Informal Sector, Competition and Labor Productivity in Africa: Evidence from Firm-Level Data

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INFORMAL SECTOR, COMPETITION AND LABOR PRODUCTIVITY IN AFRICA: EVIDENCE FROM FIRM-LEVEL DATA.

Sara Zouiri[1]

Abstract

The informal sector, a key feature of African economies, can cause significant distortions that result in loss of growth and constraint the countries' development. At the firm level, the informal sector may bind the performance of the formal sector through competition. The purpose of this study is to examine the relationship between informal sector competition and labor productivity in the formal sector. To this end, we use data from the World Bank's Enterprise Survey conducted between 2009 and 2020 for 36 African countries and a set of 27939 formal firms. The regression results reveal a negative and statistically significant relationship between informal sector competition and labor productivity. The policy implications are twofold. First, policies to reduce the size of informal sector and/or prevent negative spillovers from informal competition are required to improve productivity. Second, in order to stimulate the formal sector and promote its expansion, policy measures to improve the macroeconomic and institutional context of the region are needed.

Keywords: Informal Sector, Competition, Labor productivity, Formal sector, Business environment, macroeconomics, Institutions, Africa.

Jel classification: O17, D22, K20, J24, O43, N17

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1. Introduction

Fragility and vulnerability are the main characteristics of the formal private firms in African countries. In fact, it is known that operating in a constraining environment, and heavy institutional, political and economic obstacles, hinders firms' development. Moreover, many evidence point out that informality may constitutes another potential constraint to the performance of the private sector and its growth. In fact, while the informal sector provides a back-up for a large portion of the workforce and reduces unemployment rates, its high share in developing economies can significantly reduce labor productivity and economic growth.

In the literature, factors such as market regulation and access to finance have been emphasized as causes for low productivity levels, however a number of articles have shown that informality is also a significant factor (La Porta & Shleifer, 2014; Rauch, 1991). Papers such as Amin et al. (2019) has shown that the productivity gaps between formal and informal firms are significant. Similarly, the high size of informality can result in inefficient allocation of resources and subsequently a significant loss in overall factor productivity (Restuccia & Rogerson, 2017). Therefore, informality may be considered as a structural constraint that reduces economic growth potential and hinders its development.

In this regard, several studies have evaluated the impact of the size of the informal sector on the overall performance of the economy and its impact on the development of formal enterprises (Cimoli et al., 2006; Houston, 1987). However, little attention has been accorded to the effects of competition between formal and informal enterprises, a factor that can also constrain the development of a competitive productive business structure that favors the expansion of the most productive firms. Among these are the works of Amin et al. (2019), Beltrán (2019), Williams & Kosta (2020) et Kosta & Williams (2020), which have examined the relationship between informal competition and the performance of formal firms measured by sales growth, employment and productivity.

However, few studies have focused on African countries despite the relevance of this issue in their context. In fact, the share of informal production in Africa is estimated to be 35% of total production in 2015 and 66% of total employment (Medina & Schneider, 2018) making this continent the region with the highest size of informality in the world. In addition, low levels of economic growth, poor institutional quality and policy inefficiencies, amplify the constraints on formal enterprise development by exposing them to informal competition spillovers. Given this, the purpose of this paper is to examine the impact of informal sector competition on labor productivity of formal

firms for a sample of 36 African countries using data from the World Bank Enterprise Survey from the period 2009-2020.

The relevance of this investigation is twofold. First, quantifying the impact of informal sector competition on the formal private sector will allow us to assess the formal/informal relationship from competition perspective. Second, the policy implications of this research may be of great value given the importance of the business environment to firm's development on one hand and its impact on productivity on the other.

In what follows, next section will present a literature review on the relationship between informality and labor productivity. The third section will provide a brief overview of the economic context and the level of informality in African countries. The fourth section will detail the data and the methodology adopted and, finally, the fifth section will present the results discussion and policy implications. The document will end with a summary of the research and the findings.

2. Informal Sector and Labor Productivity: A Literature Review

Productivity is a key driver of growth that explains a large share of welfare variations' across countries (Hsieh & Klenow, 2010). Since Solow (1957)'s seminal work, many papers have examined its determinants, such as the quality of institutions and market regulation that explain how productivity grows and why some countries have higher productivity than others (Danquah et al., 2014; Fadiran & Akanbi, 2017; Kim & Loayza, 2019; Mc Morrow et al., 2010).

Among these determinants, informality appears to be a major factor that drags down overall productivity. In fact, the persistence of informality in the economy and the low level of productivity associated with its activities contribute negatively to the growth and overall productivity of the economy (Loayza, 1996). Moreover, the reallocation of labor from the formal to the informal sector stimulates the expansion of informal activities and tends to reduce growth (Voskoboynikov, 2019). Taymaz (2009), for example, presents evidence of a significant productivity gap between formal and informal firms, as well as a gap in terms of wage compensation between workers in the two sectors. The author explained that a large part of these gaps is due to the process of self-selection that directs entrepreneurs and the most educated workers towards the formal sector, making it more productive and distributing higher wages. Similarly, for a sample of developing countries.

However, informal firms compensate for their low productivity with the cost advantages they gain by avoiding taxes and regulations (Beltrán, 2019; Farrell, 2004; Papola,

1980). These elements allow informal firms to gain greater market share at the expense of formal firms and affect negatively overall productivity. In this sense, Couto et al. (2006) show that the high size of the informal sector in Brazil contributes to the explanation of almost 42% of the labor productivity gap relative to the United States.

At the micro level, competition plays an important determinant of firm productivity growth (Ospina et al., 2014). Nickell (1996) suggests that competition forces business leaders to deploy more resources to maintain market share or even adopt innovative practices, allowing them higher rates of productivity growth. Bergoeing et al. (2004) also show that increased competition should allow for the reallocation of resources from low to high productivity firms, and thus improve total factor productivity at the aggregate level.

