Brunel UNIVERSITY WEST LONDON

Department of
Economics and Finance

Working Paper No. 09-12

Economics and Finance Working Paper Series

Tomoe Moore

Large Firms and Soft Budget Constraints for Transition Economies

February 2009

http://www.brunel.ac.uk/about/acad/sss/depts/economics

Large Firms and Soft Budget Constraints for Transition Economies*

By

Tomoe Moore

Economics and Finance
Brunel University
Uxbridge
Middlesex, UB8 3PH
United Kingdom

E-mail: tomoe.moore@brunel.ac.uk

Tel: 018952 67531

Fax: 018952 69770

* Thanks are due to the British Academy, who funded this research (SG-45841). Usual disclaimers apply.

Large Firms and Soft Budget Constraints for Transition Economies

Abstract

Whilst the adverse effect of soft budget constraints (SBCs) is politically and theoretically recognised in transition economies, there is a lack of empirical investigation of SBCs to determine the extent of the bearing on the economy. This article empirically examines the impact of SBCs on investment for large firms in six new European Union (EU) member states. The conventional investment model is challenged by augmenting the model with the variable of 'bank loans' as a proxy to capture the impact of SBCs. The panel estimation reveals that there is a clear indication of SBCs for the Czech Republic and Poland, whereas for Hungary and the Baltic countries, the operation of SBCs seems to be weak. It is also found that such factors as joining the EU and financial development mitigate the practice of SBCs.

Keywords: Investment, Soft budget constraints, Transition economies, Generalized method of moments panel estimation, Large firms

JEL Classification: C1, G3

1. Introduction

The transition economies were, in general, known for soft budget constraints (SBCs). SBCs imply that government or financial institutions are willing to provide additional resources to firms, or to bail them out (Kornai, 1992 and Lízal and Svejnar 2002). If firms take advantage of SBCs, there is a risk that the funds might be used inefficiently or for survival rather than for viable investment. The operation of SBCs tends to favour former large state-owned firms, and this causes credit crunches for smaller firms or new firms, which may face expensive bank loans or are denied access to the loans altogether (Lizal and Svejnar 2002).

Evidence indicates that soft budget constraints remain into later stages of transition: although direct government subsidies have been substantially decreased,

indirect subsidies through banks or tax arrears continue to exist on a large scale (Lízal and Svejnar 2002 and Konings et al. 2003). It is, therefore, not surprising that the transition countries are prone to excessive government deficits, building up high levels of public debt. Other detrimental impacts on the economy include excess demand for labour and other resources, lack of fiscal consolidation, financial bubbles and lack of R & D (Kornai 2001 and Brücker et al 2005).

This paper empirically investigates the effect of SBCs on investment behaviour for large firms in the Czech Republic, Hungary, Poland, Estonia, Latvia and Lithuania. Data used are the firm level panel data over a relatively long time span from 1995 to 2006. The paper is one of the few empirical works on SBCs for the Central Eastern European Countries. Since the seminal work by Kornai (1979, 1980), who attributes the practice of SBCs to government paternalism, a certain amount of literature has been published, albeit mostly from the aspect of political economy, e.g. Hillman et al. (1987) and Shleifer and Vishny (1994) argue that governments allow SBCs in order to gain public support or to avoid unemployment, whereas Dewatripont and Maskin (1995) investigated a problem of governments' unintended behaviour from the initial commitment to not bail out firms. Empirical literature which deals with the direct impact on investment is very limited. Exceptions include that of Lízal and Svejnar (2002) over the sample period from 1992-1998 for the Czech Republic, and Konings et al. (2003) with a time horizon of 1994-1999 for Poland, the Czech Republic, Bulgaria and Romania. Both are based on accelerator theory using panel data. Mueller and Peev (2007) also examined SBCs for the transition economies using aggregate macroeconomic data, pooling twenty-six transition countries during the period from 1989-2002.

Investment literature for developing economies frequently involves measuring the impact of cash sensitivity on investment with the cash flow as a proxy to capture the financial constraints. This is based on an assumption that a firm is financially constrained if an increase in the supply of internal funds results in a higher level of investment spending. In the study of Jaramillo et al. (1996), Günçavdi et al. (1998) and Gelos and Werner (2002), the Euler model is utilised, whereas Konings et al. (2003), Koo and Maeng (2005) and Bhaduri (2005) adopted the Q model. In many cases, the authors tend to find significant cash flow sensitivity in investment decisions for developing economies, and a structural shift is often observed as represented by a lower cash sensitivity of investment in the post financial reform period.

We derive an investment model by drawing on both the Q and Euler models. The problem is to find an appropriate proxy variable to measure the extent of SBCs in empirical analysis. In the work of Brücker et al (2005), SBCs are measured by the degree of labour productivity, arguing that labour hoarding is one of the key features of a SBCs syndrome producing more labour intensity (Kornai 1979, 1980, Hillman et al 1987)[1]. There is, however, a limitation to this approximation in applying it to Central Eastern European countries (CEEC). When they paved the way towards membership of the EU, among other things, the increase of foreign capital from the old EU should have substantially affected the economies of the new EU member states. For example, FDI consists of management skill, know-how and technology, and that FDI generates technological diffusion to these transition economies raising economic growth. In this respect, regardless of the presence of SBCs, it is conceivable that there is a large shift in productivity in the post-entry period. In the

[1] Kornai (1979, 1980) argues that excess demand for labour is one of the key features of the SBCs. See also Hillman et al (1987) and Brücker et al (2005). Goldfeld and Quandt (1988, 1990) demonstrate that SBCs increase factor demand.

study of Lízal and Svejnar (2002), Konings et al. (2003) and Mueller and Peev (2007), all with the same mission of investigating SBCs, the principle variable to measure the SBCs is the profit or cash flow with the assumption that if firms enjoy SBCs, the sensitivity of investment to cash flows or internal funds should be insignificant. This, too, has a downside, as cash flow may be correlated with investment for other reasons than financial constraints, for example, the current level of cash flow predicts future profitability of firms (Gelos and Werner, 2002 and Bhaduri 2005). Also one of the main theories that dominate the capital structure debate is the pecking order theory, where firms have a hierarchy of capital preferences. Such that, if firms are sensitive to cash flows, it could be due to future prospects of profitability or a preference for using internal funds for investment, not necessarily due to financial constraints.

A number of different definitions of the SBCs have been discussed in literature associated with subsidy, trade credit, tax arrears, wage arears and bank loans (Schaffer 1998)[2]. In this paper, the banking system is considered to be a key route by which budget constraints are softened, where there are directed (state) credits, which often go to politically powerful firms. Evidence on whether banks provide funds to firms under the provision of SBCs is, however, less straightforward, since it is difficult to interpret the increases in loans observed in the transition economies[3]. Yet, a large and growing volume of debt classified as 'bad' by banks in transition economies may verify the presence of SBCs through this channel. Moreover, at the

[2] It is noted that total trade credit and overdue trade credit in transition economies are in fact no larger than those in developed Western economics (see Table 1, p.89 Schaeffer 1998). Also, a real flow of tax arrears is in the order of a relatively low 1 to 3% of GDP per annum as compared with Russia where the real flow of tax arrears in 1996 was around 7% of GDP.

[3] For example, Dewatripont and Maskin (1995) find that the existence of sunk costs in existing loans may give rise to soft budget constraints, though banks are subject to hard budget constraints. Berglöf and Roland (1997) argue that new lending hardens budget constraints when the average quality of investment projects is high, whereas refinancing of old loans crowds out new finance, giving rise to SBCs, causing credit crunches on new loans.

start of the transition period, independent commercial banks were created from a former monobank system, and the newly established banks had, in effect, little capability of appraising projects, meanwhile some were under government control for continuous credit to existing client firms (Lizal and Svejnar 2002)[4]. On the basis of this, the empirical focus is on bank loans in measuring SBCs, and the conventional investment model is challenged by augmenting the model with the variable of 'credit' as a proxy to capture the impact of SBCs on investment.

We also investigate whether investment behaviour of firms changes as the state of the economy changes by augmenting the model with a period dummy for joining the European Union (EU), firm size, financial development and business cycles.

It is noted that we focus on large firms on the following grounds: Financial markets in transition economies were underdeveloped so that firms were liquidity-constrained, whilst SBCs were an important component in the formation of capital investment. It is theoretically and economically supported that the investment of relatively large firms or state-owned establishments was not liquidity-constrained owing to generous financing from state banks, but that the opposite holds for smaller firms (Schaffer, 1989). See also Lizal and Svejnar (2002) for empirical evidence for the large enterprises in the Czech Republic[5]. Large firms are, therefore, suitable for the investigation of SBCs potentially generating more consistent empirical performance, and satisfying the purpose of this paper.

