Financial constraints, factor combination and Gibrat's law in Africa

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Abstract

This paper investigates the validity of the Gibrat's law in sub-Saharan African firms using data from 22,495 firms operating in 45 African countries. Results indicate that the Gibrat's law is rejected in Africa, i.e. small firms create more jobs than their larger counterparts do. We point out that usual explanations (such as diminishing returns, learning process, and minimum efficient size) are irrelevant to justify this fact. We present a new explanation based on access to capital. According to this hypothesis, employment growth is faster among small firms in Africa because they adopt labor-intensive and capital-saving technology to expand their activities. SMEs have a lower capital-labor factor because they tend to overuse labor to grow and underuse capital due to financial constraints. Hence their greatest job growth momentum. Different econometric tests give support to our intuition. Specifically, we prove that the negative relationship between firm's size and growth is mitigated for firms with credit access.

Keywords : Firm growth ; Job creation ; Gibrat's law ; Africa; financial constraints

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1. Introduction

One of the most prominent challenges for sub-Saharan African countries for the current century is to absorb the rapid growth of active population by providing sufficient jobs. As stated by McKinsey, Africa will create 54 million new jobs over the next ten year following the current trends. A figure that will not be enough to absorb the 122 million new entrants into the labor force expected over the same period. The subject of which firms create more jobs is thus a crucial issue for both academics and policy makers. We therefore investigate more deeply the relationship between firm size and job creation in Sub-Saharan African countries. We show that Small and Medium Enterprises (SMEs) create more jobs than large firms do and explain it by a combination of production factors that overuse labor for lack of access to capital.

Gibrat (1931) suggested that firms' growth is independent to initial size, after observing firm distribution in French manufacturing establishments. The Gibrat's law have been tested in both developed and developing countries (see Daunfeld and Elert, 2013; Aga et al., 2015 for references). Econometric results often indicate that small firms are the main contributors to net jobs growth, especially in developing countries (Ayyagari et al., 2014; Rijkers et al., 2014; Aga et al., 2017), in contradiction with the Gibrat's law. However, recent evidence have challenged this conclusion and underlined limitations in existing studies (Lotti et al., 2009; Haltiwanger et al., 2013). Evidence from Africa is rather scarce and mixed. To our knowledge there is no evidence based exclusively on African firms from different countries and different sectors.

Our paper adds to existing literature on firm's growth and private sector development in sub-Saharan Africa. First, while the Gibrat's law have often been tested, evidence from African countries are rather scarce and findings are mixed (see above). To fill the gap in the literature, we test whether the Gibrat's law is valid in sub-Saharan Africa using firm-level variables from Enterprises Surveys (ES henceforth). Our data consider 22,945 firms from 45 African countries over the period 2006-2016. We rely on existing literature to provide an empirical test of the Gibrat's law (Lotti et al., 2009; Daunfeld and Elert, 2013; Haltiwanger et al., 2013). We document that small firms grow faster than other firms do.

Second, despite a burgeoning literature, reasons explaining the rejection of Gibrat's law are rarely investigated (one notable exception is Daunfeld and Elert, 2013). We first show that usual explanations advanced in the literature (mechanical effect, learning effect or minimum efficient size) are irrelevant in our case. We therefore propose a new channel shedding a light on our econometric results. We argue that SMEs use a different combination of factors of production than larger counterparts, regardless of the sector. Suppose that a firm employ only capital and labor to produce an output. SMEs tend to overuse

labor because of lack of access to capital. Indeed, small firms are more financially constrained and therefore cannot employ capital as they wanted (Beck et al., 2005). As a result, they tend to overuse labor to grow and underuse capital. Hence a lower capital-labor factor for SMEs and their greatest job growth momentum. We empirically test this possible explanation. First, we show that the negative relationship between firm's size and firm's growth is more than twice larger for financially constrained firms than unconstrained firms. In other words, firms create more jobs as they are financially constrained. This finding is robust to several measures of financial access. Second, we document that the capital-labor ratio is smaller for small firms and for constrained firms, in line with our hypothesis. To sum up, we first argue that financially constrained firms create more jobs, then that SMEs are more financially constrained. Thus explaining the strongest job creation of SMEs than their larger counterparts.

The article is organized as follow. Section 2 discusses existing literature on Gibrat's law, drawing special attention to works on African firms and to explanations on its rejection. Section 3 presents baseline results indicating a rejection of Gibrat's law. Section 4 displays the potential factors that could explain this rejection, developing an original explanation based on credit constraints, input access and factor combination. The final section concludes.

2. Literature review

2.1. Empirical tests of the Gibrat's law

By considering the size of French firms in terms of employees, Gibrat (1931) showed that growth rates follow a lognormal distribution, creating the eponym law of Proportionate Effect (often called the Gibrat's law). This law states that the growth rate of a given firm is independent of its initial size (Sutton, 1997). Researchers have tried to check the validity of Gibrat's law with, so far at least, highly divergent results (see Daunfeld and Elert, 2013; Aga et al., 2017). Most of the research has focused on developed economies. One may ask whether the experience of industrialized economies can be generalized to developing countries, especially less developed countries such as African countries. Small firms are predominant in low-income countries (Ayyagari et al., 2014; Aga et al., 2017). Thus, it is of interest to extend the existing literature to the specific case of African countries.

Test of the Gibrat's law from sub-Saharan Africa is rather scarce and provide mixed results. Cross-country evidence, including sub-Saharan African firms, often supports the rejection of the Gibrat's law (Ayyagari et al., 2014; Aga et al., 2017). However, country-specific studies are less clear-cut. While some of them (Teal, 1999; Biggs and Saha, 2003; Bigsten et al., 2007) indicate that small firms are the main contributors

to net jobs growth, other papers fail to confirm this relationship (Page and Soderbom, 2012; Arrow et al. 2014).

