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## From credit crunch to credit boom: transitional challenges in Bulgarian banking (1999-2006)

### Abstract

New econometric evidence is provided to identify the determinants of the rapid credit growth in Bulgaria and evaluate whether the credit boom has increased bank fragility, based on a panel data analysis of 30 Bulgarian banks over the 1999-2006 period. Employing Fixed effects and GMM estimation techniques to explore the link between credit and capital base in a partial adjustment framework, the study provides evidence for the growing risks of credit expansion and assesses the potential for banking distress in Bulgaria.

The paper argues that after a period of severe credit crunch during 1997-1999, foreign-owned Bulgarian banks have financed a credit boom, especially since 2003 but this indicated growing risk in lending and increasing vulnerability to a systemic banking crisis as banks reduced their capital base and registered an increase in non-performing loans. Aggressive lending by less-capitalized banks without appropriate loan loss provisioning has also been verified empirically in a number of panel specifications. While well-capitalized banks have tended to expand credit in proportion to their capital base, banks with weak capital base engaged in excessive risk taking, and expanded credit despite growing ratio of non-performing loans. Hence, the credit boom has come at the expense of increased banking fragility in Bulgaria, raising the probability of bank failure in the event of a downturn in global financial flows which became a disturbing reality in 2008.

**Keywords:** credit boom, panel estimation, banking fragility, banking regulations, transition challenges, GMM estimation.

**JEL Classification:** G01, G15, G21, G32, O16.

### Introduction

Since 2003 bank credit to the private sector in Bulgaria has been growing very rapidly in excess of 20% in real terms in line with the dynamics of credit growth in a number of Central and Eastern European countries (CEECs) in recent years. Several studies (Cottarelli et al., 2003; Duenwald et al., 2005; Faure, 2007) focused on the determinants of credit booms in CEECs and concluded that such credit dynamics has, *in most part*, reflected a catching up process to the EU levels and required financial deepening consistent with the economic fundamentals. On the other hand, Sorsa et al. (2007) argued that the catch-up has been characterized by an excessive credit growth accompanied by a considerable build-up of external macroeconomic vulnerabilities, while exposing the banking sectors to new sources of lending risks and credit crises in a number of CEECs including Bulgaria. These studies also noted that similar trends in Asian economies proved unsustainable and resulted in financial crises during the 1996-1997 period.

Credit growth is not a cause for concern as long as it is reflective of underlying growth dynamics of the economy and compatible with a stable macroeconomic and financial framework. In the Bulgarian case, strong credit expansion and investment financed through large inflows of capital contributed significantly to the real income convergence toward the EU level with an average real GDP growth of

around 5.4% in 2003-2007. Yet, the rapid growth in credit was also accompanied by a worsening current account balance which reached 24% of GDP in 2007-2008, accelerating inflation, and growing systemic risk in banking and hence, casted doubt on its future sustainability.

In a comparative study of banking risks in the CEECs, Sorsa et al. (2007) provide a detailed account of the growing bank fragility associated with credit booms and warn against potential banking crises in a number of transitional economies. In particular, authors argue that most banks in these countries are foreign affiliates of European parent banks, which channel large volumes of foreign savings into these economies to tap into the potentially large profit opportunities and tend to under-price credit risks in an attempt to raise overall group profits. Hence, although the surge in bank lending is a welcome development as a major source of investment and property financing in these economies, fast credit growth conceals several un-priced risks and unsound bank practices and exposes the banking sector to significant risks of non-performing loans that could be a harbinger for potential bank failures if the foreign inflows of credit is reversed and the global financial crisis slows down the economic activity as is currently projected for Eastern Europe.

At present, around 90% of Bulgarian banks are foreign affiliates of Western European banks. These banks acquired domestic banks during the large scale privatization process which began after the 1997 financial crisis. As argued in Erdinç (2003), during the 1997-1999 period, the newly privatized

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banks enhanced their capital base and improved profitability but this came at the expense of a significant amount of financial disintermediation which generated a severe credit crunch. The pattern reflected the ongoing risks in the real sector, the new prudent banking regulations and overall risk averseness of Bulgarian banks.

Since 2000, the foreign owned banks of Bulgaria attempted to improve profitability by increasing credit to the private sector in Bulgaria, a process which was aided by several factors, including the growing global liquidity in search for higher returns, and the robust growth and the EU accession prospects of the Central and Eastern European economies<sup>1</sup>. These banks contributed significantly to the financial deepening and sophistication of the Bulgarian banking sector by enhancing their ability to assess credit risks, and channeled large flows of foreign capital to private domestic companies and households since 2003. A new banking legislation compatible with the European standards also monitored the soundness of the banking sector.

Yet, the strong credit growth which followed was deemed excessive by many observers and was accompanied by a deterioration of the banks' capital base and carried the seeds of a potential banking crisis in the event of a global downturn and a sudden reversal of foreign credit flows. It was feared that the overwhelming dominance of the most European owned banks in Bulgaria could exacerbate the problem of under-pricing of credit risks in the affiliated banks and might create significant financial distress in the banking sector. Although currently there is no alarming trend towards mounting bad loans (non-performing loans are around 5% of total loans), fast expansion in credit is generally associated with a growing share of non-performing loans ("credit risk") in the future and may eventually erode banks' capital base which has displayed a strong downward trend as percentage of assets since 2003. Besides, despite a number of attempts to put a "prudential" brake on the potential banking risks, regulatory measures were largely ineffective in reducing the speed of credit growth. This pattern suggested that these banks, driven by high profit motive, managed to circumvent regulations.

To my knowledge, there is no bank-level empirical study which analyzes the dynamics of the credit growth and its impact on bank fragility in the context of the Central and Eastern European economies, including Bulgaria. The latter represents an interesting case as there was a rapid transformation of its credit markets from "credit crunch" to "credit boom" in less than half a decade.

This paper presents the first known empirical analysis of micro-level Bulgarian bank data that assesses whether rapid credit growth aggravated the problem of bank fragility in this emerging transitional economy. Based on a panel data of Bulgarian banks, it analyzes the underlying determinants of their credit supply during 1999-2007 and assesses whether it has increased bank fragility by generating strong signs of unsound banking practices. Fixed effect and GMM panel data techniques are employed to quantify banking risks associated with the recent credit surge and to assess the likelihood of banking distress based on a number of vulnerability indicators.

In the next section, I discuss the impact of the rapid expansion of credit in Bulgaria on macroeconomic developments, level of financial deepening and economic growth to evaluate whether it reflects a sustainable boom in line with economic fundamentals. This section also draws attention to several of sources of risks deriving from worsening macroeconomic imbalances and increasing fragility in banking. In section 2, the underlying determinants of credit boom are discussed with an emphasis on the bank credit channel literature (the lending view), bank competition in the aftermath of foreign entry and aggressive lending practices of foreign banks in search of higher profits in this emerging banking market. Section 3 identifies various sources of potential distress for the future of Bulgarian banking and evaluates indicators of such vulnerability. Section 4 describes data and econometric methodology, estimates different specifications of credit supply equations in the presence of fixed and random effects and finally, explores the link between credit and capital base in a partial adjustment framework employing Generalized Method of Moments (GMM) technique. The last section provides conclusions.

