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ABSTRACT

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This paper studies the relationship between leverage and growth, focusing on a large sample of firms in emerging economies of central and eastern Europe (CEE). Contrary to the general wisdom, we find that deviation from optimal leverage, especially excess leverage, is common among firms in many CEE countries. Using firm-level panel data, the paper provides support to the hypothesis that leverage positively affects productivity growth but only below an endogenously determined threshold level.

JEL Classification: G32 and O16
Keywords: excess leverage, TFP growth and threshold model

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Excess Leverage and Productivity Growth in Emerging Economies: Is There A Threshold Effect?

1. Introduction

Economists have long recognized that financial conditions in the private sector could have a powerful effect on macro economic conditions. Increases in leverage could trigger increases in corporate risks and higher cost of external financing. The latter could lower investment, cash flow and therefore output (Kyotaki and Moore, 1997). Increases in corporate leverage could also induce severe slowdown by amplifying/propagating initial adverse shocks (e.g., demand) on the real economy (Bernanke and Gertler, 1995).

The need to understand the link between leverage decision and the wider economy has been emphasized in the wake of the current economic crisis that highlights the risks of lending boom causing subsequent downturn of the global economy.

Since Modigliani & Miller (1958), a good deal of efforts has focused on understanding/analysing corporate financial choices and policies around the world, especially in the US. This literature

highlights the firm, market and industry characteristics determining optimal leverage and also its dynamic adjustment process in case of a departure from the optimum (e.g., Driffield and Pal, 2009). While there is limited literature on the relationship between leverage and firm value/performance (e.g., McConnell and Servaes, 1995; Berger and di Patti 2003; Driffield, Mahambare and Pal, 2007), there is very little, if at all, understanding as to how departure from optimal leverage could affect productivity growth. The present paper aims to bridge this gap in the literature and argues that there is a close link between leverage and total factor productivity (TFP) growth and also that this relationship is likely to be non-linear. Increases in leverage may reduce the agency costs of outside equity, and increase firm value (and efficiency) by encouraging managers to act more in the interests of shareholders (McConnell and Servaes, 1995).[1] Thus, greater leverage is likely to be associated with greater TFP. We further argue that moderate leverage could undoubtedly boost capital stock and therefore the level of output, while very high leverage may be responsible for an economy's vulnerability to unexpected shortfalls in demand and mistakes. This is because excessive leverage could lead

[1] There can also be reverse causation. For example, more efficient firms may choose lower equity ratios (i.e., higher debt) than others, all else equal, because higher efficiency reduces the expected costs of financial distress and bankruptcy (Berger and di Patti, 2003). See further discussion in section 3.

to financial distress and even bankruptcy in response to adverse shocks (Greenspan, 2002). The adverse effect of excessive leverage is however likely to be less severe for more efficient/profitable firms, as the expected costs of financial distress are likely to be lower for them. This however remains an open empirical question that we address in the paper.

The analysis is based on the firm-level Orbis data from a group of central and eastern European (CEE) transition countries. This is an important case in point. Even after more than a decade of reform, there is a growing feeling that the reforms have failed to spur adequately the development of corporate financing opportunities in the central and eastern European (CEE) countries. While a large proportion of firms do not use any external finance, excess leverage is common among many firms with access to bank loans.

Unlike much of the literature for developed countries (e.g., see Fischer, et al, 1989; Goldstein, Ju and Leland 2001; Strebulaev 2007), the literature on capital structure for developing and transition countries has highlighted the importance of excess leverage (e.g., see Driffield and Pal, 2009). Our analysis of ORBIS firm-level panel data suggests that a large proportion of sample firms in the sample CEE

countries do not use any external finance, while presence and persistence of corporate leverage in excess of the optimal is common among many non-zero debt firms (see further discussion in section 2). In fact, the proportion of non-zero debt sample firms with excess leverage (relative to their target) appears to be comparable to the East Asian countries worst affected by the crisis of 1997-98, as found by Driffield and Pal (2009).

Following the well-developed literature on corporate leverage and its dynamic adjustment (e.g., see Booth et al. 2001; Flannery and Rangan, 2006), we start our analysis with the conventional approach of identifying firms with excess leverage in relation to an optimal (instrumented by the fitted values of leverage). Given that questions may arise about this particular definition of optimal leverage, next we use a panel threshold model (a la Hansen 2000) to endogenously determine the threshold value of leverage non-parametrically, beyond which higher leverage would lower total factor productivity growth. Indeed, there is some confirmation from both conventional and threshold analyses that TFP growth increases with leverage only up to a certain extent; however, beyond a critical level, greater leverage lowers TFP growth, even after controlling for various firm-level and

institutional characteristics. A better understanding of the causes and implications of capital structure imbalances seems important, especially in the wake of the current credit crunch and the subsequent turmoil in many countries around the globe. Results of our analysis may provide important insights into the problem and also implications for future policy of deleveraging.

The paper is structured as follows. Section 2 describes the data while section 3 explains the methodology and results. We first apply the conventional method to determine the optimal target capital structure for firms in each of the sample countries and obtain the gap between actual and target capital structure. Next we examine the factors (both firm specific and institutional) determining the likelihood of a firm having leverage in excess of the optimal and also the implications of excess leverage for TFP growth. Finally, we use an endogenous threshold model to determine the effect of leverage on total factor productivity. The final section concludes.

2. Data Description

Data used for the analysis is primarily taken from Orbis, a rich firm-level dataset, which is provided by Bureau van Dijk electronic

publishing. Firm-level Orbis data has been supplemented by country-level data obtained from the EBRD and the World Bank. The sample consists of manufacturing firms from twelve transition countries, namely, Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Poland, Romania, Russia, Serbia, Slovakia, Slovenia and Ukraine, over the period 1996-2005. Full sample data is used to determine the optimal leverage individually for each country. However, in view of the lack of all institutional data in the pre 2001 period, the subsequent analysis of deviation of corporate leverage from its optimal (or target) leverage makes use of the data for the period 2001-2005. This has been a period of steady growth of domestic credit (as a share of GDP) in the region, which stabilized around 2005 for most of the sample countries (see Figure 1). Total number of observations for the period 2001-2005 is summarized in Table 2 for each sample country.

2.1. Leverage measures

We use different measures of leverage, generally dictated by the availability of relevant information. First, we use the ratio of total debt (short and long-term debt) to total assets (abbreviated as TDTA). While we do not observe market value of equity, there is information

on shareholders' funds. We use this information to construct a measure of debt-equity ratio defined as the ratio of total debt to shareholders' funds (abbreviated as TDSF). Note however that a large proportion of firms do not use any external finance; thus the sample size is much smaller when we use either measure of debt ratios. As an alternative, we also use the ratio of total liabilities to total assets (abbreviated as TLTA), which allows us to increase sample size.

Table 1 shows the average leverage between 2001 and 2005 for twelve sample countries, using different leverage measures described above for all firms and also for non-zero debt firms. Given limited use of external finance in these CEE countries, there is a significant proportion of observations with zero debt in our sample,[2] notably in Romania (83.7%) followed by Croatia (52.2%). This reflects the fact that many firms still do not have access to debt markets in these economies and instead make heavy use of trade credit and other kinds of liabilities which do not come under total debt.

Among all firms, the average ratio of total liabilities to total assets ranges between 0.34 (Slovenia) and 0.60 (Slovakia). The range for average debt ratio is however much narrower, namely between

[2] Note also that there are also a number of cases when there was no entry for total debt in the sample countries, especially, Croatia and Slovenia (see Table 1).

0.02 (Romania) and 0.19 (Czech Republic). The average debt ratio goes up somewhat if we consider the non-zero debt firms. So we need to be cautious about choosing between all firms and firms with non-zero debt, while analyzing/interpreting debt ratios.

