Credit Constraints and Investment in Human Capital: Training Evidence from Emerging Markets*

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Abstract

Using a unique survey database of 8265 firms from 25 emerging markets, I find that lack of access to finance in general, and to bank credit in particular, is associated with significantly lower investment in human capital. Controlling for size, technology, monopsony power, and labor contract rigidity, firms for which access to finance is a major obstacle have as much as a 19% lower probability of investing in on-the-job training than firms for which access to finance is not an obstacle. In instrumental variables tests and in fixed effects panel regressions, I address concerns relating to reversed causality and to the presence of unobserved heterogeneity at the firm level.

JEL classification: G10, J21, J24, M53.

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

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1 Introduction

It is widely recognized that investment in training is essential for enhancing the firm's productivity.[1] At the same time, lack of access to external financing may depress efficient investment in human capital. Workers who are credit constrained will not be willing to accept lower wages during general training, and firms which are credit constraints may not be able to pay workers more than their marginal product during the general or specific training period (Becker, 1962). International evidence suggests that the per-employee cost of training programs in the industrial world is substantial.[2] The opportunity cost of training is also large: for example, the mean length of a training for adult workers is around 1,300 hours (or the equivalent of 32 weeks of full employment) in the OECD countries (see OECD Employment Outlook Report 1999). Given that the additional knowledge and skills generated through training may be transferable across firms and thus lost to the firm once the worker switches jobs, the literature has focused on properties of the labor markets in explaining variations in firm-level investment in human capital (see Hashimoto, 1981; Katz and Ziderman, 1990; Acemoglu and Pischke, 1998, 1999a,b; Arulampalam, Booth, and Bryan, 2004).

In this paper, I investigate empirically the extent to which another factor highlighted by human capital theory - capital market imperfections - affects negatively firm investment

[1] 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; Boon and van der Eijken (1998) measure a 0.07 elasticity of firm value added with respect to investment in human capital; Black and Lynch (2001) report a 20% increase in firm productivity as a result from computer training; and Bauernschuster, Falck, and Heblich (2009) report a strong association between lagged continuous training and innovation.

[2] Ryan (1980) and Jones (1986) report numbers of around $20,000 for the US and UK, respectively, and Dockery, Koshy, Stromback, and Ying (1997) calculate an average annual per-employee cost of training of $22,000 over a four-year period for a sample of 59 employers in a variety of trades in Australia. Franz and Soskice (1995) estimate that in 1985 German employees paid a net cost per apprintice of about DM 12300 (approximately $5000). 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).

in training. I use data from the 2005 Business Environment and Enterprise Performance Survey (BEEPS) on 8265 firms from 25 emerging markets to analyze the impact of various self-reported financing constraints on training. The survey contains detailed firm-level information on on-the-job training, on different proxies for credit access, and on variant 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 Becker's (1962) classic analysis, 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. 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), or because of incentive complementarities between general and specific training (Kessler and Lülfesmann, 2006). 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.

Following from the theories just outlined, there are three main stumbling block in the literature evaluating the impact of credit market imperfections on investment in human capital. The first one is the lack of a direct measure of credit constraints. Credit constrained firms are usually not observable, and are identified according to indirect criteria such as the response of wages to training in current and future jobs (Booth and Bryan, 2005). Such tests

are unable to reveal the magnitude of the negative effect of credit constraints on training. In addition, without data on actual credit constraints it is difficult to conclude that employees' wages are lower than their marginal product during the training period because of credit market imperfections or because of oligopsonic wage setting, for example. 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.

The second stumbling block is that 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 (Becker, 1962; Acemoglu and Pischke, 1999a,b). The detailed firm-level dataset used in this paper allows for separating the effect of credit constraints from the effect of these alternative factors. For example, I observe how long it takes the firm to fill a vacancy and use this information to control for oligopsonic power. I also observe the extent to which the firm is subject to labour and social security inspections, and interpret this information as a proxy for the degree of contractual problems between the firm and its workforce. Finally, I observe the frequency with which the firm updates its technology and use this information to control for the mix of general vs. specific training.

Finally, the use of survey-level data is prone to raise 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-section nature of the data used 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 overestimate their credit constraints, or if firms with abler 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 the first issue by employing an instrumental variable procedure where I use the firm's degree of informational transparency and the structure of credit markets as instruments for credit constraints. To address the second question, I focus on a subset of the firms which 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.

The results suggest that financing constraints do affect 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 firm for which various types of access to finance are a major obstacle has a between 5.1% and 19% lower probability of running a formal on-the-job training program for its employees than a firm for which access to finance represents no obstacle. 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).[3] Most importantly, the main results of the paper survive when I employ an instrumental variable procedure to eliminate possible endogeneity, 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, as well as by inefficient firms shifting the blame for

[3]See Kessler and Lülfesmann (2006) for a summary of some of the main contributions from the two strands of literature.

their underinvestment to the financial system.

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. However, while previous studies have pointed to the large negative effects of financing constraints on firm growth (Beck, Demirguc-Kunt, and Maksimovic, 2005), the literature has mostly focused on the effect of financing constraints and financial development on physical capital accumulation (Love, 2003). This paper is the first to study the channel of human capital accumulation through which financial underdevelopment 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. Booth and Bryan (2005) use UK data the sensitivity of wages to training to evaluate theories that relate capital constraints to firm-sponsored training. Dustmann and Schonberg (2009) provide evidence on the effect of unionization on training that the firm pays for. Arulampalam, Booth, and Bryan (2004) conclude that minimum wages have no effect on training. Neumark and Washer (2001) present evidence that minimum wages reduce formal training to improve skills on the current job without offsetting increases in

training undertaken to qualify for or obtain jobs. Several of these studies attempt to also analyze the effect of credit constraints, and when they do - like in the case of Booth and Bryan (2005) - they find it hard to distinguish the effect of credit constraints from the effect of oligopsonic wage setting. Unlike these studies, I test for the effect of credit constraints directly, and my firm-level data allow me attain numerical estimates of this effect.

