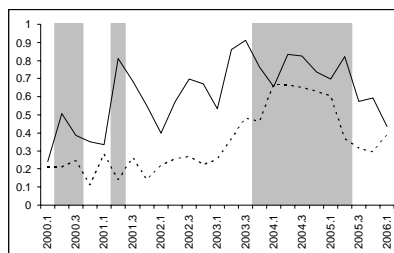
Significance in parentheses, *: ten per cent, **: five per cent, ***: one per cent.

FIGURE 2

DEVELOPMENT OF CREDIT VOLUME AND REGIME DEPENDENCE (2000:1 TO 2005:4)



Growth of loans to non-financial corporations (bold line), changes in deposits (dotted line) and periods of being in regime 1 (shadowed rectangle)



Growth of loans to households (bold line), changes in real estate prices (dotted line) and periods of being in regime 1 (shadowed rectangles)

7. Conclusions

This paper analyses the latest developments of the bank credit to non-financial corporations and households in Bulgaria by using a Markov switching error correction model to control for regimes changes. Two main issues were addressed. First, the relationship between asset prices and bank lending was explored by testing whether periods of unusual growth in asset prices could be useful in explaining the deviations from the long-term evolution of credit. Second, taking into consideration the specifics of the Bulgarian banking sector, the Markov switching model was used to identify periods when corporate and household credit were driven to a greater extent by supply-side rather than long-run demand-side factors. This issue is not only relevant in the post-crisis credit rationing period, but also in most recent times, when administrative measures to curb the credit expansion were introduced.

Since there were considerable differences in the dynamics of corporate and household credit, these variables were modeled separately. The use of a Markov switching error-correction model improved substantially the fit of the estimation as compared to a single equation error correction model and for both household and corporate credit we could identify significant differences between the two states.

As regards lending to non-financial corporations, a regime switch could be observed starting in 2002, when banks began to lend more actively and

again in the first quarter of 2005, after the additional required reserves to control for excessive credit growth were introduced. The period 2002–2005 was characterized by a much stronger role of deposits for credit growth, reflecting more efficient utilization of resources. Similarly, the effect of the change in net foreign assets was slightly more pronounced in this period. While in this period there was a co-movement between corporate and household credit, such a positive correlation was absent afterwards, probably due to substitution effects in banks' credit portfolios. Corporate credit was not significantly affected by the increase of real estate prices in the first regime (2002–2005) and even adversely related to them in the second regime. This finding should, however, be interpreted with caution as the only available series on real estate prices covered exclusively housing estates.

The results are slightly different for household credits. The regime, characterised by stronger credit growth starts later, in 2003 and ends in the beginning of 2005 with the introduction of BNB administrative measures. Similarly to corporate credit, in this regime, the role of the increased capacity of the banks, both in terms of deposits and attracted foreign liabilities was much stronger, while in the second state the availability of resources was less important than the willingness of the banks to lend. In both regimes, household credit is positively related to the increase of real estate prices. The impact of the real estate market is stronger in the period 2001–2003, when real estate prices showed increasing, but moderate growth rates, and again from 2005, when the growth rates of real estate prices began to fall again.

The estimations for both corporate and household credit confirm that there is a regime switch after the introduction of BNB administrative measures in 2005. While these findings are in support of the overall effectiveness of the measures for moderating the increase of private sector indebtedness, they also justify the need for a further research in this area in view of the phasing out of the measures in the end of 2006, which was followed by a rapid acceleration of bank credit growth.

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