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THE IMPACT OF LOAN FINANCING ON SME'S FROM TRANSITIONAL COUNTRIES

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ABSTRACT

This study considers the impact of finance (loans) on the performance and productive efficiency of a sample of 8037 SMEs from transitional countries. An extensive macro-economic literature supports the importance of finance to growth. For this to be truly convincing it is necessary to show that firm performance is strengthened by loans. There are very few firm level studies of the linking loans and firm performance. This study extends the firm level literature using the 2013 BEEPS survey. It uses three different methodologies, all incorporating firm heterogeneity. Firstly, we use propensity score matching to test whether loans result in enhanced performance and finds that loans did indeed improve performance. Secondly, we re-enforce these conclusions using inverse probability weighted regression adjustment (IPWRA) analysis. Finally, we employ a stochastic frontier approach to (a) measure firm inefficiency and (b) to show that loans create a statistically significant reduction in this inefficiency.

Keywords: SMEs, finance, transition, efficiency.
JEL: L25, G21, P27

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1. INTRODUCTION

The potential contribution of finance to economic growth and development was until comparatively recently not fully recognised in the economic literature. There now exists a strong theoretical foundation for the argument that finance can provide a stimulus to both productivity and growth. This has been increasingly supported by a growing body of empirical research, some of which specifically relates to transitional countries and some more general. Much of the empirical literature has been macro-economic in nature. For example, the most common type of study is to examine the relationship between some measure of the development of the financial sector and economic growth.

Although such studies are undeniably useful it has been widely accepted that there is a need for firm-level empirical studies of the impact of finance on firm performance. Finance is provided to firms and it is firms that make use of it to improve productivity. An examination of the contribution of finance at the level of the firm offers a degree of detail and clarity that is simply not possible with a more aggregate approach. To date there have been very few firm level studies of the impact of finance on firm performance, with some notable exceptions. This study is intended to provide a contribution to this under-researched area.

The study focuses on SMEs because existing evidence suggests that finance often has a more powerful effect of the performance of SMEs than on larger firms. It also focuses on transitional countries because it is widely supposed that issues of enhancing productivity are of even greater consequence than in other economies, particularly than in developed countries. The study focuses on loan finance rather than equity. This is not for any particular theoretical reasons but is purely the consequence of data limitations. Likewise our study uses only data from the manufacturing sector. This again reflects data constraints rather than any theoretical objection to the study of other sectors.

The analysis uses data from the 2013 BEEPS survey. Two main techniques are employed. Firstly, we use a propensity score matching approach to assess whether or not there exists a significant difference in several different indicators of firm performance between those firms which received a loan and those which did not. The matching approach allows us to control for firm heterogeneity by carefully selecting a control group for the purposes of this comparison. Secondly we use a stochastic frontier approach to examine the extent to which loans contribute to the productive efficiency of SMEs in our sample of transitional countries. This estimates a production function and the distance of each firm in our sample from this technically efficient frontier. The analysis then considers the extent to which loans and other (control) variables make firms more or less efficient in these terms.

This paper is structured in the following way. Section 2 provides a review of the relevant theoretical and empirical literature. Section 3 outlines the key characteristics of the BEEPS 2013 survey. Section 4 sets out our methodology and section 5 our data. Our matching results are presented in section 6 and stochastic frontier analysis in section 7. Conclusions are presented in section 8.

2. REVIEW OF LITERATURE

SMEs are a vital part of the economy and contribute significantly to economic growth. Access to finance, in particular, is important for funding investment, ensuring businesses reach their full growth potential, and for facilitating new business start-ups. A study by the Word Bank (2014) revealed that more than 50% of SMEs in emerging markets are credit constrained, 70% do not use external financing from formal financial institutions and out of 30% who receive credit, 15% are underfinanced from formal sources.

In Russia for example the development of the SME segment is seen as "one of the key elements in the sustainable economic development" (European Investment Bank 2013, p. 8). According to the European Investment Bank (2013) the share of SMEs in GDP is estimated at 20-25%, which is not only significantly lower than in developed countries, but in comparable developing ones as well. The number of SMEs per 1000 people is 2.5 times lower on average than in Europe (as represented by EU-27 countries). Employment in the SME segment is 1.7 times lower on average than in Europe (measured as a share of total employment). All these factors support the considerable growth potential of the SME segment in Russia and its strengthening role in the economy. These factors will also lead to increasing demand for access to finance. Consequently, SMEs are the backbone of the economic devel0pment and as such it is paramount that they get all the funding necessary to continue to grow their businesses.

The problem of lack of access to finance by SMEs has existed for a long time. The debate focuses on whether the existence of information asymmetries creates circumstances of credit shortages or credit gluts (Deakins et al., 2010). According to Stiglitz and Weiss (1981), information asymmetries considered under a basic theoretical analysis of conditions of imperfect information suggests that there will be insufficient credit available for all but 'bankable' propositions, suggesting the existence of credit gaps. There are a number of structural market failures restricting some viable SMEs from accessing finance. Also, the moral hazard problem, which means that a risk-neutral firm will prefer projects with low probability of bankruptcy and hence make lower than expected returns, drives out SMEs from the supply of bank loans. Stiglitz and Weiss (1981) argued that the problem of adverse selection and finance rationing can again occur if banks require collateral for loans. The most important conclusion from Stiglitz and Weiss (1981) argument is that information asymmetry in the form of adverse selection and moral hazard is the source of market inefficiency in developing countries and this leads to low risk borrowers, such as SMEs, being sidelined or even excluded from the stream of potential borrowers. This manifests itself in a debt funding gap affecting businesses that lack collateral or track record. SMEs often experience problems in obtaining finance because lenders rely on the SMEs' track record and the security provided by their asset base as these factors help lenders avoid the high transaction costs of conducting detailed due diligence on every SME. However, smaller and newer businesses, as well as innovative, high-growth businesses, find it difficult to give potential lenders this assurance.

Like many studies this paper measures the extent of access to finance on the basis of bank loans to SMEs without considering other sources of finance available to them such as trade credit, microfinance, crowd funding etc. (e.g. Beck et al, 2008, Beck and De La Torre, 2006, and Claessens, 2006). This has been questioned, as bank loans do not explain the overall access to finance (see for example Nanyondo et al., 2014).

The foundation of this paper is in Levine's (2005) review of the theoretical and empirical literature on finance and growth. In this review he identifies five main ways by which finance, in theory, contributes to economic growth. These are by:

- Drawing together savings and making them available for investment.
- Producing information about potential investments and helping to allocate funds accordingly.
- Providing a basis for the management and spreading of risk.
- Ensuring proper functioning of and due diligence with respect to existing investment projects.
- Facilitation of trade in economic commodities and services.

Although such considerations provide good reasons to suppose that finance has an important role to play in development they do not, as Levine (2005) argues, constitute a rationale to prefer banks over other forms of finance. Although a number of authors do argue in favour of a bank based system over an equity based one – see, for example, Stiglitz (1985) – the reason for the emphasis of this paper on loan financing is rooted in data availability rather than theory. For exactly the same the paper does not take a theoretical on stance for or against an equity based system.

As Levine (2005) notes the dominant form of empirical research has been a cross-country studies which link economic growth to a measure of financial development. The potential importance of firm level studies in resolving a number of issues including better detail, causality and firm heterogeneity has long been acknowledged in this literature. Nonetheless it remains the case that there are relatively few firm level studies of the effects of finance on productivity and other aspects of firm performance. One noteworthy recent study by Levine and Warusawitharana (2014) makes a significant contribution, in part, by enhancing the theoretical foundations for the link between finance and productivity growth. They also provide evidence of the link between finance and total factor productivity for a sample of European firms.

Berman, N., & Héricourt (2010), using firm level data, find evidence that finance enhances export performance. In a similar vein, Minetti and Zhu (2011), using a sample of Italian firms, found that firms facing credit constraints exhibited a much weaker export performance than those that did not.

Propensity score matching techniques have been used previously in studies of microfinance in India and Pakistan measuring the effect on poverty and development respectively (see Imai et al, 2010, and Setboonsarng and Parpiev ,2008).

