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Lack of access to external finance and SME labor productivity: does project quality matter?

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Abstract Small and medium-sized enterprises (SMEs) are the main engine of local economic development. However, SME growth remains an issue as labor productivity is low in emerging economies. Due to information asymmetries, constraints in access to external finance prevent a larger participation in the economy, hindering SMEs from expanding their business operations. In the absence of collateral requirements, small and medium-sized firms may rely on exporting activities to signal lenders project quality since this may indicate that firms have good projects to invest. The main purpose of this study was to investigate the impact of project quality on both SME labor productivity and on the relationship between lack of adequate access to external finance and labor productivity. Our results indicate a positive relationship between project quality and labor productivity. We also found that SMEs that applied for bank loans but were rejected have lower levels of labor productivity than SMEs that obtained financing. In addition, constrained SMEs that export internationally were found to have higher labor productivity than constrained firms with lower access to export markets, although the role of project quality in explaining labor productivity for constrained SMEs may be due to direct export sales in most part.

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1 Introduction

The growth of small and medium-sized enterprises (SMEs) aids local economic development in low- and middle-income countries since small businesses create employment, revenue, and more economic interactions among other small firms, increasing the local multiplier effect in communities (Blair and Carroll 2008). SMEs also have a greater participation in employment creation than large businesses (Ayyagari et al. 2007; Ayyagari et al. 2014). However, SME growth remains an issue as levels of labor productivity in low- and middle-income countries are much lower than in more developed economies (Beck and Demirguc-Kunt 2006).

Constraints in the access to capital markets may contribute to low productivity levels, and prevent a larger participation of SMEs. The presence of information asymmetries between borrowers and lenders may be a possible reason for the inadequate availability of access to external finance when borrowers have private information regarding their project quality. This unavailability of access to capital may lead to credit rationing in the market (Stiglitz and Weiss 1981). In this scenario, newer and smaller firms may use lending technologies, such as fixed-asset collateral guarantees and externally revised financial statements in order to signal project

quality when lenders have less information regarding a firm's operating activities (Chan and Kanatas 1985). In the absence of lending technologies, small and medium-sized firms may rely on exporting activities to signal lenders project quality since this may indicate that firms have good projects to invest.

As a result, taking into consideration whether firms have good projects to invest is critical to understanding the relationship between credit constraint and productivity as the internationalization of SMEs, through selling in international markets, may signal efficiency and competitiveness to lenders. SME project quality could be taken into consideration by measuring a firm's exporting activities, or the percentage of sales that were exports, either in direct or indirect form (Love and Roper 2015). Within the context of information asymmetry and imperfections in capital markets, having better project quality in terms of direct and indirect exports may alleviate the negative impact of financing constraints on SME labor productivity. The rationale for this possibility is that productivity is enhanced as a result of increasing exporting activity since the stronger competition in foreign markets may force firms to improve both products and processes in order to remain competitive (Ganotakis and Love 2012).

The main purpose of this study was to investigate the impact of both lack of access to external finance and project quality, measured as the percentage of export sales, on SME labor productivity. We have also examined whether exporting activities alleviate the impact of credit constraints on labor productivity. The issue of low productivity is a major challenge for SMEs in low- and middle-income countries. Low productivity levels may be explained, among other factors, by the lack of adequate access to external finance, as SMEs may not have the necessary means to expand their activities due to credit constraints. This study also aimed to examine the separate effects of direct and indirect export sales on labor productivity for credit-constrained firms due to the high costs associated with exporting directly. We classify firms SMEs that either applied for a bank loan but were rejected or were discouraged from applying as credit constrained (Leon 2015).

A major contribution of the study relates to a more focused examination of both the interplay between project quality and access to external finance, and how their interaction affects SME labor productivity. Since SMEs may be credit rationed, having high-quality investment projects may be critical to increasing firm productivity through exporting activities, and in turn, mitigate the negative effects of credit rationing on labor productivity.

Another important contribution relates to the understanding of project quality through examining the separate effects of direct and indirect export sales on labor productivity for credit-constrained SMEs. Although directly exporting to foreign markets may be costly for SMEs, the gains from collecting information and evaluating foreign markets may offset the fixed costs in terms of developing new products and increasing innovation levels (Love and Roper 2015). In turn, technological advancement and quality of information collection associated with direct exports may be positively correlated with firm performance (Commander and Svejnar 2011; Hall et al. 2009; Mateut 2018). Therefore, direct exports may have a positive impact on labor productivity for credit-constrained SMEs offsetting the potential negative effects of credit constraint.

In addition, a final contribution in our approach is the inclusion of treatment effects, through propensity score matching techniques, in order to build a comparable sample of firms with access to external finance to estimate causal effects of a treatment on an outcome using observational data, and therefore, mitigate the issue of endogeneity through selection bias. These use of matching techniques mitigate the self-selection issue such as the simultaneous relationship between access to bank loans and firm performance (i.e., better performing firms have a better quality project and, as a result, may have facilitated access to capital rather than access to external finance improving firm performance).

The study proceeds as follows. Section 2 reviews the literature on the importance of access to finance for SMEs within the framework of financial intermediation, discussing both the issue of low labor productivity and the potential role of project quality in alleviating financial constraints. Section 3 describes the methodology used in the study. Section 4 presents its results. Section 5 discusses the implications and Section 6 concludes the study, providing limitations and suggestions for future research.

