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CREDIT CONSTRAINTS AND INVESTMENT IN HUMAN CAPITAL

TRAINING EVIDENCE FROM TRANSITION ECONOMIES

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In 2013 all ECB publications feature a motif taken from the €5 banknote.


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Abstract

Using a unique survey database of 8265 firms from 25 transition economies, I find that lack of access to finance in general, and to bank credit in particular, is associated with significantly lower investment in on-the-job training. This effect is stronger in education-intensive industries and in industries facing good global growth opportunities. To address endogeneity issues, I use the structure of local credit markets as an instrument for credit constraints at the firm-level. In addition, in panel estimates, I control for the presence of unobserved firm-level heterogeneity, as well as for changes in macroeconomic conditions.

JEL classification: G10, J21, J24, M53.

Keywords: credit constraints, human capital, on-the-job training.

Non-Technical Summary

It is widely recognized that capital market imperfections can have adverse consequences for firm growth. A large empirical literature has documented the negative effect of credit constraints on capital investment (Love, 2003), R&D investment (Brown, Fazzari, and Petersen, 2009), and advertising expenses (Fee, Hadlock, and Pierce, 2009), among others. One potentially important alternative channel is investment in human capital through on-the-job training. Firm investment in human capital is costly and at the same time intangible, thus harder to finance than physical assets. Becker (1962) was the first to argue that lack of access to external financing may depress efficient investment in training, either because credit constrained workers will not be willing to accept lower wages, or because credit constrained firms may not be able to pay workers more than their marginal product during the training period. However, because direct measures of credit constraints are missing in conventional datasets, there is no microevidence that credit constraints affect training or that the magnitude of the effect is economically important.

In this paper, I attempt to uncover the missing link. I use data from the 2005 EBRD/World Bank "Business Environment and Enterprise Performance Survey" (BEEPS) on 8265 small and medium enterprises from 25 transition economies to analyze the impact of various self-reported financing constraints on on-the-job training. The survey contains detailed firm-level information on training, on different proxies for credit access, and on various firm-level characteristics which enables me to control for a variety of standard predictions of human capital theory.

There are three main stumbling blocks in evaluating the impact of credit market imperfections on investment in human capital. The first one is that while the literature has studied extensively what constitutes a credit constrained firm, credit constrained firms are usually not observable. To deal with this issue, I identify firms that do not have access to

credit markets from replies to direct questions about whether firms were denied credit or did not apply fearing that they would be denied. Second, credit constrained firms may also be firms for which the return to training is lower due to their more general technology, to their inability to lock workers into long-term contracts, or to their low degree of oligopsonic power. The detailed firm-level dataset used in this paper makes it possible to circumvent this problem by allowing me to observe these alternative factors directly and to separate their effect from the effect of credit constraints.

The most important stumbling block is that the use of survey-level data raises standard concerns about endogeneity. For example, if less efficient (low-growth) firms over-state their credit constraints, or if firms with more able managers and with better growth opportunities are also less constrained, then a negative association between credit constraints and on-the-job training will be capturing a simple correlation between the two, rather than a causal link from constraints to training. I address these issues in three ways. First, I employ a difference-in-differences specification whereby I exploit the fact that firms in certain industries are more likely to benefit - in terms of on-the-job training - from relaxed credit constraints. Second, I employ an instrumental variable procedure based on exploiting local variation in credit provision. In particular, I use the structure of local (city-level) credit markets as an instrument for the firm's credit constraints. Third, I identify a subset of firms that were also observed in the 2002 wave of the BEEPS, and employ a fixed effect panel regression in order to eliminate the effect of unobserved time-invariant firm-level heterogeneity.

My results suggest that credit constraints have a significant effect on the provision of firm-level training. Problematic access to external finance in general, and inability to access bank credit in particular, is associated with significantly lower investment in training. All else equal, a credit constrained firm has as much as a 9.3% lower probability of running a formal on-the-job training program for its employees than a firm which is not constrained in credit markets. This effect is stronger in industries that employ a relatively more skilled workforce

and that face good global growth opportunities. The results survive when I formally control for the main determinants of training suggested by standard human capital theory and by the "new training" literature. More importantly, the main results of the paper survive when I employ an instrumental variable procedure to eliminate possible reversed causality in the cross-section, and in the fixed effects panel regressions where I eliminate the bias induced by unobservable time-invariant firm-specific factors. In that sense, the estimated effects do not appear to be driven by training and financing constraints being jointly determined by various omitted variables at the firm or country level, or by inefficient firms shifting the blame for their underinvestment to the financial system. Additional tests suggest that training is positively correlated with sales growth and that firms cut other costs too, such as capital investment and advertising expenses, in response to adverse credit market conditions. My results thus confirm that lower investment in human capital is just one of several channels through which credit market imperfections depress firm growth.

The use of survey data also allows me to calculate the numerical effect of capital market imperfections on investment in training. My estimates suggest that,for example, if firms in Macedonia were on average as unconstrained as firms in Slovenia, as many as 7% more firms would be offering training to their employees, explaining around a quarter of the difference in aggregate training between the two countries. The results in the paper thus point to large and insofar not documented benefits - in terms of investment in human capital - from improving corporate access to finance.

1 Introduction

It is widely recognized that capital market imperfections can have adverse consequences for firm growth. A large empirical literature has documented the negative effect of credit constraints on capital investment (Love, 2003), R&D investment (Brown, Fazzari, and Petersen, 2009), and advertising expenses (Fee, Hadlock, and Pierce, 2009), among others. One potentially important alternative channel is investment in human capital through on-the-job training. Firm investment in human capital is costly[1] and at the same time intangible, thus harder to finance than physical assets. Becker (1962) was the first to argue that lack of access to external financing may depress efficient investment in training, either because credit constrained workers will not be willing to accept lower wages, or because credit constrained firms may not be able to pay workers more than their marginal product during the training period. However, because direct measures of credit constraints are missing in conventional datasets, there is no microevidence that credit constraints affect training or that the magnitude of the effect is economically important.

In this paper, I attempt to uncover the missing link. I use data from the 2005 EBRD/World Bank "Business Environment and Enterprise Performance Survey" (BEEPS) on 8265 small and medium enterprises from 25 transition economies to analyze the impact of various self-reported financing constraints on on-the-job training. The survey contains detailed firm-level information on training, on different proxies for credit access, and on various firm-level characteristics which enables me to control for a variety of standard predictions of human capital theory.

Under what conditions should firm-level credit constraints matter for on-the-job training? The theoretical literature provides answers to this question along two dimensions, related to the nature of training and to the structure of labor markets. In traditional human capital

[1] Total annual spending on on-the-job training in the U.S. economy routinely amounts to 2% of GDP, about one third of total expenses on formal education (for early evidence, see Mincer, 1962).

theory, firms do not pay for general training whose cost is fully borne by the workers, and so firm-level credit constraints should matter only in the case of specific training (Becker, 1962). More recently, the literature has suggested that firms are willing to pay for general training too, for example because they obtain superior information on the worker's ability during training (Acemoglu and Pischke, 1998), or because the firm's monopsonic power results in a compressed wage structure (Acemoglu and Pischke, 1999b). In these models, credit constraints on the side of the firm matter as long as the firm enjoys a certain degree of oligopsonic wage setting power, and as long as contractual problems do not prevent the firm from committing to providing training once the worker has made a wage concession.

There are three main stumbling blocks in evaluating the impact of credit market imperfections on investment in human capital. The first one is that while the literature has studied extensively what constitutes a credit constrained firm[2], credit constrained firms are usually not observable. Indirect tests based on the response of wages to training in current and future jobs (e.g., Booth and Bryan, 2005) are unable to reveal the magnitude of the negative effect of credit constraints on training. In contrast to such studies, and similar to Jappelli (1990) and Cox and Jappelli (1993), I identify firms that do not have access to credit markets from replies to direct questions about whether firms were denied credit or did not apply fearing that they would be denied. Second, credit constrained firms may also be firms for which the return to training is lower due to their more general technology, to their inability to lock workers into long-term contracts, or to their low degree of oligopsonic power. The detailed firm-level dataset used in this paper allows for separating the effect of credit constraints from the effect of these alternative factors. In particular, I observe how long it takes the firm to fill a vacancy (a proxy for oligopsonic power), the extent to which the firm is subject to labor and social security inspections (a proxy for the degree of contractual problems between the firm and its workforce), and the frequency with which the

[2]See, for example, Fazzarri, Hubbard, and Petersen (1988), Kaplan and Zingales (1997), Whited and Wu (2006), Rauh (2006), and Hadlock and Pierce (2010), among others.

firm updates its technology (a proxy for the mix of general vs. specific training).

The most important stumbling block is that the use of survey-level data raises standard concerns about endogeneity. For one, there is the problem of reversed causality: less efficient (low-growth) firms may be reporting higher financing constraints as they shift the blame for their underinvestment to the country's credit markets. For two, the cross-sectional nature of the data raises questions about omitted variable bias: for example, unobserved growth opportunities or managerial ability could be the main driving force behind the scale of the firm's on-the-job training program. If less efficient firms over-state their credit constraints, or if firms with more able managers and with better growth opportunities are also less constrained, then a negative association between credit constraints and on-the-job training will be capturing a simple correlation between the two, rather than a causal link from constraints to training. I address these issues in three ways. First, I employ a difference-in-differences specification whereby I exploit the fact that firms in certain industries are more likely to benefit - in terms of on-the-job training - from relaxed credit constraints. Second, I employ an instrumental variable procedure based on exploiting local variation in credit provision. In particular, I use the structure of local (city-level) credit markets as an instrument for the firm's credit constraints. Bank competition has been shown to affect small firms' access to credit positively by lowering the cost of credit to newcomers (Cetorelli and Strahan, 2006). At the same time, it is unclear why credit market structure should affect corporate investment in human capital directly, and so there is no reason to expect that the exclusion restriction would be violated. Third, I identify a subset of firms that were also observed in the 2002 wave of the BEEPS, and employ a fixed effect panel regression in order to eliminate the effect of unobserved time-invariant firm-level heterogeneity.