[4] It is recently reported that emerging Europe is the only region in the emerging markets sector where banks have net debt, which stands at more than $400 billion and is growing fast (Times, 1st June, 2008).

[5] Lízal and Svejnar (2002) find smaller sized firms were rationed in their access to credit, but large firms were not, providing strong evidence that many large firms have been operating with SBCs. They also argue that larger firms in the Czech Republic had virtually unlimited access to capital.

The key estimation results are as follows. There is an indication of SBCs in determining investment for the Czech Republic and Poland, whereas for Hungary and the Baltic countries, the operation of SBCs seems to be weak. A disciplinary policy to curtail the practice of SBCs in the Czech Republic and Poland is advisable. It is also found that entry to the EU, financial development and business cycles mitigate the practice of SBCs, and that the current on-going integration with EU financial markets and the promotion of financial development would enhance and improve the efficient allocation of resources.

The rest of the paper is organised as follows. Section 2 presents the structural investment model based on a dynamic optimization problem, and derives the empirical model for estimation. Section 3 describes the data. Section 4 provides the empirical results. Section 5 examines the effect of entry to the EU, firm size, financial development and business cycles on SBCs. Section 6 concludes.

2. Investment Model

We derive the Q and Euler models from the profit maximization problem. Following Gilchrist and Himmelberg (1998), Love (2003) and Koo and Maeng (2005), we assume that firms maximise the present value of the firm:

$$V_t(K_t, A_t) = \max \; D_t + E_t\left[\sum_{s=1}^{\infty} \beta_{t+s-1} D_{t+s}\right] \qquad (1)$$

Subject to: $D_t = \Pi(K_t, A_t) - C(I_t, K_t) - I_t$

where K_t = the beginning of the period capital stock ($K_{t+1} = (1-\delta)K_t + I_t$), A_t = a productivity shock, D_t = dividend, β = discount factor, δ = depreciation rate, I_t = investment, Π = profit and C = adjustment cost of investment.

1) The Q model

We define marginal Q as the ratio of the increase in a firm's value to one additional unit of capital, then the first-order condition for investment is given by (Koo and Maeng 2005):

$$\left(\frac{\partial V}{\partial I}\right)_t = -\left(\frac{\partial C}{\partial I}\right)_t - 1 + \beta_{t+1} E_t Q_t = 0 \qquad \text{where } Q_t = \left(\frac{\partial V}{\partial K}\right)_{t+1} \tag{2}$$

For the adjustment cost function, linear homogeneity in capital and investment is assumed, and it is given by:

$$C(I_t, K_t) = \frac{\alpha}{2}\left(\frac{I_t}{K_t} - \gamma \frac{I_{t-1}}{K_{t-1}}\right)^2 K_t \tag{3}$$

The lagged investment to capital implies that it may be easier for the firm to continue investment at some fraction γ of the previous period ratio, since, for example, alternative arrangements would be costly.

We assume the expected returns at the beginning of period *t* by the actual returns realized over the period plus an expectation error. Then, substituting (3) into (2) generates the form of:

$$\left(\frac{I}{K}\right)_{it} = \beta_0 + \beta_1 \left(\frac{I}{K}\right)_{it-1} + \beta_2 Q_{it} + u_{it} \tag{4}$$

Following Hsiao (1996), we specify the disturbance terms u_{it}, equal to $\mu_i + v_{it}$ where μ_i capture a firm-specific fixed effect and v_{it} is white noise.

The base model implies that Q is the sole determinant of investment. Following the investment literature, we specify the cash flow (*CF*) variable, which captures firms' internal financial positions, often providing the impact of financial

constraints on investment[6]. Specific to transition economies, credit flows (*Credit*), i.e. bank loans are also specified to capture the impact of SBCs:

$$\left(\frac{I}{K}\right)_{it} = \beta_0 + \beta_1\left(\frac{I}{K}\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(\frac{CF}{K}\right)_{it} + \beta_4\left(\frac{Credit}{K}\right)_{it} + u_{it} \quad (5)$$

The positive coefficient on *cf/k* is usually interpreted as an indication that the firms are credit constrained. It is based on the assumption that if external finance is costly due to the underdeveloped capital markets of developing countries, firms use internal finance for investment. A test for the existence of financing constraints amounts to that for the statistical significance of *cf/k*. Lízal and Svejnar (2002) and Konings et al. (2003) argue that a zero coefficient on *cf/k* signals that firms have easy access to bank credit suggesting the presence of SBCs (see also Mueller and Peev 2007). This interpretation seems to be simplistic and misleading.. For example as financial markets develop with an increase in alternative external finance, the coefficient on *cf/k* may become insignificant regardless of the presence of SBCs. In order directly to capture the impact of SBCs on investment, *Credit/k* is specified as an additional variable.

Likewise the limitation of cash flow, the sensitivity to *Credit/k* may not necessarily arise as the consequence of the SBCs. The plausible balanced interpretation is that if both cash and credit flows are statistically significant, then firms are more likely to suffer from financial constraints: the inadequate amount of credit released under SBCs may force firms to rely on internal funds. It could be the result of a pecking order in place, but again it indicates the weak operation of SBCs. On the other hand, the high sensitivity of firms' investment decisions to the supply of

[6] Love (2003) specified the stock of liquid assets scaled by total assets as a measure of the internal funds. In the presence of financing constraints, firms would accumulate cash stock to use up when the opportunities arise.

bank funds without resorting to cash flow may signal the dominance of SBCs in corporate finance.

The interpretation of *Credit* is different from that of Bhaduri (2005), who applies the investment function of the sales accelerator type, with the sales, cash flow and long-term debt as regressors, to panel data for Indian firms. Bhaduri argues that highly leveraged firms may adversely affect the availability of external finance, since an increase in leverage pushes up the cost of borrowing and reduces investment. The coefficients on credit are found to be mostly negative in Bhaduri's study[7], clearly demonstrating the adverse effect of credit for Indian firms. By contrast, in this study, the coefficients on *Credit/k* turn out to be all positive, as shown in Section 4. The message is that the same interpretation can not be applied to economies with different economic structures. Günçavdi et al. (1998) point out that if the credit constraint is binding for firms, investment will be (positively) sensitive to the flow of credit, and firms' investments will be less than predicted in the unconstrained model[8]. The role of credit in our model is conceptually similar to that of Günçavdi et al. (1998) apart from the fact that credit is interpreted as a corollary of SBCs.

2) The Euler equation model

From the profit maximization model (1), we introduce financial frictions via $D_t \geq 0$, i.e. nonnegativity constraint on dividends. The multiplier (λ_t) on the non-negativity constraint on dividends equals to the extra cost being associated with raising new equity (Love 2003). This implies that external financing incurs the extra cost. The equation (2) is modified as given by

[7] See Table 1, p.9 (Bhaduri 2005).
[8] Günçavdi et al. (1998) examined investment decisions for Turkey based on the neo-classical model with the user cost of capital. The data used are aggregated data.

$$\left(\frac{\partial V}{\partial I}\right)_t = -(1+\lambda_t)\left(\frac{\partial C}{\partial I}\right)_t - 1 + \beta_{t+1} E_t Q_t = 0 \qquad (6)$$

The envelope theorem is given by:

$$Q_{t-1} = \left(\frac{\partial V}{\partial K}\right)_t = (1+\lambda_t)\left(\frac{\partial D}{\partial K}\right)_t + (1-\delta)\beta_{t+1} E_t Q_t \qquad (7)$$

The Euler equation is derived by combining the equations (6) and (7):

$$1+\left(\frac{\partial C}{\partial I}\right)_t = \beta_t E_t\left[\Theta_t\left\{\left(\frac{\partial \Pi}{\partial K}\right)_{t+1} + (1-\delta)\left(1+\left(\frac{\partial C}{\partial I}\right)_{t+1}\right)\right\}\right] \qquad (8)$$

where $\frac{\partial C}{\partial I}$ = the marginal adjustment cost of investment and $\frac{\partial \Pi}{\partial K}$ = *MPK*= the marginal product of capital. Following Gilchrist and Himmelberg (1999), we assume that a production function has a Cobb-Douglas form, then $MPK = \theta_0 + \theta_1 \left(\frac{S}{K}\right)_{t}$ where S represents sales. Also we assume that the firm makes the period *t* investment decision at the end of the period *t-1*, thus the timing for the sales to capital ratio is the end of period *t*. The relative shadow cost of external finance in periods *t* and *t+1* is expressed as $\Theta_t = \left(\frac{1+\lambda_{t+1}}{1+\lambda_t}\right)$ referred to as a factor of financial constraint. If the shadow cost of external funds is higher in period *t* than in period *t+1*, then $\Theta_t < 1$. This may be a factor which induces the firm to postpone or reduce its investment, where the firm is said to be 'financially constrained' (Love 2003), Θ_t is the measure of financing constraints. λ_t is assumed to be associated with time-varying observable firm characteristics, and the cash flow is commonly used as the variable.[9] However, specifically for the former socialist countries, with the presence of SBCs, the firm may expect to be more constrained at *t+1* than it is today, and at time *t* its investment