## 1. A "catching up" or a credit bubble? Sustainability of credit expansion in Bulgaria

The rapid pace of credit growth in Bulgaria during 2003-2007 attracts considerable attention, highlighting the need to better understand the underlying factors driving credit dynamics in this new EU member state (as of January 1, 2007). In this section, I explore the relationship between the major macroeconomic developments and the credit boom to assess its impact on macroeconomic and financial stability as the country prepares for prospective integration into the Euro area.

Literature on credit growth identify lending booms as a manifestation of financial development (finance-growth nexus) in emerging economies but also warns against a potential credit bubble that could bust in an environment of high financial volatility, increasing fragility in the banking sectors and worsening macroeconomic imbalances (Hilbers et

<sup>1</sup> Bulgaria became a member of the EU in 2007 and has been one of the fastest growing new EU state since its accession.

al., 2006; Kiss et al., 2006). It often considers fast expansion of domestic credit among the leading early indicators of financial crises and banking

distress even though the likelihood of a crisis following a lending boom is only 20% (Kaminsky et al., 1998).

Table 1. Macroeconomic indicators

	2001	2002	2003	2004	2005	Q12006	Q22006	Q32006	Q42006
(% change in real terms)									
GDP	4.0	4.8	4.5	5.6	5.5	5.6	6.6	6.7	
Consumption	4.4	3.6	6.6	5.1	6.8	4.8	6.7	6.7	
Fixed capital	19.9	9.3	13.9	12.0	19.0	21.4	20.3	15.9	
Industrial production	2.5	4.7	14.1	17.1	6.7	6.0	6.2	6.7	3.6
(% change)									
Consumer prices	7.4	5.9	2.3	6.1	5.0	8.0	8.3	6.7	6.1
Producer prices	3.6	1.3	4.9	5.9	6.9	8.2	9.9	10.5	8.2
(% of GDP)									
Government surplus	-0.6	-0.6	0.0	1.7	3.2	1.6	3.8	5.7	5.1
M3		42.9	48.0	53.3	60.2	53.4	57.5	61.9	67.0
Domestic credit		23.7	29.7	35.9	43.6	39.5	40.2	40.1	44.1
Claims on govt. sector		3.9	2.2	-0.9	-0.9	-0.1	-2.0	-4.3	-4.5
Claims on non-govt. sector		19.8	27.5	36.8	44.5	39.7	42.2	44.4	48.6
Claims on households		4.3	7.2	11.4	16.5	14.9	16.5	17.2	18.9
Time deposit rate (%)		2.99	3.12	3.16	3.25	3.49	3.48	3.45	3.48
ST Loan rates (%)		9.18	8.56	8.94	8.67	9.23	9.19	8.68	8.47
LT Loan rates (%)		14.25	13.46	12.74	10.92	9.81	9.63	9.70	9.52
Current account	-5.6	-2.4	-5.5	-5.8	-11.3	-13.9	-14.3	-14.8	-16.0
FDI (net)	6.1	6.0	10.4	11.8	10.9	12.4	15.5	14.9	16.6
Capital and financial account		11.1	13.2	12.6	17.6	3.5	11.3	15.6	22.8
External debt-public		48.2	39.9	32.8	24.1	19.4	18.9	19.0	18.4
External debt-private		17.0	20.3	31.4	46.3	46.2	51.4	57.3	60.0
Short-term debt		9.2	8.6	13.5	17.9	18.5	20.2	22.2	23.8
ST debt/external debt		14.1	14.3	21.0	25.4	28.1	28.7	29.0	30.4
Real effec. exc. rate (97 = 100)		131.4	140.1	141.9	141.8	146.8	146.1	144.6	149.3

Source: BNB statistics.

In broad terms, the lending boom in Bulgaria has entailed a fast speed of financial deepening and has coincided with a strong pace of economic growth induced by a surge in investment and consumption financed through large inflows of foreign capital. Starting from a low base of financial intermediation in 1997-1999, when domestic credit to GDP ratio was only 20.8%, private credit to GDP ratio rose to 47.5% in 2006<sup>1</sup>. In the meantime, the country maintained an average growth of real GDP between 2004 and 2006 of over 6%. On the demand side, rising employment, real sector profitability and incomes, along with prospective EU accession and low international interest rates provided the key impetus for private sector's credit demand. On the supply side, intensified bank competition lowered interest spreads, and confidence in the foreign-controlled banking sector along with prudential bank regulations surged the deposit base of banks, raising the broad money, M3 to GDP ratio from 43% to 67% during 2002-2006.

<sup>1</sup> Current level of financial deepening is also reflected in M3 to GDP ratio (67% in 2006 up from 40% in 2001).

In an empirical study of bank credit growth to the private sector in 15 countries of Central and Eastern Europe, Cottarelli et al. (2003) study the credit to GDP developments since the mid-1990s and conclude that rapid credit was broadly consistent with the economic fundamentals and structural characteristics of these countries that generally seem to fit the pattern of a catching up movement rather than an unsustainable credit bubble. The results for Bulgaria indicate that the private credit-to-GDP ratio at 48.6% in 2006 is still below its long-term equilibrium value and hence, and the current boom in credit is reflective of this significant potential for catching up (credit-GDP ratio is still lower than its long-run fundamental value) but the pace of credit growth since 2003 has been in excess of 35% on average in Bulgaria and this fast pace is worrisome<sup>2</sup>.

<sup>2</sup> This dynamic pace of corporate lending can also be attributed to the speed of capital obsolescence in the country which surpasses the rates in several other transitional countries (Faure, 2007). Productive investment is not only a function of real economic growth but also the depreciation of capital and gains in capital productivity. The foreign owned banks also focus on household lending, especially mortgage lending which offers a favorable risk/return tradeoff.

The authors warn that if lending rises too rapidly compared to its trend and the speed of convergence implied by the equilibrium model, it can generate unsustainable macroeconomic imbalances and could trigger a systemic credit crisis, if banks get increasingly vulnerable to bad loans and low capital base.

Episodes of credit booms can entail three major risks for macroeconomic and banking stability and as such, generate significant cause for concern (Faure, 2007). First, a credit boom could potentially increase macroeconomic risks, by triggering massive current account imbalances. An upward shift in domestic demand exerts strong pressure on prices in asset (real estate boom) and goods (inflation), i.e. "macro risk". Second, it may aggravate risks to the banking sector due to potential deterioration of asset quality, i.e. "credit risk". And third, if credit booms are largely financed through foreign capital inflows, they may generate huge foreign exchange exposure, i.e. "foreign currency risk". A sudden reversal of foreign capital inflows could also risk the stability of the foreign currency regime, while creating financial distress in the banking sector if economy slows down. These risks are mutually reinforcing, creating boom-bust cycles in credit and asset markets.