My results suggest that credit constraints have a significant effect on the provision of firm-level training. Problematic access to external finance in general, and inability to access bank credit in particular, is associated with significantly lower investment in training. All else

equal, a credit constrained firm has as much as a 9.3% lower probability of running a formal on-the-job training program for its employees than a firm which is not constrained in credit markets. This effect is stronger in industries that employ a relatively more skilled workforce and that face good global growth opportunities. The results survive when I formally control for the main determinants of training suggested by standard human capital theory (Becker, 1962; Oi, 1983) and by the "new training" literature (Katz and Ziderman, 1990; Acemoglu and Pischke, 1999a,b). More importantly, the main results of the paper survive when I employ an instrumental variable procedure to eliminate possible reversed causality in the cross-section, and in the fixed effects panel regressions where I eliminate the bias induced by unobservable time-invariant firm-specific factors. In that sense, the estimated effects do not appear to be driven by training and financing constraints being jointly determined by various omitted variables at the firm or country level, or by inefficient firms shifting the blame for their underinvestment to the financial system. Additional tests suggest that training is positively correlated with sales growth and that firms cut other costs too, such as capital investment and advertising expenses, in response to adverse credit market conditions. My results thus confirm that lower investment in human capital is just one of several channels through which credit constraints depress firm growth.

This study relates to the literature on the real effects of financial market imperfections. Credit constraints have long been shown to matter for capital investment (Fazzari, Hubbard, and Petersen, 1988). La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) argue that differences in financial systems can explain much of the variation across countries in firms performance. Cooley and Quadrini (2001) and Clementi and Hopenhayn (2006) develop theoretical models of borrowing/lending relationships to support the conjecture that borrowing constraints have important implications for firm growth and survival.[3] However, while previous studies have pointed to the large negative effects of financing constraints

[3]See Hennessy and Whited (2006) for a state of the art reference on the influence of firm-level financing constraints on investment.

on firm growth (Beck, Demirguc-Kunt, and Maksimovic, 2005), the literature has mostly focused on the effect of financing constraints and financial development on investment in non-human capital, such as capital investment (Love, 2003) or R&D investment (Li, 2011). This paper is the first to study the channel of human capital accumulation through which financial market frictions may depress firm-level, as well as aggregate, productivity growth in emerging markets.

The paper also relates to the empirical literature on the determinants of human capital investment by the firm. Acemoglu and Pischke (1998) provide evidence on the effect of the firm's informational monopsony power on its incentives to provide general training. Leuven and Oosterbeek (2004) show that tax deductions lead Dutch employers to offer more training. Dustmann and Schonberg (2009) provide evidence on the effect of unionization on training that the firm pays for. Neumark and Washer (2001) present evidence that minimum wages reduce formal training to improve skills on the current job. Unlike these studies, I test for the effect of credit constraints on training, and my firm-level data allow me to attain numerical estimates of this effect.

The paper proceeds as follows. In Section 2, I introduce the data. Section 3 discusses the identification of the causal effect of financing constraints on training. I report the main results in Section 4. In Section 5, I report the results from the tests in which I account for the potential endogeneity of financing constraints. In Section 6, I compare numerically the effect of credit constraints on training to its effect on other type of firm investment. Section 7 concludes.

2 Data

The main data for this study come from the Business Environment and Enterprise Performance Survey (BEEPS). The World Bank and the European Bank for Reconstruction and

Development conducted jointly this survey in 1999, 2002, 2005, and 2008. The cross-sectional analysis in the paper is based on data from BEEPS 2005, as this survey contains the most detailed information about firm access to credit and on-the-job training.[4] The 2005 BEEPS provides data on 8265 firms from 25 countries in Central and Eastern Europe and Central Asia and covers a representative sample of firms for each of these countries.[5] In particular, the survey strives for representativeness among respondent firms in each individual economy in terms of industrial sectors and firm size distribution.[6] I complement the cross-sectional analysis with a panel analysis based on the responses of 1179 firms which participated in both the 2002 and the 2005 survey. In this section, I discuss the data used in the cross-sectional analysis. Information on the panel sample is provided in Section 5.

The main outcome variable derives from the following question: "Does your firm offer formal training to your skilled employees?". The question implies incidence of training whose general/specific mix is more skewed towards specific. I construct a binary variable equal to 1 if the firm answered "Yes", and to 0 if it answered "No". There is no further qualifying of the training program in terms of length or intensity. As a result, the dependent variable in the paper is somewhat coarse: it treats as observationally equivalent a single short training course and a large-scale ongoing training program. Naturally, firms with no skilled employees are excluded from the analysis.

The next main piece of survey information used in the paper is the information on credit constraints. Firms are asked qualitative and quantitative questions about how problematic certain financing constraints are. I construct three proxies for credit constraints based on the survey questions available. The variable *Access to finance problematic* is derived from

[4]For example, the 2002 BEEPS does not contain detailed questions on specific types of credit market experience by firms, and the 2008 BEEPS has no questions on on-the-job training.

[5]I drop Albania and Uzbekistan because the difference between the share of firms offering training in 2005 and in 2002 - the survey used in the panel exercise - is enormous (more than 50%), raising questions about the survey methodology used in these two countries. I also drop very large firms to make sure that I have a representative SME sample.

[6]See http://www.ebrd.com/country/sector/econo/surveys/beeps.htm for further detailed reports on the representativeness of the survey.

the question: "How problematic is access to financing for the operation and growth of your business?" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). The variable *Rejected* is a dummy variable equal to 1 if the firm applied for a bank loan but its application was rejected, and to 0 otherwise. Finally, the variable *Constrained* is a dummy variable equal to 1 if the firm declares that it needs a bank loan, but it does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions ("Collateral requirements for bank loans are too strict"; "Interest rates are too high"; "Did not think it would be approved"). By construction, in all cases a higher value implies a higher constraint.

The first constraint is calculated over all firms in the sample who answered the relevant question, regardless of whether they have any specific experience with bank loan applications. From the questions on actual credit experience, I classify the firms as credit constrained using two different criteria. According to the first criterion (*Rejected*), a firm is constrained if its loan application was rejected by its bank, and according to the second criterion (*Constrained*), a firm is constrained either because its loan application was rejected by its bank, or because it was discouraged from applying or informally rejected. Consequently, *Rejected* firms are calculated over the sub-sample of firms that applied for a loan, while *Constrained* firms are calculated over the sub-sample of firms with a positive demand for a loan. The first classification is in line with how studies using credit register data define the loan supply (e.g., Jimenes, Ongena, Peydro, and Saurina, 2012), while the latter classification is used in studies that use survey data to define credit constraints (see Cox and Jappelli, 1993; Duca and Rosenthal, 1993; and Popov and Udell, 2012, among others). The rationale for the latter is that rejected and discouraged borrowers are observationally identical, and discouraged borrowers either correctly anticipate that they will not be given credit, or are informally rejected by the loan officer without that information entering bank records.

< Table 1 >

Table 1 reports summary statistics for the outcome variable (on-the-job training), and the three types of credit constraints used in the empirical tests, by country. The table illustrates the different sub-samples over which the three different constraints are calculated. For instance, there are 270 firms in Bulgaria which responded to the *Access to finance problematic* question. Only 167 of these firms, however, declared a positive demand for loan, and only 111 actually applied for a loan. Out of the firms which applied, 102 received a loan and 9 were rejected, corresponding to a rejection rate of 8.1%. Out of the 167 firms with a positive demand for a loan, 9 applied and were rejected and 57 did not apply because of adverse credit conditions. This results in 66 constrained firms, or 39.5%.

Table 1 reveals large variations across countries in the main variables of interest. For example, while only 16% of the firms in Azerbaijan offer training to their employees, 81% of the firms in Slovakia do. Access to finance is between "no obstacle" and "minor obstacle" in Estonia, Latvia, and Lithuania, but a "major obstacle" in Poland and Yugoslavia. 59% of the firms that apply for a bank loan in Azerbaijan are rejected, while less than 1% of those in Bosnia are. Finally, 88% of firms in Slovenia that demand a bank loan have one, while 63% of those in Tajikistan are either formally rejected or discouraged from applying.

Next, I utilize information on a wide range of firm-level controls that may play a role in determining the level of investment in human capital. For example, it is customary to control for firm size. Larger firms generally offer more training, either because they economize on monitoring costs by training more (Oi, 1983), or because with large internal labor markets, the expected duration of employment is higher and so are the firm's incentives to train (Idson, 1996), or because large firms have a higher probability of survival which again raises their incentives to offer training (Oi and Idson, 1999). Firm ownership can also play a role if, for example, foreign-owned firms have access to larger internal capital markets. And the share of skilled/educated labor and the firm's sector of operation can affect the return to training, while access to government subsidies can affect the cost of training. Table 2 summarizes

the firm-level controls, by country. Appendix Table 1 suggests that credit constraints are correlated with more traditional proxies such as firm size and ownership.

< Table 2 >

In much empirical tests in the cross section, country fixed effects are employed to eliminate the effect of unobservable regulatory, macroeconomic, and market factors that are common for all firms in a country. However, in panel data tests I complement the firm-level data with a number of time-varying country-level variables that allow me to control for differences in institutional quality, in economic and financial development, in macroeconomic performance, in general human capital, and in labor regulations, among else. Including such variables is particularly important in transition economies, where structural and macroeconomic reforms have coincided with developments that have affected both access to finance and firms' incentives to invest in on-the-job training. For example, I include "GDP per capita" and "GDP growth"; "Creditors rights" denotes the degree of protection of the rights of creditors; "Inflation" is included as a proxy for macroeconomic stability; and "Private credit" proxies for financial development.