2 Literature review

SMEs are significant contributors of employment and job creation across different income groups, and have higher sales growth than large firms, explaining the rapid expansion of SMEs in developing economies (Ayyagari et al. 2014). However, most SMEs do not have access to external sources of capital through loan contracts from banking institutions. Because SMEs rely more on

internal funds such as owner's equity through retained earnings (Berger and Udell 1998), they are likely to be constrained by the lack of access to external finance (Berger et al. 2001). As a result, access to external finance is critical to the competitiveness of small and medium-sized firms. These firms need to be able to finance their activities through external sources in order to stay competitive and enhance financial performance.

2.1 Lack of access to external finance and labor productivity

Labor productivity, a measure of firm performance, is a key driver of economic prosperity since it is strictly related to economic growth and a key determinant of living standards, indicating the potential of wealth creation (Amin 2010; Harrison et al. 2014). However, while SMEs provide a high volume of job creation, they contribute little to production. Low productivity levels prevent the developing world from obtaining greater economic success since they reflect little contribution of the sector to per capita GDP (Busso et al. 2013). A potential reason for the sluggish productivity is that production inputs, such as labor, are not generating more productive activity, slowing income growth and local economic development (Van Biesebroeck 2005).

In addition, limitations in access to external finance tend to largely constrain SME growth (Ayyagari et al. 2008; Frazer 2005). Since firms in the SME segment tend to be less capital intensive, they are less likely to use bank financing than their large counterparts (Chavis et al. 2011). Limited access to external finance undermines the ability of SMEs to invest in their operations due to constraints in the availability of internal finance, such as retained earnings. Since SMEs lacking adequate access to bank loans may have limited growth potential, we hypothesize that:

> Hypothesis 1: Lack of access to external finance will have a negative impact on SME labor productivity.

2.2 Project quality, credit constraint, and labor productivity

Banks have a critical role in the production of information regarding potential borrowers and loan contract designs in order to minimize the rationing issue in credit markets (Diamond 1984). Specializing in information production refers to the banks' ability to monitor informationally opaque small businesses in order to reduce information asymmetries (Berger et al. 2001), since the presence of asymmetric information between lenders and borrowers limits access to capital as lenders may not adequately assess the risk profile of borrowers (de la Torre et al. 2010). To minimize information asymmetries between financial institutions and SMEs, the availability of lending technologies in loan contracts, such as pledging collateral requirements and providing externally audited financial statements, may provide a signal of project quality to banks.

In the absence of lending technologies, however, SMEs may use their sales export records to signal lenders project quality since this may indicate that firms have good projects to invest (Kumarasamy and Singh 2016). SME project quality, through exporting activities, could be taken into consideration by measuring the percentage of sales that were exports, either in direct or indirect form (Love and Roper 2015). Within the context of information asymmetry and imperfections in capital markets, exporting SMEs may have better performance than their non-exporting counterparts (Commander and Svejnar 2011). As a result, we anticipate a positive impact of sales exports on SME labor productivity by hypothesizing that:

> Hypothesis 2: Project quality, through export sales, will have a positive effect on SME labor productivity.

Linking both credit constraints and credit mechanisms with productivity may be problematic since there are complex processes that influence the relationship between access to capital and SME performance. Improving the conditions of access to capital for some SMEs may not necessarily mean that these businesses will invest in good projects, with positive net present value, which will lead to superior productivity. For instance, loans and other financial instruments as well as lending technologies may lead to superior productivity only when the firms have good projects to invest. Therefore, taking into consideration whether firms have good projects to invest, through export sales, is critical to understanding the relationship between lack of access to capital and productivity. SMEs with higher proportion of sales exports may have higher productivity since only firms with higher productivity and low marginal costs may have the profits large enough to cover the high fixed costs associated with entering foreign

markets (Golovko and Valentini 2011). Campa and Shaver (2002) and Greenaway et al. (2007) also argue that exporting activities can assist firms to reduce their financial constraints, exerting positive effects on a firm's financial health. Therefore, we anticipate that:

> Hypothesis 3: Project quality, through export sales, will have a positive impact on the labor productivity of credit constrained SMEs.

2.3 SME internationalization through direct and indirect exports

Although SMEs may be resource-constrained, lacking market power, knowledge, and access to resources to operate internationally (Fujita 1995; Hollenstein 2005), an increasing number of SMEs pursue international markets to sell their goods and services (Leonidou et al. 2007). Exporting constitutes the most popular method for firms to internationalize. In addition, it is key to firm growth since it requires fewer resources than alternative foreign market entry methods, such as mergers and acquisitions and joint venture arrangements (Reynolds 1997).

In the case of exporting, SMEs face the decision to export indirectly, through an intermediary firm, or directly to customers. On the one hand, internationalization through indirect exports indicates SME involvement with an intermediary firm in order to access international markets (Peng and York 2001). Intermediaries may assist SMEs in identifying customers, financiers, and suppliers, reducing knowledge gaps and other risks and uncertainties associated with operating in foreign markets (Peng and Ilinitch 1998). Export intermediaries may be particularly helpful to resource-constrained SMEs lacking foreign market knowledge since they may face high risks and uncertainty in the path of internationalization.