[9] In perfect capital markets, λ is zeo.

will be less constrained. In this case the firm is more likely to invest at time *t*. This is equivalent to firms being financially unconstrained. So $\Theta_t \leq 1$ or $\Theta_t \geq 1$ depending on the extent of SBCs in place, and Θ_t is expressed as a function of cash and credit flows as $\Theta_t = \varphi_0 + \varphi_1(\frac{CF}{K})_t + \varphi_2(\frac{Credit}{K})_t$. The Euler equation (8) states that the marginal cost of investing today (adjustment cost and the price of investment goods, normalized to one) is equal to the sum of the foregone marginal benefit of an extra unit in capital and the discounted marginal cost of investing tomorrow.

The stochastic discount factor Θ_t in a multiplicative form is specified as additively. Using a first-order Taylor approximation around the means to linearize the term, we have

$$\left(\frac{I}{K}\right)_{it} = \beta_0 + \beta_1\left(\frac{I}{K}\right)_{it-1} + \beta_2\left(\frac{S}{K}\right)_{it} + \beta_3(\frac{CF}{K})_{it} + \beta_4(\frac{Credit}{K})_{it} + \varepsilon_{it} \qquad (9)$$

This is the Euler model and used for estimation.

3. Data

The firm data are for 6 new EU countries of the Czech Republic, Hungary, Poland, Slovakia, Estonia, Latvia and Lithuania from 1995 to 2006. The study of relatively advanced countries among the new EU countries and the Baltic countries may provide a useful comparative study.

The firm data are collected from the Reuters databases, which contain data of large listed firms with a longer sample period. To supplement the data from this source, firms' data are also collected from the OSIRIS database, which also contains major firms. Banks and other financial institutions are excluded. Firms are chosen where data are available at the latest for the year of 2005 in order to see the effect of

entry to the EU, which took place in May 2004, and also where there are a minimum of 7 consecutive years. The turnover for the firms chosen is greater than US$15 million at 2006. The aggregate data are collected from the World Development Indicators.

The detail of the variables, means and the standard deviations of the key variables and a number of firms and observations are found in Table 1. The Czech Republic has a relatively high standard deviation for the investment-to-capital ratio amongst other countries. In general, the variable of *Q* has a lower standard deviation relative to the mean being less noisy as compared with the rest of the variables, except for Latvia. There are relatively limited data available for the Baltic countries, and this caveat needs to be taken into consideration in the empirical result, at the same time this may be one of the reasons why there is no empirical work on firms in these countries. As to the variable of credit, we consider the Current Liability (bank loans) rather than long-term loans. Long-term debt is, normally, obtained through the capital market, and this would increase in line with financial market development. It is unlikely to reflect the extent of the SBCs[10].

[Table 1 around here]

4. Estimation and result

In equations (5) and (9), the error term may capture shocks derived from changes in technology or productivity, and in turn the shocks may affect sales, cash flows or profitability. Hence regressors and error terms are, , potentially correlated, and the investment model is likely to suffer from endogeneity problems. To address this

[10] It is known that the current liability is used not only for tangible fixed assets, but also for working capital, R & D and market research, yet the latter stimulates the level of fixed assets.

issue, the Generalized Method of Moments (GMM) techniques of Arellano and Bond (1991) are applied for estimation. The methodology requires instrument variables. The GMM estimator minimizes some criterion functions. It does not require information on the exact distribution of the disturbances, and parameter estimates are chosen in a way that the correlations between the instruments and disturbances are almost zero. By choosing an appropriate weighting matrix in the criterion function, GMM can be made robust to heteroskedasticity and to serial correlation.

In the GMM model, over-identification restrictions are used to test for the validity of instrument variables, whereas a serial correlation test is used to check the presence of individual firm effects. The presence of unobserved firm effects implies that the GMM is modelled by differencing each variable in order to remove the firm-specific effects[11]. Arellano and Bond (1991) demonstrate that, in a first difference model, good instruments are the values of the endogenous explanatory variables dated t-2 or at earlier dates, as they are unlikely to correlate with the contemporaneous first differenced error term. The instrument variables used in this study are the lagged, once and twice dependent variables and regressors in level, since they are orthogonal to the disturbances.

The regression results based on Q and Euler models are reported in Table 2a-2b.

[Table 2 around here]

The first-and second-order serial correlation test statistics mostly indicate the absence of serial correlation at the 5% or at least at the 1% level (though some exhibit serial correlation in either the first order or the second order at the 1% level, but not both orders together). This suggests that little unobserved individual effects remain in the

[11] The firm-specific features include issues such as ownership and legal status.

GMM estimation results. Where there is heteroskedasticity detected, White heteroskedasticity-consistent standard errors are applied. The over-identification tests indicate that the null is not rejected in all cases at the the conventional significance level, suggesting that the one- and two-lagged levels of variables as instruments are valid. Overall these tests seem to be satisfactory, supporting the model specification. In view of the difficulties that are frequently encountered in estimating this type of model, our estimates are encouraging.

The data are increasingly supportive of the Euler rather than the Q model, when one notices that more coefficients on *s/k* are statistically significant with the correct positive sign than those on Q[12]. It is often argued that the main limitation with implementing the Q-theory is to find a proxy for the unobservable marginal *q*. The market value of assets relative to their book value is commonly used as a proxy. However, due to market imperfections, the market's valuation tends to be considerably divergent, leading to measurement error (see e.g. Kaplan and Zingales 1997 and Gomes 2001). We have proxied the *q* as the ratio of equity and debt to total assets, which might raise a measurement error and this may in part explain some of the poor performance of the Q- model. Nevertheless, we present the Q-model estimates, as they serve to provide the robustness check for the results of the Euler model.

Start with Table 2a, which shows the model without *Credit/k*. The coefficients on the cash flow take different values for the different countries in the model. As to the Czech Republic, Hungary and Poland, the coefficients are either insignificant or

[12] The coefficients on the *Q* and *s/k* are not always significant for these economies, and such results are not unusual in the investment analysis for emerging markets (see e.g. Lízal and Svejnar, 2002 and Bhaduri 2005). In underdeveloped financial markets, the imperfection in the capital market is severe, hence the variables of Tobin's Q or marginal productivity of capital are not likely to exert a strong influence.

the wrong sign of negative. This seems to imply less financial constraints in these countries. On the other hand, the coefficients are highly significant being positive for Estonia and Lithuania (also Latvia, albeit not in the Euler model). For Lithuanian firms we find a high coefficient of 7.7 and 4.4 in the Q and Euler models respectively, suggesting the strong cash sensitivity of investment. There may be a small degree of operation of SBCs in the Baltic countries, which do not have easy access to bank loans and so the financial constraints may force the Baltic countries to rely on internal finance.

Table 3b, where the model is augmented with the variable of credit flow, is more informative. In all cases, the coefficient on the *Credit/k* is positive and highly significant at the 1% level.

Given the insignificant or negative coefficients on *cf/k* for the Czech Republic and Poland, the results confirm that SBCs prevail and firms may not be operating under liquidity constraints. When access to credit is facilitated through preferential lending, there is less need of internal finance. As to Poland the coefficients on *cf/k* are negative in both Table 2a and 2b. The result seems to reflect the case (recall a component of cash flow is net profit), where the loss-making firms had access to capital under SBCs, and on average were able to maintain investment rates that were comparable to those of profitable firms (Schaeffer 1998 and Lízal and Svejnar, 2002).