However, none of these measures of leverage takes account of firms' financial constraints, which could play an important role in capital structure adjustment. Almeida, Campello and Weisbach (2004) used the cash flow sensitivity of cash savings as an indicator of financial constraint and found that this is only important for financially constrained firms in their sample. Following this argument, we also consider an alternative measure of leverage, i.e. leverage net of cash flow defined as (Total Debt – Cash flow) / Total assets. Considering the firms with positive debt, we find that net debt ratio measures are significantly lower than gross debt ratio measures in all the sample countries.

Table 2 shows the distribution of external finance, total debt and shareholders' funds among the sample firms. We classify firms according to whether they use only debt, only shareholders' funds or both. Note that the proportion of firms using only debt is zero or close to zero in all the sample countries. With the exception of Romania,

access to shareholders' funds is rather limited among firms in the sample countries: less than quarter percentage of firms uses only shareholders' funds. In contrast, relatively more firms use both equity and debt financing, though the wide dispersion among the sample countries is noteworthy. While the proportion is as high as 83% in Serbia and 80% in Ukraine, it is only 8% in Slovenia and 15% in Romania. This inter-country variation is also reflected in the descriptive statistics (mean and standard deviation) for the debt-equity ratio shown in Table 3.

We argue that the observed inter-country variation in corporate leverage in sample CEE countries is closely linked to the institutional quality in the region. Table 3 summarises various financial institutional indices in the region, prepared by putting together information obtained from the EBRD, World Bank and la Porta et al. (1998). Among others, we consider size, efficiency and stability of the banking sector, market capitalization rate, share of foreign banks, creditors' rights index. Market capitalization is generally limited in most of the sample countries; firms' external financing opportunities thus depend crucially on size and efficiency of the banking sector in the region. While 80% or more sample firms in Serbia and Ukraine

have access to bank loans, proportion of non-zero debt firms are relatively high in countries like Poland and Romania. It is noteworthy that compared to Romania, for example, scores for average creditors' rights are much higher in Serbia or Ukraine. The other important observation to note here is the dominance of foreign banks in countries like Poland, Romania or Hungary as opposed to Serbia, Slovenia or Russia. It is however important to see the progress over time as the reform deepens. This is analysed below.

2.2. Optimal leverage

The first step of our analysis is to determine the optimal leverage L_{it}^{*} (alternatively labeled as capital structure) of firms in individual countries, as is conventional in the literature (e.g., see Flannery and Rangan, 2006; Driffield et al. 2009). If leverage levels are relatively stable over time, then a simple average of the fitted values for each firm across time may provide the best estimate of optimal leverage. However, if the data are more volatile (as in our case), and firms are responding to changes in the explanatory variables, or to other shocks (e.g., ongoing reforms), then allowing the optimal level to vary year to year, and using the fitted values on an annual basis is more

appropriate, and this is what we do here. Once one allows for this, the best estimate of "optimal leverage" is conventionally taken to be the fitted value[3] derived from the following equation individually for each country:

$$\textit{Leverage}_{it} = \textit{SME dummy}_{i\ t-1} + \textit{Intangible Fixed Assets/Total Assets}_{it-1} + \textit{EBIT/Total Assets}_{it-1} + \textit{Age}_{t} + \textit{SME dummy}_{it} * \textit{Age}_{it} + \textit{Industry Median Leverage}_{t} + u_{it} \quad (1)$$

where i=1,2,....., N refers to the i-th firm in period t=1,2,..., T in a given country. We use panel data fixed effects models to estimate the leverage equation (1). Choice of fixed effects as opposed to random effects has been dictated by the sample data, whereas the choice of the explanatory variables has been guided by the existing literature (e.g., see Rajan and Zingales, 1995; Flannery and Rangan, 2006; Driffield and Pal 2008). We obtain two sets of estimates, using debt ratio (TDTA) and liability ratio (TLTA) as two possible indices.[4] Appendix Table A1 shows the panel data fixed effects estimates debt and liability ratios corresponding to equation (1).

[3] Later in the paper, we endogenously determine the optimal leverage, using threshold model.
[4] We also used alternative leverage indices as discussed in section 2.1; we find that these alternative estimates are rather similar to the ones shown in Table A1. These estimates would be available on request.

2.3. Deviation from optimal leverage

We use the predicted values of leverage ratios obtained from equation (1) estimates as the optimal target leverage L_{it}^{*} of the i-th firm in year t individually for each country. Estimation of the optimal leverage L_{it}^{*} allows us to compute the deviation of the actual from the optimal capital structure as $(L_{it}-L_{it}^{*})$. In order to understand the pattern of imbalance in corporate leverage, we classify firms into three categories: (a) firms with leverage deficit, i.e., when actual debt or liability ratio is less than their corresponding optimal; (b) firms with moderate excess leverage, i.e., when actual debt or liability ratio exceeds the optimal, but the excess is less than one and (c) firms with high excessive leverage gap, i.e., when gap is greater than one. This is summarized in Table 4. Note that the figures for the debt gaps correspond to firms with some positive debt only. Clearly most firms in the sample countries are in category (a) or (b); in particular, excess leverage tends to be less than 1 in most countries in our sample, most notable exception in this respect being Russia, where all cases of excess leverage are in category (c). Clearly the transition experience contrasts much of the existing capital structure literature for the developed countries (e.g., see Driffield and Pal, 2009).

It is also interesting to compare the frequency of firms with excess leverage in the sample CEE countries with those available for the East Asian Economies, as summarized in the Appendix Table A2. About half of the countries studied, including Serbia, Poland, Ukraine, Hungary, Bulgaria and Latvia, tend to have similar percentages of firms with excess leverage as found for the firms in the worst affected east Asian countries. In fact, relevant figures for all the CEE sample countries are higher than those for the least affected east Asian countries studied by Driffield and Pal (2009). The latter in turn raises concern for the health of the capital structure among firms in transition countries.

Persistence of deviation from the optimal leverage highlights the importance of capital market imperfections, which may prevent an instantaneous adjustment of the actual leverage to the desired level (for example, see Fisher Heinkel and Zechner, 1989; Goldstein, Ju and Leland, 2001; Strebulaev, 2007). While much of the transition literature focuses on firm-level characteristics in understanding capital structure dynamics, following Driffield and Pal (2009) we argue that persistence of leverage imbalance could be a sign of regulatory weaknesses in issuing debt as well as those in debt

management and recovery. Even allowing for the fact that a high proportion of firms in the sample countries do not have any bank loans, it is perhaps surprising to find that the probability of having excess leverage among non-zero debt firms in many CEE countries is comparable to those in the worst affected countries in East Asia. Accordingly, the next sub-section explores the role of possible firm and country-level institutional variables explaining the capital structure imbalance and total factor productivity in the sample countries.

2.4. Factors influencing excess leverage

Given that excess leverage is common among firms in CEE transition countries, especially among those with access to bank finance, this section focuses on identifying the factors determining the deviation of actual leverage from the corresponding optimal among sample firms. In doing so, we pool firm-level data for all countries over the period 2001-2005; choice of this sample period is dictated by the availability of country-level institutional variables from Financial Services Development Indicators (FSDI). To this end, we construct the following binary variable:

$EXCESS_{it}$ = 1 if the i-th firm has excess leverage (wrt to its own optimum) in year t.

= 0 if the i-th firm has leverage deficit in year t (no firm has optimal leverage in our sample)

Depending on the alternative measures of leverage, we generate two variables, namely, excess debt ratio (EXCESSTD) and excess liability ratio (EXCESSTL).

Table 5 summarises the mean values of size, age, intangible assets, ownership, growth of total assets, earnings and total factor productivity of two groups of firms, classified by excess debt ratio. In general, foreign firms and younger firms established after 1995 are significantly more likely to have excess leverage. However mean difference in intangible assets is not very significant. In addition, we compare country-level institutional characteristics for these two groups of sample firms. The latter highlights that sample firms are more likely to have excess leverage if they come from countries with lower bank efficiency, lower market capital (relative to GDP), higher inflation and also lower degree of market reform.