Although this paper is focused on the role of finance, and loans in particular, on SME performance the potential range of issues that can also affect firm performance is very wide. Our approach is to include a large number of control variables and to use these to construct a carefully matched controlled group to match the sample of SMEs with loans. However, we also consider two sets of overlapping influences in a more systematic way. This allows us to identify not just whether a loan is important in its own right but to what extent it is of importance relative to these other variables. We give particular attention to comparing the importance of loans on SME performance with that of (a) privatisation and (b) foreign ownership. We do not at all intend to imply that other potential determinants are either irrelevant or excluded from our analysis, just that we choose these two for specific comparisons with loans in one part of our analysis.

One issue that has widely been argued to also affect both SMEs and firm performance is privatisation. Some privatisation policy programmes historically focused specifically on SMEs, the so called "small privatisation" policy. Smith et al (1997) consider the links between firm performance and

privatisation in Slovenia, finding evidence that privatisation affects firm performance but that the reverse causality also holds. Arocena and Oliveros (2012) studied the effect of privatisation on the efficiency of a sample of Spanish firms, find little difference in firm efficiency between privatised and other firms. They did, however, find that the efficiency of state owned firms improved after privatisation.

Estrin et al (2009) conducted a study of privatisation and transition, finding that privatisation does not, it is own right, necessarily result in improved firm performance. They found that other factors, including foreign ownership, seem important for privatisation to yield improvements in form performance. Mukherjee and Suetrong (2009) show that privatisation and foreign direct investment in transitional countries are mutually supportive, that they encourage each other. Other authors such as Marlevede and Schoors (2005) also make a link between successful privatisation and FDI.

Wilson et al (2014) analysed SMEs in Slovakia and found that foreign ownership reduced the probability of failure. They also found evidence of a "privatisation trap" – over-valued privatisations resulting in debt burdens. Lu and Beamish (2001) found a positive effect of internationalisation and FDI, in particular, on the performance of Japanese SMEs. In contrast Majocchi and Zucchella (2003) found internationalisation through FDI adversely affected the performance of a sample of Italian SMEs.

3. KEY CHARACTERISTICS OF THE 2013 BEEPS SURVEY

This study uses the data from the 2013 BEEPS survey. The definition of firm sizes in the BEEPS survey are:

- Less than 5 employees – micro
- 5 – 19 employees – small
- 20 or more but less than 100 – medium
- 100 or more employees – large

This definition of a SME is far from universal. An immediate problem in any international analysis of SMEs is that there is no universally accepted definition of a SME As Ayyagari et al (2007) note official definitions of SMEs can result in a cut-off point which vary by country between 100 and 500 employees. For example, the European Commission definition of SMEs (by employment) is less than 250 workers, a definition shared by the UK government. Gibson and Van der Vaart (2008).provide a detailed discussion of the different definitions and conclude that a revenue based measure, appropriately scaled for country characteristics is probably the best type of classification. Aybar-Arias et al (2003), in a study of Spanish firms found key characteristics (capital structure) of firms to not be sensitive to the use of different definitions.

To deal with these inconsistencies in the way in which a SME is defined we use two different definitions. Firstly we use the classification system devised for the BEEPS survey and described above . Secondly, since a cut-off of 250 employees seems to be a widely used definition we also work with this definition too. By being able to compare results between two different definitions we are able to show that, to some limited extent, whether or not our findings are robust to different definitions.

Our sample comprised a total of 8036 firms with less than 250 employees and 7406 firms with up to 100 employees. Details of our sample(s) are presented in Table 1. Our sample is dominated by firms in the "small" (5-19 employees) size class and by the "medium" (20-99 employees) size class.

Together these two groups account for about 90% of our full sample. The addition of firms in the size class 100-249 employees forms only a small part of the overall sample (only about 8%) and micro sized firms are the least numerous category of all.

Even in the micro size class more than one in four firms had received a loan and the proportion increases with each size class such that almost 48% of all firms in the 100-249 employees class received a loan. A proportion of firms in each size class had been privatised but, again, the proportion was lowest for micro firms and highest for the largest size class. Only a very small proportion of the sample were state owned enterprises. The mean percentage foreign ownership, as with other variables, increases with respect to size class., as does the mean share of exports in total sales.

Table 1: Key Characteristics of the Sample of Firms				
Characteristic	Survey size classification, by number of employees			100 - 249 employees
	less than 5	5 - 19	20 - 99	
Number of firms	194	4475	2737	631
Mean number of employees	3.1	9.9	42.0	149.7
Firms with loans	25.3%	27.4%	39.3%	47.7%
Privatised	4.6%	5.7%	13.1%	25.4%
State owned	0.0%	0.8%	1.3%	5.7%
Mean % foreign ownership	2.3%	3.3%	5.0%	10.5%
Mean share of exports in total sales	2.7%	4.4%	9.1%	17.8%
Firms with main markets local	67.5%	65.2%	51.7%	40.3%
Firms with main markets national	28.9%	31.1%	41.0%	43.4%
Firm with internet	67.0%	78.6%	88.2%	95.2%
Mean output per worker (US $)	87339	107887	92101	99429
Mean profit per worker (US $)	78017	100769	85394	93565
Constraint of access to finance - mean score (0-4)	1.2	1.2	1.2	1.1
Constraint of worker education - mean score (0-4)	0.8	0.9	1.2	1.3
Source: BEEPS survey 2013				

Important differences also arise with respect to the main markets of individual SMEs. More than two thirds of micro firms are focused on local markets but only about 40% of firms with 100-249 employees. Conversely less than one third of micro firms see the national market as their main one but more than 40% of firms in the largest size class do. There appears little difference between firms in each size class with respect to their perceptions of access to finance. Their mean perceived importance of access to finance as an important constraint varies little by size group. Perceptions of constraints arising from lack of education in workers is stronger for the larger size groups.

An key characteristic of our sample, illustrated by Table 1, is that SMEs, however defined, are far from being a coherent or homogeneous group. There is considerable firm heterogeneity, a feature that our methodology takes into account.

The object of this study is to analyse the effects of loans on firm performance. It is not the intention to analyse behaviour with respect loan applications. Nonetheless and in the spirit of understanding better the nature of our sample Tables 2 and 3 present summary data on loan applications. Table 2 summarises loan applications and their outcomes by firm size class. As might be expected the larger the SME the more likely the firm to have applied for a loan. Only 16% of responding micro firms

reported applying for a loan compared to 37% of the 100-249 employee group. Larger SMEs were also more likely to achieve success in their applications. For the 100-249 size group 89% of respondents had their loan applications approved. For micro firms 73% of applications were approved. Taken overall the dominant reason why SMEs did not receive a loan is quite simply that they did not apply for one. In the sample only about one in four firms applied for a loan. Across the full sample about 81% of loan applications were accepted and only about 13% rejected. These proportions do not suggest that an unwillingness to lend was the dominant reason for firms not having a loan in 2013. This, of course, does not preclude the possibility of bias – that only firms more likely to succeed apply in the first place.

Table 2: Loan Applications					
	Size Class (number of employees):				
	Less than 5	**5 - 19**	**20 - 99**	**100 - 249**	**All (0 - 249)**
Number of respondents	341	7450	4589	1092	13472
Number applying for loan	56	1520	1417	407	3400
% of repondents applying for a loan	16.4%	20.4%	30.9%	37.3%	25.2%
% of applications which were:					
approved	73.2%	76.4%	83.1%	88.7%	80.6%
rejected	23.2%	17.0%	9.9%	6.1%	12.8%
still on-going	0.0%	2.0%	1.9%	2.2%	2.0%
withdrawn by applicant	1.8%	3.5%	3.9%	1.5%	3.4%
Source: 2013 BEEPS Survey					

Table 3 considers the reasons given by survey respondents for not applying for a loan. The dominant reason given in all size classes was that the firm simply had no perceived need for a loan. Nearly two thirds of all respondents not applying for a loan gave the reason that they simply did not need one. Of the remainder about 18% of responding firms did not apply fo a loan because interest rates were too high. It is worth noting that only 1.7% did not apply because they thought it likely that their application would be rejected but that 6.5% were deterred by complex procedures. A higher proportion of micro firms (3.2%0 were deterred from applying by perceived poor prospects of success but micro firms were much less deterred by perceived complexity of procedures than larger SMEs.