However, the effects of competition between formal and informal enterprises on development are yet to debate. The different links between these two sectors can lead to different conclusions. According to the dualist approach that suggests that formal and informal firms operate in different markets and produce different products, competition between firms in the two sectors cannot take place and remains without impact on productivity and development (La Porta & Shleifer, 2014). Conversely, where these firms interact in the same markets, their competition can have different impacts on the formal sector. Avenyo et al. (2021) explain these impacts are transmitted through two main mechanisms. On one hand, informal sector competition may lead formal firms to adopt differentiation strategies by improving the quality of their products and services. This strategy will allow formal firms to become more productive and avoid imitation and competition practices of informal firms "*Competition Evasion Effect*". On another hand, this competition increases market distortions by keeping inefficient informal firms in business and preventing productive formal firms from reaching their optimal size. Also, strong informal sector competition reduces firms' profitability and their ability to invest in new innovative products, limiting their productivity or pushing them to withdraw from the market "*Shumpeterien Effect*".

The relation between informal competition and productivity of formal firms has been examined in several studies, yet, the empirical results are not conclusive. For instance, Beltrán (2019) finds a negative and statistically significant effect of informal competition on the productivity of formal firms for a sample of firms from 127 countries. Also, the author showed that this effect is more pronounced in the manufacturing sector compared to services. Similarly, Amin et al. (2019) show that, for developing countries, the labor productivity of formal firms that are exposed to informal

competition is about 75% of the average labor productivity of formal firms that do not suffer from such competition. According to the authors, this negative effect can be mitigated if the business climate and economic development of the countries studied improve. The impact of informal competition on productivity is also investigated in developed countries, notably Italy. Kosta & Williams (2020) have investigated this effect on the performance of formal firms as measured by annual growth of sales, productivity and employment. The authors showed that the first two indicators of firms competing with the informal sector are significantly lower than those of firms not facing such competition, while the effect is insignificant on employment growth.

In contrast, this inverse relationship between informal competition and formal sector productivity is not verified in several cases. For sub-Saharan countries, Ali & Najman (2015) investigate the potential impact of informal competition on labor productivity. Using data from 33 sub-Saharan African countries, the authors adopted the two-step methodology of Guiso et al. (2004) to construct an indicator of regional informal competition intensity and showed that the higher this indicator is, the higher the labor productivity of formal firms. The authors described this effect as the "Schumpeterian creative-destruction effect", where formal firms tend to increase their productivity in order to outperform their informal competitors who enjoy certain cost advantages. However, this effect diminishes with decreasing firm size and low quality of the business environment. Similar to these results, Williams & Kosta (2020), using a sample of 360 firms for the case of Bosnia and Herzegovina, show that formal firms that consider informal competition as an obstacle to their activity do not necessarily perform poorly compared to other firms as they record higher sales growth, yet the effect on employment or productivity growth remains insignificant.

3. Main facts of formal sector in Africa

Over the past two decades, several African economies have experienced significant economic growth rates, announcing a new era of the development in the continent. However, this growth was not accompanied by improvements in the institutional context of many countries. In this context, informal economy has expended at the expense of a strong and productive formal sector. Compared to the rest of the world, Africa has the highest share of informal production in GDP, estimated at 35% in 2015 (Medina & Schneider, 2018), and a large share of informal employment that reaches 66% of total employment[2]. These findings are associated with the lowest average level of labor productivity in the world (See Table 1).

[2] From ILO database, self-employment is used as a proxy to informal employment.

Table 1: Informality, Informal Competition and Productivity in Africa

Region	Informal (% GDP)	Self-employ (% total employment)	% firms facing Informal Competition	Labor Productivity (log)
Africa	35.58	66.25	57.6	8.9
East Asia and Pacific	23.43	41.78	45.3	10.1
Europe and Central Asia	22.71	21.94	35.5	10.8
Latin America and the Caribbean	31.72	33.67	66.9	10.07
Middle East	20.50	18.98	45.5	11.1
South Asia	28.10	63.41	41.2	9.4
Total	28.24	41.18	48.5	9.9

Note: Data on the share of informal sector are from (Medina & Schneider, 2018), Self-employment from ILO, the share of firms facing competition from informal sector from WBES (2009-2020), and labor productivity is calculated from the Penn World Table (PWT).

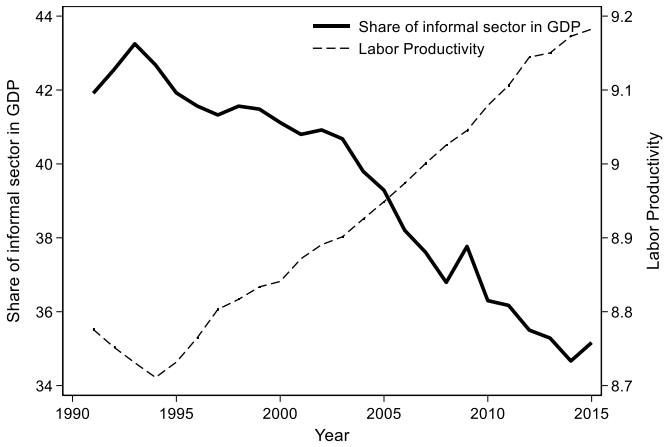
The bivariate analysis of the size of informal sector and labor productivity reveals that high levels of informality are associated with low levels of productivity. Figure 1 illustrates this finding both at the global level (see Figure 1.a) and for African countries (see Figure 1.b). Similarly, the evolution of the size of the informal sector and that of productivity between 1991 and 2015[3] shows an inverse relationship between these two variables. During this period, the share of informal sector in Africa fell slightly from 42% in 1991 to 35% in 2015, a reduction of 7 percentage points over 25 years. This reduction in the size of informality was associated with a smaller improvement in labor productivity over the same period (See figure 1.c).