The paper proceeds in four sections. 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. Section 6 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 the firm's access to credit and its on-the-job training practices.[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

[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 very large (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.

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, as it treats as observationally equivalent a single short training course and a large-scale ongoing training program.

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. The relevant questions used in this paper are: (1) How problematic is access to financing for the operation and growth of your business? (from (1) "No obstacle", to (4) "Major obstacle"); (2) Last loan application rejected (1 if the firm's last loan application was rejected, 0 otherwise); (3) Strict collateral requirements (1 if the firm did not apply for a loan because bank collateral requirements are too strict, 0 otherwise); (4) High interest rates (1 if the firm did not apply for a loan because interest rates are too high, 0 otherwise); (5) Loan would have been denied (1 if the firm did not apply for a loan because it believed the application would have been rejected, 0 otherwise). Therefore, in all cases a higher value implies a higher constraint. The first constraint is calculated over all

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

firms in the sample, the rest of the constraints are calculated for the sub-sample of firms which declared a positive demand for credit.

In addition, the data contain information on a wide range of firm-level controls that may play a role in determining the level of investment in human capital. 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. Finally, 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.

Panel A of Table 1 reports summary statistics for the outcome variable (on-the-job training), the main explanatory variables (various types of financing constraints), and the rest of the firm-level covariates. The median firm in the sample is a small firm owned by an individual or a family which does not export, receives no subsidies, offers no training, and for which access to finance is between a "minor" and a "moderate" obstacle.

In much of the empirical tests, 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 tests where country fixed effects cannot be employed (for instance, because the instrument in an IV test varies at the country level), I complement the firm-level data with a number of 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"; "Years of schooling" denotes average educational attainment in the population; and "Inflation" is included as a proxy for macroeconomic stability. All of these variables control for circumstances that affect the return to human capital investment. On the other hand, variables like "Labour regulations" and "Private credit" proxy for regulatory and financial development and thus control for circumstances that affect the cost of the on-the-job training process.

Panel B of Table 1 summarizes the country-level data. Definitions and sources 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 Labour 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 labour 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 be-

cause 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.

3.2 Endogeneity

While detecting a robust association between credit constraints and firm training would in itself be a contribution to the literature, 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 efficiency or growth opportunities.

One way to address this issue which is common in the literature is to check whether the observed effects are stronger for firms which are naturally more sensitive to credit market imperfections. Such firms are likely to be small (Beck, Demirguc-Kunt, Laeven, and Levine, 2005) and are likely to populate disproportionately industries dependent on external finance for technological reasons (Rajan and Zingales, 1998). One solution would then be to inter-

act observable constraints with observable measures of firm size and of the firm's "natural" dependence on external finance. However, interpreting such tests causally would be problematic if small (externally dependent) firms are more likely to be hit by idiosyncratic shocks that lead both to higher constraints and to lower training, or if such firms happen to have less efficient managers and unobservable managerial quality is the main determinant of both credit constraints and training.

In order to address this issue properly, I employ two empirical approaches. The first approach is based on an instrumental variables procedure whereby the endogenous element of credit constraints is extracted using an instrument that only affects training through the firm's access to finance. Ideally, such an instrument should vary at the level of the firm. The first such instrument that I use is a dummy variable equal to 1 if the firm has its annual financial statements certified by an external auditor. Firm opacity is generally associated with lower access to finance (see Berger, Klapper, and Udell, 2001), therefore the relevance condition should be satisfied. In addition, it would appear unlikely that access to an external verification technology would affect human capital investment directly, and so the exclusion restriction should be satisfied too. However, this reasoning is somewhat problematic as using external verification of financial accounts is a choice variable. As such, it is potentially affected by a whole vector of unobservables: for example, firms adopting modern management techniques are more likely to have their accounts audited and at the same time offer more training, which would violate the exclusion restriction.

As this premise cannot be properly tested, I complement the firm-level instrument with two country-level instruments which relate to the structure of credit markets, namely, the share of banking sector assets held by state banks, and the share of banking sector assets held by the three largest banks. Regarding the first instrument, state-owned banks have generally

been argued to be less efficient in allocating credit because they are used by politicians for purposes other than profit maximization, and as a result are detrimental to growth (Shleifer and Vishny, 1994; La Porta, Lopes-de-Silanez, and Shleifer, 2002). This makes state ownership of banks a good instrument for credit constraints as a higher share of banking assets held by state-owned banks should be associated with higher constraints while there is no channel through which state-owned banks should affect training other than the channel of firm access to capital. Regarding the second instrument, 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). Conversely, Petersen and Rajan (1995) 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. Therefore, I employ a measure of banking sector concentration as an instrument for access to credit and while I am ignorant as to the sign of the effect, this instrument should again satisfy both the relevance condition and the exclusion restriction. The main drawback of the two instruments is that they do not vary at the level of the firm, but at the level of the country, making it necessary to control for a wide range of country characteristics in regressions in which using country fixed effects is not feasible.