Table 3: Reasons for Not Applying for a Loan					
	Size Class (number of employees):				
	Less than 5	**5 - 19**	**20 - 99**	**100 - 249**	**All (0 - 249)**
Total respondents	280	5857	3133	680	9950
Reasons (% of total non-applicants)					
No need for loan	64.6%	64.3%	66.6%	71.5%	65.5%
Complex procedures	4.6%	7.1%	6.2%	3.7%	6.5%
Interest rates too high	16.4%	19.0%	17.5%	14.9%	18.2%
Collateral too high	4.6%	4.3%	4.1%	2.4%	4.1%
Insufficient size or maturity of loan	1.1%	1.0%	1.1%	0.7%	1.0%
Need for informal payments	0.4%	0.2%	0.3%	0.3%	0.2%
Unlikely to be approved	3.2%	1.6%	1.7%	1.9%	1.7%
Other	5.0%	2.6%	2.6%	4.7%	2.8%

Table 4 presents rates of application for loans by SMEs and rates of acceptance by country. There is some variation by country in the percentages of SMEs applying for loans with Albania, Azerbaijan, Latvia and Ukraine exhibiting rates of application of 17% or lower (against a sample mean of 25%). Armenia, Mongolia, Romania and Serbia all exhibited rates of application of 35% or higher.

The sample mean for the proportion of loans rejected was 13% but this rate was much lower in Kyrgyzstan (1.7%) and Belarus (2.9%). The rate was markedly higher in Croatia (25%) and Latvia (29%).

Table 4: Application and Approval Rates for Loans, by Country					
Country	Applicants for a loan		Response to applications		
	Respondents	% applying	Respondents	% approved	% rejected
Albania	301	10.3%	31	83.9%	3.2%
Armenia	337	35.6%	121	95.0%	3.3%
Azerbaijan	361	15.0%	53	66.0%	20.8%
Belarus	317	33.4%	105	68.6%	2.9%
Bosnia-Herzegovina	347	30.3%	105	91.4%	7.6%
Bulgaria	278	17.3%	48	93.8%	4.2%
Croatia	341	28.2%	95	70.5%	25.3%
Czech Republic	234	26.1%	60	93.3%	6.7%
Estonia	262	27.9%	73	94.5%	5.5%
Georgia	347	29.4%	99	91.9%	7.1%
Hungary	276	25.4%	70	88.6%	8.6%
Kazakhstan	547	17.9%	94	73.4%	19.1%
Kosovo	194	26.8%	52	96.2%	3.8%
Kyrgyzstan	256	25.0%	60	86.7%	1.7%
Latvia	314	10.2%	31	67.7%	29.0%
Lithuania	244	23.8%	58	72.4%	22.4%
Macedonia	352	22.2%	77	94.8%	3.9%
Moldova	342	22.5%	76	81.6%	17.1%
Mongolia	335	45.1%	148	84.5%	10.8%
Montenegro	119	25.2%	30	83.3%	10.0%
Poland	470	25.1%	115	84.3%	8.7%
Romania	514	36.2%	186	90.9%	6.5%
Russia	3963	26.3%	1031	71.7%	21.9%
Serbia	336	38.4%	129	96.1%	3.1%
Slovakia	245	24.1%	60	88.3%	5.0%
Slovenia	246	35.4%	87	92.0%	6.9%
Tajikistan	328	19.2%	63	84.1%	6.3%
Ukraine	925	15.6%	138	81.9%	11.6%
Uzbekistan	341	18.8%	64	92.2%	4.7%
Overall	13472	25.2%	3359	81.6%	13.0%
Source: 2013 BEEPS survey					

4. METHODOLOGY

This study uses two distinct techniques – propensity score matching and stochastic frontier estimation. Propensity score matching is utilised to test propositions concerning output per worker, profit per worker, growth and price-cost margins. A stochastic frontier approach is intended to measure firm productivity and efficiency in relation to finance loans.

4.1 Propensity Score Matching

The central feature of matching analysis is the relationship between a *treatment* variable and an *outcome* variable. In this study the *treatment* variable is the receipt of a loan and the *outcome* variables are different indicators of firm performance – productivity (output per worker), profit per worker and exports as a percentage of total sales. A simple approach would be to compare a sample of firms receiving a loan with a sample of other firms and test whether there is a statistically significant difference in the payment of bribes between the two. Unfortunately such an approach would almost certainly produce biased results unless the *treated* and *control* groups closely resemble each other in all relevant attributes other than the *treatment*. The selection of a control group which satisfies these conditions is known as a *matching* approach. It seeks to replicate the process of experimental random sampling using non-experimental observed data.

Detailed discussions of the matching methodology can be found in several sources, including Dehejia and Wahba (2002), Dehejia (2005), Peikes, Moreno, and Orzol (2008), Leuven and Sianesi (2015). There are a number of studies involving economic applications which also include useful expositions of this methodology. These include Sianesi (2004) and Blundell et al (2005) The matching approach focuses on three key parameters:

- ATE – the average treatment effect in the population (defined as all treated and untreated firms or individuals).
- ATT – the average treatment effect for treated firms (in this paper those from countries who joined the EU in 2004)
- ATNT – the average treatment for those that were not treated (firms from non-EU members).

These are defined as:

$$ATE = E(Y_{1i} - Y_{0i}) \equiv E(\beta_i) \quad (1)$$

$$ATT = E(Y_{1i} - Y_{0i} | D_i = 1) \equiv E(\beta_i | D_i = 1) \quad (2)$$

$$ATNT = E(Y_{1i} - Y_{0i} | D_i = 0) \equiv E(\beta_i | D_i = 0) \quad (3)$$

Where Y is the outcome, with subscript 1 for those firms that are "treated" and subscript 0 for those that are not. D is an indicator of the treatment received (by definition 1 for treated and 0 for non-treated).

The simplest (naïve) estimator of the effects of treatment (loans to SME's) on any particular outcome is to simply compare the means of the treated firms. Such an approach is biased for two sets of reasons:

- Bias from selection on observables (comparing firms that are not comparable or weighting comparable individuals differently.
- Bias from selection on unobservables.

The latter bias (from unobservables) is, in effect, a version of the problem of possible excluded confounding variables. As always there is no guarantee that an important confounding variable has been excluded but steps can be taken to limit this possibility. A common approach, which is followed in this paper, is to use a sufficient number of potentially relevant variables in selecting from observables. For example, we include firm size as one of our selection variables and on the grounds that larger firms may well be more likely than small firms to obtain loans and are more likely to be involved in international trade we limit the study to small and medium size enterprises (SME's).

Reducing bias from selection on observables is more involved. To estimate ATT it is necessary to assume that all relevant differences are captured in the observed attributes of the treated and untreated firms (that is, no bias from selection on unobservables) and that we can observe both treated and untreated firms with shared attributes (common support). Selection is performed using a propensity score p(x) where:

$$p(x) \equiv P(D=1|X=x) = E(D|X=x) \qquad (4)$$

A common approach is to use a probit model to define the propensity score and this is the approach adopted here. This probit model is not in itself a causal model but acts as a way of identifying and summarising the key characteristics of the "treated" (received loans) firms.

The next step is to use the propensity score for matching – to pair each "treated" (received loans) firm with a comparable "untreated" (no loan) firm. There are a significant number of different ways of conducting this matching process. The procedure adopted in this study was to conduct matching by kernel density, using bootstrapped standard errors.

The final step in the matching process is to assess how effective the process of matching was in selecting a control group from the untreated (non loan) firms that was comparable to the treated (received loans) group. These are, in the main, not formal statistical tests but more checks on the adequacy of matching on observables. In this study these checks were conducted and are reported in Appendix 1..

An extension of the standard matching approach which we employ in our analysis is *Inverse Probability Weighted Regression Adjustment (IPWRA)*. The standard matching approach is to select a control group which has not received the treatment with the group of interest (treated). The technique seeks to match the two groups with similar common key characteristics. This approach has possible limitations where the members of both groups might choose whether to be treated or not – in our case whether a firm decides to apply for a loan or not – and this decision is itself determined by a series of further variables. *Regression adjustment* is used to produce an estimator which incorporates a deterministic element of the assignment of each firm to the treated and untreated groups (whether they received a loan or not). The technique ,in effect, estimates counter-factuals – how would firm efficiency been affected if firms had chosen not to apply for a loan?