Our result is consistent with the study of Lizal and Svejnar (2002) for large firms in the Czech Republic, who find an insignificant coefficient on *cf/k* during 1992-1998. However, it is different from that of Konings et al (2003) for the Czech Republic and Poland, who found statistically significant cash flows and suggested that the results were due to a lesser operation of SBCs. The different sizes of firms and also different sample periods used in their study may have resulted in conflicting

results. It is, however, noted that the available data indicate that, during their sample period of 1994-1999, domestic credit to the private sector (% of GDP) for the Czech Republic amounted to a relatively high 67.9% (World Development Indicator)[13]. Also, having gone through an unexpected recession during 1996-1999, the banks in the Czech Republic relaxed budget constraints for state-owned firms, partly due to political pressure. The Czech banks accumulated a large portfolio of nonperforming loans, and by the mid-to-late 1990s many of them had reached the edge of bankruptcy. On the other hand, the large scale of corporate bankruptcies was avoided in the 1990s. It is, therefore, hard to imagine that firms in the Czech Republic face credit constraints, as Koning et al (2003) claim. As to Hungary and the Baltic countries, both coefficients on *cf/k* and *Credit/k* are positive significant (though for Lithuania, *cf/k* is insignificant in the Q-model). Investment increases in line with the available cash and credit flows. The implication is that firms are financially constrained, indicating the weak operation of SBCs.

It is argued that for Hungarian firms hard budget constraints (HBC) were in place. Bonin and Schaffer (1995) and Shaffer (1998) demonstrated that Hungarian banks were not providing net financing to firms that were unprofitable in 1991 and 1992, and as a consequence large numbers of bankruptcies were observed. Banks were apparently imposing hard budget constraints on firms in the early period of transition.

The overall result indicates that the operation of SBCs seems to be weak in Hungary, Estonia, Latvia and Lithuania, whereas it is strong in the Czech Republic and Poland. There is supporting evidence by looking at the banks' nonperforming loans. See Table 3, where the proportion of banks' nonperforming loans to total loans

[13] For other countries, the domestic credit to private sector (% of GDP) is 24.3% in Hungary, 20.6% in Poland, 19.7% in Estonia, 11.3% in Latvia and 12.9% in Lithuania (World Development Indicator).

(%) for these transition economies is presented for the period 2000 to 2004. The Czech Republic and Poland exhibit a relatively high level of an average of 12.5% and 18.8% respectively, whilst Hungary and the Baltic countries indicate less than 7%. If the non-performing assets in the banking sector are closely associated with SBCs, this confirms our results.

[Table 3 around here]

Moreover, although the transition economies have gone through a similar phase of structural change, the privatization process, regulations and institutional arrangements differ amongst them, and they may have given rise to the fact that some transition economies were prone to the persistent presence of SBCs.

In the privatization process of the Czech Republic, each bank set up investment funds, which collected the vouchers held by citizens into a mutual fund. These vouchers were used to bid for shares of companies. Since more than 60% of such vouchers went to such investment funds, banks became major owners of the large enterprises in the Czech Republic. Hence, banks were willing to make loans even to unprofitable firms in which their investment funds hold large stakes. The profitability of commercial banks has not improved as expected due to their continued lending to insolvent enterprises (Kutan and Brada, 2000). The role of financial intermediaries was also strong for Poland, where 15 National investment funds (NIF) were created to own majority of state owned enterprises (SOE). Hungary had a different stance, since some form of privatization was sought as early as 1968, well before the political changes under the New Economic Mechanism (NEM). First, enterprises were separated from direct state control by the introduction of intermediary structures, e.g. pension funds, municipalities. In order to 'corporatize' enterprises, joint stock companies were established, where not only banks, pension

funds and other SOEs could hold stock, so that stake holders were relatively split among these institutions. Individual entrepreneurship was allowed through the leasing of state assets to individuals. Greater autonomy for SOE was granted to management and that decision making was decentralized, therefore the profit maximising incentive was relatively strong, and this distinguishes Hungarian firms from those in the Czech Republic and Poland.

In terms of external funds availability, the rights of foreign shareholders under Hungarian law in Hungarian firms created a strong connection between privatization and FDI, thus there obtaining external funds from abroad became easier. The reliance on the SBCs could be, as empirically evidenced, minimal. On the other hand, the Czech government was unwilling to allow foreign banks to enter the market, which has worsened the lack of competition by the banks' ownership of enterprises and by the domination of the market by a few large banks.

The enforcement of bankruptcy law may also provide a useful insight into our results. In Hungary, a bankruptcy law was established in 1991. It was deemed as an essential component of economic reform, hence the provision of the Bankruptcy Act was extremely strict. It forced the management of firms to initiate bankruptcy proceedings, once they held overdue debts. The automatic forced bankruptcy improved the disciplinary stance amongst managements in firms and hardened the budget constraint of Hungarian firms. In the Czech Republic, the bankruptcy regulation was also enacted in 1991, yet a large number of bankruptcies was avoided, as mentioned above, due to the number of restrictions under the law. There was also a lack of accountability amongst managers of firms, as there was no specified criminal liability for failing to comply with the law until 2000 (see Janda, 2008 for more

detail). It appears that such a loose bankruptcy law played a role as a prerequisite for easing the practice of the SBCs in the Czech Republic[14].

5. EU entry, firm size, financial development and business cycle

In this section, potential factors which may cause a shift in parameters are investigated by augmenting the investment model with proxy variables. It is noted that these factors may serve as conditional variables.

1) Augmented models

EU entry

In May 2004, 10 Central Eastern European countries joined the EU. The new member states were conditioned to a series of new institutional arrangements based on the Copenhagen Criteria, including a constraint on state transfers to firms, restriction of the payment of subsidies to loss-making enterprises, decentralization of credit allocation, and privatization of state banks (Brücker et al. 2005). Although the extent of the enforcement of these conditions is not certain, during the phase of EU integration a decline in the SBCs is envisaged. Also, scope for the acquisition of external finance becomes wider, reducing the role of cash flow in investment decisions. Hence, entry to the EU is expected to mitigate financial constraints and SBCs, promoting more market-determined investment decisions. It is, therefore, hypothesised that the sensitivity to both cash and credit flows weakens in the post entry period.

[14] Maskin and Xu (2001) treats the SBCs as a financial commitment problem of not imposing bankruptcy on the defaulting entrepreneur.

To test whether joining the EU has affected determinants of investment, we specify slope dummy variables of EU for *cf/k* and *Credit/k,* 1 for 2004-2006 and 0 otherwise as given by.

$$\left(\frac{I}{K}\right)_{it} = \beta_0 + \beta_1\left(\frac{I}{K}\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(\frac{CF}{K}\right)_{it} + \beta_4\left(\frac{Credit}{K}\right)_{it} + \beta_5\left(\frac{CF}{K}\right)_{it} * d + \beta_6\left(\frac{Credit}{K}\right)_{it} * d + \varepsilon_{it} \quad (10)$$

$$\left(\frac{I}{K}\right)_{it} = \beta_0 + \beta_1\left(\frac{I}{K}\right)_{it-1} + \beta_2\left(\frac{S}{K}\right)_{it} + \beta_3(\frac{CF}{K})_{it} + \beta_4\frac{Credit}{K})_{it} + \beta_5(\frac{CF}{K})_{it} * d + \beta_6(\frac{Credit}{K})_{it} * d + \varepsilon_{it} \quad (11)$$

where *d = EU*. The re-specified Q and Euler equations (10) and (11) respectively apply to other factors of Financial development (*FD*), Size and Business cycles, and that *d = FD, Size and Business cycle* (see below).

Financial development (FD)

Investment behaviour is likely to have undergone changes as the firms proceeded through the transition process, and so we estimate both models by augmenting them with the variable of financial development (*FD*). We consider the stock market development and financial intermediaries' development as a proxy to *FD*. Stock market development is the sum of the ratio of market capitalization to GDP (i.e. the size of stock market) and total value traded to GDP. Financial intermediaries' development is the sum of the ratio of liquid liabilities (M3) to GDP and the credit for the private sector to GDP. Note that the Central Eastern European countries have gone through different phases of exchange-rate regime arrangements over the sample period. The fixed regime was an initial step in an anti-inflation strategy. Hungary and Poland moved from a fixed exchange rate regime with varying bands to a

managed and full floating rate system in 2001 and 2000 respectively. The currency crises forced the Czech Republic to introduce managed floating exchange rates in 1997. The Baltic countries have maintained fixed exchange rates over the sample period, and Estonia and Lithuania joined the ERM II in 2004[15]. Since the capital market is affected by the exchange rate system, the variable of *FD* is a way of capturing such changes in financial regimes. The main hypothesis is, similar to the case for EU entry, that financing constraints and SBCs should decrease with financial development, i.e. the interaction of *FD* with cash and credit flows is expected to be negative.

Size effect

Firm size has been commonly used to identify firms that are likely to be financially constrained. Although we have focused on large firms, there is a considerable difference in the scale of operation across large firms, making it meaningful to investigate the size effect amongst large firms. Smaller firms are more likely to suffer from financing constraints due to a larger information asymmetry and also due to a lesser degree of SBCs as compared with larger firms. In order to examine the contention, the interaction of size (measured by the log of total assets) with *cf/k* and *Credit/k* is specified in both models. See equation (10) and (11) above. It is hypothesized that $\beta_5 < 0$, i.e. financial constraints are smaller for larger firms and $\beta_6 > 0$, SBCs is larger for larger firms.