Indeed, Bulgaria displays signs of worsening macroeconomic balances, greater exposure to foreign exchange risk and increasing fragility in its banking sector against the background of visible overheating in the economy as captured by accelerating inflation, booming property prices<sup>1</sup> and widening current account deficit. These trends have been emerging due to an investment and consumption boom financed through a strong credit and wage growth (Table 1). Inflation in 2007 surged to over 12% from 6% in the previous year. After reaching almost 15% of GDP in 2005, the current account deficit ballooned to an astonishing 22% as credit growth remained strong in 2006-2007. Although such a trend is generally considered symptomatic of countries at this stage of development, the worsening current account balance is a sign of serious overheating in the economy and mounting macroeconomic risks. A future slow-down or reversal of FDI may pose a threat in the future for the financing of this deficit. There is econometric evidence that the credit boom in Bulgaria has been a significant factor in the deterioration of the trade balance despite favorable movements in terms of trade (Duenwald et al., 2005) although tighter fiscal policy moderated its impact somewhat.

But there are also several mitigating factors such as the credibility of its currency board which pegs the

Bulgarian lev against the euro, and its success in maintaining fiscal surpluses. According to the World Bank's latest EU8+2 Report, the country provides ample coverage for its current account deficit through inflows of FDI. But the coverage declined to 103.2% of current account deficit in 2006, a sharp fall from 243.5% in 2002<sup>2</sup>. Unlike many other CEEs, Bulgaria is also one of the few countries that successfully managed its structural fiscal balances. Bulgarian authorities<sup>3</sup> have been remarkably successful in maintaining fiscal prudence, and keeping public finances under control, generating a surplus in the order of 2.4% of GDP in 2004 and 3% of GDP in 2005 (Table 1). This seems to be the essence of policy credibility that the authorities preserved despite the challenges they faced because of rapid credit growth and overheating of the economy. The currency board has also been largely instrumental in underpinning Bulgaria's monetary stability and credibility but the currency peg to the euro in the face of higher Bulgarian inflation than its trading partners has led to real appreciation of the domestic currency, further fueling imports. Although lending to the household sector grew rapidly in the form of consumption and mortgage loans at around 15% on average during 2003-2006, the fastest credit growth was generated for lending to the private sector, financing investment in physical capital with a favorable impact on productive capacity.

The corporate foreign currency debt in Bulgaria is about 60% of GDP attesting to the significant exposures to foreign exchange risks in view of the widening current account deficit<sup>4</sup>. Lending in foreign currency constituted 17% of loans to households and 64% of lending to corporations, partly because of the low interest spreads on such loans. Although deposit accumulation rather than excessive borrowing from abroad mostly financed the credit boom intermediated through the banking sector, the latter's share is rising and they are often un-hedged. In many other CEEs, attracted foreign funds outpaced deposit creation to finance credit growth in recent years. Although Bulgarian banks managed to keep their foreign currency

<sup>2</sup> According to other estimates, inflows of FDI covered only 60% of current account deficit in 2005, a sharp fall from 138% in 2004.

<sup>3</sup> Bulgaria is viewed as a fast reformer and policy trendsetter in the region. The country passed the first draft of a new investment law in 2003 to promote a level playing field for domestic and foreign investors alike. In the last few years, efforts also concentrated on harmonizing Bulgarian laws with EU standards, and law enforcement improved, generating a major impetus for FDI flows.

<sup>4</sup> This fact is not always reflected by statistics because euro loans are not considered as a foreign currency loans by the BNB. Banks also operate under the assumption that under the currency board, foreign exchange risks are a priori nonexistent or very low.

<sup>1</sup> The concentration of credit in household sector for consumption creates risk of asset bubbles as evidenced by booming property prices.

exposure at a manageable level so far, since 2004, foreign currency loans have exceeded foreign currency deposits by a relatively moderate margin, implying that long-term borrowing by banks from parent banks in Europe began to be used to finance foreign currency loans, exposing the banking sector to indirect foreign exchange risk. Real appreciation of the Bulgarian lev also encouraged borrowing in foreign currency for both banks and the private sector (Table 1). Overall, these developments could be strong signs of a potentially unsustainable credit expansion in Bulgaria.

## 2. Determinants of credit boom in Bulgaria: disentangling demand and supply factors

Generally speaking, the ongoing credit boom in Bulgaria reflects a “catching up” from a depressed level of post-crisis bank intermediation and hence, a process of financial deepening. It also reflects a mix of supply and demand factors, especially a surge in the supply of credit as the system started off from a very low level of financial intermediation. The period of 1997-1999 was dubbed as a period of “credit crunch” by Erdinç (2003) as it coincided with a period of a sharp drop in financial intermediation after the implementation of the currency board in 1997, reflecting banks’ aversion to credit risks in an uncertain institutional and macroeconomic environment. Since then, Bulgaria registered sound growth and banks were restructured after their ownership was transferred to foreign banks which engaged in balance sheet rehabilitation and enhanced capital base. Consequently, banks were encouraged to expand credit since 2000<sup>1</sup>.

A variety of credit channel models consider how changes in the financial position of banks (bank lending channel) and borrowers (balance sheet channel) affect the supply of credit in an economy. In Bulgaria, the entry of foreign banks in search of lucrative markets improved loan screening and monitoring functions of the banks with a favorable shift in their loan supply (Stiglitz and Weiss, 1981). Banks assessed that firm level creditworthiness has been improving, and because of greater expertise in credit assessment and monitoring skills due to foreign ownership, credit making has been perceived as profitable again after 1999. Rising collateral values due to booming real estate markets also improved the banks’ ability to supply credit, improving the value of credit guarantees.

<sup>1</sup> During this crunch period, Bulgarian banks maintained high cash balances, invested heavily in government bonds in a flight to quality, and built up net foreign assets (Erdinç, 2003). This risk-averse behavior reflected in part the short credit history of prospective borrowers (short track records), weak contract enforcement, loss of a large client base due to the closure of state-owned enterprises (SOEs). The ensuing flight to liquidity hampered bank profitability but also boosted capital base. As a result, the credit-to-GDP ratio further declined from its already low level of 20% in 1997 to around 15% during 1997-1998 period.

Banks’ ability to fund loan expansion has been boosted by foreign capital inflows, mostly through the banking system in the midst of high global liquidity, low interest rates and strong confidence in the Bulgarian economy given its prospective accession to the European Union. In addition to these factors, increasing reliance of banks on long term foreign borrowing that supplemented the growth of the deposit base and intense competition for market share suggest that the credit boom has been mostly supply-driven.

On the demand size, the positive shock to supply was readily matched by growing demand from both private sector and households. Rising profits associated with solid economic growth and prospective accession to the European Union prompted businesses to expand investment and credit demand. Consumer and mortgage credit also took off from relatively depressed levels as rising incomes and property prices increased households’ ability to service debt. This process was also facilitated through increasing flexibility of banks in offering new banking products as part of aggressive bank competition.

Yet, banks mostly cater to large and established domestic and foreign corporations when lending (cherry-picking) and others that are small and young are still perceived as high risks. Hence, the small and medium size corporations have still limited access to credit in Bulgaria with less than 5% share in total lending and are perceived to be notoriously credit constrained<sup>2</sup>. This also supports the view that lending was supply-driven. Given that the credit markets in Bulgaria are still generating only limited amount of funding for enterprises, it can be argued that the credit boom reflected a shift in loan supply by banks more so than the shift in demand for credit by firms and households. Hence, there was a drop in the scale and extent of credit rationing rather than an adjustment of credit supply to a greater demand for credit.

