ERF Working Papers Series

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ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية

Working Paper No. 1689
December 2023

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The author would like to thank Professor Driss Frej, Professor Lahcen Oulhaj, Zakaria El Faiz, and Professor Sherine Al Shawarby, as well as the participants at the 29th ERF Annual Conference for their suggestions and comments. All errors and omissions are mine.

Send correspondence to:
Sara Zouiri
Mohammed V University in Rabat
sara_zouiri@um5.ac.ma

[1] PhD student at the Laboratory of Applied Economics, FSJES-Agdal, Mohammed V University in Rabat, Morocco.

First published in 2023 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Abstract

The informal sector, a key feature of African economies, can cause significant distortions that result in loss of growth and constrain countries' development. Many papers have shown that at the firm level, the informal sector may impact 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 in Africa. To this end, we use data from the World Bank Enterprise Survey (WBES) conducted between 2009 and 2020 for 36 African countries. 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 the 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 Classifications: O17, D22, K20, J24, O43, N17.

ملخص

يعتبر القطاع غير المهيكل سمة أساسية في اقتصادات إفريقيا، والذي قد يؤدي إلى تقييد تنمية البلدان في هذه القارة. وقد أظهرت العديد من الأبحاث إمكانية وجود تأثير للقطاع غير المهيكل على أداء القطاع المهيكل من خلال المنافسة بين الشركات. ولتحديد مدى تأثير هذه المنافسة بين القطاعين على أداء شركات القطاع المهيكل، يهدف هذا البحث إلى دراسة العلاقة بين منافسة القطاع غير المهيكل وإنتاجية العمل في القطاع المهيكل في إفريقيا. لهذا الغرض، تم استخدام بيانات جمعت من المسح الشركاتي للبنك الدولي الذي أُجري بين عامي 2009 و2020 لـ 36 دولة إفريقية. وكشفت نتائج التحليل الاستدلالي عن وجود علاقة سلبية وذات دلالة إحصائية بين منافسة القطاع غير المهيكل وإنتاجية العمل في القطاع المهيكل. تترتب على هذه النتائج تداعيات سياسية ذات أهمية مزدوجة. أولاً، تستدعي السياسات التي تهدف إلى تقليل حجم القطاع غير المهيكل ومنع التأثيرات السلبية الناتجة عن المنافسة لتحسين إنتاجية العمل. ثانيًا، اتخاذ تدابير سياسية لتحسين السياق الماكرواقتصادي والمؤسسي في المنطقة بهدف تنمية القطاع المهيكل وتعزيز توسعه.

1. Introduction

Fragility and vulnerability are the main characteristics of formal private firms in African countries. It is known that operating in a constraining environment amidst heavy institutional, political, and economic obstacles, hinders firms' development. Moreover, a lot of evidence points out that informality may constitute another potential constraint to the performance of the private sector and its growth. In fact, while the informal sector provides a backup 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 of low productivity levels. However, a number of articles have shown that informality is also a significant factor (La Porta and Shleifer, 2014; Rauch, 1991). Papers such as Amin et al. (2019) have shown that the productivity gaps between formal and informal firms are significant. Similarly, the high size of informality can result in the inefficient allocation of resources and, subsequently, a significant loss in overall factor productivity (Restuccia and Rogerson, 2017).

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

Few studies have focused on African countries despite the relevance of this issue in their context. The share of informal production in Africa is estimated at 35 percent of total production and 66 percent of total employment in 2015, making it the continent with the highest size of informality in the world (Medina and Schneider, 2018). In addition, low economic growth rates, poor institutional quality, and policy inefficiencies may amplify the constraints of formal enterprises' development by exposing them to informal competition spillovers.

This paper aims to examine the impact of informal firms' competition on the labor productivity of formal firms for a sample of 27,939 firms from 36 African countries using data from the World Bank Enterprise Survey (WBES) from the period 2009-20. The importance of this investigation is twofold. First, quantifying the impact of informal sector competition on the formal private sector allows us to assess the formal/informal relationship from a competition perspective. Second, the policy implications of this research may be of great value given the importance of the business environment to firms' development on the one hand, and its impact on productivity on the other hand.