Business Cycles

[15] The Maastricht exchange rate criterion implies a participation in the ERM II for new EU countries as a prerequisite for joining the single currency.

The financing constraints theory states that the information asymmetry between borrowers and lenders creates agency costs, which manifest themselves in the wedge between internal and external financing costs. These costs may decrease with an increase in the borrower's net worth. Since the net worth is likely to be procyclical, the agency costs may decline in a boom and rise in a recession. The interaction of the real GDP growth rate as economic conditions is, therefore, specified. Economic boom periods are associated with the lower level of financing constraints, i.e. the negative coefficient on the interaction of *cf/k*d* in equation (10) and (11) is predicted. Whether SBCs contract or expand is difficult to predict. When an economy booms, banks may be willing to release credit under SBCs with a lower risk of default, on the other hand, it is also true that it makes it easy for firms to obtain funds from the capital market, reducing borrowing from banks.

2) Results

The empirical results are found in Table 4. In terms of diagnostics, refer to Section 3, since, more or less, comments similar to those for Table 2a and 2b apply. The robustness of the results may be found in that the earlier findings of the stronger role of SBCs in investments in the Czech Republic and Poland, and the weaker operation of SBCs in Hungary and the Baltic countries, remain to be the same in the augmented models, when one notices the sign and significance of the coefficients on *cf/k* and *Credit/k*[16].

[Table 4 around here]

[16] Recall that the coefficients on both *cf/k* and *Credit/k* tend to be positive and significant for Hungary and the Baltic countries as an indication of weak SBCs, whereas the coefficient on *cf/k* is insignificant or negative and that on *Credit/k* is significant suggesting a strong role for SBCs for the Czech Republic and Poland.

EU dummies (Table 4a)

As to the effect of entry to the EU, since the sign on the coefficient on *Credit/k*EU* is negative, the operation of SBCs has weakened for all cases as predicted (except for Estonia in the Euler model.) Our results are consistent with those of Brücker et al (2005), who examined the SBCs with the variables of labour productivity, using pooled aggregate data for twenty-six transition countries during 1989-2002. Brücker et al. found that EU candidate countries had a lower labour-to-output ratio in the long run, and a high speed of adjustment of labour productivity to its long-run, which were taken as indicators of the softness of budget constraints, suggesting that EU entry condition has decreased the practice of SBCs for the candidate countries. Note, however, that for Poland and Latvia, *cf/k*EU* is positively significant. Firms in these countries may face financial constraints, as a result of reduced SBCs in the post-entry period.

FD (Table 4b)

A negative coefficient on *credit/k*FD* for the Czech Republic and Poland provides evidence that an improvement in the functioning of financial markets appears to allow firms for easier access to external funds, thus reducing their reliance on the SBCs. Also, banks may be attracted to more profitable financial innovations, and the sources of funds under SBCs may be curtailed. In the case of Hungary, investment decisions became sensitive to the availability of loans as shown with the positive coefficient on *Credit*FD*, whilst financial constraints are reduced as given by the negative coefficient on *cf/k*FD*. The results for the Czech Republic, Hungary and Poland highlight the weakening of financial constraints, being consistent with the existing

literature[17]. As to the Baltic countries, the positive sign on *cf/k*FD* and negative sign on *Credit/k*FD* seems to imply that *FD* contributes to the reduction of SBCs, though with a persistent financial constraint.

Firm Size (Table 4c)

The observation of the positive coefficient on *Credit/k*size* indicates that the larger the firm is, the more SBCs are prevalent in all cases. A negative sign on the coefficient of *cf/k*size* for the Czech Republic, Hungary, Poland and Lithuania appears to suggest that smaller firms tend to suffer from credit crunches[18]. Overall results support the prediction that larger firms benefit from SBCs and smaller firms are disadvantaged in obtaining funds.

Business cycle (Table 4d)

A sign on the interaction of cash and credit flows and business cycles (GDP) is mostly negative. Financial constraints are softened with growth in the economy, and a booming economy appears to reduce the need for rescue funds for the survival of firms, as their profitability increases. As for Hungary, with the positive sign on *Credit/k*BUSI*, banks who are shy about SBCs as discussed above, may release more loans as the economy improves with a consequential lower default risk.

6. Conclusion

Restructuring of firms in terms of their financing is viewed as one of the key factors to a successful transition from a planned to a market economy. We have used

[17] For example, using the Euler equation methodology, Laeven (2003) finds that progress in financial liberalization reduces firms' financing constraints. Galindo et al. (2001) find that financial reform has led to an increase in the efficiency with which investment funds are allocated.
[18] As for Estonia and Latvia, the coefficients are mostly insignificant. This may be due to the limited number of firms used in estimation.

comparable large firm-level data for transition economies in order to analyze the impact of soft budget constraints on firms' investment behaviour for the new EU member states.

It is found that the extent of SBCs differs across Central Eastern European countries. The Czech Republic and Poland show some signs of persistent operation of SBCs with less credit constraints, suggesting that SBCs are an important determinant of investment. The lower credit constraints point to a lower external finance premium. However, in an environment where SBCs are prevalent, this may well imply an inefficient financial sector and severe asymmetric information arising from the SBCs (Budina et al 2000). On the other hand, there is a weak indication of SBCs for the Baltic countries and Hungary, and these countries encounter financing constraints, facing a higher external finance premium.

In terms of policy implications, our results indicate that a disciplinary policy to further curtail the practice of SBCs in the Czech Republic and Poland is advisable in order to avoid a credit squeeze on small firms, whilst it should be noted that Hungary and the Baltic countries may be vulnerable to credit constraints. Given the fact that such factors as joining the EU, financial development and business cycles are more likely to mitigate the practice of SBCs and financial constraints, the currently on-going policy of integration with EU financial markets and the promotion of financial development would enhance the efficient allocation of resources.

The study sheds light on an appropriate plausible investment model for transition economies and raises a question on the application of conventional investment models to these economies. An investment model with the specification of implied bank loans seems to better approximate the complexity of corporate finance for these transition economies. Measuring the extent of the bearing on the

economy by the SBCs is, as yet, empirically incomplete, since there are variations in the form of SBCs. A further development of an empirical framework for SBCs would be useful.

References

Arellano, M. and Bond, S. (1991) some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies* 58, 277-197.

Berglöf, E. and Roland, G. (1997). Soft budget constraints and credit crunches in financial transition, *European Economic review*, 41, 807-818.

Bhaduri, S.N. (2005). Investment, financial constraints and financial liberalization: Some stylized facts from a developing economy, India, *Journal of Asian Economics*, 16(4), 704-718.

Bonin, J.P. and Schaffer, M.E. (2002). Revisiting Hungary's bankruptcy episode. In: Meyendorff, A, Thakor, A. (Eds.), *Designing financial systems in transition economies: Strategies for reform in Central and Eastern Europe*, 59-99.

Brücker, H. Schröder, P.J.H. and Weise C. (2005). Can EU conditionality remedy soft budget constraints in transition countries? *Journal of Comparative Economics*, 33, 371-386.

Budina, N., Garretsen, H. and de Jong, E. (2000). Liquidity constraints and investment in transition economies: the case of Bulgaria, Economics of Transition, 8, 453-475.

Dewatripont, M. and Maskin, E. (1995). Credit and efficiency in centralized and decentralized economies. Review of Economic Studies, 62.541-555.

Fazarri, S., G. Hubbard and B. Petersen (1988). Financing constraints and corporate investment. *Brookings Paper on Economic Activity*, 1, 141-206.

Galindo, A,.Schaiantarelli, F. and Weiss, A. (2001). Does financial liberalization improve the allocation of investment? Micro evidence from developing countries, mimeo, Boston College.

Gelos, R.G. and A.M. Werner (2002). Financial liberalisation, credit constraints and collateral: Investment in the Mexican manufacturing sector, *Journal of Development Economics,* 67, 1-27.

Gilchrist S. and Himmelberg, C. (1998). Investment, Fundamentals and finance, *NBER Working Paper Series* 6652.

Gomes, J. (2001) Financing Investment, *American Economics Review*, 91 (5) December, 1963-1285.

Goldfeld, S.M. and Quandt, R.E. (1988). Budget constraints, bailouts and the firm under central planning. Journal of Comparative Economics, 12, 502-520.