Unlike many previous studies, we include both firm and country-level (institutional and macroeconomic) factors. Among the

firm-level characteristics, we include ownership (foreign), size (SME), age (Young), share of intangible to total assets (IFATA) and profitability (EBIT as a share of total assets). In addition, we include two institutional variables, namely, the efficiency of the banking sector (BANKEFF) and also the ratio of market capitalization to GDP (MKTGDP). Tables 6 shows the conditional fixed effects (country-level) logit estimates of excess debt (EXCESSTD) and excess liability (EXCESSTL) ratios. Naturally, the time invariant variables are dropped from the logit fixed effects estimates. Two sets of estimates are shown here and these estimates correspond to the choice of sample: (a) all firms and (b) non-zero debt firms.

Among various firm-specific factors, SMEs are less likely while foreign firms are more likely to have excess leverage. Share of intangibles is not very significant while profitability (EBITTA) in general tends to have a positive effect on the probability of having excess liability, though the latter effect is not significant for having excess debt ratio. Among the institutional factors, stock market capitalization rate is particularly important; greater market capitalization rate is generally associated with lower probability of having excess leverage. This is because greater degree of market

capitalization not only offers an alternative source of external finance, but is also associated with better corporate governance. The effect of bank efficiency is negative when leverage is defined as liability ratio; however the coefficient is not significant. In other words, favourable effect of market capitalization on the likelihood of having excess leverage is highly pronounced while that of increased bank efficiency is not.

3. Implications of Excess Leverage for TFP Growth

We now move on to analyse the central objective of this paper, that is, to examine the effect of leverage on TFP growth. Our central hypothesis is that moderate level of debt can stimulate TFP growth, while too much debt can impede it, e.g., through creating excess capacity and vulnerability of firms to unexpected adverse demand shocks. We apply both conventional method as well as an endogenous threshold method to test this hypothesis.

This exercise necessitates us to construct a measure of total factor productivity (TFP). As explained in Appendix 2, our preferred measure of TFP residuals (expressed in logs) is the one obtained by using Levinsohn-Petrin method (TFP_LP). Given that we could only

find industry-level price deflators for 9 out of 12 of the sample countries, this TFP measure could be constructed for these 9 countries only, thus excluding firms from Croatia, Romania and Serbia from our original sample analysed in section 2.

Since total factor productivity is expressed in logarithm, growth of total factor productivity could be written as $\ln(TFP_{it+1}) - \ln(TFP_{it})$, which is alternatively expressed as ΔTFP. Figure 2 plots TFP growth for these nine countries during 2001-2005.

3.1. Leverage effect on TFP growth: A conventional approach

In this section we determine TFP growth in the sample countries. Our central variables of interest are two binary variables: (i) if firms have moderate excess leverage $L\text{-}L^{*}<=1$; in this respect we generate tlta_moderate and tdta_moderate respectively using liability and debt ratios; (ii) if a firm has excessive excess leverage, i.e., when the excess leverage $L\text{-}L^{*}>1$; the corresponding variables are tlta_high and tdta_high respectively for liability and debt ratios. Accordingly, we estimate the following fixed effects equation determining productivity growth:

$$\Delta TFP = \beta_0 + \beta_1 (L\text{-}L^{*}<=1) + \beta_2 (L\text{-}L^{*}>1) + \beta_3 X_{it-1} + \alpha_i + u_{it} \qquad (2)$$

We expect that $\beta_1 \neq \beta_2$ which is tested below.

Table 7 shows the panel data fixed effects estimates of TFP growth for all firms and also for non-zero debt firms, distinguishing between moderate and high leverage firms using conventional measure of optimal leverage (measured by fitted value of leverage, see sections 2.2 and 2.3). In order to minimize the potential bias arising from endogeniety, we use one period lagged values of various control variables. These include initial TFP, firm size, age, intangible assets (as a share of total assets), industry control, country-level bank efficiency and market capital as a share of GDP. After controlling for all other factors, coefficient estimates of moderate leverage turn out to be insignificant while those for excess leverage are significantly negative for all firms as well as for non-zero-debt firms. In other words, other things remaining unchanged, excessive leverage tend to exert a negative effect on TFP growth in the sample countries.

3.2. Leverage effect on TFP growth: An Endogenous Threshold Model

Conventional estimates shown in section 3.1 cannot however identify

a threshold level of leverage beyond which excessive leverage could lower TFP growth. Hence, we apply Hansen's (2000) threshold regression technique to assess the effect of leverage on total factor productivity TFP. [5] The threshold model is particularly relevant to test our central hypothesis, as it endogenously determines the existence and significance of one or more leverage thresholds (and the corresponding confidence intervals), which in turn allows us to assess the growth effects of leverage as a nonlinear process. Depending on whether the leverage is less than, equal to or greater than the threshold, we could obtain marginal effects associated with different bands of leverage in the model and also test whether the marginal effects are significantly different.

Let us start with the simplest threshold model for total factor productivity growth as follows:

$$\Delta TFP = \alpha_1 D_{it} + \beta' X_{it} + \nu_{it} \text{ if } D_{it} \leq \gamma \quad (3a)$$

$$\Delta TFP = \alpha_2 D_{it} + \beta' X_{it-1} + \nu_{it} \text{ if } D_{it} > \gamma \quad (3b)$$

Combining (3a) and (3b), we could write:

$$\Delta TFP = \beta' X_{it-1} + \alpha_1 D_{it} I(D_{it} \leq \gamma) + \alpha_2 D_{it} I(D_{it} > \gamma) + \nu_{it} \quad (4)$$

where D_{it} is the initial value of capital structure (defined as debt or

[5] This procedure is explained in detail in Henry et al. (2003) and Girma (2005).

liability ratio). I(.) represents an indicator function, indicating whether the capital structure (alternatively labeled as leverage) of the i-th firm at time t is less than, equal to, or greater than a threshold parameter γ; γ is the endogenous threshold value to be estimated from the model (please see discussion in section below). The errors v_{it} are assumed to be independent and identically distributed with mean zero and finite variance. Depending on whether the actual leverage is smaller/equal to or larger than the threshold value (γ) to be estimated, observations are divided into two "regimes" where the regimes are distinguished by differing regression slopes, α_1 and α_2.

Let $S_n(\beta,\alpha(\gamma))$ represent the sum of squared errors for equation (3), where n is the sample size. Given that α parameters depend on the threshold parameters γ, we denote this by $\alpha(\gamma)$). Because of this dependence, S(.) is not linear in the parameters but rather a step function where steps appear at some distinct values of the threshold variable γ. But conditional on a given threshold value, say $\gamma = \gamma_o$, S(.) is linear in β and α. Accordingly, $S(\beta,\alpha(\gamma_o))$ can be minimised to yield the conditional OLS estimates $\hat{\beta}(\gamma_o)$ and $\hat{\alpha}(\gamma_o)$. Among all possible leverage values, the estimate of the threshold corresponds to that value of α, which minimises the sum of squared errors $S(\beta,\alpha(\gamma_o))$ for

given $\gamma = \gamma_0$. Following Girma (2005), this minimisation problem is solved by a grid search over 393 leverage quantiles {1.00%, 1.25%, 1.50%, … , 98.75%, 99%}. Once the sample splitting value of γ is identified, the estimates of the slope parameters are readily available.