Finally, 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 14 countries. For a total of

5035 firms in 820 localities, I know the number of total branches, per locality, by banks that account for at least 80% of the assets of the country's banking sector. This instrument is related to bank penetration and competition, and again should hardly affect training through a channel other than credit access. Importantly, as it varies at the level of the local market, I can include in the regression country dummies which eliminate the effect of unobservable factors that are common to all firms in a market.

The second empirical approach is based on the fact that 1179 of the 8265 firms in the 2005 BEEPS also appear in the 2002 BEEPS. This allows me to control for unobserved heterogeneity at the firm level, for changes in macroeconomic variables, and for changes in the legal environment, using panel data constructed from the 2002 and the 2005 surveys.

Table 2 reports summary statistics by country for the outcome variable (training), the main explanatory variable (how problematic is access to finance), and the variables used as instruments for access to external credit (the firm's use of external auditing technology, the degree of state ownership and of concentration in the country's banking sector, and the number of bank branches per population in the firm's local market). It reveals large variations across countries. 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 Latvia and Lithuania, but a "major obstacle" in Poland and Yugoslavia. Also, while 81% of Estonian firms have their accounts externally audited, only 11% of firms in Moldova do. The share of state ownership in the banking sector varies from almost 0% in Armenia, Estonia, Georgia, and Lithuania, to 69% in Belarus. The banking markets varies from almost fully concentrated in the hands of three banks (0.98 in Estonia) to very competitive (0.18 in Russia). Finally, there are almost three times more branches per 100000 of population in Slovenia than in Croatia (34.0 vs. 13.1).

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

$$\text{Training}_{ijk} = \alpha + \beta \cdot \text{Financing obstacle}_{ijk} + \gamma \cdot X_{ijk} + \delta \cdot D_j + \eta \cdot D_k + \varepsilon_{ijk} \qquad (1)$$

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; $\text{Financing obstacle}_{ijk}$ denotes various financing obstacles faced by firm i in country j in industry k. 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 fixed effects D_j and a matrix of industry fixed effects D_k 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.[7] I expect the sign of β to be negative as credit constraints raise the cost of providing training.

[7] All firms are asked to list the percentage of theirs sales which come from the following 8 sectors: Mining and quarrying; Construction; Manufacturing; Transport, storage, and communication; Wholesale, retail, and repair; Real estate, renting, and business activities; Hotels and restaurants; and Others. 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.

4.2 Financing Constraints and Training

Table 3 provides the first basic test of whether the coefficient β in Model (1) is statistically different from zero. The estimates are from a probit regression, and the magnitudes reported in the text are based on evaluating the economic impact of each financing obstacle at the sample mean.

The firm-level covariates are broadly consistent with the general predictions of human capital theory. For example, 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 labour 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 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. Finally, subsidized firms train more, implying that subsidies lower the effective cost of providing training.

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. 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% lower probability of offering training to its employees.

In columns (2)-(5) I evaluate the effect of actual obstacles rather than a perceived difficulty of obtaining finance, and I do so only for the sub-sample of firms with a positive demand for credit. The sample is thus reduced by the 1753 firms which declare no need for external finance. In column (2), I find that a firm which needs credit and which had its last loan application denied has a 6.3% lower probability of offering training to its employees than a firm which needs credit and it had its loan application approved. Howvere, this effect is only significant at the 14% level. Column (3) shows that a firm which needs credit but did not apply for a loan because bank collateral requirements were too strict has a 8.7% lower probability of offering training to its employees that a firm which was not discouraged from applying for credit, and the effect is significant at the 1% level. Finally, column (5) suggests that perceiving its chances to obtain bank credit as low deters the firm both from applying for credit and from offering training: firms which did not apply for credit because they thought their loan application would be denied have a 19% lower probability of running a training program for their employees than comparable firms which applied for credit and obtained it (the effect is significant at the 1%). Discouragement due to the high costs of credit, albeit decreasing the probability of offering training, does not seem to matter in the statistical sense (column (4)).

Table 4 repeats the empirical tests from Table 3, but this time I have included in the regressions an array of country-level variables in the place of the country fixed effects. This approach is clearly inferior to a country fixed effects regression when it comes to eliminating the effect of factors that alter the probability of offering training and are common across all firms in the market. Nevertheless, it is a good data validity check in the sense that it allows me to evaluate the predictions of various theories on the particular dataset that nature

has provided me with. I find that firms train more often in richer countries, as well as in countries with higher creditors rights, suggesting that the return to human capital is indeed higher when the general technology is superior and when investment is better protected. GDP growth and the depth of the financial system seem not to matter consistently for training. The second piece of evidence suggests that the volume of credit may be less important for access to finance than the allocation of credit, justifying our instrumental variable procedure. 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 with less training, but not consistently statistically so.