The paper is structured as follows. The next section presents a literature review on the relationship between informality and labor productivity. The third section provides a brief overview of the economic context and the extent of informality in African countries. The fourth section details the data and methodology adopted. Finally, the fifth section discusses the results

and the policy implications that arise. The paper concludes with a summary of the research and key 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 and Klenow, 2010). Since Solow's (1957) 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 and Akanbi, 2017; Kim and Loayza, 2019; Mc Morrow et al., 2010).

Among these determinants, informality appears to be a major factor that drags down overall productivity. The persistence of informality in the economy and the low level of productivity associated with its activities negatively contribute to the growth and overall productivity of the developing 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 explains that a large part of these gaps is due to the process of self-selection that directs entrepreneurs and the most educated workers toward the formal sector, making it more productive and distributing higher wages. Similarly, for a sample of developing countries, Amin et al. (2019) show that the productivity of formal firms is four times higher than that of informal firms.

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), allowing informal firms to gain greater market share and affect negatively formal firms and 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 percent of the labor productivity gap relative to the United States.

At the micro level, competition plays an important determinant of firm productivity growth (Ospina and Schiffbauer, 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 be debated. 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 and Shleifer, 2014). Conversely, if these firms interact in the same markets, their competition can have different impacts on the formal sector. Avenyo et al. (2021) explain these impacts through two main mechanisms. On the one hand, informal sector competition may lead formal firms to adopt differentiation strategies by improving the quality of their products and services. This strategy would allow formal firms to become more productive and avoid imitation and competition practices of informal firms (i.e., a competition evasion effect). On the other hand, this competition increases market distortions by keeping inefficient informal

firms in business and preventing productive formal firms from reaching their optimal size. Strong informal sector competition also reduces firms' profitability and their ability to invest in new innovative products, limiting their productivity or pushing them to withdraw from the market (i.e., a Shumpeterien effect).

The relationship between informal competition and the productivity of formal firms has been examined in several studies, yet the empirical results are inconclusive and context-dependent. 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. The author shows that this effect is more pronounced in the manufacturing sector compared to services. Amin et al. (2019) show that, in developing countries, the labor productivity of formal firms that are exposed to informal competition is about 75 percent of the average labor productivity of formal firms that are not exposed to such competition. According to the authors, this negative effect could be mitigated if there is an improvement in the countries' business climate and economic development. The impact of informal competition on productivity is also investigated in developed countries, notably Italy. Kosta and Williams (2020) investigate this effect on the performance of formal firms as measured by the annual growth of sales, productivity, and employment. The authors show 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 negative relationship between informal competition and formal sector productivity is not verified in several cases. For Sub-Saharan countries, Ali and Najman (2015) investigate the potential impact of informal competition on labor productivity. Using data from 33 Sub-Saharan African countries, the authors adopt the two-step methodology of Guiso et al. (2004) to construct an indicator of regional informal competition intensity and show 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 to outperform their informal competitors who enjoy certain cost advantages. However, this effect diminishes with decreasing firm size and lowered quality of the business environment. Similar to these results, Williams and 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. Formal sector and informal competition in Africa

Over the past two decades, several African economies have experienced significant economic growth. However, this growth has not been accompanied by improvements in economic structure, human development, or institutions. In this context, the informal economy has continued to persist, maintaining its position as the highest share in the world. Compared to other continents, Africa has the highest share of informal production in GDP, estimated at 35 percent in 2015 (Medina and Schneider, 2018), and a large share of informal employment that reaches 66 percent of total employment.[2] These findings are associated with the lowest average level of labor productivity in the world (Table 1).

[2] From the ILO database, self-employment is used as a proxy for 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 the 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 the informal sector are from Medina and Schneider (2018), self-employment is from the International Labour Organization (ILO), the share of firms facing competition from the informal sector is from WBES (2009-20), and labor productivity is calculated from the Penn World Table (PWT).

The bivariate analysis of the size of the 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 the informal sector in Africa fell slightly from 42 percent in 1991 to 35 percent in 2015, a reduction of seven 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 (Figure 1.c).