On the other hand, direct exports is the predominant path to SME internationalization, although foreign market entry through direct exports may pose high costs for SMEs, such as sunk costs incurred in collecting foreign market information and costs of seeking and evaluating local partners (i.e., suppliers), to adapt products to foreign legal rules or local tastes, among others. However, the gains from collecting information and evaluating foreign markets may offset the fixed costs in terms of developing new products and increasing innovation levels (Love and Roper 2015). Empirical evidence links direct exports with technological advancement, better quality of information collection, and higher firm performance (Commander and Svejnar 2011; Hall et al. 2009; Mateut 2018). As a result, credit-constrained SMEs that directly participate in exporting may have higher levels of labor productivity than those directly exporting to foreign markets. Therefore, we anticipate that:

> Hypothesis 4: Direct export sales will have a higher impact on labor productivity than indirect export sales for constrained SMEs.

3 Methodology

We used cross-sectional firm-level data from the World Bank Enterprise Surveys (WBES) collected in Brazil in 2009. Through extensive interviews with firms in the manufacturing and service sector, the enterprise surveys capture business perceptions on the biggest obstacles to enterprise growth, and the relative importance of various constraints to increasing employment and productivity. The WBES used a standardized questionnaire instrument and stratified random sampling that generated a representative sample of nonagricultural and non-financial businesses in Brazil. The enterprise surveys for Brazil targeted a total of 1802 registered and formal businesses. The most widely used criterion in Brazil is the number of employees, adopted by both the Brazilian Institute of Geography and Statistics (IBGE) and the Brazilian Institute for the Support of Micro, Small and Medium-Sized Enterprise (SEBRAE). Table 1 provides a concise definition of SMEs in Brazil (IBGE 2003).

Table 1 Definition of small and medium-sized enterprises (IBGE 2003)

Firm size	Service and retail sector	Manufacturing sector
Small firms	10 to 49 employees	20 to 99 employees
Medium firms	50 to 99 employees	100 to 499 employees

3.1 Data analysis

Using the sample of SMEs from the WBES dataset, the analysis was conducted at both national and regional levels in order to account for potential differences among them. This relationship was specified by the OLS regression equation with robust standard errors in order to minimize the potential impact of heteroscedasticity on the explanatory variables:

$$\begin{aligned} \textit{Labor Productivity} = {} & \beta_1 + \beta_2(\textit{Lack of access to capital}) \\ & + \beta_3(\textit{Obstacle}) + \beta_4(\textit{Project Quality}) \\ & + \beta_5(\textit{Firm Characteristics}) + \beta_6 \\ & (\textit{Owner Characteristics}) + \beta_7 \\ & (\textit{Lack Access*Project Quality}) \\ & + \beta_8(\textit{Obstacle*Project Quality}) + \varepsilon \end{aligned}$$

Next, we describe the variables used in the study.

3.2 Outcome variable: labor productivity

We chose our outcome variable, *labor productivity*, as a measure of firm performance rather than total factor productivity (TFP) since TFP is commonly calculated as a residual, and therefore, prone to measurement error. This study utilized total annual revenue per number of employees, in logarithm terms, as the measure for labor productivity.

3.3 Explanatory variables: lack of access to capital and project quality

This study uses a set of explanatory variables to measure the impact of access to capital and lending technologies on labor productivity for SMEs. First, we use *export sales* to account for quality of the SME project, defined as the proportion of the establishment's sales that were destined as direct and indirect exports (Love and Roper 2015), as selling in international markets may signal better quality projects, efficiency, and competitiveness to domestic investors and creditors. We also use dummy variable *No Bank Loan* to represent credit-constrained SMEs, lacking of adequate access to external finance. The variable is coded as 1 if the firm has applied to bank loans but was rejected. Conversely, it is coded as 0 if firms have successfully obtained a loan last fiscal year (Leon 2015). We also included SME owner's perception of access to capital as an obstacle. This dummy variable *obstacle* is coded as 1 if owners perceive access to capital as a moderate, major, or very severe obstacle to the current establishment operations, and 0 if they perceive access to capital as a minor or no obstacle to the firm's activities.

3.4 Control variables: firm and owner characteristics

Consistent with previous literature, the estimated econometric models utilized several control variables that mainly referred to firm characteristics (Becchetti and Trovato 2002; Nichter and Goldmark 2009; Söderbom and Teal 2001). We also controlled for *firm age* using a continuous log-transformed variable, and firm size using a dummy variable to indicate whether firms are *small* (1 = small firms, 0 = other firms). *Sector* of activity is a dummy variable that takes the value of 1 for SMEs in the service sector and 0 for other sectors of activity, such as manufacturing. We also used a dummy to indicate sole proprietor *ownership* (1 = sole proprietor ownership, 0 = other ownership types). We have also included *experience*, a continuous variable for the owner's years of managerial experience and a dichotomous variable to control for *owner's gender* as prior research suggests the presence of gender differences in access to external finance (Aterido and Hallward-Driemeier 2011).