4.3 Technology, Monopsony Power, and Labour Contracts

I now proceed to test whether the estimates in Table 3 are not contaminated by various alternative factors highlighted both in "standard" human capital theory and in the "new" training literature. In particular, my results could be explained by the mix between specific and general training if firms which offer more specific training are less credit constrained, or by the degree of labor regulations if less constrained firms can also implement more binding labor contracts (Becker, 1962). The same will be true if wage floors imposed by strong unions lead to a higher wage compression in unconstrained firms (Dustmann and Schonberg, 2009), or if firms offer mostly general training, but credit constrained firms have a lower degree of labor market monopsony power (Acemoglu and Pischke, 1999a,b). To that end, I repeat the probit regressions from Table 3 with the three additional firm-level covariates described in Section 3.1, namely: 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 in Table 5 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. Numerically, all else equal, a firm which has introduced a new technology in the past three years has a 13.7% higher probability of running a formal on-the-job training program. The *post hoc ergo propter hoc* approach suggests is suggestive of a causal link in the sense that superior technology and the specificity of skills leads to more training, rather than the other way round. Also, firms with a higher degree of monopsony power tend to train more, although this is observed only in the full sample of firms (column (1)). In this case, I find that firms for which it takes less than 4 weeks to fill a vacancy have a 3.4% higher probability of offering training, and this effect is significant at the 1% statistical level. Finally, firms facing more frequent labour inspections have a 7% higher probability of running a formal on-the-job training program. Importantly, the effect of the various types of credit constraints registered in Table 3 survives (with the exception of credit application rejection which is now only significant at the 15% statistical level).

5 Addressing the Endogeneity of Financing Constraints

In this Section, I address the concern that while statistically strong, the results so far are suggestive of nothing more than a robust correlation between financing constraints and

training. Consequently, causal claims are unwarranted because inefficient firms may simply be reporting higher constraints, or both access to finance and training may be driven by various omitted factors. I address the first problem by employing an instrumental variable procedure in the cross-sectional regressions. The second problem is addressed by repeating the tests on a panel of firms observed both in 2002 and in 2005 which allows me to eliminate the effect of firm-level unobservables through fixed effects panel regressions. Both approaches are crucial in trying to establish causality from credit constraints to the presence of a training program at the firm level.

5.1 Instrumental Variable Regressions in the Cross-Section

I first report the estimates from instrumental variable regressions in the cross-section of firms. In Table 6, I instrument the self-reported credit constraints with a dummy equal to 1 if the firm has its accounts certified by external auditors on a regular basis. In a firm-bank relationship, firm opacity is consistently related to credit constraints in a causal way (Berger, Klapper, and Udell 2001), while informational opacity should not affect investment in human capital directly.

Columns (1), (3), (5), (7), and (9) report the results from the first stage regressions of each of my five financing constraints on the firm's use of auditing services. Auditing is consistently associated with lower financing constraints, which confirms the intuition that firms employ external verification of their financial accounts in order to facilitate access to finance by signalling their type to the banks (Verrecchia, 1983). In two of the five cases (columns (1) and (5)), this effect is significant in the statistical sense too. In addition, in one of these cases - "Access to finance problematic", column (1) - the partial F-value from the Wald test on the first-stage significance of the instrument is higher than 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). In one more case - when the firm does not apply for bank credit because of "Strict collateral requirements", column (5) - the value from the F-test is just below the critical value. The second-stage regressions imply that to the extent that the instrument is valid, access to finance (column (2)) and strict collateral requirements discouraging the firm from applying for credit (column (6)) continue to exert a large negative effect on the firm's probability of running a training program.

Despite the statistical and conceptual appeal of this instrument, it may be impossible for any firm-level instrument to convince the econometrician, the reason being that virtually all firm-level variables are choice variables and can thus be driven by any number of unobservable factors. For example, firm owners with more advanced management practices may be both more prone to use sophisticated verification technologies and to train their workforce. To address this concern, I complement the approach so far by resorting to a set of instruments that capture the structure of credit markets. The first such set consists of country-level measures of the degree of state ownership of commercial banks in the country and the degree of bank competition in the country. As pointed out in Section 3.2, state banks tend to be more inefficient due to the necessity to perform various non-profit maximizing functions. In addition, bank competition may either alleviate credit constraints by reducing the costs of credit, or raise them by destroying soft information. At the same time, there is little reason to expect that the structure of credit markets should affect training through any other channel but the firm's access to finance.

In Table 7, I test the validity of these considerations and then report the estimates from the second stage of the IV regressions. As in Table 6, columns (1), (3), (5), (7), and (9) report the results from the first stage regressions of each of the five financing constraints on

the country's credit market structure. As the instruments vary at the country level, I replace the country fixed effects with the set of country-level covariates from Table 4. Columns (1), (5), (7), and (9) suggest that bank competition is associated with lower access to finance, confirming the hypotheses in Petersen and Rajan (1995) that competition damages firm-bank relationships by raising the cost of soft information. Columns (1) and (3) also suggests that state bank ownership is significantly associated with a more problematic access to finance for the marginal firm. In general, the set of two instruments performs best in the case of general access to finance (column (1)), where not only are both instruments significantly correlated with access to finance, but also the value from the partial F-test is just below the critical value for the IV regression to have no more than 10% of the bias of the OLS estimate. The second stage of this regression (column (2)) confirms that problematic access to finance is associated with lower firm-level training. Numerically, the estimate is around 15 times higher than in the OLS case (Table 5, column (1)), suggesting that relative to a firm for which access to finance is a "major obstacle", a firm for which it is "no obstacle" has a 75% higher probability of offering its workers formal training. In that sense, the OLS estimate is a lower bound for the true effect. In the cases of discouragement due to strict collateral requirements (column (6)) and of discouragement due to high interest rates (column (8)) the second stage of the IV regression also suggests a causal effect of financing constraints on training, but the strength of the instruments is put to question by the first-stage statistics (columns (5) and (7), respectively).