2.2. Explanations advanced to justify the rejection of the Gibrat's law

Possible divergences can be justified by differences in methodology and sample considered. Alongside endogeneity issue, measurement issue and selection issue (Haltiwanger et al., 2013), results from empirical papers may be conditional to the econometric specification. In particular, results are sensitive to the inclusion of firm's age (Haltiwanger et al., 2013). The rejection of the Gibrat's law can be justified by *selection and learning effect*. Jovanovic (1982) provides an explanation for higher growth of small and young firms. Firms start learning about their efficiency once they are established. Because least efficient firms are forced out of the market, more efficient managers can adjust their activities accordingly and gain market shares. Hence young firms grow faster by discovering their efficiency level but there is no reason to believe that size matters. However, insofar as size and age are strongly related running firm's growth on firm's size without considering firm's age induces bias. Yet, from the about 60 papers taken into account by Santarelli *et al.* (2006), only a third of them control for age. Haltiwanger et al. (2013) show that net employment growth rates are higher for smaller firms but this negative relationship disappears after controlling for firm age in the U.S. Lotti et al. (2009) provide additional evidence in line with this argument. In the case of Côte d'Ivoire, Sleuwaegen and Goedhyus (2002) show that the effect of firm's size is attenuated for older firms.

Differences in findings can be explained not only by differences in methods but also by different sample considered. In particular, several papers have argued that Gibrat's law holds in some sectors but not in others.[3] The theoretical intuition is based on the minimum efficient size required to operate (Manfield, 1962; Cabral, 1995). According to this hypothesis, small entrants have to grow quickly to attain the minimum efficient size or must exit. We therefore observe that small firms grow faster than firms having already attain the minimum efficient size. As a result, Gibrat's law is more likely to hold in services than in manufacturing due to differences in sunk costs. Empirical papers give support to this explanation (Audretsch et al., 2004; Teruel-Carrizosa, 2010; Nassar et al., 2014).

2.3. Credit constraints and job creation

[3] Daunfeld and Elert (2010) present additional arguments explaining why the Gibrat's law may hold in some sectors but not in others. These explanations are based on degree of competition, of uncertainty, of innovation, the age of the sector or the surviving rate in the industry.

In this paper, we advance another possible explanation based on the idea that the lack of credit access may distort factor combination and favor labor-extensive technology. While the relation between financial constraints and capital structure choices and capital investments has been studied extensively, little is known about the role that financial constraints play in job creation. On the one hand, facilitating access to financing makes it possible to increase investments in capital, which can result in greater demand for labor because labor and capital are complements. Besides, labor has fixed costs (hiring costs, training, paying wages) so that easing financial constraints can stimulate employment. In this perspective, labor, similar to capital, needs to be financed. Some papers thus show that increased access to finance results in higher employment growth, especially among SMEs (Ayyagari et. al., 2017; Dao and Liu, 2017; Boustanifar, 2014; Benmelech et al., 2011). On the other hand, easing financial constraints may allow firms to optimally substitute capital for labor by moving towards more capital intensive production process. Access to finance will therefore play a key role in the capital-labor ratio because constrained firms, by definition, cannot invest optimally in capital. Indeed, a financially constrained firm will not be able to borrow the funds for the capital investment and might satisfy partially the demand by hiring more labor. A rare point of reference is Garmaise (2008), who shows that financially restricted firms use relatively more labor than physical capital. Our study adds to this growing body of literature in the area of labor and finance by examining the linkages between firm financing and job creation.

3. Do African SMEs grow faster than their counterparts?

3.1 Methodology

3.1.1. Econometric model

To test the Gibrat's law, we follow existing literature (Lotti et al., 2009; Daunfeld and Elert, 2013). The basic test of the Gibrat's law related the (logarithm) of previous size on the (logarithm) actual size as follows:

$$lnS_{it} = \alpha + \gamma lnS_{it-1} + \varepsilon_{it} \quad (1)$$

where $S_{i,t}$ is the size of firm *i* at time *t,* $S_{i,t-1}$ the same size in the previous period and $\varepsilon_{i,t}$ is a random variable. As stated by Chesher (1979), Gibrat's law holds if $\hat{\gamma}$ equals to unity. By contrast, if $\hat{\gamma} < 1$, small firm grow at a systemically higher rate than do their larger counterparts (the opposite is true if $\hat{\gamma} > 1$).

To make interpretation easier, we follow Lotti et al. (2009) and we regress the growth of size on firm's size. In addition, to control for unobserved country- and sector heterogeneity, as well as individual characteristics, we estimate the following equation:

$$g_{i,t/t-1} = \alpha_{ct} + \alpha_{st} + \beta lnS_{it/t-1} + \delta lnA_i + \nabla \boldsymbol{X}_i + \varepsilon_{it} \quad (2)$$

where i, c, s, and t refer to firm *i* in country *c* in sector *s*, at period *t*. $g_{i,t/t-1}$ is the annual growth of firm's size from t-1 to t, and $S_{it/t-1}$ the (average) firm's size. $\alpha_{c,t}$ is a a list of country-year dummies and $\alpha_{s,t}$ a list of sector-year dummies. A_i is the logarithm of age of the firm *i* at the time of the survey. We add a set of firm-level variables ($\boldsymbol{X}_i$) to control for observable firm-level heterogeneity. The list of firm-level control variables includes the experience of the manager, a dummy if the firm is an exporter, a dummy if a firm is a part of a larger firm, a dummy for foreign-owned firms, a dummy for state-owned firms, a dummy if the firm is privately-held and a dummy for listed firms. The coefficient of interest is $\beta = (\gamma - 1)$.[4] The Gibrat's law holds if $\hat{\beta} = 0$ ($\hat{\gamma} = 1$). Small firms grow faster if $\hat{\beta} < 0$ and large firms grow faster is the estimated β is positive. We also expect that firm's age has a negative impact of firm's growth, so we expect that $\hat{\delta} < 0$.

3.1.2 Data and variables

Firm-level data were extracted from the World Bank Enterprise Survey (ES). ES contain surveys which includes a variety of firm-level information, like number of employees, total sales, ownership structure, industry, and age of the firm, among other information. An advantage of ES is its coverage of firms of all sizes in many developing countries, contrary to other databases (such as ORBIS). ES were retrieved in October 2017. Some filters rules are applied. First, we consider only firms based in Sub-Saharan Africa. Second, firms for which dependent variables were not available and for whom at least one of the firm-level control variables were missing are dropped. Third, we remove outliers (firms for which growth is below the first percentile or above the 99th percentile). In addition, we exclude firms those size exceeds 1,000 employees or age is above one century. Finally, we excluded observations when the interviewer did not believe that the responses were reliable (question a16 in the ES). Our final sample includes 22,495 firms from 45 African countries (73 surveys). The number of firms per country is provided in Table A1 in the Appendix.