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

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

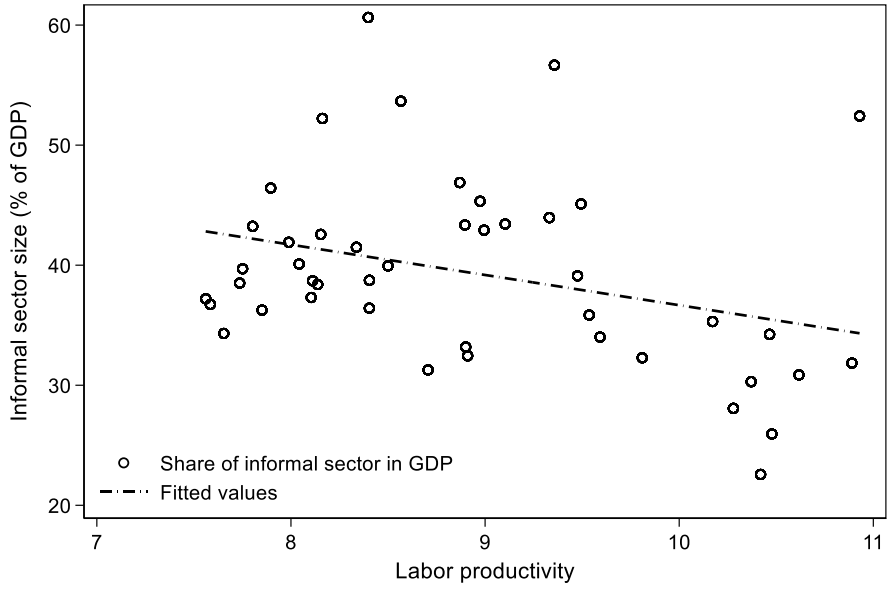
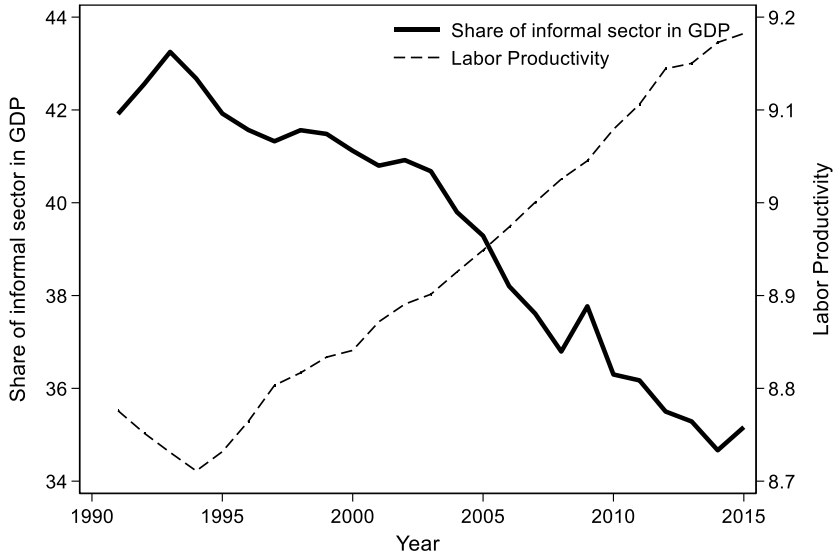


Figure 1.c: Evolution of the share of informality in GDP and labor productivity in Africa between 1991 and 2015