< Table 3 >

Table 3 summarizes the country-level controls, by country. Definitions and sources for all variables are provided in the Appendix.

3 Identification

With firm-level information on actual credit constraints, the two remaining empirical challenges I face are: 1) to separate the effect of credit constraints on training from the effect of the firm's technology, the degree of labor market monopsony, and the strictness of labor

contracts; and 2) to account for potential endogeneity arising, for example, from inefficient firms' reporting severe financing constraints as they shift the blame for their underinvestment to financial markets, or from both financing constraints and the provision of on-the-job training being determined by an omitted factor. Below I discuss how I deal with these two problems.

3.1 Technology, Monopsony, and Labor Contracts

To address the first challenge, I use firm-level data from the BEEPS which allow me to account directly for these alternative explanations. First, I employ a dummy variable equal to 1 if the firm has introduced a new technology in the past 3 years; the more advanced the firm's technology is compared with the competition, the more specific the productivity effect from training will be, and the higher the incentives to invest in training (Becker, 1962). This procedure also allows me to control for the general/specific mix of the training that the firm provides. Recall that all I know about that mix is that the firm is offering training to its *skilled* employees. While this suggests a more specific training mix, controlling for the firm's technology is crucial to ensure that credit constraints are not simply picking up variations in the training mix.

I also employ a dummy variable equal to 1 if it takes the firm on average less than 4 weeks to fill a vacancy. This variable is meant to proxy for the firm's degree of monopsony power in the local labor market. If it takes the firm a long time to fill a vacancy, this will imply competition among employers and hence abundant job-switching opportunities for employees, eroding the firm's return to training. Conversely, hiring ease would imply a relatively high degree of monopsony power, and by extension higher incentives to invest in training if such training is at least to some extent general (Acemoglu and Pischke, 1999a). In addition, with competition for workers and with no wage compression, firms would not be willing to pay for training and hence firm-level credit constraints would be irrelevant as

the workers will be bearing all of the training cost (Acemoglu and Pischke, 1999b).

Third, I employ a dummy variable equal to 1 if the firm faced regular labor and social security inspections in the past year. The strictness of labor regulation may imply stricter labor contracts and hence lower probability of losing the return to investment in training because of high worker mobility. This argument relates to recent research which has shown that by making long-term contracts feasible, unions bring training closer to the socially-optimal level (Dustmann and Schonberg, 2009). Frequent labor inspections are also a prerequisite for the elimination of contractual problems between the worker and the firm. This point relates to Acemoglu and Pischke's (1999b) distinction between a constrained and an unconstrained regime, whereby in the constrained regime, contractual problems prevent the firm from committing to providing training once the worker has made a wage concession. With credible commitment, the worker will have an incentive to take a wage cut in order for the firm to provide training that is at least in part general.[7]

These three proxies are summarized in the last three columns of Table 2, again by country.

3.2 Endogeneity

While detecting a robust association between credit constraints and firm training would in itself be a valuable result, it would be even more desirable to argue for a causal link in this association. In this regard, the final issue to address is the endogeneity of credit constraints. Self-reported problematic access to finance may simply signal that inefficient firms are shifting the blame for their inefficiency to the country's financial system (Beck, Demirguc-Kunt, and Maksimovic, 2005). Alternatively, both credit constraints and lack of training may be stemming from omitted factors, like unobservable managerial ability or growth opportunities.

[7] Arguably, this variable may also be interpreted as degree of corruption, as such inspections can be used as instruments of bureaucratic harassment.

I rely on three empirical approaches to deal with the problem at hand. First, I employ a difference-in-differences specification whereby I exploit the fact that firms in certain industries are more likely to invest in their workers' human capital as following credit market development. Such industries are likely to employ a relatively more skilled workforce, raising the return to investment (Becker, 1962), and to face good global growth opportunities (Bekaert, Harvey, Lundblad, and Siegel, 2007; Fisman and Love, 2007). I construct proxies for these industry benchmarks from firm-level information on the share of workers with university degree from the BEEPS (for human capital intensity), and from data on US industry growth over 1996-2005 (for global growth opportunities). The firms in the dataset are classified across 8 broad industry classes, arguably resulting in a relatively low variation.

The second approach is based on an instrumental variables procedure whereby the exogenous element of credit constraints is extracted using an instrument that only affects training through the firm's access to finance. To that end, I employ data on the structure of local credit markets. I make use of a detailed map of bank branches at the level of the locality in which the firms in the dataset are incorporated. As this information is only available for the European countries in the dataset, the sample is reduced to 5035 firms in 820 localities in 14 countries. Branch density should be a valid instrument for two reasons. First, the literature has provided abundant evidence that bank competition affects firm access to credit, although the sign of that effect tends to depend on the empirical set-up. For example, evidence on the effect of U.S. banking deregulation on new business creation suggests that access to finance has improved as a result from higher bank competition (Black and Strahan, 2002; Cetorelli and Strahan, 2006).[8] Second, there is no reason to expect that local credit market structure should affect training through a channel other than credit access, satisfying the exclusion restriction. Information on this instrument is summarized in Table 3 and reveals large varia-

[8]Petersen and Rajan (1995) however argue that banks are more likely to invest in soft information and forge lending relationships if they enjoy a certain degree of monopoly power which would allow them to recoup the costs of this investment, and present international evidence in support of this idea.

tions across countries. For example, there are almost three times more branches per 100,000 of population in Slovenia than in Croatia (34.0 vs. 13.1).

The third empirical approach is based on the fact that 1179 of the 8265 firms in the 2005 BEEPS also appear in the 2002 BEEPS. Similar to Brown, Jappelli, and Pagano (2009), this procedure allows me to control for changes in macroeconomic variables and in the legal environment, using panel data constructed from the 2002 and the 2005 surveys. More importantly, the panel data enables me to address concerns about omitted variable bias. Such would arise if, for example, abler managers are more capable of securing credit, and at the same time are more willing to train their employees because of complementarity in production between the employees' skill set and the manager's ability. With unobservable managerial ability, the concern related to this potential bias needs to be addressed, and I do so by running a panel regression with firm fixed effects.

4 Impact of Financing Constraints on Training

4.1 Empirical Strategy

I am interested in whether credit constraints affect the firm's ability to invest in training. My basic model using the cross-sectional data is

$$Training_{ijk} = \alpha + \beta \cdot Credit\ constraint_{ijk} + \gamma \cdot X_{ijk} + \delta \cdot D_{jk} + \varepsilon_{ijk} \tag{1}$$

where Training_{ijk} is a dummy variable identifying whether firm i in country j in industry k has offered formal training to its employees in the past year; $Credit\ constraint_{ijk}$ denotes each of the three possible financing obstacles faced by firm i in country j in industry k (see Section 2 for the exact definition of each constraint). X_{ijk} is a matrix of firm-level covariates capturing the firm's size, ownership, access to foreign markets, soft budget constraints, and

available human capital, among others. It also includes proxies for the specificity of the firm's technology, for the firm's monopsony power, and for the strictness of the labor contracts that the firm can offer, allowing me to separate the effect of credit constraints from the effect of other determinants of investment in general training outlined in the literature. ε_{ijk} is the idiosyncratic error term. The specification also includes a matrix of country and industry fixed effects D_{jk} which capture the independent effect on investment in human capital of various unobservable market characteristics and of the sector's technology or global opportunities that are common across all firms.[9] I expect the sign of β to be negative as credit constraints raise the cost of providing training.

4.2 Credit Constraints and Training: Main Result

Table 4 provides the first basic test of whether the coefficient β in Model (1) is statistically different from zero. All tables report the estimate from a probit regression[10] while the numbers in the text are calculated using the marginal effect evaluated at the sample mean.

< Table 4 >

The firm-level covariates are broadly consistent with the general predictions of human capital theory. For example, the probability of paying for training increases with firm size, consistent with the idea that large employers economize on their monitoring costs by increasing on-the-job training for new employees (Oi, 1983), or with the idea that larger internal labor markets increase the incentive to train by raising the employee's tenure at the firm. Foreign-owned firms offer more training, which is consistent with the theory that educated labor is more complementary with physical capital than unskilled labor (Griliches, 1969) if foreign-owned firms in emerging markets have a superior capital base. Firms with access to

[9] Most firms operate in more than 1 sector, and so in constructing the industry dummies, I assign each firm to the sector which accounts for strictly more than 50% of its sales.

[10] The results are quantitatively unchanged if a logit model is used instead (results are available upon request).

foreign markets have a higher probability of offering training. This is consistent with the idea that such firms face a higher return to training resulting from their superior technology; for example, Helpman, Melitz, and Yeaple (2004) show that only the most productive firms engage in foreign activities. Firms in which a larger share of the employees have university education also provide more training, suggesting complementarities between training and formal education. Subsidized firms train more, implying that subsidies lower the effective cost of providing training.

As discussed above, I also include in the regressions a dummy equal to 1 if the firm has introduced a new technology in the past 3 years (a proxy for how specific the productivity effect from training is), a dummy equal to 1 if it takes the firm on average less than 4 weeks to fill a job vacancy (a proxy for the firm's degree of monopsony power), and a dummy equal to 1 if the firm faced regular labor and social security inspections in the past year (a proxy for the degree of contractual frictions between the firm and its employees). The estimates reported suggest that all these explanatory variables have the expected sign: firms whose training mix is more specific because their technology is more advance tend to train more. According to the estimates in column (1), all else equal, a firm which has introduced a new technology in the past three years has a 13.1% higher probability of running a formal on-the-job training program (as implied by the estimate from the marginal probit). Also, firms with a higher degree of monopsony power have a higher probability of investing in on-the-job training. In particular, firms for which it takes less than 4 weeks to fill a vacancy have a 3.1% higher probability of offering training, and this effect is significant at the 5% statistical level. Finally, firms facing more frequent labor inspections have a 6.8% higher probability of running a formal on-the-job training program. Similar effects are recorded for the two actual credit constraints in columns (2) and (3), although the effect of monopsony power is no longer statistically significant.