Arguably, this IV procedure is not perfect as it involves country-level instruments, precluding me for controlling properly for unobservable country-level heterogeneity. To address this point, I next make 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 small 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 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.[8] I further normalize the number of branches per 100,000 of local population. While the initial sample is reduced from 27 to 14 countries, the major advantage of this instrument is that it describes the banking structure at the level of the local market, allowing me to include once again country fixed effects in the regression in order to eliminate unobservable country-level heterogeneity. In addition, it captures both properties of competition and of access to finance which are directly correlated with credit constraints.

[8] See Popov and Udell (2011) for more details on the data collection process.

Table 8 reports the results from the first and second stage of the IV regression where the five credit constraints have been instrumented using bank branches per unit of population. In the case of the general "Access to finance" variable, the first-stage of the regression yields a somewhat respectable value for the F-test (column (1)), and a higher concentration of bank branches is associated with significantly higher access to finance. In addition to that, the negative effect of poor access to finance on the firm's probability of offering training survives and is significant at the 10% level. In the rest of the cases, the effect of various actual financing constraints on training does not survive, and in the case when the firm did not apply for a loan because it thought it would be rejected, there aren't enough such firms in the 14 countries to conduct a proper test.

5.2 Fixed Effects Panel Estimates

The cross-sectional estimates reported so far may be biased due to omitted firm-level variables. Factors like managerial ability or the firm's growth opportunities are invisible to the econometrician, but they likely affect both the firm's ability to borrow funds and its incentives to offer training. To tackle this issue, I repeat my main analysis using a panel generated from the 2002 and 2005 BEEPS. Of the total 8265 firms covered by the BEEPS 2005, 1179 were also surveyed in 2002. 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 general access to finance variable, namely: "How problematic is access to financing for the operation and growth of your business?" (from (1) "No obstacle", to (4) "Major obstacle"). Also, the question on the frequency of labour and social security inspections is not present in the 2002 BEEPS. In Table 9, 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.

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.

Finally, 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%. From the other firm-level covariates, only the effect of the share of skilled workers survives As this regression allows me to control for time-varying market factors, I also include the country-level covariates from Table 4. 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.

6 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 labour market characteristics; and I can purge the estimated effect of credit constraints on training from the effect of omitted firm-level factors.

My results indicate that various types of credit constraints are consistently associated with lower probability of firms' offering training to their 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 two different strategy to address reversed causality (less efficient firms reporting higher credit constraints) and omitted variable bias (factors like managerial ability or growth opportunities determining both access to finance and the level of training). In the cross-section, I employ an IV procedure where I use the firm's information transparency, as well as the structure of country-level and local credit markets to extract the endogenous element of credit constraints. In fixed effect panel regressions, I eliminate the effect of unobservable time-invariant firm-

level characteristics. The main result of the paper survives both procedures.

The use of survey data also allows me to calculate the numerical effect of capital market imperfections on investment in training. For different types of access to external finance, credit constrained firms have a between 5.1% and 19% 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 former Yugoslavia were on average as unconstrained as firms in Estonia (Table 2), between 1.5% and 6% more firms would be offering training to their employees, explaining up to 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 in emerging markets.

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Table 1 - Summary Statistics

Panel A. Firm-Level Variables

Variable	mean	median	st. dev.	min.	max.
On-the-job training	0.371	0	0.483	0	1
Small firm	0.780	1	0.414	0	1
Large firm	0.220	0	0.414	0	1
Individual owner	0.768	1	0.422	0	1
Government owner	0.065	0	0.246	0	1
Foreign owner	0.043	0	0.203	0	1
Female manager	0.218	0	0.413	0	1
Privatized	0.117	0	0.321	0	1
Exporter	0.224	0	0.417	0	1
Subsidized	0.059	0	0.236	0	1
Share skilled workers	0.414	0	0.493	0	1
Share university education	0.494	0.5	0.316	0	1
Audited	0.280	0.2	0.299	0	1
Access to finance problematic	0.039	0	0.194	0	1
Last loan application rejected	0.150	0	0.357	0	1
Strict collateral requirements	0.107	0	0.309	0	1
High interest rates	0.013	0	0.115	0	1
Loan would have been denied	0.301	0	0.459	0	1
Advanced technology	0.486	0	0.500	0	1
Hiring ease	0.371	0	0.483	0	1
Frequent labour inspections	0.464	0	0.499	0	1

Panel B. Country-Level and Local Market-Level Variables

Variable	mean	median	st. dev	min.	max.
Share state banks	0.155	0.091	0.173	0.000	0.690
Bank concentration	0.617	0.623	0.169	0.184	0.980
Branches per population	21.438	18.000	21.495	0.320	584.000
Private credit	0.242	0.227	0.125	0.057	0.537
GDP per capita	9571.255	8287.041	5090.001	1438.778	22077.860
GDP growth	0.031	0.033	0.012	0.004	0.052
Creditors rights	6.057	6.333	1.789	3.000	9.000
Contract enforcement	513.979	403.333	275.956	210.000	1410.000
Inflation	9.212	5.411	6.698	1.726	24.693
Years of schooling	9.061	9.200	0.787	6.500	9.900
Labour regulations	39.727	38.000	11.999	7.000	59.000

Notes: The table gives summary statistics of all firm-level (Panel A) and country-level and local market-level (Panel B) variables used in the paper. See Appendix for all variable sources and definitions.