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

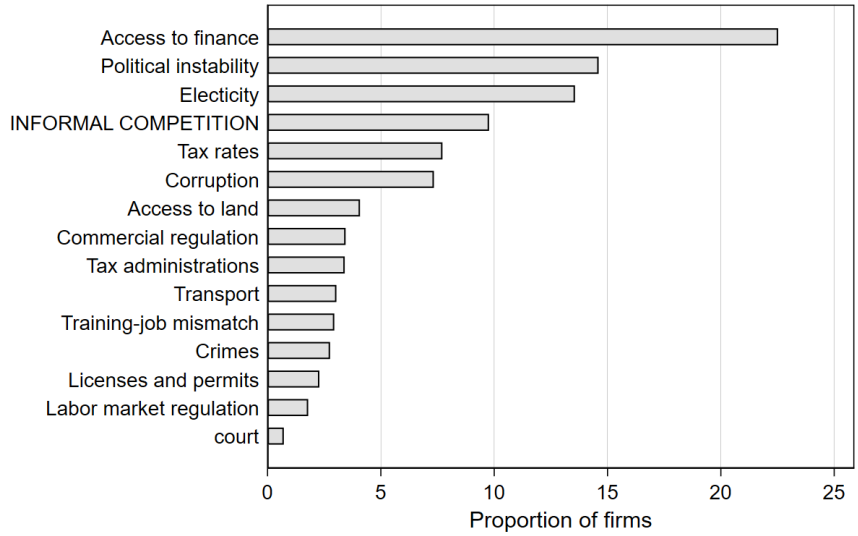
At the micro level, the formal sector in African countries, as revealed by WBES data, is mainly dominated by small and medium-sized enterprises, which account for 53 percent and 31 percent, respectively, of the formal sector, of which seven percent[4] are newly created and younger than five years old. Meanwhile, a significant proportion have been in business for many years, with 66 percent of total formal enterprises being over 10 years old. However, formal firms in Africa face many challenges, including limited international competitiveness and integration into global value chains, with 16 percent engaging in export activities.

[4] These statistics are obtained from 36 countries observed over the 2009-20 period. Details on the data are provided in the Data and Methodology section.

The experience levels of managers in the formal sector vary according to company size. On average, managers have an estimated 16 years of experience. Notably, large companies tend to have more experienced managers, with an average of around 20 years of experience, while small companies have an average of around 10 years of managerial experience. This disparity underlines the significant accumulation of human capital in large companies compared to their smaller counterparts.

Moreover, the formal sector in Africa faces significant challenges and limitations arising from the persistence of a restrictive business environment and the absence of effective policies. Political instability pervades the African landscape, perpetuating an atmosphere of chronic uncertainty that hinders business operations. According to the World Bank's Doing Business Report (2020), Sub-Saharan African countries have implemented 25 percent of the global reforms concerning business creation, construction permit procedures, and access to credit. However, even with these reforms, political instability and financing remain major constraints in Africa. As revealed by WBES data, lack of finance remains the primary obstacle to the development of formal businesses, affecting one-quarter of total firms. In addition, competition from the informal sector appears to be one of the main constraints reported by business managers. It comes in fourth place behind access to financing, political instability, and electricity problems. Around 10 percent of businesses identify informal competition as the main obstacle to their development, ahead of obstacles linked to tax pressure, access to land, and labor market regulations (Figure 2).

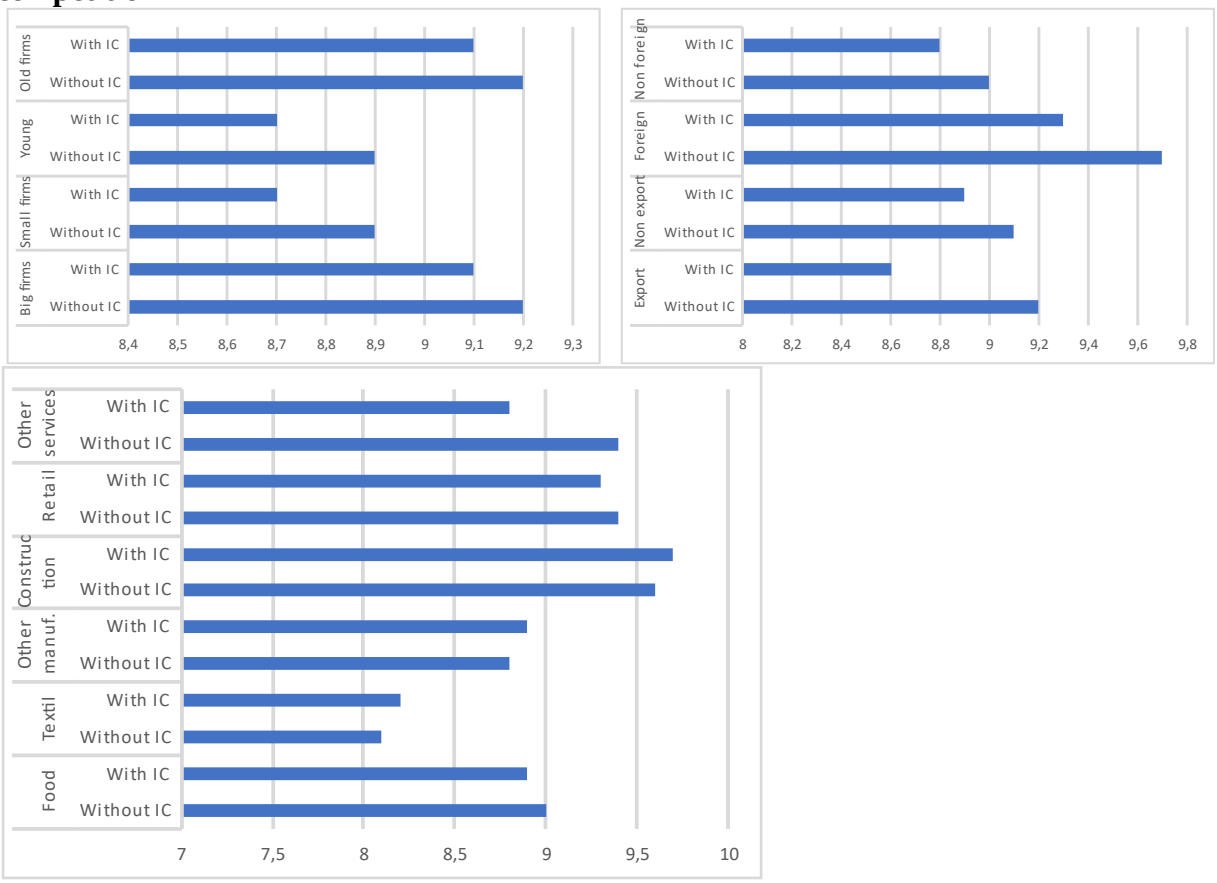
Figure 2: Major barriers to business development in African countries