Turning to the main explanatory variables, in column (1) the sign on the coefficient of the *Access to finance problematic* variable is negative and significant at the 5% level.[11] Evaluated at the sample mean, the magnitude implies that relative to a firm for which access to finance is "no obstacle", an identical firm for which access to finance is a "major obstacle" has a 5.3% lower probability of offering training to its employees.

In unreported regressions, I replace the continuous variable *Access to finance problematic* with dummies equal to 1 if the firm reports that access to finance is "no obstacle", a "minor obstacle", a "moderate obstacle", or a "major obstacle", varying the base group. The estimates imply that most of the effect of credit constraints on training is realized by moving from "minor obstacle" to "no obstacle", while there is no difference in training between firms for which access to finance is a "major obstacle" and a "minor obstacle", respectively.

In columns (2)-(3) I evaluate the effect of credit constraints for firms that have an actual experience with trying to obtain bank finance. I do so for the sub-sample of firms that applied for a bank loan (column (2)) and for the sample of firms that declared a strictly positive demand for credit (column (3)). The sample is thus reduced to the 3614 applicant firms in column (2), and to the 5525 firms that declare a positive demand for credit in column (3).

In column (2), I find that a firm which needs credit and which had its last loan application denied has a 8% lower probability of offering training to its employees than a firm which needs credit and it had its loan application approved. This effect is significant at the 5% level too. The rest of the firm-level covariates have a similar effect to column (1), implying that the sample of applicant firms is not systematically different from the full sample.

Column (3) shows that a firm which needs credit but does not have a bank loan - either because it was rejected, or because it was discouraged from applying by adverse credit conditions - has a 5.8% lower probability of offering training to its employees than a firm

[11] The number of firms in the regression is lower than the 8265 reported in Table 1 due to various missing firm-level data.

which demands a loan and has one. This effect is significant at the 1% level. I conclude that in a cross-country regression with firm-level covariates and country and industry fixed effects, credit constraints are associated with a large and significant negative effect on the firm's ability to invest in human capital. This is true not just for one definition of credit constraints, but for a range of such definitions.[12]

5 Addressing the Endogeneity of Financing Constraints

5.1 Credit Constraints and Training: Empirical Channels

The effect of credit constraints on the firm's willingness to offer on-the-job training should be higher for firms that are more likely to benefit from training and/or to respond to changes in credit markets. For example, if firms rely on highly trained employees for technological purposes, they are more likely to benefit from a decrease in the cost of training due to easier access to external finance. Analogously, financial development should increase the economy's resource allocation primarily to sectors with good growth opportunities (Bekaert et al., 2007; Fisman and Love, 2007). The basic idea is that a firm's technology is fixed, so it cannot migrate across industry classes in response to financing constraints (Rajan and Zingales, 1998). Empirically, one should then expect the detrimental effect of credit constraints on training to be relatively higher in industries with high human capital intensity and in industries facing good growth opportunities.

To address this point, I adopt a difference-in-differences specification, as follows:

[12] Appendix Table 2 repeats the empirical tests from Table 4 with an array of country-level variables in the place of the country fixed effects. I find that firms train more often in richer countries and in financially developed countries, suggesting that the return to human capital is indeed higher when the general technology is superior and when finance is abundant. Countries where it takes longer to enforce a contract are characterized by a higher share of firms offering training, suggesting that the benefits of an inefficient court system in increasing the firm's bargaining power vis-a-vis its workers may outweigh its costs associated with under-protection of investment. Finally, higher general human capital is associated on average with more training, but not statistically so.

$$
\begin{aligned}
Training_{ijk} = \; & \alpha + \beta_1 \cdot Credit\ constraint_{ijk} \cdot Growth\ opportunities_j + \\
& \beta_2 \cdot Credit\ constraint_{ijk} \cdot Human\ capital\ intensity_j + \\
& + \beta \cdot Credit\ constraint_{ijk} + \gamma \cdot X_{ijk} + \delta \cdot D_{jk} + \varepsilon_{ijk}
\end{aligned} \tag{2}
$$

Similar to Fisman and Love (2007), I use US data on value added growth to capture global growth opportunities. The basic assumption behind this approach is that if firms in the US respond perfectly to industry-specific shocks to growth opportunities (for example, because of low credit constraints), then the actual growth of US firms should be a good proxy for these growth opportunities. I average US industry growth, for the 8 industries in the dataset, for the 10 years prior to the survey, 1996-2005 (data come from Eurostat). Regarding the second industry benchmark, I exploit the information that is already in the BEEPS. Namely, I average across firms within the same industry the share of workers with university education. In order to make sure that this industry benchmark is exogenous to any individual firm, I assign to each firm a benchmark calculated using only information on firms from the other 25 countries in the dataset.

< Table 5 >

The estimates from Model (2) are reported in Table 5. The regression coefficients on the interaction variables have the expected sign, and in a number of cases, they are significant in the statistical sense, too. For example, a lower value of the *Access to finance problematic* variable is associated with higher training, in particular in industries with high human capital intensity (column (1)). The same applies to firms that are *Constrained* (column (3)). Relative to *Rejected* firms and to *Constrained* firms, firms that applied for credit and obtained it are relatively more likely to offer on-the-job training if they also belong to an industry that is facing good global growth opportunities (columns (2) and (3)). The evidence thus suggests that the relationship between financing constraints and the willingness

of firms to offer on-the-job training is not a spurious one and does not simply reflect the already established relationship between access to finance and capital investment.

5.2 Instrumental Variable Regressions in the Cross-Section

I now report the estimates from instrumental variable regressions in the cross-section of firms. I take advantage of the structure of local credit markets in the spirit of Guiso, Sapienza, and Zingales (2004) by making use of a unique hand-collected dataset on local bank branch presence. The data were originally assembled as part of a project to map the branching network in emerging economies in central and eastern Europe, and include the following 14 countries of the original 25: Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, Slovenia, and Yugoslavia.

The data collection process is as follows. The firms in the 2005 BEEPS are incorporated in a total of 820 localities (towns and villages), for an average of 10.1 firms per locality. The first task is to determine the extent of bank presence in these localities. Pursuing a trade-off between representativeness and manageability, only banks that comprise at least 80% of the banking sector assets in each country were considered. The outcome of this selection process is a range of between 4 banks in Estonia and 9 banks in Bulgaria, which arguably results in the exclusion of a number of smaller banks. Given this criterion, it was determined that the localities in the sample are served by a total of 147 banks. Out of those, 26 are domestic banks, and 121 are branches or subsidiaries of 23 foreign banks. Finally, the web sites of the 147 banks in the sample were searched in 2008 in order to determine in which city/town each bank is present, and how many branches each bank has in each locality in which it is present. In those cases where the firm is incorporated in a very small locality (for example, a village) where no bank is present, the branching network of the closest town with non-zero

bank presence is used as a branching network for this locality.[13] I further normalize the number of branches per 100,000 of local population, and take logs. The resulting variable is called *Branches per population.*

Using branch density as an instrument for credit constraints relies on two assumptions. First, I assume that firms borrow from, or are rejected or discouraged by, banks located in their locality of incorporation. A similar approach is used in, for example, Gormley (2009) and Popov and Udell (2012). In general this is expected to hold as banks tend to derive market power ex ante from geographical proximity (e.g., Degryse and Ongena (2005)). Lending support to that conjecture, empirical work regarding lending relationships in different countries has demonstrated that the average distance between SMEs and their bank is usually very small. For example, Petersen and Rajan (2002) find that the median distance between a firm and its main bank over the 1973-1993 period was only four miles; in Degryse and Ongena's (2005) sample, the median distance between a firm and its main bank is 2.25 kilometers (1.6 miles); and in Agarwal and Hauswald's (2010) sample, the median distance between a firm and its main bank is 0.55 miles.

The second assumption is that the bank branching network does not affect training through other channels but access to finance. This would not be the case if, for example, banks branched out relatively more in more dynamic local economies where firm demand for training is higher, or in localities with a superior pool of skilled workers. While it is not possible to rule out all such mechanisms, I am able to check for evidence of any such statistical association. The data lend little support to such concerns. For one, albeit I do not have data on city-level GDP per capita, I can check if there are disproportionately more banks per population in larger cities that tend to have more dynamic economies. Branching

[13] See Popov and Udell (2012) for more details on the data collection process. Arguably, the bank branching network in 2008 when it was determined is not a perfect proxy for the branching netrowk in 2005 when the BEEPS was taken. However, a comparison carried out in 2012 revealed that in more than 90% of the localities, the number of branches per bank per locality had stayed the same as in 2008, suggesting that changes in branch penetration are very slow.

concentration seems to be, if anything negatively correlated with overall population, and so there is no evidence for a positive association between bank branch concentration and the demand for training. In addition to that, the simple correlation between branch concentration and country-level GDP per capita is only 0.01. Second, using firm-level data on training, the share of skilled workers, and the share of workers with university education, I also reject the hypothesis of a positive association between branch concentration and the skill composition of the local economy. The evidence thus goes some way towards ruling out an economic channel between the mechanism that guides bank branching and the mechanism that guides optimal investment in training, other than through access to finance.