If a threshold effect is identified, i.e.., $\alpha_1 \neq \alpha_2$, it is important to form a confidence interval for the particular threshold value γ in this context. This necessitates us to test the following null hypothesis

$$Ho : \gamma = \gamma_0$$

Under normality, the likelihood ratio (LR) test statistic is routinely used in standard econometric applications to test for particular parametric values. But Hansen (2000) shows that LRn(γ) does not have a standard chi-square distribution in the threshold model; the correct distribution function and the appropriate asymptotic critical values in this needs to be obtained from the bootstrapped standard errors (see Girma 2005 for further details).

Suppose the two confidence limits of the threshold γ are given respectively by γ_1 (lower) and γ_2 (upper). This allows us to define three sets of leverage variables as follows. Using two alternative measures of initial leverage, namely debt ratio (TDTA) and liability ratio (TLTA), we generate tdta- (i.e., tdta$\leq \gamma_1$), tdta= (i.e.,

γ_1<tdta≤γ_2) and tdta+ (i.e., tdta> γ_2); similarly using the liability ratio, we generate tlta- (i.e., tlta≤γ_1), tlta= (i.e., γ_1<tlta≤γ_2) and tltahi (i.e., tlta>γ_2). Accordingly, equation (4) is modified as follows:

$$\Delta TFP = \alpha_1 D_{it} I(D_{it} \leq \gamma 1) + \alpha_2 D_{it} I(\gamma_1 < D_{it} \leq \gamma_2) + \alpha_3 D_{it} I(D_{it} > \gamma_2) + \beta' X_{it-1} + \nu_{it} \quad (5)$$

In addition to different bands of leverage as shown in equation (5), we include initial values of a number of other control variables X_{it-1}, namely, firm size (SME), age (Young), share of intangible assets (IFATA), ownership (foreign) and also some institutional characteristics, namely, efficiency of the banking sector and also the extent of market capitalization rate (as a share of country's GDP). X_{it-1} also includes the initial value of TFP as a control variable; significance of initial TFP will highlight the importance of Barro's conditional convergence hypothesis.

The final step in this estimation strategy is to establish the asymptotic distribution of the slope coefficients. Although these parameters depend on the estimated threshold limits γ_1 and γ_2, Hansen (2000) demonstrates that this dependence is not of first-order asymptotic importance. Consequently, the usual distribution

theory (i.e. asymptotically normal) can be applied to the estimated slope coefficients so that one could use the asymptotic p-values to test whether there is a significant threshold effect, i.e., if $\alpha_1 = \alpha_2 = \alpha_3 = 0$; rejection of the null hypothesis would confirm the presence of a significant threshold effect.

3.3. Threshold estimates

Threshold estimates for TFP growth are summarised in Table 8 and Table 9 respectively for all firms and non-zero debt firms respectively. We first estimate the 95% confidence interval for the threshold parameter γ. The confidence interval varies somewhat for debt and liability ratio while they tend to be robust irrespective of the choice of the sample (all firms as well as non-zero debt firms).

There is no evidence of convergence in our sample, while all three leverage terms relating to different bands of the leverage thresholds are statistically significant; this holds irrespective of the choice of the leverage measure, debt or liability ratio. There is evidence that after controlling for all other factors, moderate leverage (leverage$\leq \gamma_2$) could boost TFP growth, while excessive leverage (leverage$> \gamma_2$) lowers it. It is also evident that the marginal effect of

increase in leverage is significantly different for different bands of leverage and it decreases as we move from the lower leverage band to the higher one. In particular, these estimates suggest that a debt or liability ratio of around 40% or higher would lower TFP growth in our sample. In addition to estimate the model for the pooled data, we also estimate the threshold for individual countries, especially when we have sufficient observations. These enable us to obtain country-specific estimates for six of the nine countries. We do not show the full sets of estimates for brevity, but they are available on request. While there is significant inter-country variation in threshold estimates (see Appendix Table A3), central results remain unchanged: moderate leverage continues to be associated with positive TFP growth while high leverage with negative TFP growth; other results are similar too.

Among other results, role of institutional factors are worth highlighting here. In particular, greater efficiency of the banking sector and greater degree of market capitalization are both associated with greater TFP growth, thus confirming the role of institutions in long-run economic growth. The effect of intangible assets however turns out to be negative. While often intangible assets are taken to be

a measure of R&D, it also includes overvalued goodwill and patents (which may correspond to the expected future value of intangible assets). Thus it is not unusual for intangible assets to have a negative effect on TFP growth.

The upshot of our analysis is that unlike the conventional analysis, one is able to endogenously determine the 95% confidence interval for the leverage threshold γ. This in turn allows us to test for the non-linearity in the relationship between leverage and TFP growth. While moderate leverage could boost TFP growth, excessive leverage beyond the upper threshold limit would significantly lower TFP growth. This is a significant finding, especially in an economic climate where excessive corporate leverage has been blamed for the current credit crunch. Our analysis allows the data to identify the safe threshold limit of leverage for the sample countries, which could guarantee significantly positive TFP growth.

3.4. Implications for profitable firms

Given the possibility of reverse causation that more efficient firms may choose lower equity ratios (i.e., higher debt) than others, it is also important to test the robustness of our estimates for more/less

efficient firms. In the absence of any better indicator, we consider profitability as an index of efficiency and classify firms according to (a) profit margin and (b) return on capital. In the light of our sample distribution, we consider two benchmark values for (a) and (b): (1) whether the firm has positive profit or rate of return on capital (ROCE) and (2) whether the firm has profit margin or ROCE in excess of the median values (which are about 0.04 for both these variables in our sample). Threshold estimates for non-zero debt firms for profitable and other firms are shown in Table 10. Naturally, the estimated threshold parameters are somewhat different, but they are well in line with the previous estimates for the pooled sample. As before, these estimates confirm the significant adverse effect of excessive leverage (beyond the upper threshold) on TFP growth in our sample. The contrast between profitable and other firms is also interesting. Clearly, the upper threshold value of leverage is higher for more profitable firms. Second, marginal adverse effects of excess leverage on TFP growth is also different between these two groups of firms; relative to all non-zero debt firms, the absolute marginal effect of excessive leverage (beyond the upper threshold) is significantly higher for loss-making firms.

3.5. Inter-country distribution of firms with excess leverage

Finally, we use the leverage threshold estimates to calculate the percentage of firms above the upper threshold for each sample country. In this respect, we particularly focus on non-zero debt firms, distinguishing profitable firms from others. Results of our analysis are summarized in Table 11. Clearly, a significant proportion of all non-zero firms in many sample countries tend to have debt ratio in excess of the upper threshold limits; the proportion is significantly less when we consider more profitable non-zero debt firms in our sample. Furthermore, excess leverage is also common among loss-making firms in most sample countries, with the exception of Slovenia. This is further highlighted in the pronounced inter-country variation: the proportion of firms with excessive leverage is zero in Slovenia while it is the highest in Russia. Results from our analysis thus highlight the aspects of inefficient allocation of credit and also its adverse effects on TFP growth, especially among loss-making firms.

4. Conclusions

The sizeable literature on capital structure and its dynamics in developed countries identifies the possible factors causing under-levering of firms and ways to adjust it. It is however common among firms in many developing and transition economies to maintain excess leverage; but we know very little about the nature and implications of excess leverage for TFP growth. This paper is an attempt to bridge this gap in the literature.

The paper argues that excess leverage is non-linearly linked to productivity growth: moderate leverage could boost growth while excessive leverage exerts an adverse effect on growth. Our analysis using Orbis firm level data not only makes use of the conventional analysis of determining excess leverage in terms of an optimal derived from the fitted value of leverage, but also applies threshold model (a la Hansen, 2000) to endogenously determine the presence and significance of threshold effects of leverage on TFP growth. While moderate level of leverage could boost TFP growth, there is evidence from our analysis that too high leverage (beyond an endogenously determined upper threshold limit) could adversely affect it. These results hold for all firms including more profitable firms, while the

adverse effects of excessive leverage are particularly high for loss-making firms. Controlling for other factors, there is also evidence that greater bank efficiency and market capitalization could limit excess leverage and could thus help attaining positive TFP growth effects. We also identify significant inter-country variation in the threshold effects of leverage, which, we argue, could to some extent be attributed to institutional variation in these countries.