Goldfeld, S.M. and Quandt, R.E. (1990). Output targets, the soft budget constraint and the firm under central planning, *Journal of Economic Behaviour and Organization*, 14, 205-222.

Günçavdi, Ö., Bleaney, M. and McKay, A. (1998). Financial liberalisation and private investment: Evidence from Turkey, *Journal of Development Economics*, 57, 443-455.

Hillman, A. Eliakimand, K. and Rosenberg, J. (1987). Workers as insurance: Anticipated government assistance and factor demand. Oxford Economic Papers, 39, 813-820.

Hoshi, T. and Kashyap, A. (1991). Corporate structure, liquidity and investment: Evidence from Japanese industrial group. *Quarterly Journal of Economics*, 106, 33-60.

Janda, K. (2008). Bankruptcies with soft budget constraints in transition economies, presented at the conference, *Globalised Labour & Capital Markets, National Resources & shifts in Economic Power, European Economic and Finance Society*, Prague, Czech Republic.

Jaramillo, F., F. Schiantarelli and A. Weiss (1996). Capital market imperfections before and after financial liberalization: An Euler equation approach to panel data for Ecuadorian firms, *Journal of Development Economics*, 51, 367-386.

Kaplan, S. and Zingales, L (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics*, 112, 169-215.

Konings, J., Rizov, M and Vandenbussche, H. (2003). Investment and financial constraints in transition economies: micro evidence from Poland, the Czech Republic, Bulgaria and Romania, *Economics Letters*, 78, 253-258.

Koo, J. and Maeng, K. (2005) The effect of financial liberalization on firms' investments in Korea, *Journal of Asian Economics*, 16, 281-297.

Kornai, J (2001). Hardening the budget constraint: the experience of the post-socialist countries, *European Economic Review* 45, 1095-1136.

Kornai, J. (1979). Resource-constrained versus demand-constrained systems. *Econometrica* 47, 801-819.

Kornai, J. (1980). Economics of Shortage, North-Holland, Amsterdam.

Kornai, J. (1992) *The Socialist system: The political economy of communism*, Princeton University Press, Princeton, NJ.

Kutan, A. M. and J. C. Brada (2000). The evolution of monetary policy in transition economies, March/April, 2000, *Federal Reserve Bank of St. Louis*, 31-40.

Laeven, L. (2003). Does financial liberalization reduce financial constraints? *Financial Management*, 32 5-34.

Lízal, L. and Svejnar, J (2002). Investment, credit rationing, and the soft budget constraint: evidence from Czech panel data, *The Review of Economics and Statistics*, 84(2), May, 353-370.

Loves, I. (2003). Financial development and financing constraints: International evidence from the structural investment model, *Review of Financial Studies*, 6 (Fall), 765-791.

Maskin, E. and C. Xu (2001). Soft budget constraint theories: from centralization to the market, *Economics of Transition*, 9(1). 1-27.

Mueller, D.C. and Peev E. (2007). Corporate Governance and investment in Central and Eastern Europe. *Journal of Comparative Economics*, 35, 414-437.

Schaffer, M.E. (1989). The credible-commitment problem in the center-enterprise relationship. *Journal of Comparative Economics*, 13, 359-382.

Schaffer, M.E. (1998). Do firms in transition have soft budget constraints? A reconsideration of concepts and evidence, *Journal of Comparative Economics* 26, 80-103.

Shleifer, A. And Vishny, R. (1994). Politicians and firms, *Quarterly Journal of Economics* 109, 995-1025.

Table 1

Variable definitions

Notation	Description
i_t	Investment: $= (K_{t+1} + DEP_t - K_t)$
K_t	Capital at the beginning of period t (= tangible fixed assets at the end of the period *t-1*)
DEP_t	Deprecation during period t
Q_t	Average Q at the beginning of period *t* (=(book value of long term debt$_{t-1}$ + equity$_{t-1}$)/Total asset $_{t-1}$)
CF_t	Cash flow during the period *t* (= net profit after tax + depreciation$_{t-1}$)
$Credit_t$	Credit flow = Current liability $_t$ – Current liability $_{t-1}$
S_t	Sales during period *t*
Eu dummy	1 for 2004 -2006 and 0 otherwise
FD	= market capitalisation to GDP + total value traded to GDP + ratio of M3 to GDP + ratio of the credit for the private sector to GDP.
Size	Log of total assets
Business cycles	Annual real growth rate of GDP

Data for the equity is retrieved from Shareholders Equity in a company's balance sheet.

Descriptive Statistics

		i/k	*Q*	*s/k*	*cf/k*	*Credit/k*	*Firms*	*Obs.*
Czech	Mean	0.038	0.652	1.468	0.165	-0.004		
	Std. Dev.	0.219	0.177	0.981	0.238	0.207	278	2245
Hungary	Mean	1.111	0.689	8.184	0.221	0.068		
	Std. Dev.	1.607	0.175	11.128	0.433	1.557	122	1037
Poland	Mean	0.573	0.522	11.132	1.053	0.802		
	Std. Dev.	0.576	0.322	11.397	1.766	11.485	368	3123
Estonia	Mean	0.187	0.694	3.708	0.486	0.303		
	Std. Dev.	0.395	0.183	4.86	0.584	1.001	42	378
Latvia	Mean	0.148	0.75	2.712	0.318	0.141		
	Std. Dev.	0.403	0.171	2.943	0.663	0.626	78	678
Lithuania	Mean	0.301	0.717	4.885	0.21	1.35		
	Std. Dev.	1.475	0.168	24.651	0.267	10.725	43	386

Sample period: 1995-2006

Table 2a Dependent variable *i/k* (without credit)

	Czech Rep.		Hungary		Poland		Estonia		Latvia		Lithuania	
Q model	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.156*	(-1.721)	-0.003	(-0.649)	-0.243***	(-8.534)	-0.190*	(-1.771)	-0.505***	(-3.492)	-0.287	(-0.942)
Q	0.119	(0.541)	1.358	(1.451)	13.024***	(6.882)	1.115**	(2.228)	-1.121	(-1.532)	0.569	(0.245)
$(cf/k)_{t-1}$	0.061	(0.705)	0.047	(0.379)	-7.383***	(-22.258)	0.466***	(2.771)	0.338***	(3.735)	7.705***	(5.339)
LM auto [1]		2.624		5.881		5.030		0.139		0.886		0.039
LM auto [2]		3.335		0.223		3.957		0.031		0.467		0.576
LM Hetero [3]		7.257		0.933		3.793		1.774		0.172		3.127
Over ident [3].		9.148		9.460		8.028		2.083		3.859		1.815
Euler model	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.153*	(-1.794)	-0.003	(-0.523)	-0.007	(-1.524)	-0.174	(-1.441)	-0.437***	(-2.864)	-0.410	(-1.244)
$(s/k)_t$	0.086*	(1.873)	0.138***	(192.016)	0.230***	(160.034)	0.009	(0.207)	0.089*	(1.806)	0.024***	(3.061)
$(cf/k)_t$	0.127	(1.368)	0.215	(1.485)	-0.133**	(-2.058)	0.589***	(3.547)	0.137	(0.922)	4.498**	(2.121)
LM auto [1]		3.216		4.758		4.888		0.140		0.860		0.024
LM auto [2]		3.347		10.105		5.681		0.044		0.563		0.316
LM Hetero [3]		2.415		0.121		4.930		0.976		0.191		2.506
Over ident [3].		6.968		11.217		5.667		0.175		3.599		1.477

t-ratio *,** and *** significant at the 10%, 5% and 1%.

[.] degree of freedom. Critical value at the 5% df =1 3.84, df=2 5.99, df=3 7.82, at the 1% df=1 6.64, df=2 9.21, df=3 11.34.

Based on GMM. The instrument variables used are $(i/k)_{t-1}$, $(i/k)_{t-2}$, $(cf/k)_{t-1}$ and $(cf/k)_{t-2}$, and Q_{t-1}, Q_{t-2} and $(s/k)_{t-1}$, $(s/k)_{t-2}$ are used for the Q and Euler models respectively.