< Table 6 >

Table 6 reports the results from the first and second stage of the IV regression where the three credit constraints have been instrumented using the instrument just described. To account for the fact that if only one bank is present in a locality, but it has multiple branches, this is not really a sign of competition, I perform the tests both on the full sample (Panel A) and on the sample of firms in localities with strictly more than 1 bank (Panel B). In the case of *Access to finance problematic*, the first-stage of the regression implies that a higher number of bank branches per population in combination with higher information sharing is associated with significantly (at the 1% statistical level) higher access to finance (column (1)). The value of the first-stage Wald Statistics, reported as "Wald F-statistics", is 8.08 in Panel A, and 12.04 in Panel B, which is around the critical value for the IV regression to have no more than 10% of the bias of the OLS estimate (see Stock and Yogo, 2005). The second-stage implies that poor access to finance has a significant (at least at the 10% level) negative impact on the firm's probability of offering training (column (2)). The economic effect of access to finance increases by a magnitude of 8 relative to OLS estimates on the same sub-sample of firms. This implies that the OLS estimator is downward biased. One possible

explanation for this is that firm-level characteristics unobservable to the econometrician, such as investment opportunities, simultaneously decrease training (as resources are moved away from human capital to physical capital) and improve access to finance (as collateralizeable assets are expected to go up).

When I proxy firm credit constraints with the variable *Constrained*, the effect of credit constraints on training survives once again, and is again significant at the 10% (column (6) in both Panel A and Panel B). The first-stage suggests that a higher concentration of bank branches is again associated with significantly higher access to finance (column (5)). The results from Table 5 do not survive, in the statistical sense, in the case of *Rejected*, potentially to some extent due to the lower number of observations.

5.3 Fixed Effects Panel Estimates

In this sub-section, I employ a different approach to tackling possible endogeneity issues. In particular, I repeat my main analysis using a panel of firms generated from the 2002 and 2005 BEEPS. Of the total 8265 firms covered by the BEEPS 2005, 1179 were also surveyed in 2002.[14] This allows me to run a panel regression with fixed effects which should eliminate the bias induced by unobservable time-invariant firm-level heterogeneity.

As the BEEPS 2002 does not contain data on specific experience with credit markets, I am only left with the *Access to finance problematic* variable. Also, the question on the frequency of labor and social security inspections is not present in the 2002 BEEPS. In Table 7, I perform three types of tests. I first pool the 2002 and the 2005 samples, treating observations from the same firm as independent; I then run a random effects panel regressions; and finally I run a fixed effect estimation.

< Table 7 >

[14] Due to various missing firm-level data, I use a maximum of 863 firms in the analysis.

The estimates from the pooled OLS regression (column (1)) are broadly consistent with the results so far, implying that the 2002 and the 2005 samples are not strikingly different. For example, larger firms, firms with access to foreign markets, firms with a larger share of university educated workers, and firms with more a advanced technology offer more training. Importantly, problematic access to finance continues to exert a negative effect on the probability of on-the-job training. In column (2), where the structure of the standard errors is assumed to contain an observation-specific random effect, the main results are little changed.

Column (3) reports the estimates from the fixed effects panel regression. It confirms my finding that easier access to finance results in a higher probability of a training program at the firm level, although in this case the effect is only significant at the 10%. As this regression allows me to control for market factors that vary over time, I also include time-varying country-level covariates. I find that richer countries, countries with deeper financial markets, and countries with slower contract enforcement are associated with lower average training. It is notable that the effect of access to finance is quantitatively similar in magnitude to that of my cross-sectional estimates, even though the sample is much smaller and I control for firm-level fixed effects.

Finally, in column (4) I repeat the test from column (3), this time on the sub-sample of firms that offered on-the-job training in one period but not in the other. The sample is reduced to 316 firms, and the basic result survives.

One caveat associated with the fixed effects analysis is that it maps changes in credit constraints into changes in training. Such changes can be even more endogenous than levels at a given point in time, and so while these tests are very informative in the presence of omitted time-invariant firm-level characteristics, the 2SLS procedure presents a more compelling way of addressing the causality issue.

6 Training vs. Other Types of Investment

6.1 Credit Constraints, Training, And Other Types of Investment

Apart from a number of considerations related to labor markets and labor regulation, investment in human capital should respond to credit constraints just like other types of investment. For example, constrained firms are expected to have lower capital investment (see Fazzari, Hubbard, and Petersen, 1988), lower R&D investment (Brown, Fazzari, and Petersen, 2009; Li, 2011), and lower spending on advertising (Fee, Hadlock, and Pierce, 2009), among others. Hence, there are at least two reasons for repeating my main test for the case of other types of investment. For one, such an exercise is a test of data validity: if one finds that firms cut on employee training in response to adverse credit market conditions, but not on capital investment, the quality of the survey data used may be put into question. Second, it would allow the econometrician to answer questions about the relative importance of credit constraints for different types of investment. For example, in times of financial stress, how much do firms cut employee training compared to capital investment or R&D expenses?

I take advantage of the fact that the firms in the dataset are asked about their level of capital investment, R&D investment, and advertising expenses in the past year. I take logs of these three variables, and estimate Model (1) for each of these three new independent variables. Relative to firm training, a lot more firms did not answer these questions, so the number of observations is in the best case reduced to 3484, 565, and 2772, respectively.

< Table 8 >

Table 8 reports the estimates from these tests. I find that in general credit constraints are associated with lower capital investment (Panel A) and with lower advertising expenses (Panel C). These results are also consistently significant from a statistical point of view

(apart from the effect of *Access to finance problematic* on capital investment in Panel A, column (1)). The results are less consistent in terms of sign and not significant in the case of R&D investment; however, this result may not be surprising given the very small sample of firms that report their level of R&D investment. The 2SLS procedure using local branching network as an instrument for credit constraints yields similar results (unreported for brevity).

It is informative to juxtapose the numerical effects of credit constraints on the various types of investment. Without loss of generality, take our variable *Constrained*. The coefficients in column (3) imply that a firm which needs a loan but does not have one because it is rejected or discouraged spends 40% less on capital investment and 29% less on advertising than an unconstrained firm.[15] This needs to be compared to the 5.8% lower probability of paying for training reported in Table 4. While without knowing the cost of a training program, it is not straightforward to compare the two sets of results, it is clear that training is not a special type of investment, and firms do cut various types of costs in response to adverse credit conditions.

These results also imply that the effective cost of credit constraints on training may be higher than the one estimated in this paper: in the presence of capital-skill complementarities, credit constraints may limit on-the-job training indirectly too, via lower physical capital investment. In this case, the estimates reported in this paper are just a lower bound of the true effect.

6.2 Training, Capital Investment, And Firm Growth

One final question that the data allow me to address is related to the effect of training on firm performance. While the evidence so far points to a robust negative association between financing constraints and on-the-job training, this result would only be compelling

[15] The independent variable is logged and the credit constraint is a dummy variable, therefore the percentage change of changing the dummy from 0 to 1 is given by $e^{\beta} - 1$.

if it was also the case that the lack of on-the-job training constrained the growth of firms. There is abundant evidence for a link between training and growth in a US context. For example, Bartel (1994) finds that firms which implement new training programs experience productivity gains of up to 20%; Black and Lynch (1996) find that the duration of training has a large positive impact on productivity; and Black and Lynch (2001) report a 20% increase in firm productivity as a result from computer training. In addition, Bauernschuster, Falck, and Heblich (2009) report a strong association between lagged continuous training and innovation for German firms. However, the effect of training on firm growth may be weaker in emerging markets' institutional environment, or for firms using potentially inferior technologies. If so, the implications of sub-optimal investment in training, and by extension of credit constraints, may be less important than the negative association between constraints and training implies.

In Table 9, I report estimates from a test where the dependent variable is, in turn, the logarithm of the firm's overall sales growth, exports growth, and assets growth over the past three years. The three types of firm growth are regressed on the dummy for on-the-job training and on the logarithm of capital investment. All firm-level covariates used in the cross-sectional regressions are also included (with the exception of the credit constraints), as well as country and industry dummies.

< Table 9 >

The estimates suggest that on-the-job training has a large positive effect on sales growth. Implementing a training program increases the annual growth rate of the firm's sales by 2.7%, relative to a sample average of 9% (column (1)). Using the estimates of the effect of credit constraints on training from Table 4, a firm for which access to finance constitutes "no obstacle" has a 53% higher probability of investing in on-the-job-training, and consequently experiences a sales growth rate higher by 1.4%, than an identical firm for which access to finance is a "major obstacle". Capital investment has a large positive effect on sales growth

- doubling investment increases sales growth by 2% - but the effect is not significant.

At the same time, on-the-job training does not have a statistically significant effect on exports growth, while capital investment does (column (2)). However, this result is weakened by the fact that only 462 firms provide information on their exports growth. Finally, both types of investment matter for assets growth (column (3)): doubling capital investment increases the stock of physical assets by 3.3%, while implementing an on-the-job training program increases the stock of physical assets by 3%, with both effects being significant at least at the 10%.

7 Conclusion

Theory predicts that investment in on-the-job training is sub-optimal in the presence of capital market imperfections, but data unavailability makes it difficult to distinguish this effect from the effect of firm size, the mix between general and specific training, labor contract rigidities, or oligopsonic wage-setting. I overcome this difficulty by using a unique survey dataset on 8265 firms from 25 emerging markets, which includes replies to questions about actual experience with access to finance, in order to isolate the effect of credit constraints on training. The reliance on firm-level data allows me to achieve a substantial methodological improvement over previous empirical studies: I observe a range of actual credit constraints at the firm level; I observe reliable proxies for the main alternative factors investigated in standard human capital theory and in the new training literature, notably firm size, the training mix, technological opportunities, and labor market characteristics; and I can purge the estimated effect of credit constraints on training from the bias resulting from reversed causality (e.g., inefficient firms exaggerating their credit constraints because they blame credit markets) or from omitted firm-level factors (e.g., unobserved managerial ability driving both training and access to finance).