[3] The analysis is based on the availability of data on the size of the informal sector, which limits the period to 1991-2015.

Figure 1.a: Scatterplot of the size of the informal sector in GDP and labor productivity in 154 countries

Figure 1.b: Scatterplot of the size of the informal sector in GDP and labor productivity in Africa

Figure 1.c: Evolution of the share of informality in GDP and labor productivity in Africa between 1991 and 2015



Source: labor productivity data is calculated from the Penn World Table (PWT) and the informal sector share data is from Medina & Schneider (2018)

At the micro level, fragility and vulnerability are the main characteristics of the private sector in African countries. According to World Bank enterprise survey data, firms seems to have constraints to grow. In fact, the proportion of newly created businesses in Africa does not exceed 7%[4]. Furthermore, although small and medium-sized enterprises are considered a major source of economic dynamism and job creation, their expansion remains slow and unsustainable. Nearly 55% and 70% of small and medium enterprises, respectively, in Africa are more than ten years old, while only 17% of large

[4] These statistics are obtained from 36 countries observed over the 2009-2020 period. Details on the data are provided in the Data and Methodology section.

enterprises are less than ten years old. This observation reflects the difficulties of growth and expansion that these companies face in the short and medium term.

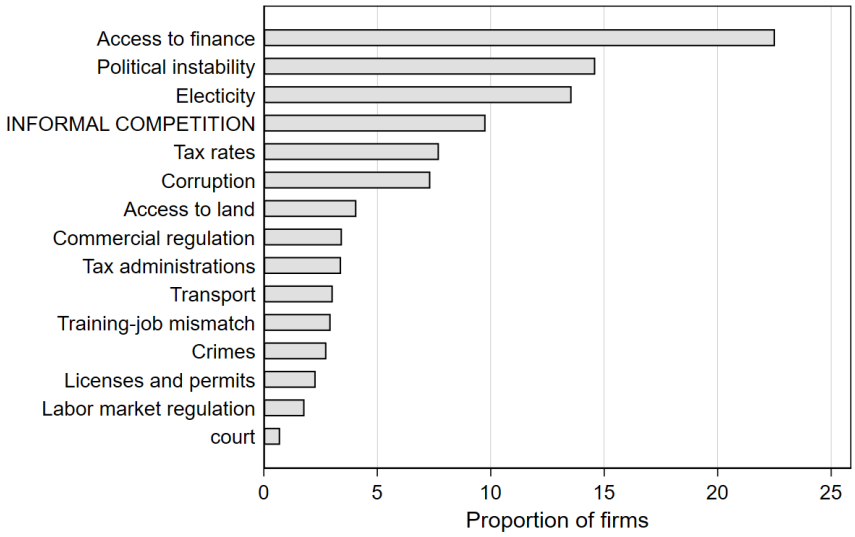
Another key feature of the continent's productive system is the lack of international competitiveness and the low integration of the African productive sector into global value chains. According to the same database, the proportion of exporting firms that channel at least 10% of their production to the external market does not exceed 16% of the total firms surveyed. Moreover, foreign ownership is not recurrent either, with only 18% of firms having at least 10% foreign ownership in their capital.

In terms of management, the average experience of managers is 16 years. With a higher average in large companies (20 years of experience) compared to small companies (10 years). This statistic reflects the high level of human capital accumulated in large firms compared to other firms.

In addition, as mentioned above, the weaknesses of the productive sector in Africa may be the result of the quality of the business environment and implemented policies. The political sphere in Africa is marked by chronic instability, which leads to a high degree of uncertainty and makes it difficult to conduct business[5]. In addition, despite several attempts of reform, access to finance remains a fundamental constraint to business development. According to the World Bank's Doing Business report (2020), 25% of the world's reforms related to business creation, construction permit procedures and access to credit have been carried out in Sub-Saharan African countries. However, despite these efforts, World Bank survey data reveal that lack of finance is still the main obstacle to formal business development, affecting one quarter of the total number of firms. Similarly, competition from the informal sector is among the major constraints reported by business leaders. This constraint is ranked fourth after access to finance, political instability, and electricity problems, where nearly 10% of firms report that competition is the main obstacle to their development, ahead of obstacles related to tax pressure, access to land, and labor market regulations (see Figure 2).

[5] Since the early 2000s, the African political scene has seen 36 military coups.

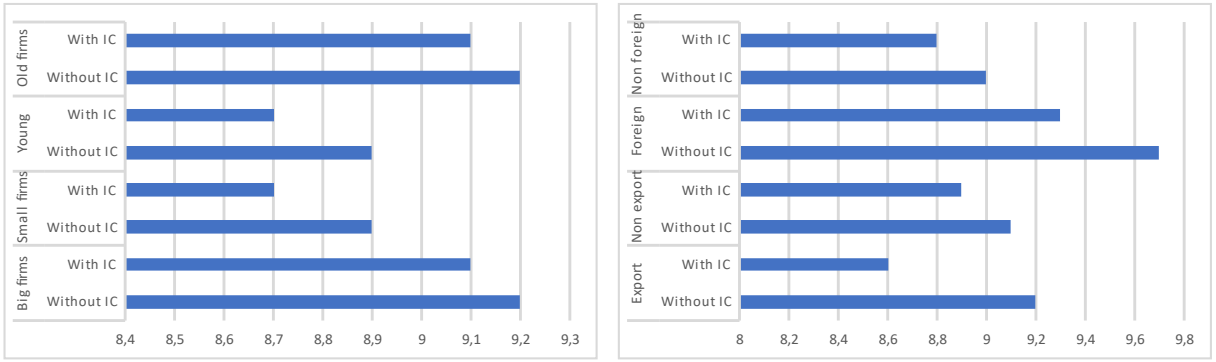
Figure 2: Major Barriers to Business Development in African Countries