This study also controls for variables at the state level since there may be differences in the size of the economy and human capital levels within a given country. As a result, we have used World Development Indicators (WDI), such as *GDP* per capita and *Income* per capita to control for size of the economy (Beck and Demirguc-Kunt 2006), and *years of schooling* to account for a human capital levels within Brazil (Demombynes and Özler 2005; Soares 2004). Table 2 depicts these indicators, in Brazilian Reais (R$), for every Brazilian state that is considered in the WBES sample.

3.5 Treatment effects using propensity score matching

Treatment effects allow estimation of causal effect of a treatment on an outcome using observational data. In order to address potential concerns of endogeneity and selection bias, we use a matching technique to estimate the treatment effects and build a comparable sample of SMEs with access to external finance, but having similar observed traits compared to constrained SMEs. The purpose of matching is to pair each treated SME (i.e.,

Table 2 Brazilian states per capita GDP, income, and years of schooling (WBES sample) in Reais (R$)

State	Region	Population	GDP per capita (in thousand)	Income per capita	Schooling years (avg)
Amazonas	North	3,221,939	16.48	527.51	7.0
Bahia	Northeast	14,080,654	9.83	498.45	5.4
Ceará	Northeast	8,185,286	8.12	462.00	5.5
Distrito Federal	Midwest	2,455,903	54.23	1744.29	9.4
Goiás	Midwest	5,647,035	14.58	824.51	6.7
Maranhão	Northeast	6,118,995	6.63	417.73	5.2
Mato Grosso	Midwest	2,854,642	18.12	728.61	6.3
Minas Gerais	Southeast	19,273,506	16.57	777.81	6.6
Paraíba	Northeast	3,641,395	7.42	540.98	5.2
Paraná	South	10,284,503	18.67	1018.16	7.1
Pernambuco	Northeast	8,485,386	9.62	483.00	5.7
Rio de Janeiro	Southeast	15,420,375	23.80	1066.73	8.1
Rio Grande do Sul	South	10,582,840	21.84	986.94	7.1
Santa Catarina	South	5,866,252	23.96	1088.16	7.3
São Paulo	Southeast	39,827,570	27.62	1111.33	7.9

with a loan) with an untreated SME (i.e., without a loan) on the basis of certain observable variables. This type of matching is preferred over random choice of the comparison group since it is less likely to induce bias by picking SMEs with different characteristics (Abadie and Imbens 2011).

While both regression and matching approaches are based on conditional independence for inferring causality, matching does not rely on the type of functional form assumptions typically used in regressions. In addition, matching explicitly assesses whether comparable untreated observations are available for each treated observation. Current econometric research indicates that mitigating selection bias in studies based on observational data may be achieved by avoiding functional form assumptions and imposing a common support condition (Imbens and Wooldridge 2009; Karhunen and Huovari 2015).

We adopted the method of propensity score matching, suggesting that the use of probability of receiving treatment is conditional on observables' characteristics. The methodology is based on the probability of receiving a treatment that is obtained from a probit regression, and it is conditional on a set of observable traits (Rosenbaum and Rubin 1983, 1984, 1985). This methodology has also been used in the context of underwriting and the bundling of loans (Drucker and Puri 2005). As a result, the propensity score is an index function that summarizes the wide set of observable traits that affect the probability of receiving the treatment (i.e., access to bank loans). In other words, the propensity score indicates a conditional probability of observations to be part of the treatment group, and is given by:

$$P(X) = \Pr(T = 1|X).$$

Under the assumption of conditional independence, $(Y_0, Y_1) \perp T \mid X$, Rosenbaum and Rubin (1983) demonstrated that all biases due to observable variables can be removed by conditioning solely on the propensity score, $(Y_0, Y_1) \perp T \mid P(X)$. As the authors show, a known propensity would incorporate all the information about the selection, and therefore, propensity score matching could achieve optimal efficiency and consistency.

We estimated the average treatment effect on the treated (ATET) of not adequate access to external finance through bank loans on SME labor productivity. ATET is the difference in average outcomes of the supported and unsupported firms, where the unsupported firm group is formed matching units based on the propensity score. The ATET measure is relevant when we want to consider the average gain from treatment for the treated (Imbens and Wooldridge 2009). However, the estimation of the propensity score only may not be enough to estimate ATET since the probability of observing two units with exactly the same propensity score

value tends to be zero due to the continuous variable characteristic of the propensity score.

To overcome this issue, several methods have been proposed. Among them, propensity score matching with a caliper specification and K-nearest neighbor matching are widely used (Caliendo and Kopeinig 2008). Specifying the caliper can avoid bad matches since it may impose a tolerance level on the maximum propensity score distance, denoted as caliper. We use a 0.05 caliper as the tolerance level in order to specify that we only want to consider a pair of observation a match if the absolute difference in the propensity scores is less than 0.05 (Oh et al. 2009). Although the variance of the estimates increases in performing few matches, specifying the caliper has the advantage of small bias. We also specified that standard errors for independent and identically distributed data be reported since the default robust standard errors for the estimated ATET require viable matches for both treated and control subjects (Abadie and Imbens 2016).