Table 2.
Firm Characteristics, By Country

	On-the-job training	Access to finance problematic	Audited	Share state-owned banks	Bank concentration	Branches per population
Armenia	0.287	2.545	0.372	0.000	0.793	-----
Azerbaijan	0.163	2.173	0.518	0.555	0.808	-----
Belarus	0.437	2.504	0.438	0.690	0.747	-----
Bosnia and Herzegovina	0.427	2.376	0.433	0.043	0.518	14.578
Bulgaria	0.297	2.094	0.363	0.022	0.476	25.989
Croatia	0.547	2.057	0.409	0.034	0.631	13.148
Czech Republic	0.588	2.519	0.301	0.030	0.597	20.926
Estonia	0.618	1.665	0.808	0.000	0.980	16.172
Georgia	0.247	2.302	0.696	0.000	0.729	-----
Hungary	0.361	2.468	0.701	0.070	0.637	22.992
Kazakhstan	0.249	1.998	0.305	0.030	0.623	-----
Kyrgyzstan	0.450	2.084	0.354	0.054	0.858	-----
Latvia	0.473	1.642	0.609	0.041	0.541	14.757
Lithuania	0.418	1.644	0.405	0.000	0.776	13.527
Macedonia	0.388	2.436	0.256	0.018	0.780	13.607
Moldova	0.296	2.512	0.108	0.175	0.616	-----
Poland	0.445	2.776	0.337	0.230	0.587	20.794
Romania	0.259	2.454	0.322	0.182	0.650	28.330
Russia	0.307	2.051	0.368	0.375	0.184	-----
Slovakia	0.806	1.689	0.497	0.013	0.821	30.960
Slovenia	0.636	2.021	0.292	0.125	0.635	34.029
Tajikistan	0.255	1.901	0.233	0.093	-----	-----
Turkey	0.197	2.118	0.700	-----	-----	-----
Ukraine	0.398	2.322	0.345	0.091	0.442	-----
Yugoslavia	0.402	2.777	0.301	0.271	-----	16.069
Total	0.371	2.289	0.414	0.155	0.617	21.438

Note: The table summarizes the main variables of interest by country. Variables are unweighted averages over all firms in the country. Data come from the 2005 BEEPS. See Appendix for all variable definitions and sources.

Table 3.
Financing Constraints and Training

	(1)	(2)	(3)	(4)	(5)
	Access to finance problematic	Last loan application rejected	Strict collateral requirements	High interest rates	Loan would have been denied
Financing obstacle	-0.033	-0.158	-0.223	0.017	-0.513
	(0.016)**	(0.106)	(0.059)***	(0.064)	(0.175)***
Small firm	-0.482	-0.444	-0.432	-0.446	-0.444
	(0.042)***	(0.049)***	(0.049)***	(0.049)***	(0.049)***
Individual owner	-0.057	-0.061	-0.056	-0.061	-0.062
	(0.053)	(0.061)	(0.061)	(0.061)	(0.061)
Government owner	-0.028	-0.058	-0.047	-0.061	-0.047
	(0.085)	(0.101)	(0.101)	(0.101)	(0.101)
Foreign owner	0.413	0.301	0.310	0.304	0.300
	(0.098)***	(0.120)**	(0.120)***	(0.120)**	(0.120)**
Female manager	-0.106	-0.086	-0.088	-0.087	-0.087
	(0.045)**	(0.051)*	(0.051)*	(0.051)*	(0.051)*
Privatized	0.007	-0.039	-0.041	-0.040	-0.041
	(0.055)	(0.063)	(0.063)	(0.063)	(0.063)
Exporter	0.192	0.209	0.203	0.211	0.208
	(0.043)***	(0.049)***	(0.049)***	(0.049)***	(0.049)***
Subsidized	0.269	0.269	0.253	0.272	0.281
	(0.072)***	(0.079)***	(0.079)***	(0.079)***	(0.079)***
Share skilled workers	-0.095	-0.097	-0.081	-0.099	-0.093
	(0.072)	(0.085)	(0.085)	(0.085)	(0.085)
Share university education	0.528	0.469	0.469	0.468	0.466
	(0.075)***	(0.091)***	(0.091)***	(0.091)***	(0.091)***
Country fixed effects			Yes		
Industry fixed effects			Yes		
Observations	6379	4626	4626	4626	4626
R-squared	0.114	0.116	0.101	0.098	0.100

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 is running a formal on-the-job training program, and to 0 otherwise. 'Financing obstacle' refers to 'Access to finance problematic' in column (1), 'Last loan application rejected' in column (2), 'Strict collateral requirements' in column (3), 'High interest rates' in column (4), and 'Loan would have been denied' in column (5). 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 4.
Financing Constraints, Training, and Country-Level Explanatory Variables

	(1)	(2)	(3)	(4)	(5)
	Access to finance problematic	Last loan application rejected	Strict collateral requirements	High interest rates	Loan would have been denied
Financing obstacle	-0.042	-0.127	-0.221	0.024	-0.461
	(0.016)***	(0.104)	(0.058)***	(0.064)	(0.171)***
Private credit	0.219	0.080	0.122	0.082	0.043
	(0.339)	(0.400)	(0.401)	(0.401)	(0.401)
GDP per capita	0.029	0.027	0.025	0.027	0.027
	(0.007)***	(0.009)***	(0.009)***	(0.009)***	(0.009)***
GDP growth	-0.058	-0.037	-0.042	-0.037	-0.037
	(0.021)**	(0.025)	(0.025)*	(0.025)	(0.025)
Creditors rights	0.028	0.023	0.021	0.022	0.023
	(0.016)*	(0.018)	(0.018)	(0.018)	(0.018)
Contract enforcement	0.014	0.019	0.020	0.019	0.019
	(0.008)*	(0.009)**	(0.010)**	(0.009)**	(0.010)**
Inflation	-0.001	-0.003	-0.002	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Years of schooling	-0.050	-0.066	-0.059	-0.067	-0.066
	(0.034)	(0.039)*	(0.039)	(0.039)*	(0.039)*
Labour regulations	0.091	0.003	0.002	0.003	0.003
	(0.177)	(0.002)	(0.002)	(0.002)	(0.002)
Firm covariates			Yes		
Country fixed effects			No		
Industry fixed effects			Yes		
Observations	5915	4388	4388	4388	4388
R-squared	0.087	0.074	0.076	0.074	0.075