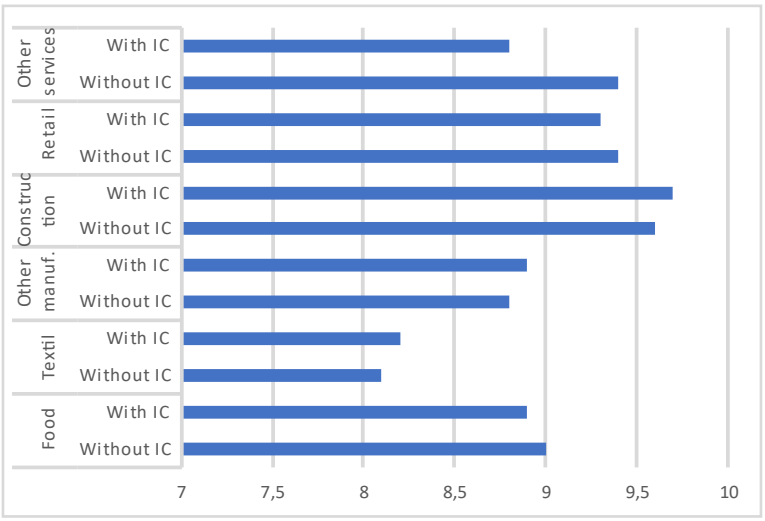


Source: Based on data from WBES 2009-2020

As for labor productivity, several observations can be underlined regarding differences between formal firms facing informal competition and those without. The first finding is that, for all individual characteristics, the average labor productivity of firms without informal competition is higher than that of firms with informal competition, whether by age, size, destination of output (local or foreign market), or capital composition.

Figure 3: A comparison of the labor productivity of formal firms with and without informal competition

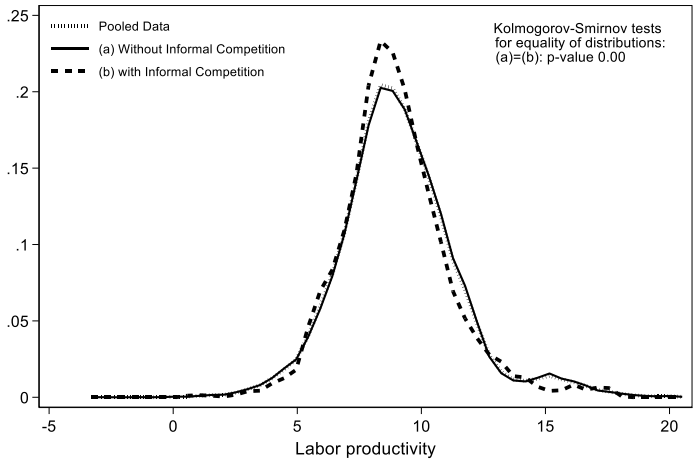




Source: Based on data from WBES 2009-2020

The second observation is related to differences in productivity levels and the presence of informal competition by sector. Firms facing informal competition and operating in the construction, textile and other manufacturing sectors have higher productivity in favor, unlike the food, trade and other services sectors. This finding suggests that, on average, this relationship is not necessarily negative and depends on a number of factors, among which production technology and investment and the products produced are key. However, at the aggregate level, the distribution of labor productivity indicates the existence of a productivity gap between the two categories of firms. Figure 4 below illustrate these distributions, where we observe the existence of greater productivity among firms that are not subject to informal competition. This result is confirmed by the Kolmogorov-Smirnov test, rejecting the hypothesis of equality of the two distributions.

Figure 4: Distribution of labor productivity



Source: Based on data from WBES 2009-2020

4. Data and Methodology

To answer our research question, we use data from the World Bank Enterprise Survey (WBES) for a sample of 36 African countries, conducted between 2009 and 2020. The survey covers a representative sample of formal non-agricultural private sector firms of nearly 144 country and provides information related to firms' characteristics and perceptions of the business environment, including issues related to access to finance, corruption, infrastructure, crime and competition. The survey follows a uniform sampling methodology and produce comparable data across countries.

The empirical approach consists to estimate the effect of informal sector competition on labor productivity of formal firms. The nature of the questions related to these two variables in the survey differs. In fact, labor productivity is observed from firms' balance sheets, whereas the questions on the presence or absence of informal competition are obtained from the perception of the top manager of the firm (a latent variable). Therefore, there may be an inverse causal relationship in which reporting the presence of strong informal sector competition may be driven by low productivity levels.

The literature presents many ways to address the reverse causality problem. For instance Amin et al. (2019) replace the informal competition faced by a formal firm with the average level of informal competition experienced by all other formal firms in the same region, sector, and size group, except the firm in question, and firms with similar characteristics are grouped into categories. This approach assumes that reverse causality between the productivity of a formal firm and the informal competition experienced by other formal firms in the same category is very unlikely. In another paper, to examine the effect of informal sector competition on formal firms' innovation, Pérez et al. (2019) measure the average informal competition by region to reduce subjectivity in the respondent's perception.

Another approach based on the two-stage methodology of Guiso et al. (2004) is also adopted in the literature. This approach consists of constructing indicators of informal competition based on individual firm characteristics and business environment constraints. Ali & Najman (2015) adopted this methodology to construct an indicator of regional informal competition. Similarly, Avenyo et al. (2021) used it to construct two indicators, the first is for region-specific informal competition and the second is specific to industry. Those two methods have a limitation related to the number of observations, which is reduced to the regional or industry level by eliminating the heterogeneity that can arise between firms.