Regression adjustment can be performed by constructing counter-factuals by a number of different methods. *Inverse probability weighting* explicitly model the decision process for treatment or not. In this paper that implies modelling the decision for a firm to apply for a loan or not. This takes the form of a model (logit) of the probability that a firm will apply for loan based on a series of explanatory

variables. These probabilities are used to weight each observation. The final extension to the IPWRA model is that both outcome and treatment are adjusted by using weighted inverse probabilities. For a much more detailed exposition of IPWRA and related estimators see Cattaneo (2010) and Cattaneo et al (2013).

The attraction of using an IPWRA estimator is not just its statistical properties as outlined above. It also permits multiple treatment effects. This is also of particular use in this study where we use IPWRA estimators with two treatment effects (more treatment effects are, in theory, possible but increasingly complex). This enables to assess the relative significance of loans in determining firm performance. Firstly, we use IPWRA estimation with both loans and (past) privatisation as treatment variables. This enables us to compare and contrast the implications of loans for firm performance with that of privatisation. Secondly, we repeat the analysis but with loans and foreign ownership as treatment variables.

4.2 Stochastic Frontier Estimation

A widely used technique for measuring firm technical efficiency is to estimate a production function in the first instance. Firm inefficiency is measured as the distance from the estimated frontier and this allows a second tier of estimation in which the relationship between the estimated (in)efficiency and a set of determinants is estimated. Both non-stochastic techniques and stochastic techniques are possible but the stochastic model allows for measurement and other random errors.

A stochastic frontier model was first developed by Aigner, Lovell and Schmidt (1977). Battese and Coelli (1995).later developed the model to include estimation of the determinants of inefficiency. The specification involves interaction between both the variables determining inefficiency and those used in the estimation of the stochastic frontier. The approach was initially developed for cross-sectional data (which remains its most common use) but has been extended to versions for use with panel data.

A stochastic frontier model is used in preference to OLS and related estimators because of the properties of OLS. An OLS regression will produce a best fit to the data by minimising squared errors but it is not appropriate for there to be positive (more efficient) as well as negative (less efficient errors. A production function is a technically efficient frontier so it should not be possible to observe firms more efficient than the frontier. A stochastic frontier estimator first uses the data to estimate the technically efficient frontier. This enables efficiency measures to be calculated for each firm – essentially the distance from the technically efficient frontier. Finally a series of independent variables is used to estimate the determinants of variations in (in)efficiency between one firm and another.

Stochastic frontier models use (iterative) maximum likelihood estimation techniques to estimate both the frontier and the efficiency model together. For a full description see Coelli, Rao and Battese (2005). The model estimates the following equation:

$$y_{it} = f(x_{j,it}, t, \beta) + \varepsilon_{it} \quad where\ \varepsilon_i = V_{it} - U_{it}$$
$$with \quad U_{it} \sim |N(\mu_{it}, \sigma_U^2)| \quad and \quad V_{it} \sim N(0, \sigma_V^2) \qquad \textbf{(5)}$$

Where:

- y_{it} is firm i's output at time t
- xj,it is input j, and

- βi a vector of parameters to be estimated.

The error term (ε_i) is assumed to comprise two components – well behaved (random, independently and identically distributed) error terms V_{it} and inefficiency terms (non-random) U_{it}. The model's second component makes these inefficiency terms a function of key characteristics of each firm – represented by a vector of variables, denoted z_{ikt}. Since positive errors (efficiency in excess of the frontier) are not permissible the model uses one of several different truncations of the normal distribution such that:

$$U_{it} \sim N\left[\delta_0 + \sum_{k=1}^{M} \delta_k z_{k,it}, \sigma^2\right] \quad \textbf{(6)}$$

For each firm technical (in)efficiency is measured in relation to the frontier, conditional upon the firm's inputs. For firm i at time t technical efficiency (TE_{it}) is defined as:

$$TE_{it} = E[\exp(-U_{it})|(V_{it} - U_{it})] \quad \textbf{(7)}$$

Equation 7 is the conditional expectation of technical inefficiency, given ε_{it}. U_{it} has a minimum value of 0 and a maximum value of 1.

5. DATA

The data for this study was taken from the *Business Environment and Enterprise Survey* (BEEPS) produced by the World Bank and European Bank for Reconstruction and Development (EBRD). We obtained data from the 2013 survey consisting of 28 countries.

For the matching analysis we used two different outcome variables (separately) , intended to capture different aspects of firm performance. These were:

- Productivity (output per worker).
- Profitability (profit per worker).

The treatment variable (loan) was a variable taking on the value of 1 if the firm received a loan and 0 if not. The variables used for selecting a matched control group comprised:

- Number of full-time employees (intended as a measure of firm size)
- Foreign ownership (%)
- Age of the firm
- Infrastructure constraints – mean score of 3 different questions (each rated 0-4)
- Administrative constraints - mean score of 4 different questions (each rated 0-4)
- Privatised firm (0,1)
- National market the firm's main market (0,1)
- Access to finance as a constraint (rated 0-4)
- Three country dummies – Soviet (1 if formerly part of the Soviet Union, 0 otherwise), Oil exporting country (1,0) and EU07 (1 if member of the EU in 2007, 0 otherwise).

For our stochastic production function analyses the production function variables employed were:

- Output - total value, converted to US $

- Capital – net book value, converted to US $
- Labour - total employment, full-time workers and full-time equivalents of temporary workers.

For the estimation of the inefficiency terms the explanatory variables were:

- LOAN – 1 = loan,, 0 = no loan
- AGE – Age of the firm
- SIZE1 – Measured as Micro (<5), Small (5>19), Medium (20>99), Large (>100)
- LNR (Log of rental costs) – capital equipment and real estate
- BURCY - Administrative constraints - mean score of 4 different questions (each rated 0-4)
- NATIONAL - National market the firm's main market (0,1)
- PRIVATISED – (0,1)
- LOCAL - Local market the firm's main market (0,1)
- FOREIGN - Foreign ownership (%)
- Three country dummies – SOVIET (1 if formerly part of the Soviet Union, 0 otherwise), OILX -Oil exporting country (1,0) - and EU07 (1 if member of the EU in 2007, 0 otherwise).

An important limitation of our stochastic frontier approach (and almost all comparable studies) is that our measures of output (total sales) and of capital are based on values rather than physical quantities. Labour is measured in terms of number of employees (full-time and full-time equivalents). As Katayama et al (2009) argue the use of value measures entails a risk that these are correlated with important omitted confounding variables. This is a point well taken but, as their paper suggests, a truly satisfactory solution does not yet exist. Our approach to reducing the risk of omitted confounding variables was crude. In both the matching and stochastic frontier analysis we included as many relevant variables as the data would allow. Early specifications (not reported) included more variables than are reported here and some of the retained variables were still found to be statistically insignificant in all specifications. We omitted a number of these but tried to err on the side of caution and kept a number of variables that an approach less concerned with the risk of confounding variables might also have omitted.

6. PROPENSITY SCORE MATCHING ANALYSIS

Table 5 below reports the results of our matching analysis, conducted in *Stata14* using the *psmatch2* routine. The analysis was conducted for each of our two main outcome (performance) variables – productivity (output per worker) and profitability (profit per worker. Results are reported separately for both the sample of firms up to 250 employees (8037 observations) and that of firms up to 100 employees (7406 observations). Checks on the adequacy of the matching process (selection on observables) are reported in Appendix 1.

Table 5: Propensity Score Matching, kernel density, using bootstrapped standard errors.						
Variable	**Sample**	**Treated**	**Controls**	**Difference**	**S.E.**	**T-stat**
Sample = firms with up to 250 employees						
log of output per worker	Unmatched	10.48322	9.94085	0.54237	0.03945	13.75
	ATT	10.48224	10.09814	0.38410	0.03552	10.81
log of profit per worker	Unmatched	10.35876	9.82950	0.52926	0.04003	13.22
	ATT	10.35876	9.98821	0.37055	0.04226	8.77
Sample = firms with up to 100 employees						
log of output per worker	Unmatched	10.48738	9.93149	0.55589	0.04135	13.45
	ATT	10.48738	10.09031	0.39706	0.04789	8.29
log of profit per worker	Unmatched	10.35910	9.82362	0.53548	0.04189	12.78
	ATT	10.35910	9.99057	0.36853	0.04737	7.78

The results are very clear. Having a loan results in a statistically significant gain in productivity (log of output per worker) and a statistically significant gain in profitability (log of profit per worker). These gains are not just statistically but also significant in economic terms. Both productivity and profitability are just under 50% higher for SMEs with loans than without, evaluated at their means.