Source: Based on data from WBES 2009-20.

As for labor productivity, several observations can be underlined regarding differences between formal firms facing informal competition and those not facing it. The first finding is that, for all firm-specific 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: Comparison of the labor productivity of formal firms with and without informal competition

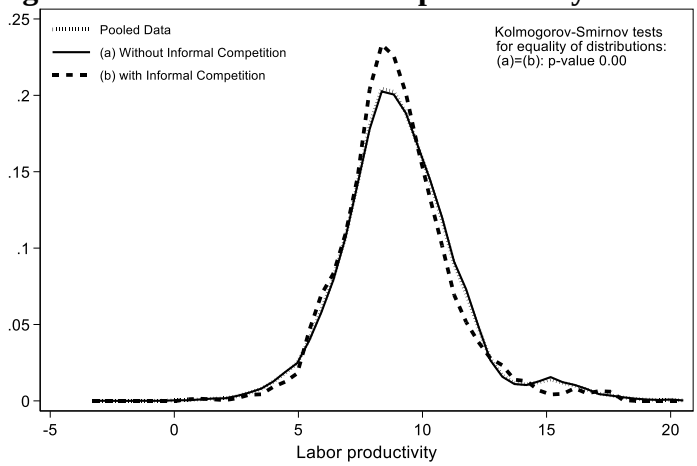


Source: Based on data from WBES 2009-20.

The second observation is related to differences in productivity levels and the presence of informal competition by sector. In the construction, textile, and other manufacturing sectors, firms facing informal competition have higher productivity than those without informal competition, 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, investment, and the products produced are key.

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 illustrates these distributions, where we observe the existence of higher 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 2009-20.

4. Data and methodology

To answer our research question, we use WBES data for a pooled sample of 27,939 formal firms from 36 African countries, conducted between 2009 and 2020. The survey covers a representative sample of formal non-agricultural private sector firms 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 produces comparable data across countries.