[4] To prove it, we just change the annual growth as difference in logarithm as follows: $g_{i,t/t-1} = lnS_{it} - lnS_{it-1}$.

3.1.3 Variables

We employ the number of employees to compute the firm's growth. In doing so, we used data on the number of employees in the year before the survey and three-year before the survey. The number of employees refers to permanent and full-time workers (questions l1 and l2 in the ES). To avoid the regression-to-the-mean effect (Davis et al., 1996; Haltiwanger et al., 2013), growth of employment refers to the change of the variable during the period *t* and three years before, divided by the firm's simple average of variable during the same period (instead of using the initial value).

All independent variables are extracted from the Enterprises Surveys[5]. Our main interest variable is the size of firm *i*. The Gibrat's law provides a relationship between firm's size and subsequent growth. The firm's size is based on the number of employees. A simple way to compute firm's size consists on using the number of total employees in the beginning of the period. However, the regression-to-the-mean problem may occur when we rely on initial size (Davis et al., 1996). Employing initial size may induce bias relationship between firm's size and subsequent growth. We therefore follow recent works (e.g., Haltiwanger et al., 2013) and use the average size over the period by using the average between the initial size and final size.

Haltiwanger et al. (2013) also point out that the negative relationship between size and growth vanishes when controlling for firm age in the U.S. We therefore control for firm age by using the time laps between firm creation (question b5 in the ES) and year of the survey. In line with recent works using ES (e.g., Beck et al., 2005; Harrison et al., 2014), we add usual firm-control that correct for firm heterogeneity. We include the top manager's years of experience in the sector. We also consider dummy variables capturing whether the firm is an exporter, foreign-owned, or government-owned and if the firm belongs to a larger firm, is privately held or is listed.

3.2. Results

3.2.1. Descriptive statistics

Table 1 displays basic descriptive statistics. On average, firms experienced a positive growth of their employment. However, there are hide variations in growth. For instance, one quarter of firms destroyed employment while another quarter witnessed an employment growth above 10 percent.

[5] We control for country's differences by adding country-year fixed effects.

On average, firms retained in our sample are relatively large with 37 employees. However, this figure is driven by outliers as documented in Figure A1. The median average size is 12 employees, and more than three quarters of firms have less than 30 employees. Table 1 also indicates that firm's age is on average 15 year-old. In addition, 15% of firms are exporters, 18% are part of a larger group and 12% are foreign-owned (state-owned is marginal and concerns less than 1% of firms). The definition of all variables is reported in Table A2.

< Insert here Table 1 >

In Figure 1, we show that firm's growth is negatively correlated with firm's size, as expected (results is unchanged when we consider initial size). Small firms have created 8.7 jobs on overage over the last three years prior the survey, a growth that is more than four times the growth of employment in large firms (only 2 jobs created on average). Besides, while only 7% of small firms have experienced job destruction, more than a quarter of large firms have experienced a negative growth of employment.

< Insert here Figure 1>

3.2.2. Baseline results

We report in Table 3 the baseline model testing the relevance of the Gibrat's law in Africa using Eq. 2. In the first column, we report model without control variables and without sector and country dummies. We then include control variable in column (2), and then country-year dummies in column (3) and sector-year dummies in column (4). In column (5), we report the complete specification.

Findings, displayed in Table 3, provide strong evidence in favor of rejection of the Gibrat's law. The coefficients associated with average size are negative and highly significant in all specifications. The impact of size is also economically significant. When the number of employees doubles, growth is reduced by 0.7 point representing more than 10% of employment growth average. It should be noted that young firms grow faster than their counterparts. In addition, the impact of age is particularly strong in economic terms. An additional year reduces growth of employment by almost 2 points. Among control variable, we show that growth is stronger for exporters, subsidiaries, firm with experienced managers, foreign-owned and state-owned firms and privately held firms.

< Insert here Table 3 >

To sum up, our baseline regressions indicate that Gibrat's law can be rejected in models explaining employment growth. In other words, SMEs seem to have a stronger employment dynamic than large firms.

3.2.3. Robustness checks

First, we change measures of dependent variables (growth) and interest variables (firm's size). In the baseline model, to avoid the regression-to-the-mean bias (see Section 3), we employ average growth and firm's size growth. In robustness check, we consider usual measures of growth (based on initial size) and initial size instead of average firm's size. Result, unreported but available upon request, indicate that our conclusion are not altered by these changes.

Second, we also confirm that our findings are not altered by the method retained to correct standard errors. Using clustered standard errors at the country-year or sector-year level provide similar results. Only statistical significance of control variables are affected by this change.

Third, to test whether our findings are sensitive to the inclusion of one country or one sector, we apply the baseline model by excluding country one by one and sector one by one. Once again, our econometric results are unchanged: size has a negative effect on firm's employment growth but not on firm's sales growth. In the following, we present an explanation of this paradox. Before to do it, we show that usual suspects cannot help us to explain this puzzle.

4. Why do African SMEs create more jobs? The usual suspects are not guilty

Our paper not only tests whether the Gibrat's law is valid for African firms but we also try to understand why. There are three possible suspects for this rejection: diminishing returns, learning process (Jovanovic, 1982) or the minimum efficient size (Manfield, 1962; Cabral, 1995). However, the three possible explanations do not allowed us to fully understanding why African SMEs create more jobs than their larger counterparts. Nonetheless, we provide additional tests to prove that our results cannot be explained by the three explanations.