Clearly these results highlight the aspects of microeconomic inefficiencies in credit allocation among firms in selected transition countries, especially in countries with low bank efficiency and market capitalisation. While it is essential for firms to deleverage under the circumstances, one also needs to be cautious so that 'virtuous' firms are not starved of essential credit.

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Table 1: Cross-country variation in leverages 2001-2005

				All firms						Non-zero debt firms		
			Zero debt firms ([1])	TLTA		TDTA		Net TDTA		TLTA	TDTA	Net TDTA
Country	Firms	Total Obs.	Share (%)	Mean	SD	Mean	SD	Mean	SD	Mean	Mean	Mean
Bulgaria	207	1035	18.2 (17.7)	0.59	0.94	0.18	0.33	0.53	0.80	0.62	0.64	0.19
Croatia	129	645	7.3 (86.7)	0.39	0.22	0.06	0.13	0.34	0.27	0.37	0.07	0.10
Czech	68	340	12.6 (28.8)	0.52	0.66	0.19	0.32	0.45	0.77	0.58	0.59	0.14
Hungary	22	110	16.4 (43.6)	0.40	0.21	0.09	0.12	0.33	0.33	0.43	0.40	0.06
Latvia	26	130	10.8 (31.5)	0.49	0.53	0.18	0.20	0.33	0.21	0.55	0.58	0.08
Poland	162	810	25.3 (39.1)	0.53	0.35	0.10	0.13	0.44	0.28	0.56	0.36	0.07
Romania	51	255	78.4 (6.3)	0.45	0.32	0.02	0.06	0.40	0.31	0.47	0.15	0.04
Russia	415	2075	11.6 (31.6)	0.42	0.26	0.13	0.15	0.07	0.20	0.69	0.57	0.03
Serbia	289	1445	13.7 (2.5)	0.37	0.23	0.12	0.15	0.31	0.30	0.39	0.84	0.08
Slovakia	119	595	6.9 (20.0)	0.60	1.57	0.12	0.13	0.56	1.57	0.59	0.73	0.085
Slovenia	65	325	0.9 (90.8)	0.34	0.17	0.07	0.06	0.24	0.18	0.40	0.08	0.03
Ukraine	159	795	17.4 (1.1)	0.42	0.26	0.13	0.16	0.36	0.31	0.45	0.82	0.10

Note: TL/TA is the total liability as a share of total assets while TD/TA is total debt (both short and long-run) to total assets. Net TL/TA and net TD/TA are obtained by netting out the cash flows.

[1] Number in the parentheses shows the proportion of firms for which no information on total debt was available.

Table 2: Distribution of debt and equity, 2001-2005

Country	Proportion of all firms with: Only debt	Only equity	Both debt and equity	Proportion of all firms: Debt>0	Equity>0	Debt-equity ratio Non-zero debt firms Mean (sd)
Bulgaria	0	0.16	0.58	0.64	0.75	0.23 (2.7)
Croatia	0.01	0.07	0.62	0.07	0.94	0.08 (0.14)
Czech Republic	0	0.12	0.55	0.59	0.67	0.19 (0.60)
Hungary	0	0.16	0.38	0.40	0.64	0.11 (0.40)
Latvia	0	0.11	0.56	0.58	0.50	0.72 (1.93)
Poland	0	0.24	0.35	0.36	0.78	0.42 (1.52)
Romania	0	0.75	0.15	0.15	0.91	0.54 (0.37)
Russia	0	0.11	0.53	0.57	0.67	0.28 (6.9)
Serbia	0.01	0.14	0.83	0.84	0.96	0.45 (2.6)
Slovakia	0	0.07	0.71	0.73	0.78	0.32 (1.8)
Slovenia	0	0.09	0.08	0.08	0.93	0.14 (0.13)
Ukraine	0	0.17	0.80	0.82	0.97	0.53 (3.2)

Source: Authors' own calculation using Orbis data.

Table 3. Institutional environment in CEE countries 2001-2005

COUNTRY	[1] Size of the banking sector	[1] Efficiency of the banking sector	[1] Stability of the banking sector	[1] EQT Efficiency	[3] Market capital to GDP	[2] Creditors' rights	[3] Share of foreign banks	[3] Bank reform	[3] Competition reform
Bulgaria	4.84	5.51	4.64	6.68	8.74	2.00	77.34	3.40	2.38
Croatia	5.76	4.89	4.42	NA	23.69	3.00	89.64	3.74	2.30
Czech Republic	5.35	4.72	5.01	3.55	22.69	3.00	86.10	3.76	2.94
Hungary	5.21	5.37	4.70	4.23	23.51	1.00	76.12	4.00	3.12
Latvia	4.71	5.34	3.47	4.78	10.38	3.00	53.50	3.62	2.60
Poland	5.07	5.67	5.04	5.03	20.77	1.00	72.00	3.38	3.06
Romania	3.95	4.23	4.69	3.85	11.03	1.67	55.36	2.82	2.30
Russian Federation	4.5	5.04	4.82	3.00	46.59	1.67	8.04	2.00	2.30
Serbia	NA	4.51	NA	NA	10.17	2.00	36.46	2.12	1.00
Slovakia	5.52	4.76	6.07	NA	7.84	2.00	90.54	3.46	3.12
Slovenia	5.43	5.09	3.77	4.55	23.38	3.00	18.74	3.30	2.70
Ukraine	4.49	4.68	2.05	NA	12.12	2.00	2.30	13.98	3.32

[1]: Source: FSDI, World Bank. [2] Source: La Porta et al. [3] Source EBRD.

Table 4: Distribution of leverage gap in the sample countries

Country	Leverage deficit L-L*<0		Moderate excess leverage 0<=L-L*<=1		High excess leverage L-L*>1	
	Debt ratio	Liability ratio	Debt ratio	Liability ratio	Debt ratio	Liability ratio
Bulgaria	54	58.8	44.5	38.7	1.5	2.5
Croatia	20	38.6	80	54.3	0	7.1
Czech Republic	61.9	63.9	35.4	34.6	2.8	1.4
Hungary	48.6	37.5	51.4	62.5	0	0
Latvia	52.5	25.8	47.5	72.7	0	1.5
Poland	38.4	43.1	61.6	56.3	0	0.6
Romania	81.8	57.4	18.2	41.2	0	1.2
Rusia	49.8	56.3	0	0.3	50.2	43.4
Serbia	58.4	47.7	41.6	52.3	0	0
Slovakia	36	53.0	64	46.8	0	0.3
Slovenia	46.8	34.0	53.2	61.0	0	5.0
Ukraine	55.4	56.8	44.6	43.2	0	11.4

Note: Each cell denotes the percentage of total sample firms in the country. Figures corresponding to debt ratio gap refer to firms with non-zero debt.

Table 5. Mean comparison of selected characteristics of firms with/without excess debt ratio 2001-2005

	Excess leverage (debt ratio) of non-zero debt firms		
	$L-L^*>0$	**$L-L^*<0$**	**T-stat**
SME	0.43	0.48	-3.731**
Young	0.40	0.29	7.333**
Foreign	0.32	0.25	5.623**
Intangible assets (as a share of total assets)	0.008	0.0095	-1.708
Profitability growth EBITTA	2.6	3.2	-1.172
Growth of total assets	1	2.8	-1.910*
Efficiency of the banking sector	4.9	4.94	-1.768*
Market capitalization	20.8	22.2	-2.518*
Inflation rate	14.8	13.4	2.571*
Index of market competition	2	2.2	-6.499**

Note: There are no firms where actual leverage is equal to the optimal leverage.