In addition, *K*-nearest neighbor matching matches *k*-closest SMEs in terms of propensity scores. The choice of *k* also imposes a tradeoff between bias and variance, where large *k* may lead to large bias and small variance. We start with the default choice of 1. However, on the basis of earlier SME studies (Eliasson et al. 2012; Hottenrott and Lopes-Bento 2014; Kobayashi 2014), we also use 3 as the threshold for *k*. In other words, we use nearest neighbor matching to match a SME to three other SMEs in the opposite treatment group.

4 Results

Table 3 depicts the descriptive statistics and the correlation matrix, including both the outcome and explanatory variables (a star indicates at least 5% significance level in the correlation matrix). The average labor productivity is slightly over Brazilian Real (R$) 149,000 per employee with a standard deviation of nearly R$ 440.5 thousand. The mean for the percentage of sales that were export is 3.89% (standard deviation of 13.33%), while the average age of SMEs is 22.42 years, with a standard deviation of 16.64 years. The average experience of owners was 23 years, with a standard deviation of 11 years. Finally, the mean results for GDP per capita, income per capita, and years of schooling were R$20,427, R$ 912, and 7 years respectively. The WBES dataset for Brazil is comprised of 1039 SMEs and 763 large firms. Among the SMEs observed in the dataset, 48% did not have access to external finance, 85% are part of the manufacturing sector, 74.5% are small-sized enterprises, as 13% were women-owned SMEs.

4.1 Project quality, lack of access to capital and labor productivity

Table 4 shows the findings of the impact of lack of adequate access to external finance, through bank loan contracts, on labor productivity. The first column contains the model including the full sample of SMEs in Brazil. Column 2 represents a model without both explanatory variables of interest, while columns 3 and 4 contain either one of the explanatory variables of interest (no bank loan or obstacle). As expected, not having access to bank loans had a significant negative impact on labor productivity. This finding, significant at the 1% significance level, confirms hypothesis 1. The perception of access to capital as a major obstacle by SME owners also had a significant negative impact on labor productivity. In addition, SMEs with higher-quality projects, measured by the percentage of sales that were direct and indirect exports, had a positive impact on labor productivity, confirming our second hypothesis. This finding is significant at the 5% significance level, and indicates that SMEs with a higher proportion of export sales had higher labor productivity.

Our results also suggest that an increase in firm age has a positive effect in SME labor productivity. We also found significant evidence to support that women-owned SMEs have greater labor productivity than their male counterpart. Other firm characteristics, such as sector of activity, ownership, and firm size did not have a significant impact on labor productivity for SMEs. Finally, state-level variables for economic growth and human capital, such as per capita GDP, per capita income and years of schooling, were found to have a significant positive relationship with labor productivity.

Due to potential issues of multicollinearity between not having a bank loan and perceiving access to finance as a major obstacle, we ran a variance inflation factor (VIF) test in order to calculate the centered VIFs for the independent variables specified in the regression model. As Table 5 shows, we found that the VIF for not having a loan and perceived obstacle were 1.04 and 1.01 respectively. As a result, multicollinearity does not pose any problems in the analysis.

Table 3 Descriptive statistics and correlation matrix

Variable	Mean	Std. Dev.	Min	Max	Labor Prod.	No loan	Obstacle	Sales export	Sector
Labor Prod.	149,083.30	440,451.60	70.27027	950,000	1				
No loan	0.46	0.50	0	1	− 0.0704	1			
Obstacle	0.78	0.42	0	1	− 0.1264	− 0.0577*	1		
Sales export	3.89	13.33	0	100	0.0284*	− 0.0025	− 0.0132	1	
Sector	0.14	0.35	0	1	0.0379	0.1112*	0.0346	− 0.0993*	1
Ownership	0.07	0.25	0	1	− 0.0542	0.032	0.0063	− 0.0562	0.018
Small firm	0.73	0.44	0	1	− 0.042	0.1471*	0.044	− 0.1896*	0.0736
Firm age	22.42	16.64	2	183	0.0343	− 0.0641	− 0.0306	0.126*	− 0.1524*
Experience	22.79	11.44	1	60	0.0119	− 0.0592	− 0.0195	0.1076*	− 0.0839*
Gender	1.87	0.33	1	2	0.0639	0.03	− 0.0564	0.0123	0.0061
GDP capital	20.43	7.11	6.63	54.23	0.107	0.0083	− 0.0247	0.0641	0.0141*
Income capita	911.89	246.00	417.73	1744.29	0.1039	− 0.0318	− 0.0478	0.1092*	− 0.0568
Yrs. school	7.07	0.86	5.2	9.400001	0.1094	− 0.0215	− 0.0232	0.0638	− 0.0088

Variable	Ownership	Small firm	Firm age	Experience	Gender	GDP capital	Income capita	Yrs. school
Labor Prod.								
No loan								
Obstacle								
Sales export								
Sector								
Ownership	1							
Small firm	0.0759*	1						
Firm age	− 0.1045*	− 0.2035*	1					
Experience	− 0.1082*	− 0.0904*	0.3023*	1				
Gender	− 0.0126	− 0.0053	0.0014	0.082*	1			
GDP capital	− 0.0798*	− 0.0534	0.087	0.0876*	0.1206*	1		
Income capita	− 0.1247*	− 0.0804	0.1171*	0.1093*0.1395*	0.9234*	1		
Yrs. school	− 0.093*	− 0.0671	0.1288*	0.1001*	0.114*	0.9371*	0.9091*	1