To test the diminishing returns hypothesis, we merely consider the growth based on sales. If a mechanical process explains the rejection of the Gibrat's law, we should observe a similar result when we consider alternative measure of growth (e.g., sales growth). Total annual sales refer to firm's declaration regarding its activity in the previous year (question d2) and three year before (question n3). Sales values have been deflated using the same base year (100 = 2010) and country's GDP deflators from the World Development Indicators (WDI). Growth of sales refers to the change of the variable during the period *t* and three years

before, divided by the firm's simple average of variable during the same period (instead of using the initial value) in order to avoid the regression-to-the-mean effect (Davis et al., 1996; Haltiwanger et al., 2013). In Table 4, we consider the sales growth as dependent variable. While age continues to play a role in explaining growth of sales, the impact of size is less clear-cut. Indeed, coefficients associated with size are only negative and statistically significant in column 4. In addition, if we ignore statistical significance, we observe that the impact of size is also economically reduced. An increase of firm's size by six employees reduces sales growth by 0.35 point (around 10 percent of its average). In other words, the negative relationship between firm's size and growth holds for employment growth but vanishes when we consider sales growth. The rejection of Gibrat's law is less clear-cut when we consider sales growth, suggesting that employment dynamic is not solely explained by sales momentum.

< Insert here Table 4 >

We then investigate whether the relationship between firm's size and firm's growth is explained by learning effect. We run our baseline model for firms of different age (5-year windows). We confirm findings obtained in previous articles (*e.g.*, Sleuwaegen and Goedhyus, 2002) indicating that the rejection of Gibrat's law is stronger for young firms. In particular, for firms above 20 years, the negative relationship between firm's size and employment growth vanishes. However, the learning effect hypothesis does not provide clear arguments justifying the absence of impact of firm's size on sales growth but a negative one with employment growth.

< Insert here Table 5 >

A third explanation often advanced in the literature refers to sunk costs, *i.e.* costs that cannot be recovered if a firm goes bankrupt, and minimum efficient size. SMEs that invest less in the first period must rapidly adjust their capabilities to their optimum level. SMEs will thus have a higher growth rate. If this explanation is true, Gibrat's law should hold in sector where sunk costs are law (as in the services sectors) but should be rejected when sunk costs are high (as in the manufacturing sectors). Yet, in the case of African countries, we can show that Gibrat's law hold for every sector. Indeed, we distinguish between firms in manufacturing and firms in services in order to test the role of minimum efficient scale (Teruel-Carrizosa, 2010). Using sub-sample analysis and interaction between firm's size and a dummy for manufacturing firms, we have not found any difference in the relationship between firm's size and growth for firms in manufacturing and services sectors.

< Insert here Table 6 >

To sum up, the three usual suspects for this rejection of the Gibrat's law (diminishing returns, learning process or the minimum efficient size) do not help us understanding the negative relationship between firm's size and growth of employment. In the following, we propose an alternative explanation based on credit constraint and factor combination.

5. Credit constraints, factor combination and rejection of the Gibrat's law

We argue that the negative relationship between size and employment growth may be, at least partially, explained by the role of firm's size on optimal factor combination. To recall our intuition, we state that small firms face higher financial constraints and limited access to capital factor. As a consequence, small firms overuse labor in their production process. This hypothesis helps us to justify why the Gibrat's law is rejected when we consider employment growth but not always when we consider sales growth (as shown previously). In the following we propose additional tests in line with our intuition.

5.1. Does credit access shape the firm's size-growth relationship?

In this section, we argue that the relationship between firm's size and growth can be shaped by firm access to credit. We firstly investigate whether correlations between size and growth is stronger for constrained firms than for unconstrained firms but only when we consider growth of employment. To capture credit constraints, we employ three frequently used different measures based on subjective evaluation of firm's credit constraints and objective credit experience, in line with recent works (e.g., Léon and Weill, 2018). Our three dummies have been built the same way: each dummy takes the value of zero if the firm is financially constraint and one for unconstrained firms. First, we consider firm's subjective evaluation of credit constraints (FIN1). The firms were asked in ES whether finance is an obstacle for their growth (question k30). We create a dummy equals to one if a firm declares that finance is not an obstacle, a minor obstacle, or a moderate obstacle. This dummy equals zero if the manager's answer stipulates that finance is a major or a very severe obstacle. Second, we consider a firm as unconstrained if the firm has a loan or an overdraft (questions k7 and k8). We create a dummy equals to one if a firm has a loan and 0 otherwise (FIN2). Contrary to the subjective measure, this variable is based on real credit experience. Third, we consider precise credit experience of the firm is the past year (questions k16 to k20). Indeed, firms without a credit may be credit constrained or just no need a loan for its operations. To control for this aspect, we create a final dummy based on credit experience in the past year (FIN3). This new variable allows us to distinguish between firms without a need for credit and real constrained firms. A firm is declared as credit constrained if (i) the firm applied for a loan but its demand had been rejected by the banks; or, (ii) the firm did not applied because it had been discouraged to do it. Based on question on credit experience, we built

a dummy equals to one for unconstrained firms (applied and received a loan) and 0 for rejected and discouraged firms. We therefore ignore firms that did not apply due to a lack of demand (for more details on data construction, see Léon and Weill, 2018). Descriptive statistics, displayed in Table 1, indicate that between 55% (FIN1) and 80% (FIN3) of firms are credit constrained. In table A3 in Appendix, we document that small firms are more credit constrained than medium firms and large firms, irrespective of measures of financial access considered. Indeed, while more than half of large firms have access to credit (FIN3), only 12% of small firms and 28% of medium firms have access to credit.

In Table 2, we display correlation coefficients between firm's growth and firm's size. We report coefficients for all firms and by distinguishing between unconstrained firms (FIN=1) and constrained firms (FIN=0). We also report Jenrich's (1970) test for equality of correlation coefficients between two groups. Our intuition is valid if correlation coefficients are stronger for unconstrained firms but only when we consider growth of employment. Statistics and tests reported in Table 2 give support to our hypothesis. We show that correlation coefficients are stronger for constrained firms, irrespective of measures of credit access considered, and difference in statistically significant at the 1% level. These basic descriptive statistics tend to give support to our intuition. In the next sub-section, we present a more robust analysis.

< Insert here Table 2 >

We then empirically test our hypothesis by adding an interaction between in our baseline model, as follows:

$$g_{i,t/t-1} = \alpha_{ct} + \alpha_{st} + \beta_1 lnS_{it/t-1} + \beta_2 lnS_{it/t-1} * FIN_i + \theta FIN_i + \delta lnA_i + \nabla \boldsymbol{X}_i + \varepsilon_{it} \quad (3)$$

Where FIN_i is a dummy equals to one if a firm has access to credit and zero if a firm is credit constrained. As explained above, we employ three different ways to compute FIN_i. Our hypothesis is confirmed if $\beta_1 < 0$ and $\beta_2 > 0$ when we consider employment growth as dependent variable.