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 is running a formal on-the-job training program, and to 0 otherwise. 'Financing obstacle' refers to 'Access to finance problematic' in column (1), 'Last loan application rejected' in column (2), 'Strict collateral requirements' in column (3), 'High interest rates' in column (4), and 'Loan would have been denied' in column (5). All firm-level covariates from Table 3 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 5.
Financing Constraints and Training: Accounting for Technology, Monopsony, and Labour Contracts

	(1)	(2)	(3)	(4)	(5)
	Access to finance problematic	Last loan application rejected	Strict collateral requirements	High interest rates	Loan would have been denied
Financing obstacle	-0.036	-0.134	-0.202	0.029	-0.475
	(0.016)**	(0.106)	(0.059)***	(0.065)	(0.145)***
Advanced technology	0.347	0.356	0.352	0.358	0.355
	(0.038)***	(0.044)***	(0.044)***	(0.044)***	(0.044)***
Hiring ease	0.084	0.028	0.027	0.028	0.026
	(0.036)**	(0.042)	(0.042)	(0.042)	(0.042)
Frequent labour	0.182	0.114	0.113	0.114	0.114
inspections	(0.037)***	(0.044)***	(0.044)***	(0.043)***	(0.044)***
Firm covariates			Yes		
Country fixed effects			Yes		
Industry fixed effects			Yes		
Observations	6379	4626	4626	4626	4626
R-squared	0.128	0.112	0.113	0.111	0.112

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 is running a formal on-the-job training program, and to 0 otherwise. 'Financing obstacle' refers to 'Access to finance problematic' in column (1), 'Last loan application rejected' in column (2), 'Strict collateral requirements' in column (3), 'High interest rates' in column (4), and 'Loan would have been denied' in column (5). All firm-level covariates from Table 3 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.
Reversed Causality: Using Firm's Information Transparency as an Instrument for Financing Constraints

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Access to finance problematic		Last loan application rejected		Strict collateral requirements		High interest rates		Loan would have been denied	
	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training
Financing obstacle		-0.588		-10.296		-2.958		-6.212		-15.786
		(0.169)***		(7.775)		(1.192)**		(4.500)		(11.384)
Audited	-0.129		-0.009		-0.030		-0.014		-0.006	
	(0.031)***		(0.006)		(0.011)***		(0.010)		(0.004)	
Firm covariates					Yes					
Country fixed effects					Yes					
Industry fixed effects					Yes					
KP Wald *F*-statistics	17.59		1.82		7.15		1.99		1.99	
Observations	6379	6379	4626	4626	4626	4626	4626	4626	4626	4626
R-squared	0.092		0.020		0.072		0.036		0.022	

Note: The table reports coefficients from instrumental variable regressions where the dependent variable is 'On-the-job training', defined as an indicator equal to 1 if the firm is running a formal on-the-job training program, and to 0 otherwise. 'Financing obstacle' refers to 'Access to finance problematic' in columns (1) and (2), 'Last loan application rejected' in columns (3) and (4), 'Strict collateral requirements' in columns (5) and (6), 'High interest rates' in columns (7) and (8), and 'Loan would have been denied' in columns (9) and (10). In the second stage (columns (2), (4), (6), (8), and (10)), each respective financing constraint has been instrumented using 'Audited', a dummy variable equal to 1 if the firm employs external auditors to verify its financinal accounts. All firm-level covariates from Table 3 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.
Reversed Causality: Using Credit Market Structure as an Instrument for Financing Constraints

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Access to finance problematic		Last loan application rejected		Strict collateral requirements		High interest rates		Loan would have been denied	
	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training
Financing obstacle		-0.540		6.455		-2.016		-2.721		0.292
		(0.189)***		(6.813)		(0.966)**		(1.321)**		(1.778)
Share state-owned	0.346		0.004		0.083		0.039		0.014	
banks	(0.111)***		(0.027)		(0.050)*		(0.036)		(0.014)	
Bank concentration	-0.246		0.025		-0.080		-0.077		-0.023	
	(0.111)**		(0.027)		(0.040)**		(0.035)**		(0.011)**	
Firm covariates						Yes				
Country covariates						Yes				
Country fixed effects						No				
Industry fixed effects						Yes				
KP Wald *F*-statistics	6.234		0.51		2.96		2.83		2.31	
Observations	5582	5582	4144	4144	4144	4144	4144	4144	4144	4144
R-squared	0.062		0.011		0.049		0.028		0.013	