Table 4 Impact of lack of access to external finance and external sales on labor productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No bank loan	− 0.537*** (0.185)		− 0.490*** (0.188)		− 0.533*** (0.185)	− 0.531*** (0.186)	− 0.520*** (0.185)
Obstacle	− 0.443** (0.184)			− 0.412** (0.184)	− 0.430** (0.181)	− 0.420** (0.182)	− 0.437** (0.181)
Export sales	0.0124*** (0.00464)	0.0110** (0.00494)	0.0122** (0.00483)	0.0110** (0.00478)	0.0113** (0.00456)	0.0110** (0.00459)	0.0115** (0.00455)
Sector	− 0.0155 (0.238)	− 0.161 (0.236)	− 0.0729 (0.238)	− 0.108 (0.236)	− 0.0156 (0.238)	0.0206 (0.241)	− 0.0266 (0.238)
Ownership	− 0.0747 (0.240)	− 0.109 (0.242)	− 0.0804 (0.241)	− 0.109 (0.242)	0.0177 (0.251)	0.0340 (0.252)	0.00746 (0.250)
Small firm	− 0.0365 (0.195)	− 0.136 (0.197)	− 0.0888 (0.198)	− 0.0905 (0.195)	− 0.0179 (0.193)	− 0.0189 (0.193)	− 0.0158 (0.193)
Firm age	0.289** (0.130)	0.262** (0.131)	0.273** (0.130)	0.277** (0.132)	0.259** (0.130)	0.253* (0.130)	0.245* (0.131)
Experience	− 0.00260 (0.00722)	− 0.00217 (0.00728)	− 0.00332 (0.00729)	− 0.00135 (0.00721)	− 0.00390 (0.00727)	− 0.00360 (0.00726)	− 0.00369 (0.00730)
Owner gender	0.731*** (0.263)	0.734*** (0.264)	0.762*** (0.264)	0.708*** (0.264)	0.651** (0.260)	0.646** (0.261)	0.648** (0.259)
GDP capita					0.678*** (0.193)		
Income capita						0.766*** (0.241)	
Schooling							2.174*** (0.594)
_cons	8.936*** (0.658)	8.600*** (0.641)	8.627*** (0.638)	8.868*** (0.662)	7.177*** (0.843)	3.999** (1.720)	4.984*** (1.285)
N	627	637	634	630	627	627	627
F	4.259	3.330	3.747	3.867	5.431	5.159	5.471
r^2	0.0566	0.0321	0.0449	0.0408	0.0729	0.0694	0.0746

Outcome variable: labor productivity (log terms)

Robust standard errors in parentheses

*$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Table 5 Variance inflation factor

Variable	VIF
No loan	1.02
Obstacle	1.01
Export sales	1.06
Sector	1.05
Small firm	1.09
Firm age	1.18
Ownership	1.02
Owner gender	1.01
Experience	1.13
Mean VIF	1.07

In order to assess the third hypothesis, Table 6 displays the interaction effects between project quality and lack of adequate access to capital. Our results indicate that for a given proportion of export sales, SMEs that lack access to external finance have lower labor productivity than firms having access to bank loans. In other words, credit-constrained SMEs with lower access to foreign markets have lower labor productivity than constrained SMEs with higher proportion of export sales. However, this particular interaction shows no statistical significance, so hypothesis 3 is not supported.

In addition, we found a negative and weak statistically significant interaction between project quality and access to capital as a perceived obstacle. This suggests that the slope of the proportion of export sales is smaller for SMEs that perceive access to finance as a greater obstacle. The significance of this interaction terms holds when both interactions are added in the model.

4.2 Direct and indirect export sales

We also decomposed the effects of export sales between the proportion of sales that were direct and indirect exports. These results are presented in Table 7. When examined separately, both indirect and direct export sales are statistically significant, although the coefficient for indirect exports is, on average, lower than the coefficient for direct export sales. In addition, direct and indirect exports can have different effects. Our results show that the slope of the proportion of indirect exports for credit-constrained SMEs is lower than the slope for SMEs with access to bank financing. In other words, the negative coefficient of the interaction term suggests a negative impact of credit constraint and indirect exports on labor productivity. This finding indicates a negative association between indirect exports and labor productivity for credit-constrained SMEs.

Table 6 Interaction effects of project quality lack of access to capital

	No bank loan	Obstacle	Both
No bank loan	− 0.523*** (0.196)	− 0.549*** (0.186)	− 0.534*** (0.196)
Obstacle	− 0.445** (0.184)	− 0.344* (0.199)	− 0.346* (0.199)
Export sales	0.0136** (0.00572)	0.0319*** (0.0112)	0.0332*** (0.0126)
Sector	− 0.0153 (0.238)	− 0.00392 (0.238)	− 0.00367 (0.238)
Ownership	− 0.0760 (0.241)	− 0.0597 (0.240)	− 0.0611 (0.240)
Small firm	− 0.0362 (0.195)	− 0.0621 (0.195)	− 0.0619 (0.196)
Firm age	0.290** (0.130)	0.296** (0.131)	0.297** (0.131)
Experience	− 0.00262 (0.00722)	− 0.00294 (0.00721)	− 0.00296 (0.00721)
Owner gender	0.731*** (0.264)	0.736*** (0.263)	0.735*** (0.264)
No loan*exports	− 0.00340 (0.00917)		− 0.00356 (0.00878)
Obstacle*exports		− 0.0236* (0.0123)	− 0.0237* (0.0127)
_cons	8.933*** (0.657)	8.850*** (0.661)	8.847*** (0.661)
N	627	627	627
F	3.872	4.263	3.791
r^2	0.0567	0.0599	0.0600