Results are displayed in Table 7. In the first three columns, we consider the subjective measures of financial access (FIN1), in columns (4-6) financial access is assessed by the use of loan or overdraft (FIN2) and in the three last columns we consider previous year firm's credit experience FIN3 (for details, see Section 3.2.). For each proxy of financial constraints, we firstly display models without measure of financial access and interaction (because the number of observation is reduced when we consider different proxies of financial access). We then include each measure of financial access (FIN1, FIN2, and FIN3) and we finally report model with interaction. Econometric results are in line with our prediction. The coefficients associated with the interaction is positive and highly statistically significant, irrespective of measures of financial

constraints considered (FIN1, FIN2, or FIN3). In addition, in economic terms, we note that the relationship between size and employment growth is three times larger for constrained firms than their unconstrained counterparts. In addition, we underline that unconstrained firms have a higher level of growth.

< Insert here Table 7 >

In an unreported analysis (but available upon request), we test whether these econometric results are robust to alternative specification. First, we consider sub-samples instead of an interaction between financial access and firm's size. Our conclusions are not altered by this change. In addition, financially constrained firms can be the most dynamic ones. To control for this aspect we add sales growth in models as independent variable (in spite of its endogeneity). Econometric results are very close to those obtained in Table 5.

5.2. Relationship between credit access and capital-labor ratio

According to our hypothesis, we expect that the ratio of capital to labor is lower for constrained firms than unconstrained firms, hence small firms should have a lower capital to labor ratio because they are more financially constrained. This hypothesis is confirmed by our data: large firms have a capital to labor ratio eighteen times higher than small firms.

To empirically test this prediction, we run the following model:

$$k/l_{i,t} = \alpha_{ct} + \alpha_{st} + \beta FIN_{it} + \nabla \boldsymbol{X}_i + \varepsilon_{it} \quad (4)$$

where $k/l_{i,t}$ is the ratio of capital to labor for firms i, FIN_{it} is an index of financial access (see above), and $\boldsymbol{X}_i$ is a matrix of control variables including the average firm's size, age, and other control variables employed above. According to our hypothesis, we expect that $\beta > 0$, indicating that firms with credit access employed more capital per worker. To compute the capital-labor ratio, we need a measure of capital intensity and of labor intensity. We follow Enterprises Surveys' staff (World Bank Group – Enterprise Analysis Unit, 2017) that defined a measure of capital and labor in order to assess the total productivity factor. Capital is assessed by the replacement value of machinery, vehicles, and equipment (question n7a) and labor is proxied by the total annual cost of labor (question n2a). Our aim is not to provide a casual analysis but rather to offer some advanced stylized facts between capital-labor ratio and financial constraints.

Econometric results are displayed in Table 8, we scrutinize the determinants of capital-labor ratio. We first report model without the measure of financial access and then included it. We consider the three

measures of financial access presented above. First, it should be noted that we are able to compute the ratio of capital to labor for less than half of firms (due to the lack of data). Nonetheless, results displayed in Table 7 indicate that firms with access to credit have higher level of capital per worker. Specifically, coefficients associated with financial access are always positive and statistically significant when we consider the fact to have a loan (FIN2). Among control variables, we observe that firm's size is not related to the capital intensity, contrary to the fact to be a subsidiary and firm's age.

< Insert here Table 8 >

6. Conclusion

Using a database of over 22,000 firms from 45 African countries over the period 2006-2016, our results indicate a strong link between firm size and job growth. The rejection of the Gibrat's law in Africa implies that SMEs create more jobs than their larger counterparts do. These findings appears to be of particular interest and makes an important contribution to the firm growth literature. To date, most of the research has focused on developed economies, with a particular emphasis on the United States. One may wonder to what extent the American experience generalizes to other economies, especially less developed countries such as African countries. We provide evidence on this issue using Enterprise Surveys data covering a broad range of Sub-Saharan African countries and including both manufacturing and services sector.

While the literature would explain this relationship by diminishing returns, learning process or minimum efficient size, we show that these factors are irrelevant to justify this fact. We then propose a new channel shedding a light on our econometric results. We argue that SMEs use a different combination of factors of production, regardless of the sector. SMEs tend to overuse labor because of lack of access to capital. Indeed, small firms are more financially constrained and therefore cannot employ capital as they wanted. As a result, SMEs have a lower capital-labor factor because they tend to overuse labor to grow and underuse capital. Hence their greatest job growth momentum. Different econometric tests give support to our intuition. Specifically, we prove that the negative relationship between firm's size and growth is more than twice larger for financially constrained firms than unconstrained firms. This finding is robust to several measures of financial access. We then document that the capital-labor ratio is smaller for small firms and for constrained firms, in line with our hypothesis. To sum up, we first argue that financially constrained firms create more jobs, then that SMEs are more financially constrained. Thus explaining the strongest job creation of SMEs than their larger counterparts.

These results have strong implications for African countries. In order to be able to absorb the strong population growth and provide job opportunities to all African people, it seems essential to support small businesses. Because they are at the heart of job creation, fostering the emergence of small businesses must be a top priority. Yet, it raises the question of financial support for small businesses. Indeed, providing finance to small businesses to allow them to grow could ironically slow down their job creation dynamics. By releasing their financial constraint, we can encourage the use of capital, to the detriment of labor. On the other hand, we do not take into account for productivity gain and survival probability. Providing finance to SMEs can also enable them to survive and stay on the market. Further research is still needed to understand better the consequences of providing funding to SMEs at a more aggregated level.