For our methodology and given that our objective is to study the impact of informal competition on productivity at the firm level, we adopt a methodology close to the one used by Amin et al. (2019) by inferring the presence or absence of informal competition for a firm from the firm's managers' perception of their business environment and not their perception of informal competition. In this model, we suppose that the competition of informal sector is more likely to take place in a constrained environment, and a firm facing many obstacles related to access to finance, corruption, transport or other obstacles, can be subject to informal competition or operate in a market with high share of informal units. Although it is true that if the top manager of the company perceives that his environment is constraining, it may be the same for his perception of informal competition, nevertheless, when investigating the co-movement of the various variables reflecting business environment and that of the competition, we can observe a very weak correlation between these indicators (see Table 2), and thus weakening this assumption.

The issue of informal competition is addressed in the survey through the two following questions: "Does the firm face competition from the informal sector?" and "Do you think that the practices of competitors in the informal sector are not an obstacle (0), or are a minor obstacle (1), a moderate obstacle (2), a major obstacle (3), or a very serious obstacle (4) to the current operations of this establishment?" the answer to these questions are used in our first empirical model as indicators of the presence of informal competition as well as its impact to construct the endogenous variable.

We use a probit model to build a proxy for informal competition which will be used as the principal explanatory variable of the second model. The probit model is formulated as follow:

$$Inf.Comp_i = \beta_0 + \beta_1 P_i + \beta_2 D_{country} + \beta_3 D_{year} + \varepsilon_i \quad (1)$$

Where Inf_Comp_i is the informal competition indicator defined according to two specifications namely the broad and the narrow specification. In the first one, Inf_Comp_i takes the value of 1 if the firm reports: (1) that it faces competition from the informal sector and (2) if this competition presents a moderate, major or severe obstacle to their development; 0 otherwise. In the second specification, the variable Inf_Comp_i takes the value 1 if the firm declares: (1) that it faces competition from the informal sector and (2) if this competition presents a major or severe obstacle to their development; 0 otherwise. P_i is the vector of variables that indicates the firms' perception of their business environment, namely: financing constraints, labor market regulations, administrative procedures, transportation problems and the level of corruption.

Based on the results of this first estimation, we assign the presence of informal competition (indicator variable equal to 1) to firms with a probability of facing competition from the informal sector of more than 75% and 0 if this probability is below this threshold. We use this new indicator as the main explanatory variable for the labor productivity of formal firms according to the following model:

$$labprod_i = \beta_0 + \beta_1 Inf\_Comp_i + \beta_2 X_i + \beta_3 D_{sector} + \beta_4 D_{country} + \beta_5 D_{year} + \varepsilon_i \quad (2)$$

The dependent variable of the model is labor productivity. This variable is measured by the ratio of the firm's value added to the number of permanent employees[6]. The value added is computed as the difference between the total sales and the total intermediate inputs constituted mainly by the expenses related to electricity, fuel, water and other production expenses:

$$labprod_i = log\left(\frac{Value\ Added_i}{Number\ of\ permanent\ employees_i}\right) \quad (3)$$

A set of individual firm characteristics and macroeconomic control variables are used then as explanatory variables where Inf_Comp_i is a Bernoulli variable (obtained from the first estimation. The vector X_i corresponds to the individual characteristics of the firm identified based on literature on the determinants of productivity. Those are the size of the firm measured by the number of employees (1 if the firm belongs to the first quartile of the employment distribution, 0 otherwise), the age of the firm (1 if the firm belongs to the first quartile of the age distribution, 0 otherwise) and the experience of the manager measured by the logarithm of years of experience in the same sector of activity. Similarly, we include dummy variables to indicate exporting firms if the share of their production destined for the foreign market exceeds 10%, and foreign ownership if the share of foreign capital in a firm exceeds 10%. The variables D_{sector}, $D_{country}$ and D_{year} are indicator variables that capture the fixed effect of the sector of activity in which the firm operates, the country and the year.

Variables indicating macroeconomic and business environment context are included in equation (2). This vector includes the economic vulnerability index, the human development index, the political stability index, business dynamics, worker mobility, and the productivity-related pay[7].

[6] We used different numbers of employees (permanent + temporary)/(permanent+(temporary*average employment duration)) and found no significant differences in labor productivity. We adopted the number of permanent employees only to keep higher number of observations.

[7] The definition of these variables and their sources are presented in table 7 in the appendix.

The data used in the estimations have been preprocessed. The measure of labor productivity is computed from the value added expressed in USD using the exchange rate corresponding to the year of data collection. Next, we removed observations with missing values and observations with negative value added or negative total sales. To control for outliers' problem, we removed 1% of the tails of continuous variables, including age and value added.

5. Results discussion

This section presents the different results of the regressions carried out along three points. The first addresses the results of the construction of the main explanatory variable, the second presents the effect of informal sector competition on the labor productivity of formal firms, and the third point analyzes the robustness of the results.

Table 3 in the appendix presents the results of the Probit model used to construct the informal competition proxy. It estimates the probability that a firm faces informal competition as a function of the business environment constraints according to the two specifications of the dependent variable. The results of both models show that increasing constraints related to access to finance, the level of corruption, infrastructure, and political instability increase the likelihood that the firm will experience intense competition from the informal sector. According to Table 3, it appears that the model with the narrow specification is better fitted compared to the broad specification, where the pseudo-R^2 increases from 0.09 to 0.11. Moreover, the classification rate of the broad specification has a correct classification rate of 66% while it amounts to 75% in the narrow specification.

Based on these criteria, we use the narrow specification and approximate the informal competition variable as perceived directly by the top manager by the one predicted by the model and whose probability exceeds the defined threshold. It is also worth mentioning that the business environment variables, although obtained from the perceptions of business managers, are not correlated with the perception of informal competition (see Table 2). The highest correlation coefficient does not exceed 0.22 associated with informal competition and access to finance.