Table 6. Conditional Fixed Effects Logit Estimates of Excess Leverage

	All firms				Nonzero debt firms			
	Excesstl		**Excesstd**		**Excesstl**		**Excesstd**	
Variables	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
sme	-0.541*	-1.87	-0.982*	-2.52	-0.367	-1.04	-1.067*	-2.49
young	-0.194	-0.7	-0.115	-0.43	0.0416	0.12	-0.043	-0.15
ifata	5.318	1.27	3.90	1.02	4.504	1.02	5.17	1.04
ebitta	3.983**	4.7	0.264	0.47	4.27**	4.01	0.478	0.81
bankingeff	-0.0308	-0.16	0.060	0.32	-0.146	-0.65	0.402	1.3
Mktcap_GDP	-0.0205**	-2.62	-0.017*	-1.85	-0.023*	-2.52	-0.0237*	-2.02
Log likelihood	-441.132		-431.68		-328.661		-328.781	
LR chi2(6)	40(0)		13.076(0.03)		28.51(0)		15.14(0.02)	
Nobs	4595		4595		3743		3743	

Note: * denotes significance at 10% or lower level while '**' denotes the same at 1% or lower level.

Excesstl, excesstd=1 if the firm has excess leverage (liability and debt ratio respectively) and 0 if deficit leverage.

Table 7. Fixed effects estimates of TFP growth – conventional method

	All firms		Firms with debt>0			All firms		Firms with debt>0	
Variable	Coef.	t	Coef.	t	**Variable**	Coef.	t	Coef.	t
Initial TFP	-0.88	-27.38**	-0.85	-26.3**	**Initial TFP**	-0.91	28.65**	-0.86	-26.5**
sme	0.119	1.43	0.154	1.7	**sme**	0.121	1.44	0.1509	1.67
foreign	(dropped)		(dropped)		**foreign**	(dropped)		(dropped)	
young	-0.0978	-1.4	-0.131	-1.84*	**young**	-0.076	-1.09	-0.129	-1.83*
intangibles	-1.0588	-1.09	-0.765	-0.8	**intangibles**	-0.978	-1	-0.772	-0.81
tlta_moderate	0.0498	0.62	-0.1023	-1.2	**tdta_moderate**	-0.248	-1.56	-0.219	-1.43
tlta_high	-0.432	-3.5**	-0.186	-1.54	**tdta_high**	-0.366	-1.88*	-0.361	-1.97*
bankingeff	0.044332	0.62	0.0198	0.27	**bankingeff**	0.0561	0.78	0.0194	0.26
Mktcap_gdp	-0.00256	-0.73	-0.002	-0.55	**mktcaptogdp**	-0.003	-0.72	-0.00185	-0.47
Intercept	-0.14	-0.41	0.0245	0.07	**Intercept**	-0.183	-0.53	0.0167	0.05
rho	0.417		0.4083		**rho**	0.3495		0.386	
R-sq	0.0228		0.0317		**R-sq**	0.018		0.0154	
F-stat	2.78		1.63		**F-stat**	1.82		1.83	
Nobs	1243		1062		**Nobs**	1243		1062	

Note: Note: * denotes significance at 10% or lower level while '**' denotes the same at 1% or lower level.

Table 8. Estimates of TFP growth (all firms) - Panel threshold model

Variable	(1) Coefficient	t-statistic	Variable	(2) Coefficient	t-statistic
TFP_INI	0.126699	0.959595	**TFP_INI**	0.127223	0.960581
TDTA>0.404	-0.024226	-3.21458**	**TLTA>0.412**	-0.204268	-2.40342**
0.322<TDTA<0.404	0.089215	2.930289**	**0.348<TLTA<0.412**	0.058413	1.915012*
TDTA<0.322	0.350741	1.82689*	**TLTA<0.348**	0.394431	2.36437**
SME	0.143156	2.77914**	**SME**	0.147616	2.88400**
YOUNG	-3.34E-03	-0.077172	**YOUNG**	-6.97E-03	-0.161321
FOREIGN	0.280277	1.38231	**FOREIGN**	0.295057	1.45004*
IFATA	-2.26983	-3.71606**	**IFATA**	-2.1469	-3.52047**
BANKEFF	0.095357	2.57299**	**BANKEFF**	0.092482	2.49775**
MKTCAP_GDP	0.010349	4.02834**	**MKT_GDP**	0.010322	4.01593**
Intercept	0.449349	1.60934*	**Intercept**	0.365951	1.29955
Sector	Yes		**Sector**	Yes	
R-square	0.042		**R-square**	0.039	
95% CI for γ	0.322-0.404		**95% CI for γ**	0.348-0.412	

Note: * denotes significance at 10% or lower level while '**' denotes the same at 1% or lower level.

These estimates are based on data from 9 of the sample countries and exclude firms from Croatia, Romania and Serbia. This is because we could not find industry-level deflators for these countries and hence we could not calculate the TFP residuals.

Table 9. Estimates of TFP growth (non-zero debt firms) - Panel threshold model

Variable	(1) Coefficient	t-statistic	**Variable**	(2) Coefficient	t-statistic
TFP_INI	0.155852	1.06343	**TFP_INI**	0.168956	1.14858
TDTA>0.399	-0.438213	-4.22543**	**TLTA>0.406**	-0.279262	-5.21194**
0.318<TDTA<0.399	0.088776	2.468972**	**0.354<TLTA<0.406**	0.084452	2.62755**
TDTA<0.318	0.23567	3.118497**	**TLTA<0.406**	0.585551	4.25187**
SME	0.203393	3.64635**	**SME**	0.202249	3.67908**
YOUNG	-0.02566	-0.577607	**YOUNG**	-0.017047	-0.387835
FOREIGN	0.421101	1.96136**	**FOREIGN**	0.437864	2.03162**
IFATA	-1.79247	-2.86757**	**IFATA**	-1.6335	-2.64248**
BANKEFF	0.074301	1.87058*	**BANKEFF**	0.070297	1.79326*
MKTCAP_GDP	9.31E-03	3.35352**	**MKT_GDP**	9.87E-03	3.59513**
Intercept	0.409825	1.35935	**Intercept**	0.231641	0.766973
Sector	Yes		**Sector**	Yes	
R-square	0.054		**R-square**	**0.04**	
95% CI for γ2	0.318-0.399		**95% CI for γ2**	0.354-0.406	

Note: Note: * denotes significance at 10% or lower level while '**' denotes the same at 1% or lower level.

Table 10. Estimates of TFP growth for profitable and non-profitable firms with positive debt: Panel threshold model

	Firms with profit<0.04		Firms with profit >0.04		firms with ROCE<0.04		Firms with ROCE >0.04	
Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
TFP_INI	0.0271	0.1513	0.2294	1.3229	0.0135	0.0755	0.2279	1.3169
TDTA+	-0.5982	-3.0784**	-0.0227	-3.2838**	-0.7655	-4.187**	-0.1421	-3.1335**
TDTA=	0.5340	2.2141**	-0.0531	-1.5035	-0.0043	-0.0094	0.1067	2.5672**
TDTA-	0.2419	3.5171**	0.1596	2.1746	0.5536	2.0419**	0.2776	1.45586*
SME	0.11553	0.9091	0.1561	2.7733**	0.1223	2.9300**	0.1593	2.8338**
YOUNG	-0.2041	-1.7376*	0.0077	0.1814	-0.2084	-1.7157*	0.0076	0.1800
FOREIGN	0.1367	0.5405	0.6022	2.4505**	0.1272	0.5062	0.5997	2.4458**
IFATA	-0.2763	-0.1099	-1.5836	-3.00466**	0.0953	0.0373	-1.7853	-3.3797**
BANKEFF	0.2745	2.2474**	0.039713	1.1451	0.2648	2.0524**	0.0381	1.0977
MKTCAP_GDP	0.0097	1.0607	0.0088	3.56645**	0.00688	0.711086	0.0084	3.4425**
Sector	Yes		Yes		Yes		Yes	
Intercept	-0.4250	-0.7062	0.5280	1.5874*	-0.2747	-0.4455	0.5668	1.7083*
R-square	0.078		0.063		0.048		0.068	
threshold	0.224		0.577		0.425		0.522	
threshold range	0.187-0.301		0.509-0.624		0.354-0.496		0.453-0.616	

Note: These estimates use effects of debt ratio on TFP growth**.** * denotes significance at 10% or lower level while '**' denotes the same at 1% or lower level.