The argument that large outward shift of credit supply relative to the shift of demand under conditions of persistent excess demand for credit helps mitigate the well-known identification problem with respect to the relative shifts in demand or supply of bank loans in estimating credit equations. In section 5, the credit supply equations are estimated based on this assumption to disentangle demand and supply effects. In support of this assumption, it should be also noted that loan-total debt quantity mix<sup>3</sup> has increased while the interest rate spreads came down from over 8% to 4% dur-

<sup>2</sup> Procredit Bank specializes in lending to small and medium sized local enterprises perceived risky by other banks.

<sup>3</sup> It reflects the fraction of bank loans in total liabilities of firms and households or in total private debt.

ing the credit boom, providing further evidence for a positive supply shock<sup>1</sup>.

### 3. Does credit boom increase bank fragility? Signs of vulnerability among Bulgarian banks

The lending boom in Bulgaria accelerated in the aftermath of a massive transfer of bank ownership to foreign parent banks located mostly in Europe through takeovers and coincided with a period of intense bank competition for market share and enhanced profits in this potentially lucrative banking market. It also represented a dramatic shift towards bank intermediation and financial deepening in the aftermath of a deep financial crisis and credit crunch of 1997-1999. Since then, Bulgarian banks improved efficiency, enhanced profitability and competition against a stringent regulatory framework with prudential regulations since the enactment of the new banking law adopted in June 1997. The institutional framework for the financial sector – in terms of prudential regulations has been quite adequate in Bulgaria, reducing risks for a possible banking crisis<sup>2</sup>.

Bulgarian banks are considered well-capitalized and liquid with relatively small level of non-performing loans (5-6% in 2007)<sup>3</sup>, but the ratio can easily keep pace with the growth in credit<sup>4</sup>. Domestic lending is primarily financed through domestic deposits, without excessive resort to external financing through

foreign inflows. Foreign banks which hold a dominant position in the sector have arguably better management and oversight with expertise in loan monitoring and evaluation that could potentially mitigate problems of credit quality.

Easy access to external finance of foreign banks, coupled with their eagerness to make profits in their newly acquired foreign subsidiaries and to expand market share in a potentially lucrative market boost their credit supply. In Bulgaria, “this aggressive stance in loan portfolio expansion has been actively encouraged by the banks’ foreign parents, located in relatively less profitable mature markets, to gain market share, thereby contributing to the acceleration of credit” (Duenwald et al., 2005). The drive of the European parent banks to boost their overall group profitability with high profits from the emerging Southeastern European banking markets may exacerbate the problem of systematic risk underpricing, especially in a weak institutional setting regarding credit quality (Sorsa et al., 2007). Parent banks set high return on equity (ROE) targets for their affiliates between 20 to 25%, compared with an EU average of 14%. Local managers may have an incentive to generate rapid loan growth while downplaying risks and thus provisions. Hence, fast credit growth may surge non-performing loans as banks’ ability to assess risks becomes overstretched, affecting the quality of portfolios<sup>5</sup>.

Table 2. Selected indicators of Bulgarian banking system

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
(% of GDP)										
Total credit	20.8	15.6	15.3	17.8	20.2	23.7	27.1	36.1	43.8	44.0
Deposits	27.6	22.5	27.1		32.2	34.9	39.3	51.0	60.6	60.4
(% change)										
Assets					25.0	19.1	19.0	43.8	31.8	17.0
Total credit					55.4	45.5	55.4	47.3	33.1	4.1
Credit to firms					35.0	45.6	50.2	38.1	21.7	-9.3
Credit to HHs					46.3	45.3	75.0	79.3	63.0	43.8
Deposits					34.3	18.1	20.5	43.7	30.1	12.0
(%)										
Capital adequacy	4.3	7.9	10.4		31.3	25.2	22.2	16.1	15.2	16.0
Capital to assets	22.8	23.4	18.9	18.6	16.1	13.3	18.9	15.0	14.5	12.9
NPLs to total loans	17.5	9.2	9.4	6.6	3.3	2.4	2.5	1.9	1.7	5.0
Provisions to NPLs					61.6	59.6	50.0	48.5	45.3	45.3
Return on assets		0.7	2	1.8	2.9	2.1	2.4	2.1	2.1	2.6
Return on equity					21.9	17.9	22.7	20.6	22.1	25.8

Source: BNB banking reports, and author’s calculations.

<sup>1</sup> Kashyap et al. (1993) suggest that shocks to bank credit supply reveal themselves on the relative quantities and interest rates of bank loans vs. other financing substitutes.

<sup>2</sup> Financial Sector Assessment Program conducted during 2002-2003 assessed positively the Bulgarian regulatory framework and bank supervision activity. The major recommendations for Bulgaria included strengthening supervision on a consolidated basis and training bank supervisors in international accounting standards (Duenwald et al., 2005).

<sup>3</sup> This is according to the latest estimate by the World Bank.

<sup>4</sup> It shot up to around 11% in Asia prior to its crisis.

<sup>5</sup> This problem tends to be more acute in emerging markets with weaker institutional frameworks or lower human capital.

According to Sorsa et al. (2007), this under-pricing may be compounded by poor accounting and auditing standards, unreliable financial disclosure and incomplete credit registries, implying that data on creditworthiness of borrowers are often misleading or insufficient. This mechanism can lead to a potential build-up of credit risk in banks' balance sheets, eventually triggering a credit crisis, if bank credit quality deteriorates, non-performing loans build up and bank capital erodes. Indeed, the upward surge in the return on equity (ROE) seems to be reflective of the downward trend in the capital base, and declining amount of loan loss provisions as percent of loans may be consistent with inadequate level of provisioning – a pattern consistent with a tendency to downplay risks and even unsound bank practices. As can be seen from Table 2, there is a disturbing trend towards lower levels of capital adequacy ratios and the capital to asset ratios have been consistently declining over the 2001-2006 period. In the meantime, consistent with the rapid pace of credit growth, there is some evidence of rising credit risks as revealed by the increasing amount of non-performing loans as percentage of loans and capital.

Moreover, according to Sorsa et al. (2007), centralization of risk management in parent banks may focus on the overall risks of the entire operations, and may underestimate the risk exposures of their affiliates which represent a small share of total operations<sup>1</sup>. Hence, foreign banks may contribute to a potential credit risk build up through mispricing of risks and by relying on foreign funding to finance credit expansion, they could generate large parent-affiliate exposures and vulnerability to a sudden stop or reversals of capital inflows. The recent subprime lending crisis in the US is an example of a bust caused by mispricing of risks and shows that even in sophisticated financial markets, overly aggressive lending behavior may induce unsound banking practices, leading to mounting credit risks and eventual bursting of the bubble in the economy.