The relation between informal competition and labor productivity of formal firms is examined based on the results of models (1-4) presented in Table 4. These results reveal that informal sector competition has a significant and negative impact on formal firms' labor productivity. Without specifying the country fixed effect, the coefficient associated with informal competition reaches -0.325, which implies that firms facing

informal competition have a 28%[8] lower labor productivity than those not facing such competition. While controlling for the country fixed effect increases this coefficient to -0.126 and reduces the productivity gap between the two types of firms to 12%[9]. This difference implies that the negative relationship between productivity and informal competition is explained more by the differences between countries than by the characteristics of each country.

The introduction of the firm-specific variables, as well as those related to the business environment, lowers the coefficient associated with informal competition to -0.169, which is equivalent to a labor productivity gap of 15% in favor of firms that escape this constraint. The significance and sign of the main explanatory variable do not change after the introduction of the firm-specific variables (Table 4 column 3). The coefficients associated with individual firm characteristics are significant at the 1% level, and highlight many important features. The age and size of firms explain a large part of the productivity level. Young and small firms are associated with significantly lower labor productivity than large firms and those operating in the market for a relatively longer period. Similarly, increased exports and foreign ownership are positively associated with higher labor productivity. In terms of human capital, it is shown that increasing the number of years of managerial experience is positively associated with increasing labor productivity in formal firms.

The fourth regression in our empirical approach consists of introducing country-specific macroeconomic variables, namely, the economic vulnerability index, the human development index, political stability, worker mobility, productivity-related pay, and business dynamics. Table 4, column 4, presents intuitive results for these variables that are significantly associated (at the 1% level) with labor productivity of formal firms. In fact, it is shown that higher labor mobility and a high productivity-related pay have a positive impact on formal firm's labor productivity. In addition, economies with enhanced levels of human development, political stability, and low levels of economic vulnerability have higher labor productivity in the formal sector.

To check the results' robustness, we substitute the explanatory variable "Informal Competition" constructed from the Probit model, firstly, by the declaration of business leaders (Table 5, columns 1 and 2) and secondly by the share of the informal sector in the total economy (Table 5, columns 3 and 4). Both variables show a significant and negative relationship with labor productivity of formal firms. The presence of informal

[8] The productivity gap is equal to the exponential of the coefficient related to the explanatory variable minus one. $(e^{-0.325} - 1) * 100 = -28\%$

[9] This value is obtained by: $(e^{-0.126} - 1) * 100 = -12\%$

sector competition or an increase in the share of the informal sector in GDP has a negative impact on formal sector labor productivity. Similarly, the coefficient on the first variable remains close to the baseline regression, showing 11% productivity gap in favor of firms that do not face informal competition. However, in the second specification, an increase of the informal share in GDP of 1% is associated with a decrease in formal sector labor productivity of 3%. This result shows the sharp deterioration in productivity following the expansion of informal activity in African countries. The introduction of all the control variables does not change the significance of the explanatory variables and follows the same pattern as the basic regressions (model 1-4).

Our results on the relation between informal competition and labor productivity are consistent with those previously reported by Kosta & Williams (2020) for the case of Italy, Beltrán (2019) for a sample of firms from 127 countries and Amin et al. (2019) for a sample of developing countries. Moreover, and similar to this latter, the effect of competition remains non-negligible, yet it is mitigated by the improvement in firm-specific characteristics and the context in which the firm operates.

In contrast, for sub-Saharan countries, Ali & Najman (2015) find a positive effect of competition from the regional informal on formal sector productivity. The analysis conducted in their paper focuses on a regional informality indicator which may explain this difference. However, their work highlights that the smaller the size of the firm and the more constraining its environment, the more likely that informal competition has an inverse effect, which is consistent with the main results obtained in our paper, where the economic context and the size of the firm largely determine the magnitude of the effect of informal sector competition.

The results of this work reveal some key findings. The determinants of informal sector competition highlight the importance of the quality of the business and institutional environment in determining the intensity of informal sector competition, where the more constraining the environment, the more likely competition is. The study of the relationship between this competition and the labor productivity of formal firms indicates a significant and non-negligible effect of informal competition, and the explanatory power of the other variables introduced reveals the plurality of elements that interact in this effect and requires intervention at different policy levels.

This analysis emphasizes the importance of improving the business environment and the quality of institutions, both to strengthen the position of the formal sector, its competitiveness and to ensure its differentiation from the informal sector, and to reduce its exposure to informal sector competition. Facilitating access to financing can be one

of the channels to explore. It allows the private sector to develop its activities and adopt new technologies and innovations and encourages informal operators to integrate their activities into the formal sector.

6. Conclusion

This paper examines the impact of informal sector competition on labor productivity of formal firms in Africa. The importance of the informal sector in the continent, as well as the vulnerability of its formal firms and its economic and institutional context, motivated the interest in investigating the extent to which competition from the informal sector affects productivity. To do so, we used data from the World Bank's Enterprise Survey administered between 2009 and 2020 for a sample of 36 countries in Sub-Saharan and North Africa.

The results reveal a negative relation between the labor productivity of formal firms and informal sector competition, where the productivity gap is estimated at 28% in disadvantage of firms facing this competition. This coefficient remains stable after testing various specifications using firm-specific and macroeconomic context-specific control variables. Robustness tests of these relationships also show the existence of a negative effect of informality in general on formal sector labor productivity. The results revealed that large and old firms as well as exporting firms have higher productivity. Moreover, it gets improved in a favorable economic and institutional context.