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Table 1: Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
Gr(Empl)	22,495	5.40	11.36	-32.95	47.51
Gr(Sales)	18,232	2.92	23.21	-66.67	66.67
Empl	22,495	37.34	82.18	1	1000
Age	22,495	15.58	12.72	0	100
Export	22,495	0.150	0.357	0	1
Subsidiary	22,495	0.184	0.387	0	1
Manag Exp	22,495	14.53	9.44	0	50
Foreign-owned	22,495	0.129	0.335	0	1
State-owned	22,495	0.005	0.068	0	1
Privately-held	22,495	0.209	0.407	0	1
Sole proprietorship	22,495	0.552	0.497	0	1
FIN1	16,006	0.454	0.498	0	1
FIN2	21,929	0.373	0.484	0	1
FIN3	13,389	0.196	0.397	0	1

Table 2: Coefficient correlations between size and growth

Employment growth						
	FIN1		FIN2		FIN3	
	coef.	Obs.	coef.	Obs.	coef.	Obs.
All firms	-0.121	16,006	-0.135	21,929	-0.160	13,389
Unconstrained firms	-0.081	7,274	-0.085	8,187	-0.112	2,625
Constrained firms	-0.159	8,732	-0.173	13,742	-0.184	10,764
Jenrich test (p-value)	0.00		0.00		0.00	

Table 3: Baseline results, employment growth

	(1)	(2)	(3)	(4)	(5)
ln($Empl_{initial}$)	-0.677***	-0.701***	-0.782***	-0.715***	-0.757***
	(-10.06)	(-9.24)	(-10.24)	(-9.14)	(-9.61)
ln(Age)	-3.257***	-3.204***	-2.618***	-2.719***	-2.647***
	(-26.21)	(-22.58)	(-18.39)	(-19.00)	(-18.49)
Export		0.198	0.450**	0.412*	0.421*
		(0.90)	(2.04)	(1.85)	(1.87)
Subsidiary		0.174	0.539***	0.591***	0.539***
		(0.89)	(2.72)	(3.01)	(2.71)
Manag		-0.00953	0.0129	0.00836	0.0126
		(-1.05)	(1.41)	(0.91)	(1.36)
Foreign-owned		0.149	0.0575	0.243	0.0486
		(0.66)	(0.25)	(1.07)	(0.21)
State-owned		0.901	0.266	0.678	0.402
		(0.83)	(0.25)	(0.63)	(0.37)
Privately held		1.935***	0.0777	0.0955	0.0543
		(8.85)	(0.33)	(0.42)	(0.23)
Sole proprietorship		1.198***	0.212	0.316	0.179
		(6.21)	(1.08)	(1.64)	(0.91)
Dummy					
- Country#year	No	No	Yes	No	Yes
- Sector#year	No	No	No	Yes	Yes
Obs.	22495	22495	22495	22495	22495
Adj. R2	0.049	0.052	0.112	0.098	0.115

The dependent variable is the annual growth of employment. Robust t-statistics are reported in parentheses. *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

Table 4: Baseline results, sales growth

	(1)	(2)	(3)	(4)	(5)
ln($Empl_{initial}$)	0.275*	0.00524	-0.282	-0.339*	-0.229
	(1.71)	(0.03)	(-1.55)	(-1.77)	(-1.22)
ln(Age)	-3.040***	-3.406***	-2.357***	-2.902***	-2.443***
	(-10.44)	(-10.06)	(-7.36)	(-8.75)	(-7.59)
Export		-1.113**	1.504***	0.541	1.323**
		(-2.02)	(2.81)	(0.99)	(2.45)
Subsidiary		0.344	-0.268	0.0220	-0.427
		(0.71)	(-0.55)	(0.05)	(-0.88)
Manag		0.0507**	0.0340	0.0456**	0.0346*
		(2.35)	(1.63)	(2.14)	(1.65)
Foreign-owned		1.935***	0.628	1.261**	0.629
		(3.65)	(1.19)	(2.40)	(1.20)
State-owned		1.863	0.938	2.376	1.829
		(0.58)	(0.31)	(0.78)	(0.62)
Privately held		2.182***	-0.220	0.396	-0.257
		(4.22)	(-0.42)	(0.74)	(-0.49)
Sole proprietorship		0.197	-0.143	-0.208	-0.170
		(0.40)	(-0.30)	(-0.43)	(-0.36)
Dummy					
- Country#year	No	No	Yes	No	Yes
- Sector#year	No	No	No	Yes	Yes
Obs.	18232	18232	18232	18232	18232
Adj. R2	0.006	0.009	0.130	0.073	0.135

The dependent variable is the annual growth of sales (in constant US$). Robust t-statistics are reported in parentheses. *, **, *** indicate significance at 10%, 5%, and 1%, respectively

Table 5: Testing Gibrat's law by age group

	[0. 5[(1)	[5; 10[(2)	[10; 15[(3)	[15; 20[(4)
$\ln(Empl_{avg})$	-1.628***	-1.003***	-0.778***	-0.707***
	(-5.55)	(-6.44)	(-4.39)	(-3.31)
Control variables	Yes	Yes	Yes	Yes
Dummy - Country#year	Yes	Yes	Yes	Yes
Dummy - Sector#year	Yes	Yes	Yes	Yes
N	3300	6799	4477	2789
adj.	0.100	0.088	0.081	0.088

	[20; 25[(5)	[25; 30[(6)	[30; 35[(7)	[35; 40[(8)
$\ln(Empl_{avg})$	-0.362	-0.443	0.455	-0.493
	(-1.34)	(-1.28)	(1.09)	(-0.82)
Control variables	Yes	Yes	Yes	Yes
Dummy - Country#year	Yes	Yes	Yes	Yes
Dummy - Sector#year	Yes	Yes	Yes	Yes
N	1636	1094	694	497
adj.	0.071	0.075	0.001	0.059

The dependent variable is the annual growth of employment. Robust t-statistics are reported in parentheses. *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

Table 6: Testing the Gibrat's law, by sector

	MANUF. (1)	SERV. (2)	Inter. (3)
ln($Empl_{avg}$)	-0.741***	-0.774***	-0.746***
	(-6.67)	(-6.81)	(-7.00)
ln($Empl_{avg}$)*Manufacturing			-0.0205
			(-0.15)
ln(Age)	-2.916***	-2.461***	-2.647***
	(-13.93)	(-12.39)	(-18.49)
Export	0.616**	0.107	0.425*
	(2.09)	(0.30)	(1.88)
Subsidiary	0.976***	0.251	0.538***
	(3.26)	(0.93)	(2.70)
Manag	-0.00175	0.0282**	0.0125
	(-0.13)	(2.16)	(1.35)
Foreign-owned	-0.0161	0.0439	0.0486
	(-0.05)	(0.14)	(0.21)
State-owned	-0.215	0.859	0.400
	(-0.14)	(0.56)	(0.37)
Privately held	0.352	-0.234	0.0558
	(1.04)	(-0.71)	(0.24)
Sole proprietorship	0.516*	-0.154	0.180
	(1.76)	(-0.58)	(0.92)
Dummy			
- Country#year	Yes	Yes	Yes
- Sector#year	Yes	Yes	Yes
Obs.	10410	12085	22495
Adj. R2	0.126	0.106	0.115