Table 11. Percentage distribution of indebted firms with excess leverage

Country	All non-zero debt firms Debt ratio γ_2> 0.399	Profitable non-zero debt firms Debt ratio γ_2> 0.577	Loss making non-zero debt firms debt ratio γ_2>0.301
Bulgaria	0.1657	0.0226	0.0798
Czech Republic	0.1055	0.0101	0.0503
Hungary	0.0455	0.0000	0.0227
Latvia	0.1733	0.0133	0.0533
Poland	0.0625	0.0069	0.0104
Russian Federation	0.1959	0.0348	0.0365
Slovakia	0.0322	0.0092	0.0115
Slovenia	0.00	0.0000	0.000
Ukraine	0.0864	0.0108	0.0278

Note: These estimates make use of the threshold parameters obtained in Tables 9-10.

Figure 1. Growth of domestic credit in the CEE region

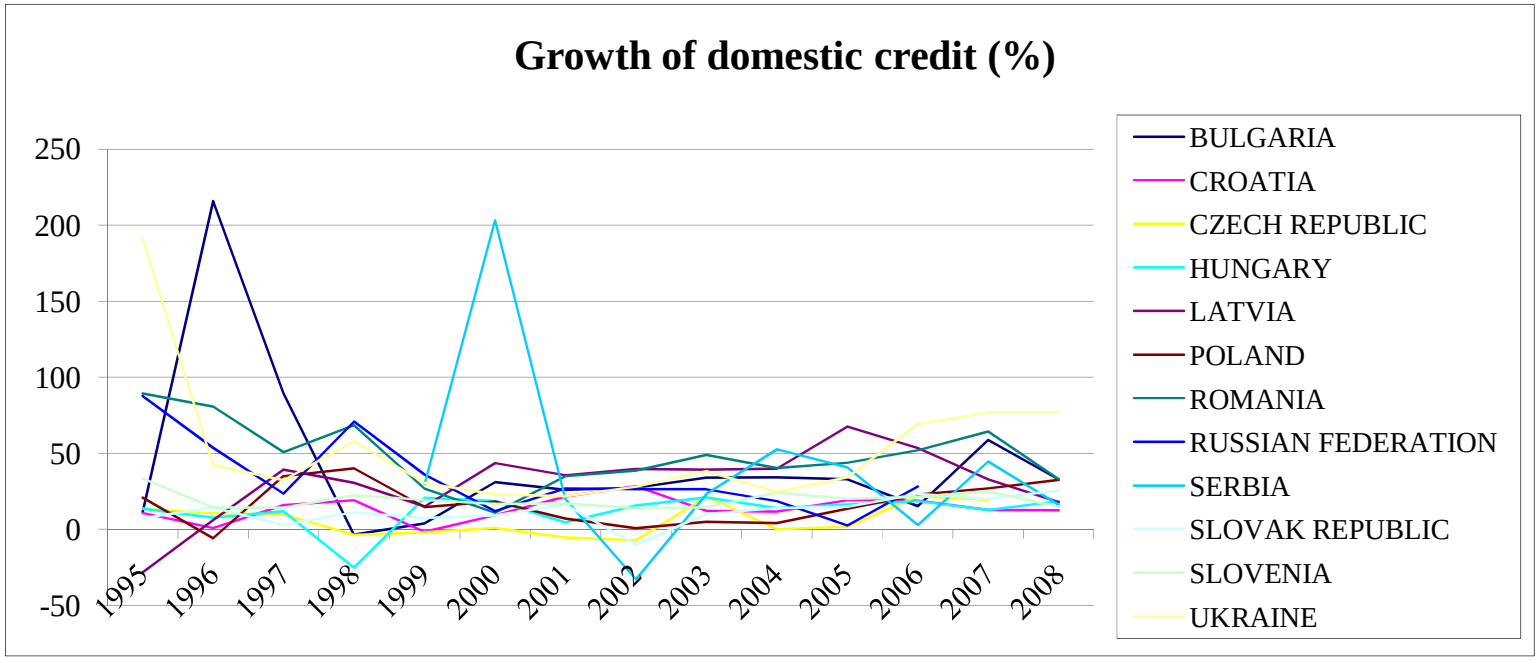
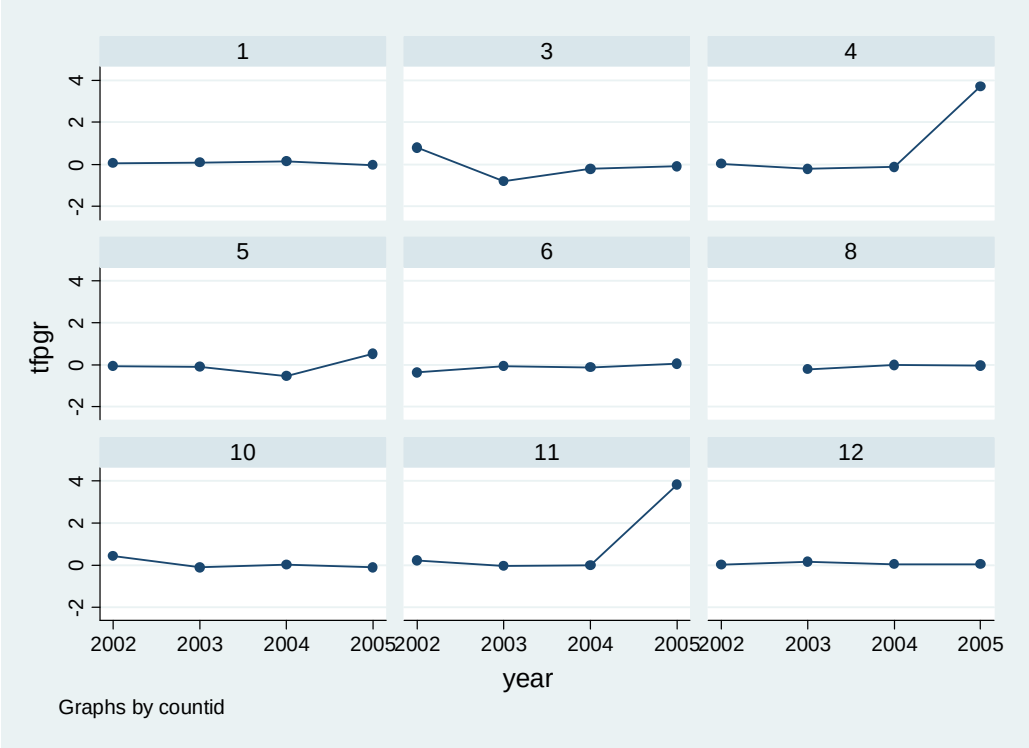


Figure 2. Distribution of TFP growth in sample countries



Note: List of countries: 1: Bulgaria; 3: Czech Republic; 4: Hungary; 5: Latvia; 6: Poland; 8: Russia; 10: Slovakia; 11: Slovenia; 12: Ukraine.