As noted in the methodology section it is possible, indeed likely, that the decisions of firms to apply for and accept loans is also affected by a series of observable characteristics. To address this possibility we used an Inverse Probability Weighted Regression Adjustment (IPWRA) estimator. Since this allows for more than one treatment effect w, firstly, estimated the effects of (a) loans and (b) past privatisation on our two indicators of firm performance (log of output per worker and log of profit per worker). Table 6 reports the results for both samples.

For both the sample defining SMEs as less than 250 employees and the sample defining them as having less than 100 employees the results are comparable. For both sample loans have a statistically significant (at 99% confidence) positive effect on productivity (log of output per worker). In both cases the magnitude of the effect is substantial. For past privatisation the effect is negative and again statistically significant (at 99%). This suggests that privatised firms exhibit a significantly and substantially lower level of productivity than other firms. Care needs to be taken over this finding. In general theory predicts that privatisation will improve the firm's performance. The proper test of such a hypothesis would be to measure each firm's performance over time and to compare it to a counter-factual in which the firm was never privatised. Our findings are not, therefore, any test of whether privatisation increases efficiency or not. What they do reveal is that those firms that were privatised inherited a legacy which left them in 2013 still comparing unfavourable with other firms in terms of labour productivity.

The combined effect of loans and past privatisation on labour productivity was not statistically significant. This is because the negative effect of past privatisation offsets the positive effect of a loan on output per worker.

Table 6 : IPWRA Analysis with Loans and Privatisation as Treatments				
Outcome variable: log of output per worker				
I. All firms (up to 250 employees)				
	Treatment Group			
Control Group	**None**	**Loan**	**Privatisation**	**Both**
None	-	0.38623***	-0.39647***	-0.06921
		(0.0430659)	(0.0679076)	(0.1002911)
Loan	-0.41745***	-	-0.78625***	-0.41725***
	(0.0446752)		(0.0714084)	(0.0986884)
Privatisation	0.44576***	0.76572***	-	0.34829***
	(0.0803776)	(0.0990005)		(0.1223534)
Both	0.08880	0.47175***	-0.30592**	-
	(0.1379757)	(0.1003266)	(0.1312713)	
II. Firms up to 100 employees				
	Treatment Group			
Control Group	**None**	**Loan**	**Privatisation**	**Both**
None	-	0.40466***	-0.40837***	-0.00697
		(0.0456193)	(0.07034)	(0.1114775)
Loan	-0.42318****	-	-0.89917***	-0.46392***
	(0.0465764)		(0.0779011)	(0.1079901)
Privatisation	0.45024***	0.77118***	-	0.35961**
	(0.0853739)	(0.1104072)		(0.1287185)
Both	0.09406	0.50257***	-0.35399***	-
	(0.1589175)	(0.1151154)	(0.1717122)	
Outcome variable: log of profit per worker				
I. All firms (up to 250 employees)				
	Treatment Group			
Control Group	**None**	**Loan**	**Privatisation**	**Both**
None	-	0.37694***	-0.36488***	-0.08748
		(0.0443415)	(0.0700116)	(0.1050348)
Loan	-0.39436***	-	-0.74983***	-0.45490***
	(0.045917)		(0.0738807)	(0.1024469)
Privatisation	0.40776***	0.71556***	-	0.28251**
	(0.083741)	(0.1031828)		(0.1351284)
Both	0.23481	0.56123***	-0.21888	-
	(0.1587111)	(0.1066241)	(0.1358895)	
II. Firms up to 100 employees				
	Treatment Group			
Control Group	**None**	**Loan**	**Privatisation**	**Both**
None	-	0.37560***	-0.3931219	-0.11300
		(0.0461289)	(0.0720644)	(0.1143784)
Loan	-0.39071***	-	-0.85808***	-0.53870***
	(0.0478837)		(0.0801069)	(0.1119896)
Privatisation	0.4147&***	0.71257***	-	0.23803*
	(0.0888514)	(0.1144055)		(0.1342582)
Both	0.22457	0.58517***	-0.24711	-
	(0.18463)	(0.1193001)	(0.1774031)	

With respect to profitability (log of profit per worker) the results are similar to those for labour productivity. Again using the two different definitions of a SEM makes little real difference to the results. The effect of a loan on profitability was found to be positive and statistically significant at 99% confidence and the effect of past privatisation to be statistically significant but negative. Both effects are not just statistically but also of sufficient magnitude to be economically significant. They suggest that loans enhance profitability relative to other firms and that having been privatised in the past reduces it. The combined effect of the two is statistically insignificant because both effects offset each other.

Table 7 presents comparable results for labour productivity and profitability but using loans and foreign ownership as the two treatment variables. The results for both definitions of SMEs are again very similar. With respect to labour productivity (log of output per worker) having a loan has a positive and statistically significant (at 99%) effect on firm performance. Having some foreign ownership also has a statistically significant (at 99%) effect on labour productivity. In both cases the effect is not only statistically but also economically significant. The combination of both a loan and foreign ownership is, unsurprisingly, also statistically significant and even more substantial than either of the two individual effects – both treatments re-enforce each other. Using a loan or foreign ownership as a control and the other as a treatment produces no statistically significant effect. That is, neither the effect of having a loan nor of foreign ownership dominates the other. Loans appear to have approximately similar consequence for labour productivity as foreign ownership.

With respect to profitability (log of profit per worker) the results are again comparable. Both loans and foreign ownership have a statistically significant (at 99%) and positive effect of profitability. In terms of economic effects both are also of significance. As with labour productivity the combined effect of both on profitability is both statistically significant and of some magnitude. Both the loan and foreign ownership treatment effects are comparable since using one as control and the other s treatment produces no statistically significant result.

Table 7 : IPWRA Analysis with Loans and Foreign Ownership as Treatments				
Outcome variable: log of output per worker				
I. All firms (up to 250 employees)				
	Treatment Group			
Control Group	**None**	**Loan**	**Foreign**	**Both**
None	-	0.38283***	0.40308***	0.77252***
		(0.0425956)	(0.0856963)	(0.1146687)
Loan	-0.38892***	-	0.02110	0.40503***
	(0.0440341)		(0.088643)	(0.1115275)
Foreign Ownership	-0.21436**	-0.00022	-	0.38669***
	(0.0913988)	(0.0900674)		(0.1314353)
Both	-0.79995***	-0.32953**	-0.36722**	-
	(0.1303587)	(0.1225363)	(0.1376324)	
II. Firms up to 100 employees				
	Treatment Group			
Control Group	**None**	**Loan**	**Foreign**	**Both**
None	-	0.40547***	0.40010***	0.78272***
		(0.0450475)	(0.0942465)	(0.1204755)
Loan	-0.40372***	-	-0.01687	0.36032***
	(0.0464338)		(0.0974971)	(0.1220768)
Foreign Ownership	-0.21679**	-0.03261	-	0.31010**
	(0.0955706)	(0.1027042)		(0.1572305)
Both	-0.83285***	-0.32761**	-0.36435**	-
	(0.1426229)	(0.1564065)	(0.1749627)	
Outcome variable: log of profit per worker				
I. All firms (up to 250 employees)				
	Treatment Group			
Control Group	**None**	**Loan**	**Foreign**	**Both**
None	-	0.367886***	0.39372***	0.76928***
		(0.0443881)	(0.0885149)	(0.1219236)
Loan	-0.35242***	-	0.03387	0.40502***
	(0.0453579)		(0.0915101)	(0.11426)
Foreign Ownership	-0.22881**	-0.02489	-	0.37022**
	(0.0917201)	(0.0925757)		(0.1374395)
Both	-0.84515***	-0.37430**	-0.45302**	-
	(0.1356607)	(0.1422142)	(0.1759124)	
II. Firms up to 100 employees				
	Treatment Group			
Control Group	**None**	**Loan**	**Foreign**	**Both**
None	-	0.36925***	0.38357***	0.72859***
		(0.0455626)	(0.0956871)	(0.1203102)
Loan	-0.3570***	-	0.01621	0.36164**
	(0.0480338)		(0.1001087)	(0.1226401)
Foreign Ownership	-0.21679**	-0.03261	-	0.31010**
	(0.0955706)	(0.1027042)		(0.1572305)
Both	-0.83285***	-0.32760**	-0.36435**	-
	(0.1426229)	(0.1564065)	(0.1749627)	

7. STOCHASTIC FRONTIER ANALYSIS

The object of our stochastic frontier analysis is to strengthen and support the conclusions of our matching analysis. The performance measures employed in the matching analysis are widely used and well established but do not provide as complete a picture of firm performance as might be desired. Efficiency in the sense of achieving the best output with the least inputs also matters. To do this we use stochastic frontier analysis.