Note: The table reports coefficients from instrumental variable regressions where the dependent variable is 'On-the-job training', defined as an indicator equal to 1 if the firm is running a formal on-the-job training program, and to 0 otherwise. 'Financing obstacle' refers to 'Access to finance problematic' in columns (1) and (2), 'Last loan application rejected' in columns (3) and (4), 'Strict collateral requirements' in columns (5) and (6), 'High interest rates' in columns (7) and (8), and 'Loan would have been denied' in columns (9) and (10). In the second stage (columns (2), (4), (6), (8), and (10)), each respective financing constraint has been instrumented using 'Share state-owned banks' (the fraction of the country's banking sector assets held by state-owned banks) and 'Bank concentration' (the fraction of assets held by the three largest banks to the assets of all commercial banks). All firm-level covariates from Table 3 and all country-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 8.
Reversed Causality: Using Local Credit Market Structure as an Instrument for Financing Constraints

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Access to finance problematic		Last loan application rejected		Strict collateral requirements		High interest rates		Loan would have been denied	
	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training	1st stage	On-the-job training
Financing obstacle		-0.784		-8.835		4.156		3.279	---	---
		(0.465)*		(10.304)		(4.788)		(3.004)		
Branches per population	-0.116		-0.106		0.226		0.287			
	(0.070)*		(0.121)		(0.253)		(0.241)			
Firm covariates						Yes				
Country fixed effects						Yes				
Industry fixed effects						Yes				
KP Wald *F*-statistics	2.26		0.78		0.80		1.41			
Observations	3332	3332	2470	2470	2470	2470	2470	2470		
R-squared	0.130		0.025		0.075		0.053			

Note: The table reports coefficients from instrumental variable regressions where the dependent variable is 'On-the-job training', defined as an indicator equal to 1 if the firm is running a formal on-the-job training program, and to 0 otherwise. 'Financing obstacle' refers to 'Access to finance problematic' in columns (1) and (2), 'Last loan application rejected' in columns (3) and (4), 'Strict collateral requirements' in columns (5) and (6), 'High interest rates' in columns (7) and (8), and 'Loan would have been denied' in columns (9) and (10). In the second stage (columns (2), (4), (6), (8), and (10)), each respective financing constraint has been instrumented using 'Branches per population', the number of banks branches in the firm's town of incorporation divided by the twon's population. All firm-level covariates from Table 3 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.
2002 and 2005 samples: Pooled OLS, Random, and Fixed Effects Panel Estimates

	(1)	(2)	(3)
	Pooled 2002 and 2005	Panel random effects	Panel fixed effects
Access to finance problematic	-0.025	-0.023	-0.027
	(0.010)***	(0.010)**	(0.016)*
Small firm	-0.169	-0.162	-0.011
	(0.029)***	(0.030)***	(0.070)
Individual owner	-0.049	-0.042	-0.006
	(0.032)	(0.032)	(0.057)
Government owner	-0.017	-0.005	-0.041
	(0.046)	(0.047)	(0.111)
Foreign owner	-0.019	-0.013	-0.115
	(0.052)	(0.053)	(0.104)
Privatized	-0.016	-0.015	-0.084
	(0.034)	(0.035)	(0.088)
Exporter	0.056	0.062	0.061
	(0.029)*	(0.030)**	(0.066)
Subsidized	0.021	0.014	-0.052
	(0.043)	(0.044)	(0.077)
Share skilled workers	-0.064	-0.078	-0.174
	(0.044)	(0.044)*	(0.078)**
Share university education	0.187	0.177	0.028
	(0.043)***	(0.045)***	(0.104)
Advanced technology	0.124	0.116	0.036
	(0.025)***	(0.025)***	(0.040)
Hiring ease	0.021	0.013	-0.057
	(0.023)	(0.023)	(0.036)
Private credit			-0.938
			(0.385)**
GDP per capita			-0.057
			(0.034)*
GDP growth			-0.071
			(0.387)
Creditors rights			-0.003
			(0.059)
Contracts enforcement			-0.002
			(0.001)**
Inflation			0.002
			(0.002)
Year 2005	-0.017	-0.017	0.103
	(0.022)	(0.021)	(0.061)*
Country fixed effects	Yes	Yes	No
Firm random effects	No	Yes	No
Firm fixed effects	No	No	Yes
Observations	1726	1726	1657
R-squared	0.173	0.173	0.071

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 is running a formal on-the-job training program, and to 0 otherwise. 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. 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
Large firm	Dummy=1 if firm has more 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
Audited	Dummy=1 if the firm has its annual financial statements certified by an external auditor, =0 otherwise	BEEPS
Financing obstacle	How problematic is access to financing for the operation and growth of the firm, from 1 (no obstacle) to 4 (major obstacle)	BEEPS
Last loan application rejected	Dummy=1 if firm's last loan application was rejected, =0 otherwise	BEEPS
Strict collateral requirements	Dummy=1 if the firm did not apply for a loan because it perceives bank collateral requirements as too strict, =0 otherwise	BEEPS
High interest rates	Dummy=1 if the firm did not apply for a loan because it perceives interest rates on loans as too high, =0 otherwise	BEEPS
Loan would have been denied	Dummy=1 if the firm did not apply for a loan because it thought the application would have been rejected, =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 labour inspections	Dummy=1 if the firm was subject to regular labour and social security inspections in the past year, =0 otherwise	BEEPS

Country Characteristics		
Share state-owned banks	The fraction of the country's banking sector assets held by state-owned banks	EBRD
Bank concentration	The fraction of assets held by the three largest banks to the assets of all commercial banks	WB FDSD
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
Labour regulations	Index of labour market stringency	WB DBD

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