Appendix 1

Table A1. First-stage fixed effects estimates – liability ratio (P-values in parentheses) 1996-2005

	SME Dummy	Intangible to total assets (lagged)	EBIT to total assets (lagged)	age	SME *age	Industry median TL/TA
Bulgaria	.01298	.3929	-.4048	-.0039	.0006	1.1586**
	(0.797)	(0.207)	(0.125)	(0.552)	(0.353)	(0.010)
Croatia	-.0058	-.4093	-.19402**	.00521*	-.0004*	.8083**
	(0.667)	(0.303)	(0.008)	(0.060)	(0.034)	(0.000)
Czech Republic	-.0010	-2.0344**	-.1712*	-.0049	.01184	.9280**
	(0.969)	(0.000)	(0.100)	(0.573)	(0.128)	(0.000)
Hungary	-.01912	1.0065*	.1915	.0038	-.0006	1.0443**
	(0.613)	(0.068)	(0.121)	(0.287)	(0.686)	(0.001)
Latvia	.08193	-.6646	-1.5797**	.02769*	.0009	.3357
	(0.258)	(0.646)	(0.000)	(0.056)	(0.451)	(0.218)
Poland	.01975	.4956	-.2684*	.0065	.0001	.9031*
	(0.674)	(0.331)	(0.074)	(0.110)	(0.771)	(0.072)
Romania	-.00131	1.7285*	-.4209*	-.0069	.00012	.8944*
	(0.967)	(0.090)	(0.028)	(0.552)	(0.803)	(0.089)
Russia	0.1102 **	0.909	-0.802**	0.0005	-0.0001	.5686**
	(0.042)	(0.958)	(0.089)	(0.0005)	(0.0006)	(0.106)
Serbia	.00268	-.3144	-.1327*	.0078*	.0009*	.7149**
	(0.893)	(0.125)	(0.024)	(0.023)	(0.041)	(0.000)
Slovakia	.00239	.1122	-.0065	.00382	-.0024	.9977**
	(0.930)	(0.573)	(0.633)	(0.297)	(0.396)	(0.000)
Slovenia	-.0484*	.02766	-.0684	.01247*	.00024*	.5403**
	(0.016)	(0.936)	(0.725)	(0.035)	(0.017)	(0.012)
Ukraine	-.05218*	-.3626	-.3716**	.01254**	-.0016	.6736**
	(0.031)	(0.271)	(0.005)	(0.009)	(0.600)	(0.000)

Note: Standard errors are shown in the parentheses. Level of significance: * - 10% or lower; **- 1% or lower.

Table A1. (Continued) First-stage fixed effects estimates – Debt ratio 1996-2005

	SME dummy	Intangible fixed assets to total assets (lagged 1 period)	EBIT to total assets (lagged 1 period)	age	Interaction SME dummy and age	Industry median TD/TA
Bulgaria	-.068955**	.08833	-.1065	.00378	.00033	.9319**
	(0.010)	(0.634)	(0.223)	(0.384)	(0.491)	(0.000)
Croatia	-.006294	-.01339	.005401	.00008	-.00011	.9275**
	(0.498)	(0.958)	(0.894)	(0.961)	(0.370)	(0.000)
Czech Republic	.00638	-1.1191**	-.09927	-.00022	.00829	.9337**
	(0.806)	(0.029)	(0.071)	(0.973)	(0.137)	(0.004)
Hungary	-.02799	-1.0176**	-.24796**	.00179	-.00028	.9180**
	(0.384)	(0.001)	(0.000)	(0.491)	(0.816)	(0.006)
Latvia	.001086	1.0451**	-.1633**	.00087	-.00043	.6067**
	(0.946)	(0.122)	(0.012)	(0.841)	(0.416)	(0.001)
Poland	.009351	.02242	-.01756	-.0004	.00015	.7602**
	(0.335)	(0.795)	(0.444)	(0.854)	(0.181)	(0.000)
Romania	-.01123	.5126**	-.04656	-.00616	.00008	.9633**
	(0.163)	(0.173)	(0.062)	(0.099)	(0.624)	(0.000)
Russia	0.1714**	1.48	-1.292**	-0.004	0.0001	0.3664**
	(0.0558)	(1.495)	(0.101)	(0.008)	(0.0007)	(0.1368)
Serbia	.00693	-.12781	.02372	.00427	.00015	.70913
	(0.610)	(0.113)	(0.536)	(0.051)**	(0.457)	(0.000)**
Slovakia	-.00935	-.02215	-.00614	.00122	-.00007	.8578**
	(0.467)	(0.894)	(0.247)	(0.614)	(0.967)	(0.000)
Slovenia	(dropped)	.08955	-.26525	.00279	(dropped)	.8814**
		(0.622)	(0.261)	(0.451)		(0.019)
Ukraine	-.01507	0.2509**	.00153	.0068	-.00296	.7322**
	(0.374)	(0.013)	(0.971)	(0.012)	(0.205)	(0.000)

Table A2. Incidence of Excess Leverage in East Asia 1995-2002

Countries	**% of firms with excess leverage i.e., TD/TA > own (TD/TA)***
Indonesia	43.6
Korea	42.3
Malaysia	42.5
Thailand	45
Mean for the worst affected countries	**43.4**
Hong Kong	19.5
Singapore	21
Taiwan	24.9
Mean for the least affected countries	**21.8**

Source: Driffield and Pal (2009). TDTA: Debt ratio.

Table A3. Inter-country variation in threshold estimates for debt ratio: selected estimates

	Debt ratio		Liability ratio	
	All firms	**Non-zero debt firms**	**All firms**	**Non-zero debt firms**
Bulgaria	0.354 (0.307, 0.387)	0.307 (0.288, 0.367)	0.354 (0.310, 0.366)	0.339 (0.269, 0.384)
Croatia				
Czech Republic				
Hungary				
Latvia				
Poland	0.409 (0.366, 0.437)	0.388 (0.344, 0.441)	0.399 (0.328, 0.451)	0.415 (0.377, 0.463)
Romania				
Russia	0.514 (0.439, 0.570)	0.529 (0.446, 0.604)	0.514 (0.491, 0.561)	0.547 (0.449, 0.674)
Serbia	0.288 (0.266, 0.344)	0.327 (0.276, 0.388)	0.347 (0.310, 0.397)	0.377 (0.354, 0.406)
Slovakia				
Slovenia				
Ukraine	0.461 (0.377, 0.503)	0.442 (0.394, 0.505)	0.439 (0.399, 0.488)	0.483 (0.450, 0.509)

Appendix 2

Calculation of TFP

The approach and methodology are well developed and adopted from the existing literature (see e.g., Griffith 1999). This essentially involves estimating the following basic production function:

$$y_{it} = \alpha_k k_{it} - \alpha_l l_{it} - \alpha_m m_{it} + \varepsilon_{it} \quad \text{(A1)}$$

where subscripts *i, t* refer to firm and year; y_{it}, k_{it}, l_{it}, and m_{it} represent the logarithm of a firm's output (sales) and the production inputs: capital (measured as the book value of fixed assets), labour (number of employees) and material costs respectively. We estimate ε_{it} from (1) as TFP and then determine the log(TFP). To deflate monetary values we use the appropriate producer price index for each manufacturing industry and consumer price index for services available from EU-KLMS (Gottingen) and also WWII (Vienna).

One of the most common econometric problems with the estimation of TFP concerns endogeneity, when regressors and the error terms become correlated. This is because at least a part of the TFP will be observed by the firm at a time early enough so as to allow the firm to change the factor input decision. If that is the case, then profit maximization implies that the realisation of the error term is expected to influence the decision on factor inputs. Consequently the OLS estimates could turn out to be inconsistent. As an alternative we use Levinsohn-Petrin correction, who extend Olley and Pakes (1996) approach by using material inputs as a proxy to control for unobservable productivity shocks, as it is more common for firms to register material costs every year. Accordingly, we generate two series TFP and TFP_LP using the standard and Levinsohn-Petrin methods respectively, although TFP_LP remains our preferred measure.