In terms of policy implications, the results of this paper highlight two key points. First, the negative effect of informal sector competition on formal sector labor productivity requires policies to reduce this competition without jeopardizing the social balance provided by the informal sector. Second, improving the business environment can have direct and indirect effects on the size of the informal sector, its competition, and the productivity of formal firms. This can be achieved by creating an environment favorable to firm creation and integration of the informal sector into the formal sector, on the one hand, and by ensuring that formal enterprises grow and reach critical sizes that will allow them to be more productive, on the other.

This study reveals also that at the aggregate level, the informal sector, through competition, affects the performance of the formal sector, in our case via labor productivity. However, an analysis disaggregated by firm size or by industry may reveal more explanatory elements. Although firm size is correlated with productivity, the explanatory factors specific to each size remain to be investigated, and interaction effects may be an avenue to explore. Moreover, based on the stylized facts of the formal sector in Africa, sectoral disaggregation reveals disparities in the effect of competition

on productivity; a sectoral analysis of this relationship will allow us to better identify the forces underlying these relationships.

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Appendix

Table 2: Correlation between the informal competition variable and the business environment variables

	IC (Narrow Sp.)	IC (Broad Sp.)	Financ Ct.	Taxation Ct.	Labor regul Ct.	Lic Ct.	Corr Ct.
IC (Narrow Sp.)	1.0000	--					
IC (Broad Sp.)	--	1.0000					
Financ Ct.	0.2222	0.1892	1.0000				
Taxation Ct.	0.1714	0.1427	0.2935	1.0000			
Lab-Regu Ct.	0.1223	0.0885	0.2739	0.3071	1.0000		
Lic Ct.	0.1146	0.0925	0.2455	0.3838	0.4215	1.0000	
Corr Ct.	0.1589	0.1295	0.2504	0.3684	0.3113	0.3690	1.0000

Note: The variable CI (Sp. Nar) and CI (Sp. Broad) refers to the Narrow and Broad specification of informal sector competition where the first includes two modalities of the variable e30 from the database (WBES) namely: major and severe barrier and the second includes 3 modalities namely; moderate, major and severe barrier.

Table 3: Determinants of Informal Competition

Informal Competition	Spec. Broad	Spec. Narrow
Financ Ct.	0.344***	0.393***
	(0,019)	(0,02)
Taxation Ct.	0.213***	0.239***
	(0,02)	(0,021)
Labor regul Ct.	0.151***	0.191***
	(0,021)	(0,029)
Licences Ct.	0.106***	0.132***
	(0,021)	(0,026)
Corruption Ct.	0.168***	0.262***
	(0,02)	(0,021)
Constante	-1.344***	-1.514***
	(0,172)	(0,174)
Sector	Oui	Oui
Nbre of obs	23107	23107
chi2	2983,131	3166,564
ll	-14238,516	-12183,715
Pseudo-R	0,095	0,115
Correct Class. rate	65,98%	74,06%

Note: */**/*** indicates significance at the 10%, 5% and 1% levels respectively.

Table 4: Determinants of labor productivity in formal enterprises

Labor Productivity	MOD1	MOD2	MOD3	MOD4
Informal competition (Narrow Spec.)	-0.325***	-0.126**	-0.110*	-0.169***
	(0,051)	(0,046)	(0,046)	(0,049)
Age (Young)			-0.272***	-0.243***
			(0,028)	(0,03)
Size (Small)			-0.253***	-0.237***
			(0,028)	(0,03)
Manager Experience.			0.069***	0.149***
			(0,02)	(0,022)
Share foreign cap			0.435***	0.388***
			(0,039)	(0,046)
Export			0.201***	0.212***
			(0,039)	(0,042)
Labor mobility				12.778***
				(1,213)
Business Dynamic				-29.443***
				(2,967)
Productivity related pay				42.071***
				(4,203)
Economic vulnerability				-10.886***
				(1,118)
HDI				19.677***
				(1,873)
Political stability				10.692***
				(0,962)
Constante	9.142***	11.070***	10.926***	34.475***
	(0,062)	(0,3)	(0,314)	(2,619)
Country	No	Yes	Yes	Yes
Sector and Rear	Yes	Yes	Yes	Yes
Nbre of Observ	20807	20807	20274	16451
R-squared	0,13	0,393	0,413	0,244

Note: */**/*** indicates significance at the 10%, 5% and 1% levels respectively.

The dependent variable is labor productivity measured by the logarithm of VA over the number of permanent employees.

Table 5: Determinants of labor productivity

Labor Productivity	MOD5	MOD6	MOD7	MOD8
Informal Competition	-0.141***	-0.120***		
	(0,03)	(0,033)		
Informal (% du PIB)			-3.528***	-1.658***
			(0,486)	(0,162)
Age (Young)		-0.235***		-0.244***
		(0,031)		(0,03)
Size (Small)		-0.243***		-0.240***
		(0,03)		(0,03)
Manager Experience.		0.149***		0.148***
		(0,023)		(0,022)
Share foreign cap		0.388***		0.389***
		(0,048)		(0,046)
Export		0.205***		0.209***
		(0,043)		(0,041)
Labor mobility		13.480***		-0.202*
		(1,263)		(0,082)
Business Dynamic		-31.259***		0.377***
		(3,089)		(0,09)
Productivity related pay		44.598***		-1.122***
		(4,377)		(0,08)
Economic vulnerability		-11.667***		0,137
		(1,166)		(0,107)
HDI		20.757***		-0.445***
		(1,95)		(0,107)
Political stability		11.270***		-0.425**
		(1,002)		(0,129)
Constante	11.312***	36.099***	10.805***	8.416***
	(0,312)	(2,727)	(0,266)	(0,111)
Country, Sector, Year	Oui	Oui	Oui	Oui
Nbre of Observ	19709	15557	20807	16451
R-squared	0,398	0,248	0,393	0,244

Note: */**/*** indicates significance at the 10%, 5% and 1% levels respectively.