Table 2b Dependent variable *i/k* (with credit, base model)

	Czech Rep.		Hungary		Poland		Estonia		Latvia		Lithuania	
Q model	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.161*	-1.860	0.001	0.332	-0.007	-1.430	-0.065	-0.736	-0.427***	-3.182	-0.529***	-4.296
Q	-0.158	-0.697	0.428	0.633	0.614*	1.818	0.132	0.305	-0.698	-1.032	0.138	0.149
$(cf/k)_t$	0.040	0.477	0.824***	7.535	-0.126*	-1.637	0.362***	2.704	0.356***	4.302	1.187	1.444
$(Credit/k)_t$	0.233***	3.084	0.919***	12.967	0.868***	142.512	0.857***	5.527	1.196***	3.262	2.384***	15.250
LM auto [1]		2.188		5.308		9.419		0.212		0.904		0.002
LM auto [2]		3.116		0.004		7.522		0.193		0.687		0.115
LM Hetero [4]		6.515		9.460		10.406		1.069		0.588		1.420
Over ident. [4]		8.993		6.999		8.567		2.721		4.206		4.386
Euler model	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.122	-1.439	0.002	0.601	-0.008*	-1.719	-0.012	-0.130	-0.439***	-3.074	-0.388	-1.262
$(s/k)_t$	0.061	1.214	0.105***	6.028	0.134***	13.002	0.045	1.324	0.014	0.261	0.087**	2.108
$(cf/k)_t$	0.039	0.479	0.938***	8.567	-0.088	-1.404	0.325***	2.449	0.331**	2.148	4.841**	2.442
$(Credit/k)_t$	0.202***	2.931	1.126***	13.982	0.363***	9.321	0.903***	6.267	1.208***	2.888	0.167***	2.743
LM auto [1]		2.695		8.524		6.321		0.212		0.904		0.495
LM auto [2]		3.462		0.000		5.691		0.193		0.687		0.007
LM Hetero [4]		3.859		12.794		4.134		0.872		0.458		3.456
Over ident. [4]		7.046		11.900		7.872		-0.688		3.553		5.414

t-ratio *,** and *** significant at the 10%, 5% and 1%.

[.] degree of freedom. Critical value at the 5% df =1 3.84, df=2 5.99, df=4 9.49, at the 1% df=1 6.64, df=2 9.21, df=4 13.28.

Based on GMM. The instrument variables used are $(i/k)_{t-1}$, $(i/k)_{t-2}$, $(cf/k)_{t-1}$, $(cf/k)_{t-2}$, $(credit/k)_{t-1}$ and $(credit/k)_{t-2}$, and Q_{t-1}, Q_{t-2} and $(s/k)_{t-1}$, $(s/k)_{t-2}$ are used for the Q and Euler models respectively.

Table 3 Bank non-performing loans to total (%)

	Czech Rep	Hungary	Poland	Estonia	Latvia	Lithuania
2000	29.3	3	15.5	1	4.6	11.3
2001	13.7	2.7	18.6	1.3	2.8	8.3
2002	10.6	2.9	22	0.8	2	6.5
2003	4.9	2.6	22.2	0.4	1.4	3
2004	4.1	2.7	15.5	0.3	1.1	2.3
Mean	12.52	2.78	18.76	0.76	2.38	6.28

(Source: World Development Indicators)
The data prior to 2000 are not available.

Table 4a Dependent variable *i/k* (with EU dummy)

	Czech Rep.		Hungary		Poland		Estonia		Latvia		Lithuania	
Q model	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.155**	-1.918	0.003	1.268	-0.012**	-2.256	-0.061	-0.671	-0.519***	-3.378	-0.409***	-2.830
Q	-0.590	-1.509	-0.554	-0.932	-0.310	-1.387	0.191	0.428	-0.308	-0.315	-0.868	-1.023
$(cf/k)_t$	0.150	0.660	0.064	0.333	-0.615***	-4.388	0.431***	2.805	0.752	1.476	0.277	0.218
$(Credit/k)_t$	0.768***	2.590	1.291***	17.308	0.802***	5.207	0.863***	5.143	0.610***	2.446	2.707***	2.850
$(cf/k)_{t*}EU$	-0.040	-0.181	0.458*	1.963	2.052***	14.116	-0.137	-1.222	0.932**	2.042	1.283	1.021
$(Credit/k)_t$*EU	-0.263	-0.518	-0.860***	-7.641	-0.456***	-2.841	-0.004	-0.020	-0.192	-0.884	-0.379	-0.367
LM auto [1]		2.072		7.087		8.238		0.384		0.798		0.000
LM auto [2]		2.893		6.119		5.043		0.218		0.618		0.548
LM Hetero[6]		6.461		15.974		9.832		1.536		0.544		1.608
Over ident.[6]		2.543		8.641		7.954		3.261		5.126		4.520
Euler model	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.115	-1.362	0.004	1.136	-0.003	-0.852	-0.018	-0.187	-0.454***	-3.070	-0.359***	-2.544
s/k	0.121**	2.332	0.159***	8.866	0.147***	5.358	0.038	0.968	0.157*	1.705	0.049***	8.954
$(cf/k)_t$	-0.036	-0.156	0.334*	1.820	-0.775***	-8.111	0.380**	2.324	1.141**	2.172	4.428***	4.626
$(Credit/k)_t$	0.541*	1.892	1.376***	16.584	0.683***	7.142	0.894***	5.836	0.456*	1.811	2.772***	3.126
$(cf/k)_{t*}EU$	0.145	0.648	0.211	0.907	1.584***	17.316	-0.096	-0.816	1.014**	2.367	-3.167***	-2.944
$(Credit/k)_t$*EU	-0.730	-1.400	-0.691***	-5.807	-0.324***	-3.249	0.042	0.209	-0.228	-1.082	-0.157	-0.174
LM auto [1]		2.453		7.811		4.536		0.384		0.798		0.073
LM auto [2]		3.462		7.321		8.101		0.218		0.618		0.056
LM Hetero[6]		4.007		2.337		13.588		2.075		0.502		1.869
Over ident.[6]		6.691		11.969		10.868		-0.832		3.419		2.618

t-ratio *,** and *** significant at the 10%, 5% and 1%.

[.] degree of freedom. Critical value at the 5% df =1 3.84, df=2 5.99, df=6 12.59, at the 1% df=1 6.64, df=2 9.21, df=6 16.81.

Based on GMM. The instrument variables used are $(i/k)_{t-1}$, $(i/k)_{t-2}$, $(cf/k)_{t-1}$, $(cf/k)_{t-2}$, $(credit/k)_{t-1}$, $(credit/k)_{t-2}$, (cf/k)t-1*EU, $(Credit/k)_{t-1}$*EU, $(cf/k)_{t-2}$*EU and $(Credit/k)_{t-2}$*EU. Q_{t-1}, Q_{t-2} and $(s/k)_{t-1}$, $(s/k)_{t-2}$ are used for the Q and Euler models respectively.

Table 4b Dependent variable *i/k* (with FD)

	Czech Rep.		Hungary		Poland		Estonia		Latvia		Lithuania	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.162*	-1.877	0.002	0.655	-0.004	-0.865	-0.254**	-2.220	-0.547***	-3.734	-0.513***	-4.041
Q	-0.176	-0.776	-0.289	-0.471	-0.304*	-1.730	1.266**	2.074	0.163	0.183	0.426	0.418
$(cf/k)_t$	0.484	0.370	3.681***	4.115	-1.942	-0.869	0.365	0.515	6.004***	3.037	1.017	-0.401
$(Credit/k)_t$	2.127**	1.963	2.148***	5.332	8.233***	18.578	0.737*	1.686	1.934**	2.194	3.001**	2.395
$(cf/k)_t$*FD	-0.003	-0.278	-0.035***	-3.540	-0.054***	-7.984	0.013	1.395	0.133***	3.196	0.001	0.015
$(Credit/k)_t$*FD	-0.019*	-1.739	0.031***	7.753	-0.105***	-17.125	-0.007	-1.348	-0.033*	-1.796	-0.009	-0.469
LM auto [1]		2.363		2.639		2.987		0.320		0.696		0.007
LM auto [2]		3.191		1.038		1.868		0.200		0.537		0.374
LM Hetero[6]		6.675		19.078		20.342		1.349		0.505		2.077
Over ident.[6]		9.390		8.935		9.038		3.084		4.679		4.467

	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.123	-1.452	0.003	0.947	-0.002	-0.586	-0.165	-1.426	-0.507***	-3.604	-0.667***	-3.199
s/k	0.059	1.181	0.092***	5.917	0.109***	18.301	0.004	0.085	0.135	1.576	1.521***	8.292
$(cf/k)_t$	0.279	0.217	4.783***	6.895	-1.042	-1.389	0.726	1.008	6.452***	3.353	7.980	-1.570
$(Credit/k)_t$	2.107*	1.955	1.011***	3.316	5.549***	13.927	0.939**	2.108	1.845**	2.166	7.303***	8.149
$(cf/k)_t$*FD	-0.001	-0.124	-0.044***	-5.765	-0.008	-1.278	0.017*	1.913	0.136***	3.395	0.332***	3.713
$(Credit/k)_t$*FD	-0.019*	-1.763	0.022***	7.291	-0.069***	-12.589	-0.009*	-1.662	-0.034**	-1.964	-0.071***	-8.002
LM auto [1]		3.006		4.890		5.977		0.320		0.696		0.057
LM auto [2]		3.646		4.243		7.623		0.200		0.537		0.016
LM Hetero[6]		3.942		8.931		27.485		1.659		0.415		1.629
Over ident.[6]		7.318		11.778		10.808		-0.759		2.671		3.760

t-ratio *,** and *** significant at the 10%, 5% and 1%.