My results indicate that various types of credit constraints are consistently associated with a lower probability that a firm will pay for the training of its employees. This effect survives the inclusion of a wide range of observable firm-level and country-level characteristics, as well as the elimination of factors common for all firms in a market or an industry. Crucially, I employ three different strategies to address concerns about endogeneity. I use a difference-in-differences specification whereby I test whether credit constraints are more detrimental for investment in human capital in industries that are more likely to benefit - in terms of training - from better access to finance. In the cross-section, I employ an IV procedure where I use the structure of local credit markets and the degree of information sharing in national credit markets to extract the exogenous element of credit constraints. In fixed effect panel regressions, I eliminate the effect of unobservable time-invariant firm-level heterogeneity. The main results of the paper survive these procedures. Finally, I find that firms cut other costs too, like capital investment and advertising expenses, in response to adverse credit market conditions, confirming that lower investment in human capital is just one of several channels through which credit constraints depress firm growth.

The use of survey data also allows me to calculate the numerical effect of capital market imperfections on investment in training. According to the preferred instrumental variables regression, credit constrained firms have as much as a 15% lower probability of offering training to their employees. My estimates thus allow for a rudimentary calculation of the aggregate effect of credit constraints on training. For example, if firms in Macedonia were on average as unconstrained as firms in Slovenia (Table 1), as many as 7% more firms would be offering training to their employees, explaining around a quarter of the difference in aggregate training between the two countries. The results in the paper thus point to large and insofar not documented benefits - in terms of investment in human capital - from improving corporate access to finance.

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Table 1. Training and credit constraints: Sample means

Country	On-the-job training	Number of firms	Access to finance problematic	Applied for a loan	Rejected	Need a loan	Constrained
Armenia	0.287	328	2.545	158	0.025	235	0.345
Azerbaijan	0.163	313	2.173	70	0.586	162	0.821
Belarus	0.437	290	2.504	123	0.106	224	0.509
Bosnia	0.427	180	2.376	106	0.009	133	0.211
Bulgaria	0.297	270	2.094	111	0.081	167	0.389
Croatia	0.547	203	2.057	135	0.037	155	0.161
Czech Republic	0.588	316	2.519	110	0.127	172	0.442
Estonia	0.618	198	1.665	93	0.065	117	0.256
Georgia	0.247	184	2.302	76	0.092	113	0.389
Hungary	0.361	561	2.468	302	0.030	425	0.311
Kazakhstan	0.249	532	1.998	237	0.076	380	0.424
Kyrgyzstan	0.450	181	2.084	84	0.071	140	0.443
Latvia	0.473	184	1.642	93	0.108	122	0.320
Lithuania	0.418	185	1.644	91	0.055	126	0.317
Macedonia	0.388	180	2.436	50	0.040	118	0.593
Moldova	0.296	314	2.512	166	0.090	241	0.373
Poland	0.445	906	2.776	349	0.077	610	0.472
Romania	0.259	541	2.454	271	0.089	379	0.348
Russia	0.307	530	2.051	186	0.081	339	0.496
Slovakia	0.806	197	1.689	90	0.022	116	0.241
Slovenia	0.636	195	2.021	125	0.024	139	0.122
Tajikistan	0.255	180	1.901	49	0.143	113	0.628
Turkey	0.197	504	2.118	211	0.142	253	0.285
Ukraine	0.398	534	2.322	223	0.036	364	0.409
Yugoslavia	0.402	259	2.777	105	0.029	182	0.440
Total	0.371	8265	2.289	3614	0.079	5525	0.397

Note: On-the-job training is a dummy equal to 1 if the firm offers formal on-the-job training to its employees. *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). *Applied for a loan* refers to the number of firms that applied for a loan from a bank. *Rejected* is a dummy equal to 1 if the firm applied for a loan and was rejected. *Need a loan* refers to the number of firms that declared a strictly positive demand for a bank loan. *Constrained* is a dummy equal to 1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions. Source: BEEPS 2005.

Table 2. Firm-level control variables: Sample means

Country	Small firm	Individual Owner	Government owner	Foreign owner	Female owner	Privatized	Exporter	Subsidized	Share skilled workers	Share university educated workers	Advanced technology	Hiring ease	Frequent labor inspections
Armenia	0.845	0.881	0.052	0.009	0.113	0.277	0.177	0.024	0.430	0.281	0.515	0.585	0.637
Azerbaijan	0.770	0.642	0.054	0.083	0.102	0.067	0.080	0.003	0.403	0.435	0.441	0.470	0.224
Belarus	0.800	0.790	0.076	0.055	0.193	0.038	0.217	0.017	0.552	0.385	0.262	0.655	0.562
Bosnia	0.678	0.756	0.050	0.039	0.200	0.156	0.311	0.028	0.553	0.216	0.422	0.456	0.706
Bulgaria	0.822	0.752	0.067	0.052	0.281	0.093	0.204	0.067	0.412	0.289	0.267	0.511	0.559
Croatia	0.754	0.670	0.079	0.049	0.133	0.172	0.310	0.158	0.470	0.275	0.394	0.419	0.379
Czech Republic	0.826	0.804	0.063	0.063	0.177	0.051	0.244	0.073	0.593	0.139	0.196	0.396	0.560
Estonia	0.823	0.646	0.066	0.106	0.232	0.116	0.288	0.040	0.396	0.319	0.157	0.308	0.167
Georgia	0.810	0.777	0.098	0.071	0.293	0.250	0.147	0.011	0.206	0.581	0.245	0.250	0.092
Hungary	0.788	0.813	0.027	0.062	0.332	0.078	0.330	0.182	0.533	0.166	0.128	0.478	0.560
Kazakhstan	0.803	0.767	0.060	0.023	0.286	0.171	0.090	0.019	0.497	0.273	0.288	0.500	0.434
Kyrgyzstan	0.707	0.762	0.083	0.050	0.210	0.348	0.166	0.028	0.376	0.401	0.403	0.381	0.680
Latvia	0.826	0.761	0.087	0.043	0.337	0.076	0.239	0.071	0.455	0.302	0.217	0.321	0.375
Lithuania	0.757	0.735	0.097	0.043	0.189	0.162	0.314	0.081	0.431	0.319	0.249	0.373	0.551
Macedonia	0.817	0.800	0.067	0.044	0.133	0.111	0.267	0.022	0.435	0.223	0.300	0.289	0.672
Moldova	0.726	0.707	0.061	0.016	0.201	0.207	0.220	0.032	0.563	0.337	0.369	0.506	0.774
Poland	0.805	0.827	0.047	0.043	0.278	0.050	0.232	0.115	0.637	0.201	0.323	0.457	0.339
Romania	0.721	0.701	0.046	0.030	0.200	0.085	0.200	0.061	0.577	0.179	0.399	0.562	0.697
Russia	0.751	0.766	0.083	0.023	0.223	0.091	0.117	0.017	0.400	0.383	0.289	0.494	0.345
Slovakia	0.751	0.706	0.076	0.046	0.127	0.051	0.320	0.076	0.516	0.268	0.218	0.437	0.355
Slovenia	0.810	0.672	0.092	0.036	0.246	0.133	0.421	0.133	0.484	0.216	0.251	0.441	0.292
Tajikistan	0.683	0.861	0.050	0.028	0.194	0.339	0.111	0.000	0.425	0.295	0.339	0.783	0.583
Turkey	0.792	0.865	0.075	0.012	0.079	0.018	0.373	0.022	0.497	0.199	0.262	0.744	0.218
Ukraine	0.788	0.740	0.073	0.058	0.266	0.135	0.157	0.032	0.461	0.430	0.275	0.418	0.429
Yugoslavia	0.761	0.757	0.100	0.062	0.201	0.097	0.282	0.058	0.513	0.241	0.355	0.440	0.676
Total	0.780	0.768	0.065	0.043	0.218	0.117	0.224	0.059	0.494	0.280	0.301	0.486	0.465

Note: The table gives summary statistics of all firm-level variables used in the cross-sectional analysis. See Appendix for all variable sources and definitions.

Table 3. Country-level and local variables: Sample means

Country	Private credit/GDP	Log GDP per capita	GDP growth	Creditors' Rights	Contract enforcement days	Inflation	Years of schooling	Labor regulations	Branches per local population
Armenia	0.06	8.30	0.05	5.00	302.33	4.70	9.90	31.00	---
Azerbaijan	0.08	8.30	0.05	6.00	267.00	10.15	9.70	38.00	---
Belarus	0.13	9.05	0.03	3.00	253.00	24.69	9.20	27.00	---
Bosnia	0.18	8.45	0.00	3.67	695.00	1.87	7.60	42.00	14.58
Bulgaria	0.30	9.02	0.03	8.00	564.00	4.61	9.70	47.00	25.99
Croatia	0.53	9.41	0.04	4.33	561.00	3.73	6.50	50.00	13.15
Czech Republic	0.31	9.89	0.02	7.00	663.00	1.73	9.50	28.00	20.93
Estonia	0.54	9.59	0.04	6.00	425.00	3.99	9.20	58.00	16.17
Georgia	0.09	8.16	0.03	5.00	375.00	6.57	8.50	7.00	---
Hungary	0.42	9.68	0.02	7.00	335.00	4.18	8.80	34.00	22.99
Kazakhstan	0.23	9.01	0.05	4.00	403.33	15.25	8.70	23.00	---
Kyrgyzstan	0.06	7.56	0.02	6.00	260.00	5.41	8.70	38.00	---
Latvia	0.44	9.33	0.04	9.00	281.00	6.92	9.50	59.00	14.76
Lithuania	0.25	9.41	0.04	5.00	210.00	2.79	9.30	48.00	13.53
Macedonia	0.20	8.77	0.01	7.00	521.67	1.80	7.70	54.00	13.61
Moldova	0.19	7.64	0.03	8.00	365.00	10.73	9.10	54.00	---
Poland	0.27	9.47	0.02	8.00	993.33	2.38	9.90	33.00	20.79
Romania	0.13	8.97	0.03	7.00	537.00	17.10	9.50	51.00	28.33
Russia	0.20	9.35	0.03	3.00	281.00	17.79	9.20	44.00	---
Slovakia	0.32	9.64	0.02	9.00	595.00	4.52	9.20	39.00	30.96
Slovenia	0.46	10.00	0.02	5.00	1410.00	3.53	7.40	57.00	34.03
Tajikistan	0.07	7.27	0.03	3.00	430.00	18.18	9.60	31.00	---
Turkey	0.15	9.01	0.07	5.70	465.00	8.20	5.40	26.00	---
Ukraine	0.23	8.64	0.04	6.33	354.00	15.98	9.20	55.00	---
Yugoslavia	0.19	8.63	0.02	7.00	897.00	13.90	7.50	28.00	16.07
Total	0.24	8.99	0.03	6.04	510.99	8.84	8.84	38.89	21.44

Note: The table gives summary statistics of all country-level and local market-level variables used in the cross-sectional analysis. See Appendix for all variable sources and definitions.