The explanatory variable Informal Competition refers to the constraint of competition from the informal sector as perceived by the firm manager.

Table 6 : les variables utilisées à partir du WBES

Variable	Nom de la variable dans la régression	Code - WBES	Description
Firm size	Size (Small)	L1	Calculated by the logarithm of the number of employees.
Firm age	Age (Young)	B5	Generated by the difference between the year of the interview and the year of creation plus one.
Exporting company	Export	d3c	Variable dummy: 1 if the firm exports more than 10% of its production, 0 otherwise
Foreign ownership	Share foreign cap	B2b	Variable dummy: 1 if the share of foreign ownership is more than 10%, 0 otherwise
Firm Manger experience	Manager experience	B7	Continuous variable represents the number of years of experience of the firm top manager.
Sector of activity	Sect. Acti	A4a / a4b	Discrete variable: The sectors identified are: - Food, -Textile and leather, - Construction - Retail trade, - Other manufacturing sectors - Other Services
Access to financing	Financ Ct.	K30	These variables describe the extent to which business environment indicators present an obstacle to the conduct of firm activity. These ordered variables take the value: -0 for the modality "no obstacle" -1 minor obstacle, - 2 moderate obstacle - 3 major obstacle - 4 severe obstacle.
License and permit	License Ct.	J30c	
Political Instability	Political stability	j30e	
Transport	Transport Ct.	d30a	
Corruption	Corrup Ct.	j30f	
Taxation	Taxation Ct.	j30a	
Labor market regulation	Lab-Reg Ct.	l30a	
Informal Competition intensity	Ct. Con Informel	e30	
Informal Competition	Informal Competition (CI)	e11	Dummy variable: 1 if the firm reports that it faces competition from the informal sector and 0 otherwise

Table 7: Variables from other databases

Variable	Source	Description
Informal (% of GDP)	Medina & Schneider (2018)	The share of the informal sector in GDP, calculated by the MIMIC method over the period 1991-2015 for 157 countries.
Self-employment (% total employment)	International Labour Organization (ILO)	The share of self-employment in total employment. Self-employment reflects the share of informal employment in an economy, which is dominated by the self-employed.
GDP per capita	The World Development Indicators (WDI) database	Measured in US$ PPP
HDI	United Nations Development Programme (UNDP)	The Human Development Index (HDI) ranges between 0 (low level) and 1 (high level).
Political Stability	World Governance Indicators (WGI)	This indicator reflects the quality of governance in an economy, and ranges from -2.5 (the most deficient) to 2.5 (the most effective).
Business Dynamics	World Bank-Global Competitiveness Index (GCI)	The ability of the private sector to generate and adopt new technologies and new ways of organizing work.
Worker mobility		Measures flexibility, i.e. the extent to which human resources can be reorganized, and skills management, i.e. the extent to which human resources are exploited.
Compensation by productivity		Mesure à quel point le paiement des travailleurs est lié à leur productivité.
Economic Vulnerability Index	Ferdi (Guillaumont, 2008).	The economic vulnerability index reports the probability that a country's development will be affected by exogenous shocks (Guillaumont, 2008). This synthetic indicator reflects structural vulnerability and is composed of the magnitude and exposure to shocks.

Table 8: List of countries included in the estimation

Pays	Informal (% GDP) en 2015	Informal Competition	Labor productivity*	Nbre. Of observation	Year of survey
Angola	35,3	33,3	10,7	360	2009
Benin	48,3	69,7	9,6	300	2009/2016
Botswana	24,0	52,2	10,2	268	2010
Burkina-Faso	29,6	63,7	9,7	394	2009
Burundi	35,7	52,2	9,2	157	2014
Cameroun	28,9	79,4	8,9	724	2009/2016
Cap-Vert	30,2	46,2	9,4	156	2009
Chad	28,8	75,6	9,2	303	2009/2018
Egypt	33,3	43,6	9,0	4711	2013/2016
Ethiopia	25,1	33,6	8,9	1492	2011/2015
Gabon	52,0	69,3	11,0	179	2009
Gambia	43,6	66,2	7,9	151	2018
Ghana	39,4	61,1	8,8	720	2013
Guinea	41,6	58,0	9,0	150	2016
Kenya	33,4	57,2	9,6	1782	2013/2018
Lesotho	32,3	54,7	9,0	150	2016
Liberia	43,7	64,1	5,6	301	2009/2017
Madagascar	45,3	64,3	8,2	977	2009/2013
Malawi	33,6	72,4	8,5	673	2009/2014
Mali	29,5	67,7	9,1	545	2010/2016
Mauritania	25,8	75,3	12,3	150	2014
Maurice	19,2	51,5	9,6	398	2009
Morocco	27,1	39,7	9,5	1503	2013/2019
Mozambique	31,0	55,1	8,5	601	2018
Namibia	21,8	45,7	9,1	580	2014
Niger	34,1	78,7	10,0	301	2009/2017
Nigeria	52,5	4,7	7,0	2676	2014
Rwanda	28,1	33,4	9,1	601	2011/2019
Senegal	33,7	77,9	9,3	601	2014
Sierra-Leo	34,2	60,6	7,4	302	2009/2017
Tanzania	38,9	60,3	7,9	813	2013
Togo	31,5	68,9	9,3	305	2009
Tunisia	30,9	44,7	10,2	1207	2013/2020
Zambia	33,0	67,2	12,6	1321	2013/2019
Zimbabwe	67,0	71,5	-	1200	2011/2016
Côte D'Ivoire	42,4	67,4	8,9	887	2009/2016
Total	35,13	58,0	9,2	27939	2009-2020

*Labor productivity is calculated according to equation (3) in the methodology. It is calculated only for formal enterprises; it does not reflect labor productivity in the country's economy as a whole.