The results of our stochastic frontier analysis for the sample of firms with up to 250 employees are reported in Table 8. Estimation used a truncated normal distribution with a sample of 8037 observations. The model assumes a translog functional form. A Cobb-Douglas functional form was also estimated and a likelihood ratio test conducted for the required restrictions. This test rejected the null hypothesis (of a Cobb-Douglas functional form) so neither are reported. Both the LR test and LM test for the inefficiency model versus OLS suggest that we can reject the null hypothesis (that an OLS specification is preferable).

For the stochastic frontier all coefficients were statistically significant and positive except for the log of capital (not statistically significant) and the cross product of the log of capital with the log of labour (negative). Our main interest is in the inefficiency terms. The coefficient for loans was statistically significant (at 99%) and negative. That implies that loans have a statistically significant and positive effect on efficiency (a negative effect on inefficiency). The size class of firms was also found to have a statistically significant effect (at 95% confidence), suggesting that larger SMEs are more technically efficient than smaller ones. The log of rental costs was statistically significant (at 99%) but positive. This implies that firms who rent capital and real estate tend to be less efficient than those who own their own.

The dummy variable for national markets was negative and that for local markets positive. Both were statistically significant at 99% confidence. This suggests that, as one might expect, that SMEs that focus on supplying the national market are more efficient than those that focus on local markets. An interesting finding, consistent with some of the empirical findings covered earlier in our review of literature, was that past privatisation was statistically significantly related to inefficiency (positive coefficient). Of our country-related dummies, all were statistically significant at 99% confidence. Both being based in a former Soviet country and being based in an oil exporting country were associated with greater inefficiency (positive coefficients). Being a member of the EU in 2007 was associated with greater efficiency (negative coefficient)

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Table 8: Stochastic Frontier Estimates, firms up to 250 employees				
Dependent Variable:	**Coefficient**	**Standard**	**z**	**Prob.**
Log of output		**Error**		**|z|>Z***
Deterministic Component of Stochastic Frontier Model				
Constant	10.0602***	0.18330	54.88	0
Log Capital	-0.0060	0.02364	-0.26	0.7984
Log Labour	0 .83935***	0.07174	11.7	0
Log Capital Squared	0 .02436***	0.00146	16.69	0
Log Labour Squared	0 .04123***	0.01231	3.35	0.0008
Log Capital.Log Labour	-0.04639***	0.00590	-7.86	0
Mean of underlying truncated distribution				
Constant	-.11709	0.76129	-0.15	0.8778
Scale parameters. for random components of e(i)				
ln sigma(U)	0-.62186	-1.52	0.1273	-1.42111
ln sigma(V)	0 .13461***	15.18	0	0.11723
Heteroscedasticity in variance of truncated u(i)				
LOAN	-0.40084***	0.11112	-3.61	0.0003
SIZE1	-0.13756**	0.05729	-2.4	0.0164
LNR	0 .05716***	0.01578	3.62	0.0003
BURCY	0.00900	0.00966	0.93	0.3513
NATION	-0.15220***	0.04347	-3.5	0.0005
PRIVAT	0.32971***	0.10079	3.27	0.0011
LOCAL	0.15227***	0.04347	3.5	0.0005
FOREIGN	-0.0002	0.00038	-0.4	0.6886
AGE	-0.0002	0.00024	-0.09	0.9294
SOVIET	0 .80114***	0.21156	3.79	0.0002
OILX	2.19865***	0.70606	-3.11	0.0018
EU07	-0.42992***	0.13983	-3.07	0.0021
Log likelihood function -12840.58341				
N = 8037, K = 21				
Variances:				
Sigma-squared(v)= 1.30894				
Sigma-squared(u)= .12377				
Sigma(u) = .35180				
Sigma(v) = 1.14409				
LR test for inefficiency vs. OLS v only				
Degrees of freedom for sigma-squared(u): 1				
Degrees of freedom for heteroscedasticity: 12				
Degrees of freedom for truncation mean: 1				
Degrees of freedom for inefficiency model: 14				
Chi-sq=2*[LogL(SF)-LogL(LS)] = 1093.764				
Kodde-Palm C*: 95%:23.069, 99%: 28.485				
LM test for sigma(u) = 0 based on ols e				
Chi-sq[1]=(N/6)*[m3/s^3]^2 109.536				

Table 9 presents the stochastic frontier results for the sample of SMEs up to 100 employees (7406 observations). As with the larger sample the frontier was estimated for a translog functional form and using a truncated normal model. A Cobb-Douglas specification was also estimated but is not reported since the appropriate likelihood ratio test did not support the necessary restrictions.

In the stochastic frontier the log of labour and square log of capital are both statistically significant (at 99%) and positive. The cross product of the log of capital and the log of labour was also statistically significant (at 99%) but negative.

The inefficiency component of the model again suggests a statistically significant (99%) and negative effect of a loan on inefficiency. That is, we find that a loan has a positive effect on the productive efficiency of SMEs in our sample. The magnitude of the effect suggests it to be economically as well as statistically significant. Other variables which also had a statistically significant (at 99%) and negative effect on inefficiency (that is, increased efficiency) included the size of the SME, focusing on national markets, being based in an oil exporting country and in a country which was an EU member in 2007. Variables which had a statistically significant and positive effect on inefficiency (reduced productive efficiency) comprised the log of rental costs, past privatisation, focusing on local markets and being based in a former Soviet country.

Table 9: Stochastic Frontier Estimates, firms up to 100 employees				
Dependent Variable:	**Coefficient**	**Standard**	**z**	**Prob.**
Log of output		**Error**		**|z|>Z***
Deterministic Component of Stochastic Frontier Model				
Constant	10.1303***	0.21153	47.89	0
Log Capital	-0.02917	0.02666	-1.09	0.274
Log Labour	0.86776***	0.09782	8.87	0
Log Capital Squared	0.02424***	0.0015	16.21	0
Log Labour Squared	0.02017	0.01816	1.11	0.2666
Log Capital.Log Labour	-0.03673***	0.0073	-5.03	0
Mean of underlying truncated distribution				
Constant	-0.11551	0.78872	-0.15	0.8836
Scale parameters. for ra	cale parms. for r	andom comp	onents	of e(i)
ln sigma(U)	-0.57813	0.41288	-1.4	0.1614
ln sigma(V)	.13311***	0.00927	14.36	0
Heteroscedasticity in variance of truncated u(i)				
LOAN	-.43115***	0.12198	-3.53	0.0004
SIZE1	-.16907**	0.07169	-2.36	0.0184
LNR	0.05606***	0.01617	3.47	0.0005
BURCY	0.00927	0.01006	0.92	0.3564
NATION	-.16732***	0.04837	-3.46	0.0005
PRIVAT	.34162***	0.10879	3.14	0.0017
LOCAL	.16738***	0.04837	3.46	0.0005
FOREIGN	-0.00016	0.00038	-0.43	0.6674
AGE	.21424D-04	0.00025	-0.09	0.9319
SOVIET	0.79654***	0.21805	3.65	0.0003
OILX	-2.14090***	0.71018	-3.01	0.0026
EU07	-0.42805***	0.14431	-2.97	0.003
Log likelihood function -11823.48871				
N = 7406, K = 21				
Variances:				
Sigma-squared(v)= 1.30502				
Sigma-squared(u)= .12784				
Sigma(u) = .35755				
Sigma(v) = 1.14237				
LR test for inefficiency vs. OLS v only				
Deg. freedom for sigma-squared(u): 1				
Deg. freedom for heteroscedasticity: 12				
Deg. freedom for truncation mean: 1				
Deg. freedom for inefficiency model: 14				
Chi-sq=2*[LogL(SF)-LogL(LS)] = 1030.909				
Kodde-Palm C*: 95%:23.069, 99%: 28.485				
LM test for sigma(u) = 0 based on ols e				
Chi-sq[1]=(N/6)*[m3/s^3]^2 103.461				