In view of mounting pressures on macroeconomic balances, and a potential banking distress associated with too rapid lending growth, Bulgarian regulatory authorities took a host of measures to curb the credit growth and contain a potential systemic crisis in banking in the face of mounting macroeconomic and prudential risks with only limited results in 2006-2007. In 2005, credit controls in the form of marginal reserve requirements on excessive credit

expansion exceeding a certain limit and on banks' foreign borrowing (including from their parent banks) were adopted in addition to fiscal tightening and moral suasion<sup>2</sup>. The authorities also increased reserve requirements from 8 to 12% in September 2007 and implemented tighter loan classification and provisioning, risk-weighted capital requirements, lower loan-to-value ratios and collateral rules. The Bank has been closely monitoring the banking sector dynamics. Yet, such measures proved largely ineffective as banks found alternative routes to circumvent regulations by diverting credit to less supervised channels like their own leasing companies.

As such, presence of foreign banks in Bulgaria is no guarantee for prudent banking practices and the relative ineffectiveness of new prudential regulations in curbing credit growth in 2005-2006 confirm the existence of strong incentives for circumventing regulations by these aggressive banks<sup>3</sup>. Without downplaying the importance of effective prudential regulations and bank supervision, it can be argued that probably one of the most effective instruments of ensuring prudent behavior derives from a radical change in risk perceptions that could induce these banks to re-price their exposure in these emerging markets. Foreign banks increase the risk of contagion (Sorsa et al., 2007). A shock in the region or in the home country causes parents to change the policy of their Bulgarian affiliates, no matter how well they perform<sup>4</sup>. The full-blown US subprime mortgage crisis in 2007 and early 2008 seems to modify risk perceptions among Bulgarian banks. Following a general slow-down in capital inflows, banks recently increased the lending rates as of March 2008, a sign of reduced willingness for crediting.

Moreover, foreign subsidiary banks in Bulgaria may be expected to be supported financially by their parent banks in case of financial distress such that possibility of bailouts by the foreign parent bank increases (moral hazard problem)<sup>5</sup>. But how likely this is in the event of system-wide crisis is open to discussion. Nothing guarantees that a parent bank will help its Bulgarian affiliate in the case of crisis.

<sup>2</sup> These measures included the introduction of quantitative limitations on the increase of credit portfolios and additional required reserves for the banks violating the restrictions. In October 2006, BNB decided to fully abolish the administrative restrictions on credit growth, and the decision was put in force from January 1, 2007.

<sup>3</sup> Under the Currency Board regime, bank rescue operations are against the law (along with lender of last resort function for the BNB) and given the aggressive lending behavior of banks, vigilant bank supervision is necessary at all times to reduce the probability of bank failures in case a system-wide banking crisis hits.

<sup>4</sup> For instance, after suffering capital losses because of a drop in the stock market, the Japanese banks reduced lending in their US affiliates more than at home.

<sup>5</sup> The Banking Act permits the Central Bank to provide liquidity to commercial banks only if a general banking crisis is imminent. Otherwise, the BNB does not get involved in bank rescue operations.

<sup>1</sup> Parent banks may not effectively validate the risk pricing method (relying on local managers' judgment) applied in their subsidiaries. Consolidated supervision at the group level may also focus on risks for parent banks rather than the impact of a wide range of shocks on affiliates. The foreign banks in Bulgaria represent only a small part of the overall portfolio of the big European financial conglomerates such as BNP Paribas, Raiffeisen, Societe General, Unicredito, ING (parent banks).

As a case in point, when Croatian Rijecka bank suffered large losses in 2002, its parent bank, the German Bayerische Landesbank Girozentrale, did not rescue its affiliate.

### 3. Data and econometric methodology

In this section, I assess whether Bulgarian banks practice sound lending practices and measure several indicators of bank fragility by employing panel estimation techniques. Is there evidence for growing risks of banking distress associated with the credit surge in Bulgaria? All variables in the model have been created from the balance sheets and income statements of 30 Bulgarian banks (entire commercial banking sector in Bulgaria) published by the Bulgarian National Bank (BNB). All data are quarterly over the 1999-2006 based on the availability of published reports<sup>1</sup>.

**3.1. Determinants of credit supply and their expected signs.** I rely on the model of credit supply by banks under credit rationing and asymmetric information (Stiglitz and Weiss, 1981; Greenwald and Stiglitz, 1990) and assume that there is excess demand for bank credit in Bulgaria during the period under consideration. According to these models, supply of credit depends positively on banks' deposit and capital base. Especially, prudent banks expand credit only if they have greater capital base to cover potential loan losses. The greater the informational asymmetries regarding borrowers' creditworthiness, the greater the capital base required to expand loans.

The following financial ratios and dummy variables are included in the regression equations to assess this theory: (dependent variable) **credit** – logarithm of bank loans to non-financial institutions, **cap** – a natural logarithm of bank capital which includes owners' equity, reserves, and current profit/loss, **deposit** – logarithm of bank deposits, **ltliab** – logarithm of long-term debt borrowed by banks as a measure of foreign inflows of capital into the banking sector, **fown** – a dummy variable indicating the year when a particular bank was acquired by a foreign owner, **size** – logarithm of the bank asset which measures the size of the bank, **nintincome** – logarithm of net interest income as a measure of bank profitability, **lprov** – a logarithm of net loan loss provisions, **cr10** – concentration ratio accounting for the 10 biggest banks in terms of assets, **loandep** – loan to deposit ratio, **fowncap1** – the product of **fown** and **cap** lagged one period, **lprovcap4** – the logarithm of bank capital and bank provisions lagged four periods, **d2004**, **d2005** – dummy vari-

ables to assess the effectiveness of regulations enacted in 2004 and 2005 by the BNB in order to curb the ongoing credit boom. These dummy variables have a value of 0 before the particular year, and 1 from the year onwards.

I expect **cap** to have a positive sign in credit equations: If banks take calculated risks in expanding credit and are careful in lending then greater amount of capital must be the basis for expanding credit. A negative coefficient, by contrast, may indicate excessive risk taking due to moral hazard among banks. I use **size** to account for differences in bank size as measured by total assets. Larger banks tend to make more credits than smaller ones – because of their branch networks, and hence, ability to collect deposits. Moreover, **size** may be an indicator of the bank's access to long-term borrowing and capital. Thus, it is expected to have a positive sign.

Alternatively, I use **deposit** as a measure of size, or to account for the significance of deposits as opposed to alternative forms of financing such as **ltliab** (mostly external borrowing from parent banks). Since both boost the ability of banks to make loans, they are expected to have positive signs in credit equations.

Since banks in Bulgaria are primarily foreign owned, the Bulgarian affiliates have the chance to receive financial injections from their foreign owners. The availability of such easy-to-acquire financing plays a role in the decision of the bank how much credit to extend. Furthermore, the ability of multinational banks to move capital in and out from Bulgaria can be a serious source of instability (Weller, 2001). When mother banks have problems on other regional or home markets, liabilities to mother banks may increase Bulgarian banks' risks associated with foreign currency liabilities ("contagion effect"). Since the long-term borrowing of Bulgarian banks is primarily from their mother banks, greater reliance on such borrowing may increase their risk to such contagion effects while financing a credit boom, potentially reversible when global markets get hit by adverse financial shocks.