[.] degree of freedom. Critical value at the 5% df =1 3.84, df=2 5.99, df=6 12.59, at the 1% df=1 6.64, df=2 9.21, df=6 16.81.

Based on GMM. The instrument variables used are $(i/k)_{t-1}$, $(i/k)_{t-2}$, $(cf/k)_{t-1}$, $(cf/k)_{t-2}$, $(credit/k)_{t-1}$, $(credit/k)_{t-2}$, $(cf/k)_{t-1}$*FD, $(Credit/k)_{t-1}$*FD, $(cf/k)_{t-2}$*FD, $(Credit/k)_{t-2}$*FD. Q_{t-1}, Q_{t-2} and $(s/k)_{t-1}$, $(s/k)_{t-2}$ are used for the Q and Euler models respectively.

Table 4c Dependent variable *i/k* (with firm size)

	Czech Rep.		Hungary		Poland		Estonia		Latvia		Lithuania	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.200***	-2.473	0.011***	3.743	-0.003	-0.812	-0.233**	-1.966	-0.421***	-3.129	-0.468***	-3.765
Q	-0.635***	-2.917	0.687	1.172	-0.232*	-1.793	1.156*	1.854	-1.114	-1.394	-0.617	-0.495
$(cf/k)_t$	1.187	0.702	7.393***	3.228	-6.390***	-15.880	1.506	0.957	1.239	0.701	1.182	0.151
$(Credit/k)_t$	3.474**	2.078	4.896***	8.662	4.325***	13.157	1.914	1.294	1.240	0.335	5.735***	3.942
$(cf/k)_{t*}$SIZE	-0.219***	-2.651	-0.337***	-3.090	-0.406***	-18.315	0.107	1.324	0.100	0.905	-0.030	-0.079
$(Credit/k)_t$*SIZE	0.188	0.956	0.702***	9.206	0.282***	14.362	0.084	1.161	0.000	0.001	1.405***	4.316
LM auto [1]		2.666		6.604		5.562		0.129		0.781		0.018
LM auto [2]		3.191		5.987		3.062		0.091		0.641		0.982
LM Hetero[6]		6.828		9.344		13.890		1.010		0.606		1.044
Over ident.[6]		6.728		10.187		11.850		0.523		4.999		4.673
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.171**	-1.964	0.005	1.398	-0.002	-0.522	-0.143	-1.210	-0.398***	-2.626	-0.466***	-3.427
s/k	0.094**	1.823	0.145***	7.190	0.048***	7.809	0.015	0.312	0.064	0.794	0.039***	9.767
$(cf/k)_t$	1.749	1.372	6.802***	2.904	-4.341***	-9.263	2.290	1.454	1.516	0.623	5.745***	3.582
$(Credit/k)_t$	4.058**	2.545	3.630***	2.861	3.996***	12.534	1.962	1.220	1.124	0.301	4.927**	2.463
$(cf/k)_{t*}$SIZE	-0.200**	-2.324	-0.284**	-2.553	-0.276***	-10.161	0.147*	1.828	0.108	0.758	-0.753***	-3.467
$(Credit/k)_t$*SIZE	0.202	0.990	0.209***	3.750	0.264***	13.873	0.084	1.086	0.001	0.002	0.874***	2.917
LM auto [1]		3.394		9.650		5.590		0.129		0.781		0.856
LM auto [2]		3.992		6.494		4.995		0.091		0.641		0.164
LM Hetero[6]		3.727		13.950		13.600		1.414		0.554		3.608
Over ident.[6]		6.773		11.263		10.998		-1.307		4.291		3.671

t-ratio *,** and *** significant at the 10%, 5% and 1%.

[.] degree of freedom. Critical value at the 5% df =1 3.84, df=2 5.99, df=6 12.59, at the 1% df=1 6.64, df=2 9.21, df=6 16.81.

Based on GMM. The instrument variables used are $(i/k)_{t-1}$, $(i/k)_{t-2}$, $(cf/k)_{t-1}$, $(cf/k)_{t-2}$, $(credit/k)_{t-1}$, $(credit/k)_{t-2}$, (cf/k)t-1*SIZE, $(Credit/k)_{t-1}$*SIZE, $(cf/k)_{t-2}$*SIZE, $(Credit/k)_{t-2}$*SIZE. Q_{t-1}, Q_{t-2} and $(s/k)_{t-1}$, $(s/k)_{t-2}$ are used for the Q and Euler models respectively.

Table 4d Dependent variable *i/k* (with business cycle)

	Czech Rep.		Hungary		Poland		Estonia		Latvia		Lithuania	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.041	-0.497	0.001	0.233	-0.007	-1.372	-0.176	-1.552	-0.513***	-3.432	-0.412***	-2.877
Q	0.283	1.458	0.293	0.433	-0.263	-1.244	1.262**	2.309	0.714	0.781	-2.723**	-2.089
$(cf/k)_t$	-0.179	-1.496	0.538	0.505	-4.284***	-19.828	0.279	1.109	3.298**	2.501	2.080	1.247
$(Credit/k)_t$	0.420***	4.974	0.282	0.775	2.253***	11.335	0.736***	2.717	1.315**	2.074	2.966***	4.789
$(cf/k)_{t*}$BUSI	-0.044	-1.058	-0.067	-0.295	-0.549***	-10.792	-0.050	-1.589	0.515***	2.763	-0.113	-0.605
$(Credit/k)_t$*BUSI	-0.041**	-2.338	0.137*	1.788	-0.342***	-8.564	-0.073**	-2.544	-0.146*	-1.716	-0.069	-0.902
LM auto [1]		2.877		5.595		3.764		0.284		0.653		0.014
LM auto [2]		3.788		0.091		3.645		0.128		0.549		0.041
LM Hetero[6]		6.065		21.980		25.623		1.148		0.461		1.327
Over ident.[6]		6.842		13.749		5.924		1.078		3.738		2.464

	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$(i/k)_{t-1}$	-0.086	-1.054	0.002	0.590	-0.003	-0.828	-0.083	-0.720	-0.496***	-3.389	-0.402***	-2.596
s/k	0.076*	1.634	0.107***	6.381	0.135***	23.743	0.010	0.241	0.115	1.298	0.035***	9.384
$(cf/k)_t$	-0.006	-0.043	2.978***	5.635	-1.283***	-6.197	0.318	1.201	3.324**	2.566	2.954	1.242
$(Credit/k)_t$	0.368***	4.137	0.445**	1.972	1.307***	8.408	0.877***	3.095	1.059*	1.704	3.179***	5.390
$(cf/k)_{t*}$BUSI	-0.002	-0.040	-0.436***	-3.897	-0.158***	-3.772	-0.047	-1.424	0.480**	2.648	-0.203	-0.575
$(Credit/k)_t$*BUSI	-0.031**	-2.112	0.151***	3.276	-0.161***	-5.156	-0.079**	-2.624	-0.135*	-1.642	-0.078	-1.033
LM auto [1]		3.418		9.072		3.137		0.264		0.653		0.584
LM auto [2]		4.154		0.370		10.660		0.128		0.549		0.035
LM Hetero[6]		3.324		28.780		21.477		0.630		0.391		3.595
Over ident.[6]		6.452		16.501		9.246		-0.867		3.323		5.141

t-ratio *,** and *** significant at the 10%, 5% and 1%.

[.] degree of freedom. Critical value at the 5% df =1 3.84, df=2 5.99, df=6 12.59, at the 1% df=1 6.64, df=2 9.21, df=6 16.81.

Based on GMM. The instrument variables used are $(i/k)_{t-1}$, $(i/k)_{t-2}$, $(cf/k)_{t-1}$, $(cf/k)_{t-2}$, $(credit/k)_{t-1}$, $(credit/k)_{t-2}$, (cf/k)t-1* BUSI, $(Credit/k)_{t-1}$* BUSI, $(cf/k)_{t-2}$* BUSI, $(Credit/k)_{t-2}$* BUSI. Q_{t-1}, Q_{t-2} and $(s/k)_{t-1}$, $(s/k)_{t-2}$ are used for the Q and Euler models respectively.