The dependent variable is the growth of employment. Robust t-statistics are reported in parentheses. *, **, *** indicate significance at 10%, 5%, and 1%, respectively

Table 7: Model with interaction between size and financial constraint

	FIN1			FIN2			FIN3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Empl)	-0.635***	-0.655***	-0.964***	-0.761***	-0.842***	-1.347***	-0.973***	-1.098***	-1.406***
	(-6.49)	(-6.67)	(-7.47)	(-9.54)	(-10.35)	(-12.47)	(-8.88)	(-9.83)	(-10.79)
FIN		0.548***	-1.114**		0.903***	-1.949***		1.615***	-1.370**
		(2.97)	(-2.38)		(5.22)	(-4.57)		(5.91)	(-2.05)
ln(Empl)*FIN			0.612***			1.004***			0.982***
			(3.99)			(7.55)			(5.10)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummy									
- Country#year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Sector#year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	16006	16006	16006	21929	21929	21929	13389	13389	13389
Adj R^2	0.110	0.111	0.112	0.112	0.113	0.115	0.132	0.134	0.136

The dependent variable is the growth of employment. Control variables as well as country-year and sector-year dummies are included but unreported. Robust t-statistics are reported in parentheses. *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

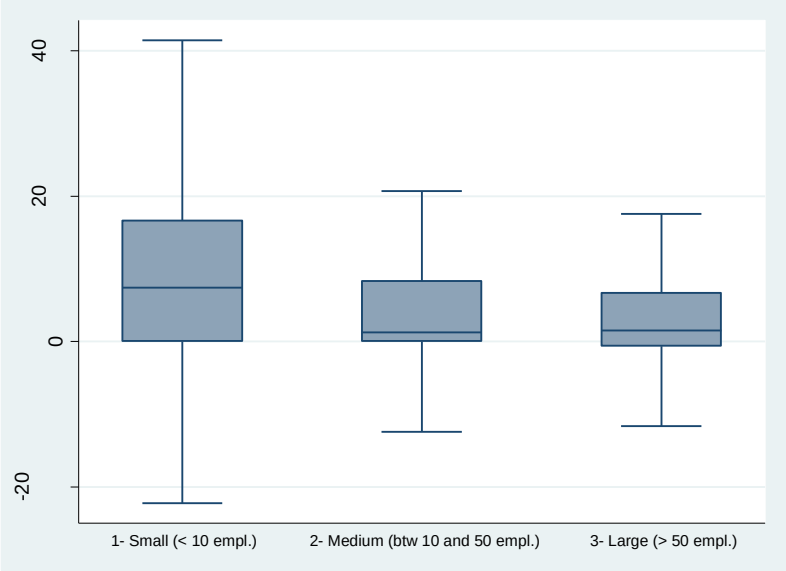
Table 8: Determinants of capita-labor ratio

	(1)	(2)	(3)	(4)	(5)	(6)
ln(Empl)	-0.199	-0.205	0.0528	-0.0373	-0.473*	-0.558**
	(-0.67)	(-0.69)	(0.21)	(-0.15)	(-1.75)	(-2.07)
ln(Age)	1.419***	1.421***	0.541	0.529	0.826*	0.812*
	(2.62)	(2.62)	(1.26)	(1.23)	(1.80)	(1.77)
Export	-0.152	-0.157	-0.480	-0.543	-0.326	-0.424
	(-0.21)	(-0.22)	(-0.84)	(-0.95)	(-0.47)	(-0.61)
Subsidiary	1.226	1.217	1.674***	1.643***	1.944**	1.903**
	(1.56)	(1.55)	(2.66)	(2.61)	(2.24)	(2.19)
Manag	-0.0255	-0.0256	-0.00268	-0.00203	-0.0165	-0.0165
	(-0.78)	(-0.79)	(-0.10)	(-0.08)	(-0.51)	(-0.51)
Foreign-owned	0.931	0.925	0.651	0.674	1.572*	1.600*
	(1.12)	(1.11)	(0.99)	(1.03)	(1.85)	(1.88)
State-owned	7.658	7.666	5.349	5.429	4.654	4.783
	(1.02)	(1.02)	(1.03)	(1.04)	(1.02)	(1.05)
Privately held	-0.0345	-0.0422	0.351	0.282	0.102	0.0578
	(-0.04)	(-0.05)	(0.53)	(0.43)	(0.14)	(0.08)
Sole proprietorship	-1.134	-1.133	-0.752	-0.705	-1.222*	-1.196
	(-1.41)	(-1.41)	(-1.14)	(-1.07)	(-1.66)	(-1.62)
FIN1		**0.168**				
		(0.33)				
FIN2				**0.988****		
				(2.09)		
FIN3						**0.994**
						(1.35)
Obs.	4913	4913	7285	7285	4870	4870
Adj R^2	0.051	0.051	0.066	0.066	0.069	0.069

The dependent variable is the ratio of capital to labor. FIN1, FIN2, and FIN3 take value one for unconstrained firms and 0 for constrained firms. Robust t-statistics are reported in parentheses. *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