Financial liberalization framework suggests that entry of foreign banks enhances overall efficiency of the domestic banking sector by improving market discipline, importing foreign expertise in lending, and managerial know-how while increasing bank capital through foreign infusions of fresh capital (McKinnon, 1993; Shaw, 1973). Yet, along with better credit evaluation skills, foreign banks require higher returns from their subsidiaries located abroad and set higher profit targets for such markets than those prevalent in their home markets. Thus, I conjecture that foreign ownership is associated with aggressive lending and hence, **fown** is expected to

<sup>1</sup> The data could be extended to cover the year 2007 once the detailed statistics are published by the BNB. Given the continuous expansion of credit in Bulgaria during 2007-2008, the results of this analysis are expected to be strengthened with the arrival of new data.



have a positive effect on credit making<sup>1</sup>. Foreign banks are also expected to be better in loan evaluation and credit monitoring, potentially having a positive impact on the credit supply. I also include **nintincome** as the true measure of bank profitability (rather than ROA) which is expected to have a positive effect on credit making. This is because the more profitable banks get in lending, the greater their incentives for making more new loans.

The concentration ratio, **cr10**, shows the level of competition in the banking sector. The higher the concentration ratio, the less is the level of competition in the banking industry and consequently, the incentive for expanding credit is reduced. The banking sector in Bulgaria is still highly concentrated despite the trend towards greater competition with the entry of foreign banks. Thus, high concentration may mitigate the aggressiveness of Bulgarian banks, having a negative effect on loan supply. Thus, I expect **cr10** to have a negative coefficient.

The prudential regulations enacted in 2004 and 2005 took the form of marginal reserve requirements and credit controls and are expected to put a brake on credit growth. They are captured by **d2004** and **d2005** dummies and if effective, they should have a negative sign, implying reduced speed of credit growth. Another way to check if banks follow regulations is through loan-loss provisions. I expect loan-loss provisions, **lprov**, to have a positive sign as greater amount of loans requires more provisioning if banks appropriately follow the prudential regulations and set aside part of their income for potential loan losses. On the other hand, lagged values of this variable might have a negative effect on credit as an increase in loan losses as captured by **lprov** in the previous periods can constrain banks' incentives for credit making in the future. The loan to deposit ratio, **loandep**, is an indicator of the depth of the domestic banking sector, and thus reflects the profit opportunities for multinational banks (Weller, 2001). A relatively well-developed banking sector with expertise in credit making increases the ability of banks to transform deposits to loans. The greater this value, the greater the bank's willingness to extend loans per unit of deposits.

**3.2. Regression analysis. 3.2.1 Fixed effect and random effect estimation.** In Table 3, I present the fixed effects (FE) estimation results without time dummies along with random effects and FE with AR(1) serial correlation. The dependent variable is the logarithm of the bank credit, **credit**. Based on the F-test, I reject the hypothesis of pooled estimation in favor of a fixed effect estimation using

EvIEWS<sup>2</sup>. This implies that a significant amount of bank heterogeneity is present among the Bulgarian banks during the sample period. The FE approach can incorporate both time and cross-section bank dummies in estimation. Time dummies capture the common set of macroeconomic and policy changes (e.g., regulations) that affect all banks over the sample period. Lag values of the regressors are used in estimation to mitigate possible endogeneity problem between **credit** and other variables, some in the form of interactions, under the assumption of well-behaved disturbances.

$$credit_{i,t} = \alpha + \beta_1 cap_{i,t-1} + \beta_3 deposit_{i,t-1} + \beta_4 ltiab_{i,t-1} + \beta_5 lprov_{i,t-1} + \beta_6 size_{i,t} + \beta_7 nintincome_{i,t-1} + \beta_8 cr10_{i,t} + \beta_9 fown * cap_{i,t-1} + \beta_{10} lprov * cap_{i,t-1} + u_{i,t} \quad (1)$$

where  $u_{it} = \alpha_i + \lambda_t + \eta_{it}$  ;

$$\eta_{it} \sim N(0, \sigma_\eta^2)$$

I tested for the significance of the cross section and time dummies using the Likelihood Ratio test and found evidence for cross section effects but not time effects (Table 3). This was followed by Hausman specification test for random versus fixed effects which favored the fixed effects estimation.

Additional tests for fixed effects have been performed by employing Hausman and Breusch-Pagan LM tests for random effects using Stata software. But contrary to the earlier findings, both tests favored random effects. This inconsistency may be due to the unbalanced nature of the panel with missing observations for some years.

In Table 3, DW statistic for FE estimation indicates the presence of serial correlation of order one<sup>3</sup>. Both FE and RE estimation results are still consistent but inefficient in the presence of serial correlation (Baltagi, 2005) and serial correlation may reflect persistence and dynamic structure for the credit equations as well as trend in the data. As a robustness check for the parameter estimates, FE estimation results are reported in the same table under the assumption of first-order serial correlation, AR(1).

Table 3. Fixed and random effects estimation

Dependent variable	1 FE <i>credit</i>	2 RE <i>credit</i>	3 FE with AR(1) <i>credit</i>
cap(-1)	-0.0818**	-0.0846***	-0.1016**
deposit(-1)	0.11399***	0.10647***	0.1174***
ltliab(-1)	0.01375	0.02253**	0.0261*
size	0.90550***	0.92828***	0.9861***

<sup>2</sup> As is well-known, estimates of the pooled are biased if bank-specific effects are present and are inefficient if disturbances are serially correlated or heteroscedastic (Baltagi, 2005).

<sup>3</sup> Stata reports the modified Bhargava et al. Durbin-Watson statistic as 0.7293865 and Baltagi-Wu LBI as 1.1246718 for xtregar fixed effect regression with the lbi option, and confirms the presence of first-order serial correlation.

<sup>1</sup> Those banks with foreign ownership stake in excess of 85% as captured by the date of privatization are included.

Table 3 (cont.). Fixed and random effects estimation

lprov(-1)	-0.02112	-0.03304**	-0.0401*
cr10	0.54583	-5.6892***	-5.7508
nintincome(-1)	-0.025592	-0.00278	0.0401
fown*cap(-1)	0.02567***	0.02476***	0.0266***
lprov*cap(-1)	0.00468***	0.00293**	-0.00133
Constant	-0.7700	3.9187***	3.267
Dummies	time and cross section	no	cross section
Obs (unbalanced panel)	292	292	170
Adj. R <sup>2</sup>	0.9469	0.9471	0.9542
F-statistic	80.99***	580.67***	96.30***
DW-statistic	2.403	2.030	2.249
Hausman test	-----	FE***	-----
Likelihood Ratio test	No time effects		No CS effects

Notes: \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5 and 10 percent level, respectively, in a two-tailed test.

In all three specifications, **size** and **deposit** are highly significant with positive signs and strongly influence the credit supplied by Bulgarian banks which is consistent with earlier findings in the literature. Long-term borrowing, **ltliab** also has the expected positive sign but only significant for RE and FE under AR(1) estimations. A comparison of the coefficient values also indicates that deposits are more important than long-term borrowing from affiliated banks for Bulgarian subsidiaries in supplying credit<sup>1</sup>.

On the other hand, if banks with smaller loan loss provisions tend to be more aggressive in lending, the negative sign for **lprov** may indicate moral hazard and excessive risk taking. An aggressive bank, abiding by the loan-loss provision norms, should increase provisions in line with its loans. For instance, in the US banks, the relationship between credit and loan loss provisions is positive as reported by Aggarwal and Jacques (2001) as an indication of sound banking practices. Hence, to disentangle these effects, I also use the interactive variable, **lprov\*cap** and observe the sign to be positive and significant in both FE and RE estimations (but negative and insignificant for FE with AR(1)). This means that better capitalized Bulgarian banks suffer less from moral hazard problem and increase their provisions along with their credit.