8. CONCLUSIONS

This study adds to the existing literature concerning the impact of finance on economic growth and productivity. As one of the still comparatively rare firm level studies it addresses the impact on firm performance (productivity, profitability and firm efficiency). By addressing transitional countries it also focuses on economies where improved firm performance is of particular importance. The study uses techniques – propensity score matching and stochastic frontier estimation – which explicitly take into account firm heterogeneity and, in consequence, are less prone to problems of firm heterogeneity than many similar studies. The study also focuses on SMEs, for which existing literature suggests loans are more important than for larger firms. Since there is no universally accepted definition of a SME our analysis is conducted for two different definitions.

Our results consistently show that receiving a loan had a statistically significant and positive effect on firm performance. Our matching analysis found loans to significantly enhance both productivity and profitability. The extension of the analysis to IPWRA estimation not only confirmed these effects but found the positive effects of a loan on productivity and profitability to be comparable to those of foreign investment in the firm, a well-documented source of efficiency. It also found that the positive effects of a loan on firm performance can, in large measure, offset the negative effects of the "privatisation trap" Finally, our stochastic frontier analysis examined more carefully the effects of a loan on the productive efficiency of SMEs in transitional countries. We find that loans had a statistically significant positive effect on the productive efficiency of firms in the sample.

Macro-economic studies have often supported the view that financial development supports economic development but such studies are, amongst other difficulties, beset by difficulties in measuring "financial development". Firm level analysis allows a much more direct question to be asked – does having a loan make a difference to the performance of the firm? Few previous studies have addressed this question. In this study we find that, for SMEs in transitional countries, that the answer is that the evidence supports the view that loans do make an important and positive difference.

In our matching analysis we find that loans have a statistically significant and positive effect on tkey indicators of firm performance – productivity (output per worker) and profitability (profit per worker). Our stochastic frontier analysis provides a more direct and explicit treatment of productive efficiency at the firm level. Again we find loans to have a statistically significant and positive effect on the productive efficiency of the SMEs in our sample. Our control variables also suggest that medium sized firms tend to be less efficient than smaller ones and that a positive association exists between firm efficiency and perceived infrastructure constraints.

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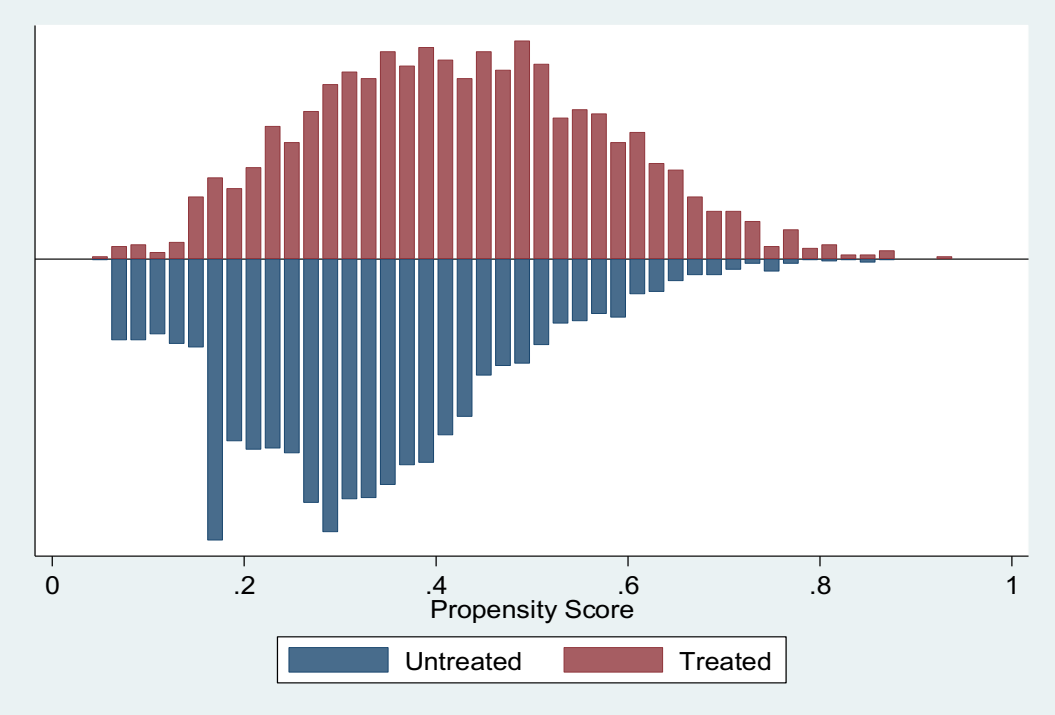
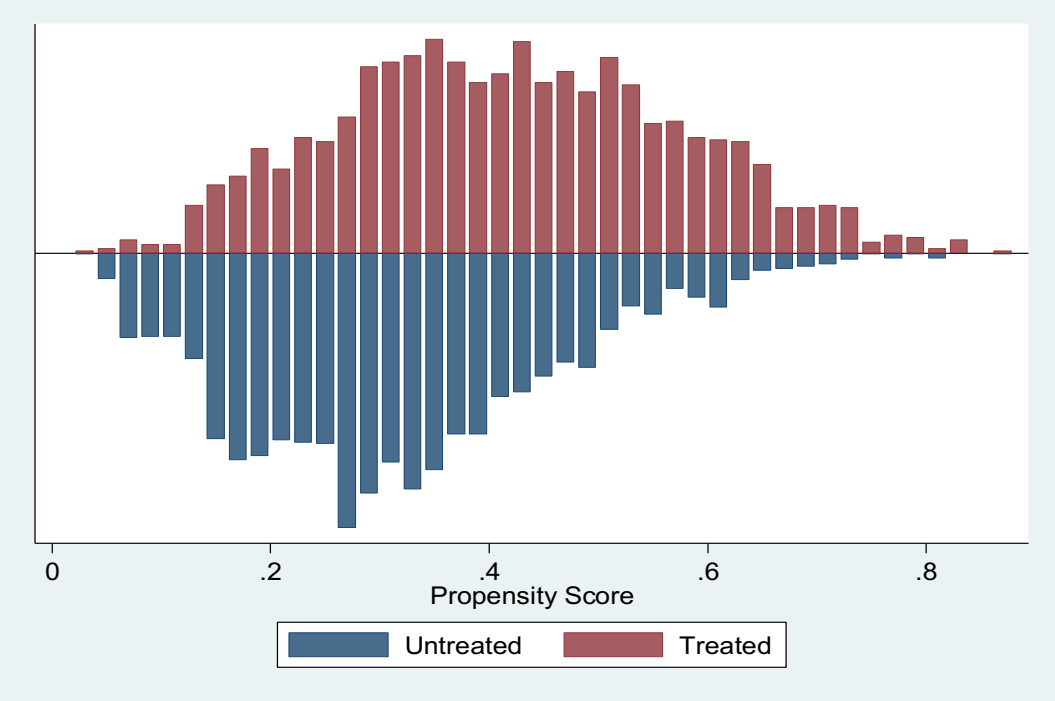
APPENDIX 1: MATCHING CHECKS (selection on observables)

A1.1 PropensityScores

All firms (up to 250 employees)