Figure 1: Relationship between firm's size and firm's growth

(a) Growth of employment



(b) Growth of sales

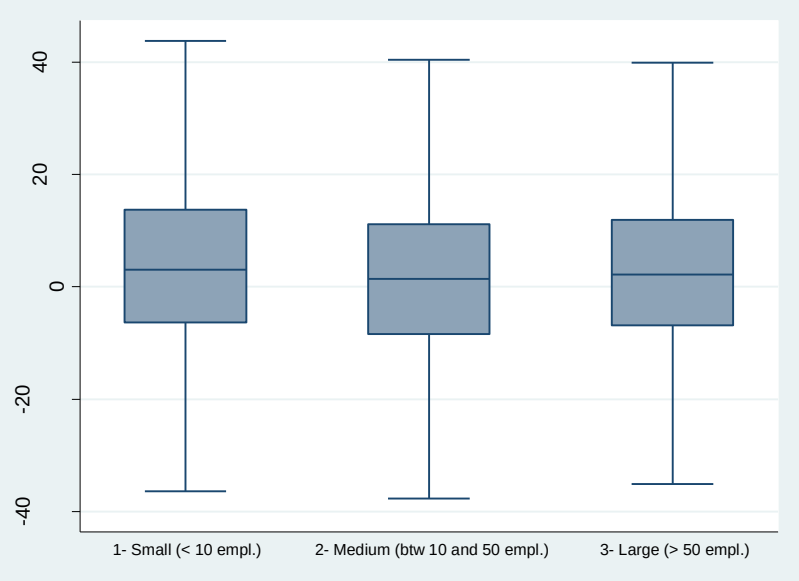
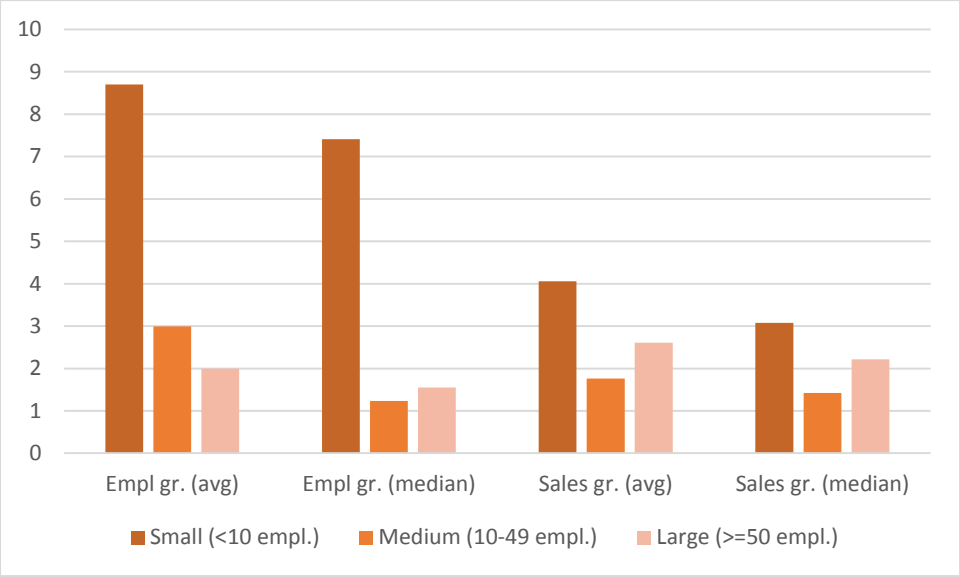


Figure 1: Relationship between firm's size and firm's growth



-Appendix-

Table A1: Sample description

Country	Wave 1		Wave 2		Wave 3	
	year	# Obs.	year	# Obs.	year	# Obs.
Angola	2006	270	2010	186		
Benin	2009	107	2016	128		
Botswana	2006	243	2010	237		
Burkina-Faso	2009	304				
Burundi	2006	211	2014	139		
Cameroon	2009	323	2016	264		
Cape Verde	2009	100				
Central Afr. Rep.	2011	121				
Chad	2009	126				
Congo	2009	65				
Côte d'Ivoire	2009	284	2016	246		
Dem. Rep. Congo	2006	269	2010	288	2013	399
Eritrea	2009	134				
Ethiopia	2011	474	2015	706		
Gabon	2009	120				
Gambia	2006	124				
Ghana	2007	438	2013	609		
Guinea	2006	175	2016	97		
Guinea-Bissau	2006	125				
Kenya	2007	560	2013	539		
Lesotho	2009	104	2016	104		
Liberia	2009	140				
Madagascar	2009	384	2013	297		
Malawi	2009	119	2014	351		
Mali	2007	421	2010	247	2016	124
Mauritania	2006	198	2014	119		
Mauritius	2009	272				

Mozambique	2007	402		
Namibia	2006	232	2014	370
Niger	2009	102	2017	98
Nigeria	2007	1 637	2014	1 267
Rwanda	2006	151	2011	196
Senegal	2007	408	2014	453
Sierra Leone	2009	138		
South Africa	2007	781		
South Sudan	2014	379		

(Continued on the next page)

Sudan	2014	197		
Swaziland	2006	198	2016	92
Tanzania	2006	354	2013	463
Togo	2009	117	2016	130
Uganda	2006	485	2013	553
Zambia	2007	394	2013	608
Zimbabwe	2011	478	2016	437

Table A2: Variable definition

Variable	Definition
Gr(Empl)	Growth of the total number of permanent and full-time employees (annual average)
Gr(Sales)	Growth of the total sales, deflated using the GDP deflator (annual average)
Empl	Number of permanent full-time employees (average of the period)
Age	Age of the firm (in years)
Export	Dummy variable equals to 1 if 10% or more of sales are exported
Subsidiary	Dummy variable equals to 1 if the rm is part of larger firm
Manag Exp	Experience in this sector that the top manager has (in years)
Foreign-owned	Dummy variable equals to 1 if 50% or more of the firm is owned by foreign organization
State-owned	Dummy variable equals to 1 if 50% or more of the firm is owned by the government
Privately-held	Dummy variable equals to 1 if the firm is a limited liability company
Sole proprietorship	Dummy variable equals to 1 if the firms is sole proprietorship
FIN1	Dummy variable equal to 1 if a firm declared that access to financing is not an obstacle or a minor obstacle to its current operations
FIN2	Dummy variable equals to 1 if a firm has a loan or an overdraft
FIN3	Dummy variable equal to 1 if a firm that desired bank credit had access to credit and 0 if a firm that desired bank credit refused to apply for a loan or applied but was turned down.

Table A3: Firm's access to credit, by firm size category

	FIN1	FIN2	FIN3
Small	41.91	26.08	12.16
Medium	49.85	49.46	28.43
Large	55.46	69.35	50.74
All	45.55	37.33	19.61

We report the percentage of firms having access to credit by category and indicator

Figure A1: Firm's size distribution (excluding firms with size above 100 employees)