Capital variable, **cap**, is highly significant in all three equations but has a negative sign. In several specifications, **fown** was also found to be positive and highly significant but when interacted with capital, it turns out to be insignificant. In Table 3, **fown\*cap** is positive and significant, implying that foreign owned banks tend to expand credit, along with their capital base. Moreover, I find that **d2004**

<sup>1</sup> This somewhat exposes Bulgarian banks to the risks associated with foreign currency liabilities as borrowing is in Euros. Moreover, about 60% of deposits are denominated in foreign currency which adds to the foreign currency exposure of banks.

and **d2005** are insignificant with positive signs, which imply that prudential measures were largely ineffective in controlling credit growth in Bulgaria during this period<sup>2</sup>.

A surprising result is that bank profitability has no bearing on credit supply in Bulgaria: **nintincome** is insignificant with a negative sign in two out of three specifications, contrary to expectations. Similarly, **cr10** is found to have the expected negative effect on credit but is insignificant. Along with **loandep**, several other measures such as the nominal GDP, FDI flows and inflation rates were used in order to capture potential demand effects but were found to be insignificant in estimation and were dropped in final specifications.

**3.2.2. Fixed effect estimation with lagged dependent variable.** To capture persistence, fixed estimation in levels and first differences were carried out with lagged credit as an additional regressor. Both fixed and random effects estimators are biased in dynamic specifications including a lagged dependent variable even with exogenous regressors and serially uncorrelated disturbances as lagged dependent variable does introduce serial correlation into panel estimation (Bond, 2002). So, the results should be interpreted with caution. As a robustness check on coefficient signs, the results are presented in Table 3. In addition to significant persistence in the **credit** variable, the signs and significance of most variables included in the model remain the same with the exception of **lprov\*cap** and **ltliab** which turn insignificant in this specification.

Table 4. Fixed effect estimation with lagged dependent variable

Dependent variable	FE credit
credit(-1)	0.0756
credit(-2)	0.0622**
cap(-1)	-0.1026***
deposit(-1)	0.1038***
size	0.9498***
lprov(-1)	-0.0570***
cr10	-0.6911
nintincome(-1)	-0.0802
ltliab(-1)	0.0080
lprov*cap(-1)	-0.0002
fown*cap(-1)	0.0210***
constant	-0.4582
Obs (Unbalanced Panel)	252
Adj. R <sup>2</sup>	0.9444
DW-statistic	1.9843
Hausman test	FE***

Notes: \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5 and 10 percent level, respectively, in a two-tailed test.

<sup>2</sup> Some banks are known to be creative in concealing their credit through their affiliated leasing companies to evade credit regulations.

3.2.3. *Generalized method of moments (GMM) estimation.* According to the capital buffer theory extended by (Milne and Whaley, 2001), banks first increase capital and decrease risk following an increase in the regulatory minimum, and after a period of adjustment to build capital buffers, they increase *both* capital and risk. Hence, for banks with low capital buffers, adjustments in credit (asset risk) and capital are negatively related and for banks with high capital buffers they are positively related. The theory effectively endogenizes the decisions to acquire capital and expand credit in the context of adjustment to a target level of capital and credit. In the context of Bulgarian banking, the credit crunch period (1997-1999) has coincided with the former type of behavior when banks accumulated capital and curtailed lending in the aftermath of the new Banking Law (1997) which imposed higher minimum capital requirements. According to this model, during the credit boom, Bulgarian banks should have expanded credit and capital simultaneously. This positive relationship is based on the assumption that banks have reached their desired capital buffers beyond which they set aside more capital for credit risks.

Another study by Helmann et al. (2000) argues that, in the face of competition which erodes banks' charter value, banks decrease capital and increase asset risk, while increasing fragility in banking. Similarly, Stiglitz and Weiss (1981) predict that in the presence of diminishing risk aversion, risk averse (sound) banks with higher capital base tend to increase their credit risk. At the extreme, banks may have an incentive to decrease capital and increase asset (credit) risk, evading the risk-weighted capital requirements. This pattern of bank behavior is well-known as the moral hazard problem and is based on expectations of a "bail-out" by the parent banks or regulatory agencies (Merton, 1977)<sup>1</sup>. The relative ineffectiveness of the prudential measures employed by the Bulgarian authorities to curb credit growth and contain potential banking risks during the 2005-2006 period may confirm the aggressive behavior of Bulgarian banks in search of higher profits and possible excessive risk taking.

Clearly, these theories generate rivaling predictions on the relationship between banks' choices of capital and credit which can only be resolved empirically. Hence, a finding of a *negative* relationship between capital and credit could be attributed to a combination of the following factors: a) Bulgarian banks were inefficiently over-capitalized during the crunch period and attempted to improve return on equity by reducing credit-capital ratio; b) interbank rivalry prompted banks to improve profitability by reducing credit-capital ratio; and c) the banks were increasingly engaged in risk-taking behavior (diminishing risk-aversion) and financed a credit boom while reducing capital. At the extreme, this type of bank behavior could eventually erode the capital base if risks are mispriced and the size of non-performing loans requires significant write-offs. Bank fragility and the likelihood of bank failures increase, potentially destabilizing the entire banking sector.

To evaluate if Bulgarian banks engage in excessive risk taking during the credit boom period, I specify two partial adjustment equations for credit and capital to capture the simultaneity between capital and credit decisions. This framework assumes that banks aim at establishing optimum capital and risk levels but only gradually and partially adjust to these target levels due to adjustment costs:

$$\Delta credit_{i,t} = \alpha(credit_{i,t}^* - credit_{i,t-1}) + \beta \Delta cap_{i,t} + u_{i,t}; \quad (2)$$

$$\Delta cap_{i,t} = \theta(cap_{i,t}^* - cap_{i,t-1}) + \delta \Delta credit_{i,t} + w_{i,t}, \quad (3)$$

where  $\alpha$  and  $\theta$  are speeds of adjustment, and optimum levels are indicated with stars. Hence, actual adjustments in *credit* and *cap* at time  $t$  are a function of the optimum (target) levels of the variables in addition to random disturbances captured by  $u_{i,t}$  and  $w_{i,t}$ . As is standard in the literature, optimal levels are unobservable for both variables and are modeled as functions of other bank specific variables. In the presence of bank heterogeneity, both disturbances  $u_{i,t}$  and  $w_{i,t}$  should contain a cross-section bank specific effects, say  $\mu_i$  and  $v_i$  as in equation (1).