Table 4. Credit constraints and training

	On-the-job training		
	Credit constraint = Access to finance problematic	Credit constraint = Rejected	Credit constraint = Constrained
	(1)	(2)	(3)
Credit constraint	-0.036**	-0.211**	-0.153***
	(0.016)	(0.100)	(0.044)
Small firm	-0.421***	-0.358***	-0.380***
	(0.043)	(0.058)	(0.051)
Individual owner	-0.065	-0.020	-0.045
	(0.054)	(0.073)	(0.063)
Government owner	0.031	0.136	-0.038
	(0.085)	(0.135)	(0.103)
Foreign owner	0.422***	0.263*	0.308***
	(0.098)	(0.136)	(0.121)
Female manager	-0.078*	-0.067	-0.057
	(0.045)	(0.065)	(0.052)
Privatized	0.019	-0.011	-0.033
	(0.056)	(0.074)	(0.064)
Exporter	0.175***	0.185***	0.178***
	(0.043)	(0.058)	(0.050)
Subsidized	0.234***	0.185***	0.224***
	(0.073)	(0.090)	(0.080)
Share skilled workers	-0.071	-0.058	-0.035
	(0.073)	(0.105)	(0.086)
Share university education	0.525***	0.466***	0.458***
	(0.075)	(0.118)	(0.093)
Advanced technology	0.347***	0.358***	0.351***
	(0.038)	(0.053)	(0.044)
Hiring ease	0.084**	0.043	0.025
	(0.036)	(0.052)	(0.042)
Frequent labor inspections	0.182***	0.085*	0.121***
	(0.037)	(0.054)	(0.044)
Fixed effects		Country × Industry	
Observations	6379	3020	4537
R-squared	0.128	0.114	0.114

Note: The table reports coefficients from probit regressions where the dependent variable is *On-the-job training*, defined as an indicator equal to 1 if the firm offers formal on-the-job training to its employees, and to 0 otherwise. *Credit constraint* refers to *Access to finance problematic* in column (1), *Rejected* in column (2), and *Constrained* in column (3). *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). *Rejected* is a dummy equal to 1 if the firm applied for a loan and was rejected. *Constrained* is a dummy equal to 1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions. Standard errors adjusted for heteroskedasticity within countries and industries appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.

Table 5. Credit constraints and training: Empirical channels

	On-the-job training		
	Credit constraint = Access to finance problematic	Credit constraint = Rejected	Credit constraint = Constrained
	(1)	(2)	(3)
Credit constraint	-0.009	-0.228*	-0.058
	(0.020)	(0.142)	(0.059)
Credit constraint ×	-0.030	-0.540**	-0.274**
Growth opportunities	(0.039)	(0.277)	(0.111)
Credit constraint ×	-0.050**	0.223	-0.110*
Human capital intensity	(0.022)	(0.197)	(0.060)
Firm covariates	Yes		
Fixed effects	Country × Industry		
Observations	6379	3020	4537
R-squared	0.129	0.115	0.115

Note: The table reports coefficients from probit regressions where the dependent variable is *On-the-job training*, defined as an indicator equal to 1 if the firm offers formal on-the-job training to its employees, and to 0 otherwise. *Credit constraint* refers to *Access to finance problematic* in column (1), *Rejected* in column (2), and *Constrained* in column (3). *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). *Rejected* is a dummy equal to 1 if the firm applied for a loan and was rejected. *Constrained* is a dummy equal to 1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions. *Growth opportunities* equals the average value added growth of the respective US industry over the period 1996-2005. *Human capital intensity* equals the average share of workers with university degree in the respective industry in all countries in BEEPS with the exception of the country where the firm is incorporated. All firm-level covariates from Table 4 are also included in the regressions (coefficients not reported for brevity). Standard errors adjusted for heteroskedasticity within countries and industries appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Firm-level data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.

Table 6. Credit constraints and training: Using local credit market structure as an instrument for credit constraints

Panel A. All localities

	Credit constraint = Access to finance problematic		Credit constraint = Rejected		Credit constraint = Constrained	
	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training
	(1)	(2)	(3)	(4)	(5)	(6)
Credit constraint		-0.378**		-10.171		-1.494*
		(0.183)		(15.892)		(0.871)
Branches per population	-0.119***		-0.005		-0.025**	
	(0.029)		(0.008)		(0.012)	
Wald *F*-statistics	8.08		0.41		4.12	
Firm covariates			Yes			
Fixed effects			Country × Industry			
Observations	3332	3332	1686	1686	2429	2429
R-squared	0.100	0.165	0.038	0.022	0.139	0.118

Panel B. Localities with more than one bank

	Credit constraint = Access to finance problematic		Credit constraint = Rejected		Credit constraint = Constrained	
	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training
	(1)	(2)	(3)	(4)	(5)	(6)
Credit constraint		-0.184*		-6.753		-1.085*
		(0.120)		(9.651)		(0.706)
Branches per population	-0.110***		-0.006		-0.028**	
	(0.032)		(0.009)		(0.014)	
Wald *F*-statistics	12.04		0.52		4.14	
Firm covariates			Yes			
Fixed effects			Country × Industry			
Observations	3332	3332	1686	1686	2429	2429
R-squared	0.115	0.446	0.048	0.025	0.136	0.070

Note: The table reports coefficients from probit regressions where the dependent variable is *On-the-job training*, defined as an indicator equal to 1 if the firm offers formal on-the-job training to its employees, and to 0 otherwise. *Credit constraint* refers to *Access to finance problematic* in columns (1) and (2), *Rejected* in columns (3) and (4), and *Constrained* in columns (5) and (6). *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). *Rejected* is a dummy equal to 1 if the firm applied for a loan and was rejected. *Constrained* is a dummy equal to 1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions. Columns (1), (3), and (5) report estimates and statistics from the first-stage regression in the case of each respective credit constraint. In the second stage (columns (2), (4), and (6)), each respective credit constraint has been instrumented using the variable *Branches per population* (the logarithm of the number of bank branches in the firm's town of incorporation divided by the town's population). All firm-level covariates from Table 4 are also included in the regressions (coefficients not reported for brevity). Standard errors adjusted for heteroskedasticity within countries and industries appear below

each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Firm-level data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.

Table 7. 2002 and 2005 samples: Pooled OLS, random, and fixed effects panel estimates

	On-the-job training			
	(1)	(2)	(3)	(4)
Access to finance problematic	-0.025***	-0.023**	-0.027*	-0.073*
	(0.010)	(0.010)	(0.016)	(0.043)
Small firm	-0.169***	-0.162***	-0.011	-0.202
	(0.029)	(0.030)	(0.070)	(0.181)
Individual owner	-0.049	-0.042	-0.006	0.115
	(0.032)	(0.032)	(0.057)	(0.162)
Government owner	-0.017	-0.005	-0.041	0.222
	(0.046)	(0.047)	(0.111)	(0.553)
Foreign owner	-0.019	-0.013	-0.115	-0.152
	(0.052)	(0.053)	(0.104)	(0.244)
Privatized	-0.016	-0.015	-0.084	-0.318
	(0.034)	(0.035)	(0.088)	(0.325)
Exporter	0.056*	0.062**	0.061	0.146
	(0.029)	(0.030)	(0.066)	(0.170)
Subsidized	0.021	0.014	-0.052	-0.245
	(0.043)	(0.044)	(0.077)	(0.239)
Share skilled workers	-0.064	-0.078*	-0.174**	-0.384*
	(0.044)	(0.044)	(0.078)	(0.207)
Share university education	0.187***	0.177***	0.028	0.063
	(0.043)	(0.045)	(0.104)	(0.284)
Advanced technology	0.124***	0.116***	0.036	0.080
	(0.025)	(0.025)	(0.040)	(0.106)
Hiring ease	0.021	0.013	-0.057	-0.211**
	(0.023)	(0.023)	(0.036)	(0.203)
Private credit			-0.938**	-2.862**
			(0.385)	(1.188)
GDP per capita			-0.057*	-0.014
			(0.034)	(0.010)
GDP growth			-0.071	0.004
			(0.387)	(0.134)
Creditors rights			-0.003	-0.078
			(0.059)	(0.169)
Contracts enforcement			-0.002**	-0.004
			(0.001)	(0.003)
Inflation			0.002	0.006
			(0.002)	(0.004)
Country × Industry fixed effects	Yes	Yes	No	No
Firm random effects	No	Yes	No	No
Firm fixed effects	No	No	Yes	Yes
Observations	1726	1726	1656	632
R-squared	0.173	0.173	0.071	0.191

Note: The table reports coefficients from probit regressions where the dependent variable is *On-the-job training*, defined as an indicator equal to 1 if the firm offers formal on-the-job training to its employees, and to 0 otherwise. *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). Standard errors adjusted for heteroskedasticity within countries and industries appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Firm-level data come from the 2002 and the 2005 BEEPS. Only firms appearing both in 2002 and 2005 are included in the regressions. In column (4), only firms that changed on-the-job training status between 2002 and 2005 are included. See Appendix for all variable definitions and sources.