Outcome variable: labor productivity (log terms)

Robust standard errors in parentheses

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table 7 Project quality decomposition between indirect and direct exports

	Indirect export sales			Direct export sales		
	No bank loan	Obstacle	Both	No bank loan	Obstacle	Both
No bank loan	− 0.500*** (0.192)	− 0.539*** (0.186)	− 0.499*** (0.193)	− 0.535*** (0.189)	− 0.535*** (0.184)	− 0.534*** (0.188)
Obstacle	− 0.441** (0.185)	− 0.432** (0.191)	− 0.444** (0.192)	− 0.438** (0.185)	− 0.311 (0.194)	− 0.311 (0.195)
Indirect exports	0.0225*** (0.00509)	0.0156*** (0.00581)	0.0216*** (0.00755)			
Direct exports				0.0104 (0.00977)	0.0668*** (0.0191)	0.0673*** (0.0195)
Sector	− 0.0317 (0.237)	− 0.0350 (0.238)	− 0.0320 (0.238)	− 0.0262 (0.237)	− 0.0108 (0.237)	− 0.0108 (0.237)
Ownership	− 0.0789 (0.239)	− 0.0787 (0.239)	− 0.0791 (0.239)	− 0.0867 (0.240)	− 0.0653 (0.239)	− 0.0654 (0.240)
Small firm	− 0.0999 (0.192)	− 0.0931 (0.193)	− 0.0990 (0.193)	− 0.0460 (0.196)	− 0.0506 (0.196)	− 0.0503 (0.196)
Firm age	0.299** (0.131)	0.294** (0.132)	0.299** (0.132)	0.304** (0.131)	0.305** (0.130)	0.305** (0.130)
Experience	− 0.00265 (0.00725)	− 0.00240 (0.00725)	− 0.00265 (0.00726)	− 0.00188 (0.00723)	− 0.00238 (0.00722)	− 0.00238 (0.00723)
Owner gender	0.730*** (0.263)	0.723*** (0.263)	0.730*** (0.264)	0.752*** (0.265)	0.759*** (0.264)	0.759*** (0.265)
No loan* indirect exports	− 0.0195** (0.00909)		− 0.0198** (0.00897)			
Obstacle* indirect exports		− 0.00423 (0.00893)	0.00149 (0.00906)			
No loan* direct exports				0.0112 (0.0205)		− 0.000702 (0.0132)
Obstacle* direct exports					− 0.0601*** (0.0205)	− 0.0604*** (0.0196)
_cons	8.973*** (0.659)	8.997*** (0.660)	8.975*** (0.660)	8.862*** (0.664)	8.741*** (0.666)	8.742*** (0.667)
N	627	627	627	627	627	627
F	5.837	4.702	5.486	3.403	4.738	4.521
r^2	0.0552	0.0534	0.0552	0.0544	0.0613	0.0613

Outcome variable: Labor Productivity (log terms). Robust standard errors in parentheses

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table 8 Treatment effects

	PSM	PSM with caliper	1-Nearest neighbor	3-Nearest neighbor
ATET	0.517* (0.306)	0.517** (0.250)	0.752*** (0.284)	0.556** (0.239)
N	634	634	634	634

Outcome variable: labor productivity (log terms)

Robust standard errors in parentheses in columns 1, 3, and 4

Standard errors for independent and identically distributed data in parentheses in column 2

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

However, we found a positive impact on labor productivity when interacting credit constrained and direct export sales, although the coefficient is not statistically significant. This may indicate that the role of project quality in explaining labor productivity for constrained SMEs may be due to direct exports in most part. This particular finding was in line with our prediction of a higher impact of direct exports than indirect exports would have on the labor productivity of constrained SMEs. However, due to the non-significance of the interaction term between constraint and direct export sales, hypothesis 4 is partially supported.

4.3 Propensity score matching

Our matching results, presented in Table 8, show that the average labor productivity for all SMEs without access to bank loans had a coefficient of approximately 0.52, less than the average that it would occur if all SMEs had loans. These results are statistically significant for both PSM methods used. We also ran a regression on the matched sample, defined as the observations in the treated group (with a bank loan or line of credit) plus the observations in the control group, which were matched to the treatment group, after the matching. Table 9 shows the results of the regression in the matched sample. As expected, the difference between SMEs with access to bank loans and those with no bank loans is statistically significant, confirming the previous matching results.