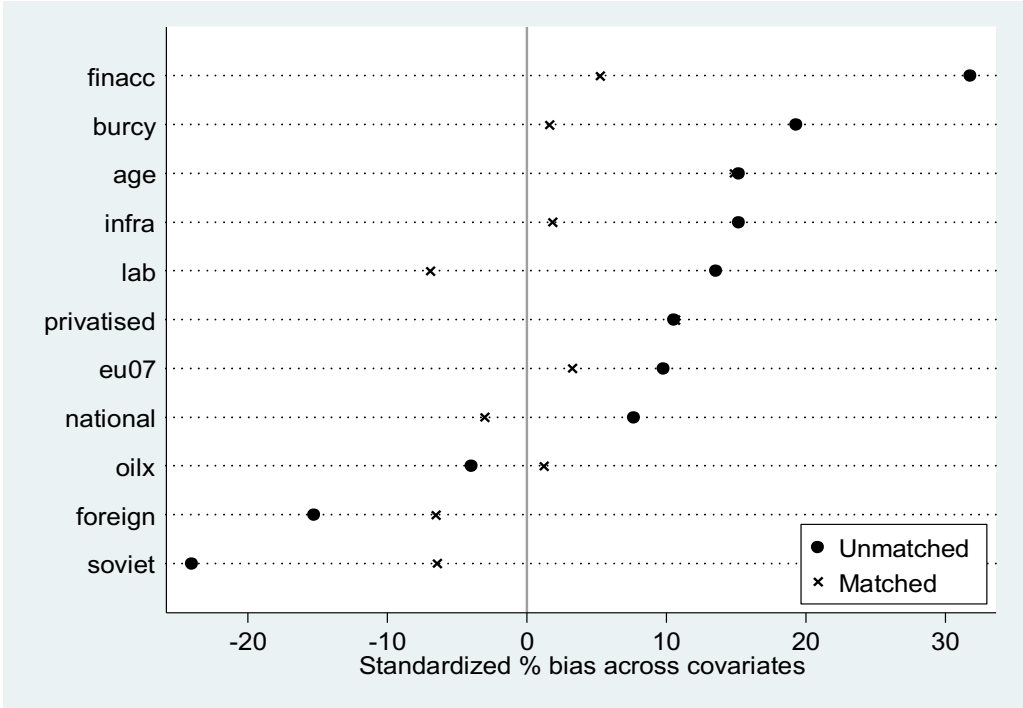
Firms up to 100 employees



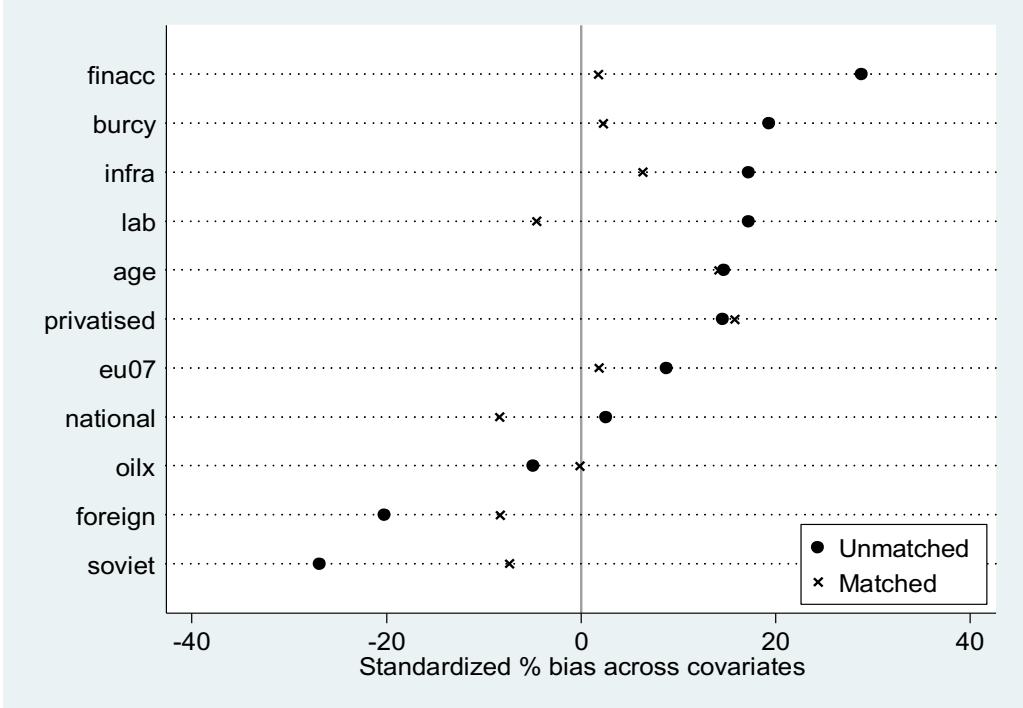
APPENDIX 1 (continued)

A1.2 Selection on observables (figures)

All firms (up to 250 employees)



Firms up to 100 employees



APPENDIX 1 (continued)

A1.3 Selection on observables - tables

All firms (up to 250 employees)

Variable	Unmatched Matched	Mean Treated	Mean Control	% bias	% reduction in bias	t-test t	t-test p>t
lab	U	50.845	43.813	13.5		2.35	0.019
	M	49.926	53.511	-6.9	49	-1.12	0.264
foreign	U	9.6927	14.229	-15.3		-2.65	0.008
	M	9.7575	11.696	-6.5	57.3	-1.18	0.237
age	U	37.35	16.005	15.2		2.63	0.009
	M	37.416	16.504	14.9	2	2.56	0.011
infra	U	2.99	2.5233	15.2		2.63	0.009
	M	2.9699	2.914	1.8	88	0.31	0.758
burcy	U	3.9734	3.3688	19.3		3.34	0.001
	M	3.9515	3.9005	1.6	91.6	0.27	0.784
privatised	U	0.14286	0.10797	10.5		1.83	0.068
	M	0.14381	0.10869	10.6	-0.7	1.83	0.068
national	U	0.49336	0.45515	7.7		1.33	0.185
	M	0.48997	0.50503	-3	60.6	-0.52	0.603
finacc	U	1.4967	1.0781	31.7		5.51	0
	M	1.4833	1.4139	5.3	83.4	0.87	0.383
soviet	U	0.28405	0.39701	-24		-4.16	0
	M	0.28595	0.31633	-6.5	73.1	-1.14	0.253
oilx	U	0.01329	0.01827	-4		-0.69	0.488
	M	0.01338	0.01185	1.2	69.3	0.24	0.813
eu07	U	0.37043	0.32392	9.8		1.7	0.09
	M	0.36789	0.35248	3.2	66.9	0.55	0.579

APPENDIX 1 (continued)

Firms up to 100 employees

Variable	Unmatched Matched	Mean Treated	Mean Control	% bias	% reduction in bias	t-test t	t-test p>t
lab	U	29.778	25.921	17.2		2.74	0.006
	M	29.277	30.312	-4.6	73.2	-0.69	0.491
foreign	U	7.6453	13.317	-20.2		-3.21	0.001
	M	7.7071	10.047	-8.3	58.7	-1.41	0.159
age	U	36.369	15.628	14.7		2.36	0.019
	M	36.479	16.496	14.2	3.7	2.22	0.027
infra	U	2.99	2.4553	17.2		2.74	0.006
	M	2.9818	2.7847	6.3	63.1	0.98	0.326
burcy	U	3.9719	3.3638	19.3		3.08	0.002
	M	3.9596	3.8883	2.3	88.3	0.35	0.727
privatised	U	0.11423	0.07198	14.6		2.32	0.021
	M	0.11313	0.0674	15.8	-8.3	2.52	0.012
national	U	0.50501	0.49222	2.6		0.41	0.684
	M	0.50303	0.5451	-8.4	-228.8	-1.32	0.185
finacc	U	1.493	1.1128	28.8		4.59	0
	M	1.4788	1.4555	1.8	93.9	0.27	0.789
soviet	U	0.26052	0.38521	-26.9		-4.27	0
	M	0.26263	0.2967	-7.3	72.7	-1.19	0.233
oilx	U	0.01002	0.01556	-4.9		-0.78	0.434
	M	0.0101	0.01023	-0.1	97.7	-0.02	0.984
eu07	U	0.36473	0.32296	8.8		1.4	0.162
	M	0.36566	0.35694	1.8	79.1	0.29	0.775