Table 5. Generalized method of moments (GMM) estimation for credit equation

Dependent variable	1 Eviews $\Delta Credit(one-step)$	2 Stata $\Delta Credit(one-step)$	3 Stata $\Delta Credit(two-step)$
credit(-1)	-1.092587***	$\Delta credit(-1)$ .1853768***	.1889766***
$\Delta cap$	-0.077121**	$\Delta cap$ -.0130653	-.015292**
deposit(-1)	0.065675	$\Delta deposit$ .0286353	.0413763
ltliab(-1)	0.044676**	$\Delta ltliab$ .0446876***	.0632756***
size	0.907933***	$\Delta size$ .7580138***	.702656***
lprov(-2)	-0.036197	$\Delta lprov$ -.0085667	-.0107614***
nintincome(-1)	0.150072**	$\Delta nintinc$ .0210227*	.0199231***

<sup>1</sup> Merton (1977) shows that banks have an incentive to decrease capital-to-asset ratios and to increase asset risk, thereby increasing the probability of default and bankruptcy.

Table 5 (cont.). Generalized method of moments (GMM) estimation for credit equation

fown*cap(-1)	insig	insig	insig
lprov*cap(-4)	insig	insig	insig
Constant	-0.713274	Constant -.0033069	.0002522
Obs (unbalanced panel)	83	385	385
Adj. R <sup>2</sup>	0.973142		
DW-statistic	1.847911		
AR(1)-AR(3)	All significant at 5%	AR(1) sign, AR(2) insig	AR(1) sign, AR(2) insig
Sargan test (p-values)		Significant at 1%	Insignificant
Cross section dummies	yes	yes	yes

Notes: \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5 and 10 percent level, respectively, in a two-tailed test.

Since first differencing of the relevant variables eliminates the bank specific cross section effects,  $\mu_i$  and  $v_i$ , both random and fixed effect estimators are biased in the presence of lagged dependent variables or endogenous variables as regressors. Hence, Arellano-Bond GMM method for the estimation of these equations has been employed using the lagged values of the dependent variable as instruments. GMM takes into account the dynamic structure of the panel data and permits a better understanding of dynamics of adjustment in the panel framework. High persistence and trend in the data for **cap** and **credit** variables may suggest the existence of a unit root. To check for their stationarity, I conduct the Levin, Lin & Chu as well as Im, Pesaran and Shin tests for panel unit roots and reject the existence of unit roots.

I estimate the GMM model both with Eviews and Stata under alternative specifications. The Sargan's test for over-identifying restrictions confirms the validity of the instruments to avoid possible misspecification of the model (p-values reported in Table 5) and the presence of AR(1) but not AR(2) is also verified as expected<sup>1</sup>. Two step GMM which is more efficient than one-step version confirms the previous results on the effect of capital base on the credit activities of banks in Bulgaria. In addition to strong persistence in its level, and rate of change, **credit** variable is strongly influenced by the capital base, **cap** of banks but in a negative manner.

It is also noteworthy that the variables **ltliab** and **nintincome** turn highly significant with positive signs while **deposit** variable loses much of its significance in two step estimations as a source of funding for credit expansion. This finding confirms that credit expansion is mainly financed through long-term borrowing from the parent banks. Also, banks that are more profitable in terms of net interest income tend to adjust their credits more to their target level. The variable **size** has a positive sign in credit equations in contrast to the previous findings

(Stolz, 2007), which implies that larger banks adjust their credit better than smaller banks towards their optimum levels.

Due to space limitations, GMM estimation results for the equation taking capital, **cap** as the dependent variable are not reported here. But results show once again that there is a negative coordination of credit and capital adjustment as banks that expand **credit** also reduce their capital base, **cap** as indicated by the negative and significant coefficient of the **credit** variable. Also, **size** has a positive impact on capital base in contrast to the previous findings (Stolz, 2007)<sup>2</sup>. Larger banks need to adjust their capital more than small banks in Bulgaria although they have easier access to funds for attaining their target levels.

## Conclusions

The analysis of the determinants of credit supply in Bulgaria during 1999-2006 shows that the sustainability of the credit growth in Bulgaria may be questionable as there are signs of banking fragility which may cause risks in the immediate future and pose threats to the catching-up process in terms of credit intermediation. This paper identifies several sources of vulnerability in Bulgarian banking: In the face of intensifying interbank competition along with better access to long-term funding by parent banks in search for higher returns, Bulgarian banks have expanded credit (and their asset risk) while reducing their capital base, possibly reflecting the pressure on these affiliates to enhance return on equity. But the trend also raises the probability of financial distress and exposes banks to the risk of costly adjustment in their capital base in the event of unexpected loan losses deriving from a sudden downturn in economic activity and mispricing of credit risks. The credit boom of this period contrasts sharply with the pattern of bank behavior during 1997-1999 which was characterized as a period of "credit crunch" and

<sup>1</sup> First-order differencing in GMM models generates serial correlation of order one when original panel model is characterized by serially uncorrelated disturbances.

<sup>2</sup> For German savings banks, Stolz (2007) finds that capital and asset risk adjustments are negative only for banks with low capital buffers above the minimum capital requirement, similar to our findings. By contrast, high capital buffer banks tend to adjust capital and asset risk in the positive direction.

the scale and speed of this transformation add to the growing risk perceptions in the sector.

In addition, the partial adjustment model estimated with GMM confirms that more aggressive form of credit expansion was carried out by less capitalized banks. These banks seemed to be overly aggressive in lending as compared to their capital and loan loss provisions and may have engaged in risky lending. Moreover, less capitalized banks, generally smaller in size, tended to expand credit risks at a faster pace but without adequate loan loss provisioning.

The Bulgarian National Bank so far has implemented various prudential measures to instigate sound lending practices among banks, which proved ineffective during 2004-2005 to curb the euphoric lending activities of banks. Bulgarian banks that seem to be under great pressure for enhancing profitability by their parent banks ignored credit controls or evaded marginal reserve requirements through alternative channels such as their leasing affiliates. This supports the view that the overwhelming presence of foreign owned banks has been no guarantee for prudent lending and mispricing of credit risks could mount the overall fragility of the sector.

The US subprime mortgage crisis demonstrates the hazards associated with the systematic underpricing of risks by aggressive lenders even in a sophisticated banking industry as in the US and Europe. The US financial meltdown suggests that in the absence of vigilant and effective supervision, credit may surge uncontrollably but without appropriate pricing

and provisioning for risks. Given the current instability in the international financial markets, Bulgaria is exposed to greater amount of banking risks than ever. A general economic slow-down which is projected for the entire Central and Eastern Europe can raise the level of non-performing loans in the sector and exhaust banks' capital base and worse, can lead to bank failures.

It seems FDI inflows in the form of long-term borrowing from mother banks have played a significant role for banks' credit supply but this trend has already been reversed in a time of global financial crisis. In late 2008, rising risk perceptions in the global markets have forced these banks to limit their credit as borrowing from their parent banks in Western Europe has come to an abrupt halt. There are also signs that in the regional markets of Central and Eastern Europe, syndication credits are being significantly curtailed and carry a large risk premium, reflective of the global credit crunch. This dramatically raises the cost of raising equity capital and makes banks susceptible to capital deficiency. Since March 2008, in response to the global financial slowdown, most Bulgarian banks have raised their lending rates and dramatically reduced credit so as to contain their banking risks. It remains to be seen how the Central and Eastern European banks in general and Bulgarian banks in particular will withstand the global financial shocks, given that they were mostly caught off-guard-overexposed in lending and under-capitalized.

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