Table 8. Credit constraints and other types of investment

Panel A. Credit constraints and capital investment

	Capital investment		
	Credit constraint = Access to finance problematic	Credit constraint = Rejected	Credit constraint = Constrained
	(1)	(2)	(3)
Credit constraint	-0.012	-0.308**	-0.502***
	(0.019)	(0.129)	(0.052)
Firm covariates		Yes	
Fixed effects		Country × Industry	
Observations	3257	1812	2485
R-squared	0.376	0.373	0.404

Panel B. Credit constraints and R&D investment

	R&D investment		
	Credit constraint = Access to finance problematic	Credit constraint = Rejected	Credit constraint = Constrained
	(1)	(2)	(3)
Credit constraint	0.038	0.580	-0.209
	(0.048)	(0.405)	(0.157)
Firm covariates		Yes	
Fixed effects		Country × Industry	
Observations	530	341	418
R-squared	0.475	0.450	0.484

Panel C. Credit constraints and advertising expenses

	Advertising expenses		
	Credit constraint = Access to finance problematic	Credit constraint = Rejected	Credit constraint = Constrained
	(1)	(2)	(3)
Credit constraint	-0.070***	-0.301**	-0.343***
	(0.022)	(0.147)	(0.063)
Firm covariates		Yes	
Fixed effects		Country × Industry	
Observations	2603	1504	2007
R-squared	0.375	0.371	0.378

Note: The table reports coefficients from probit regressions where the dependent variable is the logarithm of the firm's total capital investment in the past year (Panel A), the logarithm of the firm's total R&D investment in the past year (Panel A), and the logarithm of the firm's total advertising expenses in the past year (Panel C). *Credit constraint* refers to *Access to finance problematic* in column (1), *Rejected* in column (2), and *Constrained* in column (3). *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). *Rejected* is a dummy equal to 1 if the firm applied for a loan and was rejected. *Constrained* is a dummy equal to 1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions. All firm-level covariates from Table 4 are also included in the regressions (coefficients not reported for brevity). Standard errors adjusted for heteroskedasticity within countries and industries appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Firm-level data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.

Table 9. On-the-job training, capital investment, and firm growth

	Log sales growth	Log exports growth	Log assets growth
	(1)	(2)	(3)
On-the-job training	0.077**	-0.059	0.087*
	(0.040)	(0.126)	(0.054)
Log capital investment	0.019	0.080*	0.099***
	(0.017)	(0.048)	(0.022)
Firm covariates		Yes	
Fixed effects		Country × Industry	
Observations	2161	462	1510
R-squared	0.077	0.148	0.133

Note: The table reports coefficients from OLS regressions where the dependent variable is the logarithm of the firm's sales growth in the past three years (column (1)), the logarithm of the firm's exports growth in the past three years (column (2)), and the logarithm of the firm's assets growth in the past three years (column (3)). All firm-level covariates from Table 4 are also included in the regressions (coefficients not reported for brevity). Standard errors adjusted for heteroskedasticity within countries and industries appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Firm-level data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.

Appendix. Variable Definitions and Sources

Variable Name	Definition	Source
	Firm Characteristics	
On-the-job training	Dummy=1 if the firm is running a formal on-the-job training program, =0 otherwise	BEEPS
Small firm	Dummy=1 if firm has fewer than 50 employees, =0 otherwise	BEEPS
Individual owner	Dummy=1 if the firm is owned by an individual or a family, =0 otherwise	BEEPS
Government owner	Dummy=1 if the firm is owned by a government agency, =0 otherwise	BEEPS
Foreign owner	Dummy=1 if the firm is owned by a foreign company or individual, =0 otherwise	BEEPS
Female manager	Dummy=1 if the general manager of the firm is female, =0 otherwise	BEEPS
Privatized	Dummy=1 if the firm was formerly state-owned, =0 otherwise	BEEPS
Exporter	Dummy=1 if the firm has export sales, =0 otherwise	BEEPS
Subsidized	Dummy=1 if the firm received subsidized from the government in the past 3 years, =0 otherwise	BEEPS
Share skilled workers	Ratio of skilled employees to the firm's total employment	BEEPS
Share university education	Ratio of employees with at least some university education to the firm's total employment	BEEPS
Access to finance problematic	The answer to the question "How problematic is access to finance for the operation and growth of your business?" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle)	BEEPS
Applied for a loan	Dummy=1 if the firm applied for a loan from a bank	BEEPS
Rejected	Dummy=1 if the firm applied for a loan and was rejected, =0 otherwise	BEEPS
Need a loan	Dummy=1 if the firm declared that it needed a loan from a bank	BEEPS
Constrained	Dummy=1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions, =0 otherwise	BEEPS
Advanced technology	Dummy=1 if the firm has introduced a new technology between 2002 and 2005, =0 otherwise	BEEPS
Hiring ease	Dummy=1 if it takes the firm less than four weeks on average to fill a vacancy, =0 otherwise	BEEPS
Frequent labor inspections	Dummy=1 if the firm was subject to regular labor and social security inspections in the past year, =0 otherwise	BEEPS
Capital investment	The firm's total capital investment in the past year	BEEPS
R&D investment	The firm's total R&D investment in the past year	BEEPS
Advertising expenses	The firm's total expenditure on advertising in the past year	BEEPS
Sales growth	The change in the firm's sales over the past 3 years	BEEPS
Exports growth	The change in the firm's exports over the past 3 years	BEEPS
Assets growth	The change in the firm's fixed assets (land, buildings, and machinery and equipment) over the past 3 years	BEEPS

	Industry Characteristics	
Growth opportunities	The average value added growth of the respective US industry over the period 1996-2005	Eurostat
Human capital intensity	The average share of workers with university degree in the respective industry in all countries with the exception of the country where the firm is incorporated	BEEPS
	Country Characteristics	
Branches per population	The number of bank branches in the firm's locality per 100,000 of local population	WWW
Private credit	The ratio of private credit by deposit money banks and other financial institutions to GDP	WB FDSD
GDP per capita	Gross domestic product per capita, average over the past three years	PWT 6.3
GDP growth	Annual growth in gross domestic product per capita, average over the past three years	PWT 6.3
Creditors rights	Degree of protection of creditors rights	WB DBD
Contract enforcement	The number of days it takes to enforce a legal contract	WB DBD
Inflation	Annual inflation, average over the past three years	EBRD
Years of schooling	Average number of years of schooling per adult population	Barro-Lee
Labor regulations	Index of labor market stringency	WB DBD

Note: The Table uses the following sources: A search of banks' web-sites on the World Wide Web in 2008 (WWW); World Bank Financial Development and Structure Database by Thorsten Beck, Asli Demirguc-Kunt, and Vojislav Maksimovic, 2010 (WB FDSD); Penn World Tables (PWT); European Bank for Reconstruction and Development Transition Report 2000-2005 (EBRD); Barro-Lee Database on educational Attainment (Barrol-Lee).

Appendix Table 1. Correlations

	Access to finance problematic	Rejected	Constrained	Small firm	Individual owner	Government owner	Foreign owner
Access to finance problematic	1.000						
Rejected	0.131	1.000					
Constrained	0.131	1.000	1.000				
Small firm	0.044	0.065	0.065	1.000			
Individual owner	0.037	0.032	0.032	0.245	1.000		
Government owner	0.017	0.049	0.049	-0.168	-0.384	1.000	
Foreign owner	-0.068	-0.049	-0.049	-0.124	-0.404	-0.046	1.000

Note: The table reports simple correlations between financing constraints and selected firm variables. Source: BEEPS (2005).

Appendix Table 2. Credit constraints, training, and country-level explanatory variables

	(1)	(2)	(3)
	Access to finance problematic	Rejected	Constrained
Credit constraint	-0.040	-0.269	-0.203
	(0.015)***	(0.095)***	(0.043)***
Private credit	0.659	0.429	0.532
	(0.261)***	(0.355)	(0.304)*
GDP per capita	0.021	0.024	0.018
	(0.006)***	(0.009)***	(0.007)**
GDP growth	-0.090	-0.053	-0.078
	(0.015)***	(0.021)**	(0.017)***
Creditors rights	0.010	0.015	0.003
	(0.013)	(0.018)	(0.015)
Contract enforcement	0.015	0.019	0.020
	(0.008)*	(0.011)*	(0.009)**
Inflation	-0.001	-0.006	0.002
	(0.004)	(0.005)	(0.004)
Years of schooling	0.004	0.036	-0.008
	(0.019)	(0.027)	(0.023)
Labor regulations	0.092	0.005	0.003
	(0.177)	(0.003)*	(0.002)
Firm covariates		Yes	
Country fixed effects		No	
Industry fixed effects		Yes	
Observations	6379	3020	4537
R-squared	0.091	0.077	0.079

Note: The table reports coefficients from probit regressions where the dependent variable is *On-the-job training*, defined as an indicator equal to 1 if the firm offers formal on-the-job training to its employees, and to 0 otherwise. *Credit constraint* refers to *Access to finance problematic* in column (1), *Rejected* in column (2), and *Constrained* in column (3). *Access to finance problematic* is the answer to the question: "How problematic is access to finance for the operation and growth of your business" (1 = no obstacle, 2 = minor obstacle, 3 = moderate obstacle, 4 = major obstacle). *Rejected* is a dummy equal to 1 if the firm applied for a loan and was rejected. *Constrained* is a dummy equal to 1 if the firm needs a bank loan but does not have one, either because it applied and was rejected, or because it was discouraged from applying by adverse credit conditions. All firm-level covariates from Table 4 are also included in the regressions (coefficients not reported for brevity). Standard errors adjusted for heteroskedasticity within countries and industries appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Firm-level data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.