Table 9 Regression of the matched sample

	(1)	(2)
Bank loan	0.496*** (0.176)	
Export sales		0.0204*** (0.00619)
Sector		− 0.0592 (0.222)
Ownership		0.0350 (0.301)
Small firm		0.247 (0.162)
Firm age		0.213* (0.115)
Experience		− 0.00182 (0.00641)
Owner gender		0.529** (0.230)
Bank loan		0.544*** (0.143)
_cons	10.24*** (0.147)	8.387*** (0.587)
N	634	884
F	7.961	4.437
r^2	0.0124	0.0390

Outcome variable: labor productivity (log terms)

Robust standard errors in parentheses

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

We must also confirm that the means of covariates between the treatment and control groups do not differ significantly from zero. In this case, our matching results may be regarded as reliable since covariates are balanced when the distribution of a covariate is the same for all treatment levels. Table 10 shows the average covariates of each group and the *p* value after the matching for mean equality as well as the standardized differences and variance ratios. The match sample indicates that matching on the estimated propensity score balanced the covariates. The standardized differences are all close to zero while the variance ratios are close to one. Although we rely on the standardized differences for conclusions about balance in the unmatched sample, the baseline means with respective non-significance of the *p* values give us an idea of the scale of these differences. This finding suggests that the treated and control groups generally do not have similar characteristics prior to matching.

5 Discussion and implications

The main purpose of this study was to investigate the impact of both lack of access to external finance and

Table 10 Balance test

	Mean			Standardized differences		Variance ratio	
	Control	Treated	*p* value	Raw	Matched	Raw	Matched
Export sales	4.438	3.611	0.986	− 0.061	− 0.001	0.792	1.099
Sector	0.188	0.129	0.471	− 0.161	0.049	0.735	1.119
Ownership	0.078	0.061	0.578	− 0.067	0	0.794	1
Small firm	0.786	0.704	0.657	− 0.191	− 0.0299	1.238	1.028
Firm age	2.891	2.888	0.190	−0.005	− 0.0882939	1.115	1.053
Experience	22.271	23.097	0.330	0.073	− 0.0656018	1.042	0.990
Owner gender	1.870	1.878	0.285	0.024	− 0.0720271	0.944	1.196

project quality, measured as the percentage of export sales, on SME labor productivity. We have also examined exporting activities as potentially alleviating SME constraints in access to external finance by measuring whether constrained SMEs with greater levels of exporting sales have higher labor productivity. In addition, this study examined the separate effects of indirect and direct export effects. Consistent with prior research pointing to lack of adequate access to external financing options as a potential explanation for low productivity in developing economies (Beck et al. 2008; Daskalakis et al. 2013; Pissarides 1999), our findings reinforce the importance of access to capital for SME growth.

However, constrained SMEs with higher proportion of export sales were also found to have greater productivity at statistically significant levels, confirming the notion that firms with higher-quality projects to invest may lead to superior productivity (David et al. 2006). Firms rationed out of debt markets may express a demand for bank loans, but they may lack the necessary access due to the absence of lending technologies. Since SMEs may be credit rationed, having high-quality investment projects in terms of exporting activities may alleviate the negative effect of financial constraints through increased productivity. This confirms the notion that project quality may mitigate the issue of information asymmetries for constrained SMEs (Peluffo 2016). In other words, productive SMEs are likely to have higher exporting activities and exporting makes SMEs more productive, even when they are rationed out of the credit market. Since there are fixed costs involved in entering foreign markets, more productive firms may have facilitated market entry (Helpman et al. 2004). The reasoning indicates that firms with sufficient low marginal costs are profitable enough to cover the fixed costs of entry, such as engaging in market research, negotiating with potential new partners, modifying their product features, among others. In addition, productivity may be improved as a result of increasing exporting activities, since the stronger competition in foreign markets may force SMEs to improve their products and processes in order to remain competitive. There is also the "learning by exporting" component indicating that exposition to foreign knowledge and technology may assist in improving productivity levels (Eliasson et al. 2012).

When separately examining indirect and direct export effects, we found that credit-constrained SMEs that directly export to foreign markets have higher labor productivity than constrained SMEs that export through intermediary firms. This suggests that the role of project quality in explaining labor productivity for constrained SMEs may be due to direct export sales in most part. Our results are in line with previous findings that associate firms that directly export are having better quality than those that export through intermediary firms (Ganotakis and Love 2012), and complement the models of heterogeneous firms and trade with credit constraints that imply higher likelihood of directly exporting if firms are less credit constrained (Muuls 2015).

6 Conclusion

Although SMEs contribute to local economic development, they face a set of challenges that prevents greater participation in the economy. Among

them, SME growth remains an issue as levels of labor productivity in low- and middle-income countries are much lower than in more developed economies. In addition, lack of adequate access to external finance hinders SMEs from expanding their business operations due to information asymmetries between SMEs and financial intermediaries. Since SMEs may not have adequate access to lending technologies in order to mitigate asymmetric information, they may rely on exporting activities to mitigate the effects of credit constraint.

This study investigated the impact of both lack of access to external finance and project quality, measured as the percentage of export sales, on SME labor productivity. Our results indicate a positive relationship between project quality and labor productivity. We also found that SMEs that applied for bank loans but were rejected have lower levels of labor productivity than SMEs that obtained financing. In addition, constrained SMEs that export internationally were found to have higher labor productivity than constrained firms with lower access to export markets, although the role of project quality in explaining labor productivity for constrained SMEs may be due to direct export sales in most part.

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