The WBES offers a lot of useful information to estimate the effect of informal sector competition on the labor productivity of formal firms. However, a few details need to be considered regarding the nature of the questions related to these two variables in the survey. Labor productivity is observed from firms' balance sheets, whereas information on the presence or absence of informal competition is obtained from the perception of the top manager of the firm (a latent variable). Therefore, bias may be present due to the possible 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 for the firm in question, and then group firms with similar characteristics 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. 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 respondents' 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 and Najman (2015) adopt this methodology to construct an indicator of regional informal competition. Similarly, Avenyo et al. (2021) use it to construct two indicators, the first is for region-specific informal competition and the second is specific to the 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 manager's perception of their business environment and not their perception of informal competition. In this approach, we suppose that the competition of the 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 a high share of informal units. Although one can argue that if the top manager of the firm perceives their environment as constraining, it may be the same for their perception of informal competition. Nevertheless, when investigating the co-movement of the various variables reflecting the business environment and that of the competition, we observe a very weak correlation between these indicators (Table 2), 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), are a minor obstacle (1), a moderate obstacle (2), a major obstacle (3), or a severe obstacle (4) to the current operations of this establishment?" The answers to these questions are used in our first empirical model to construct an indicator of the presence of informal competition as well as its impact.

We use a Probit model to build a proxy for informal competition, which will be used as the principal explanatory variable in the second model. The Probit model is formulated as follows:

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

Where Inf_Comp_i is the informal competition indicator defined according to two specifications, namely: the broad and narrow specifications. 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 its development; 0 otherwise. In the second specification, the variable Inf_Comp_i takes the value of 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 its 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.

Once probabilities of facing informal competition are predicted from model (1), we convert it into a binary variable to assess the impact of informal competition on the labor productivity of formal firms in terms of gaps. To do so, we use the results from the initial estimation and assign a value of 1 to firms with a probability of facing informal competition exceeding 75 percent, and 0 to firms with a probability below this threshold. By setting the threshold at 75 percent, we ensure that the presence of informal competition is limited to firms with a high probability. This new indicator is used then as an explanatory variable of labor productivity of formal firms in the following model:

$$\ln labprod_i = \beta_0 + \beta_1 Inf_{Comp_i} + \beta_2 X_i + \beta_3 Z_i + \beta_4 D_{sector} + \beta_5 D_{country} + \beta_6 D_{year} + \varepsilon_i \quad (2)$$

Where $\ln labprod_i$ is labor productivity expressed in log. It is measured by the ratio of the firm's value added to the number of permanent employees,[5, 6] expressed as follows:

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

Inf_Comp_i is a discrete variable derived from equation (1) as explained above, and takes the value of 1 if the firm i faces informal competition and 0 otherwise. X_i is a set of individual firm characteristics used to control for firms' heterogeneity. It includes the firm size measured by the number of employees (1 if the firm belongs to the first quartile of the employment distribution and 0 otherwise), the firm age (1 if the firm belongs to the first quartile of the age distribution and 0 otherwise), the experience of the manager measured by the logarithm of years of experience in the same sector of activity, and a dummy variable to indicate exporting firms if the share of their production destined for the foreign market exceeds 10 percent, and foreign ownership if the share of foreign capital in a firm exceeds 10 percent. Z_i is a set of macroeconomic and business environment variables introduced to control for country-specific contexts. It includes the Economic Vulnerability Index, the Human Development Index, the Political Stability Index, business dynamics, worker mobility, and productivity-related pay.[7]

In addition, we include dummies D_{sector}, $D_{country}$ and D_{year} to control for differences in the sector of activity in which the firm operates, the country where it is located, and the year of observation, respectively.

It is worth noting that labor productivity is expressed in USD using the exchange rate corresponding to the year of data collection. Also, we remove observations with missing observations and negative value added or negative total sales values. To control for outliers, we trim one percent tails of firms' value added.

5. Results discussion

The results section is structured into three parts. First, we present the findings related to the probabilities of facing informality competition. Second, we analyze the impact of informal sector competition on the labor productivity of formal firms. Lastly, we conduct a robustness check 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 two specifications of the dependent variable. The results of both models show that increasing constraints related to access to finance, labor regulation, taxation, and the level of corruption increase the likelihood that the firm will experience intense competition from the informal sector. According to Table 3, it

[5] We use different measures of number of employment (permanent + temporary) and (permanent + (temporary*average employment duration)) and found no significant differences in labor productivity. We adopt the number of permanent employees only to keep a higher number of observations.

[6] The value-added is computed as the difference between the total sales and the total intermediate inputs, including expenses related to electricity, fuel, water, and other production expenses.

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

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 percent while it is 75 percent 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 where the 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 (Table 2). The highest correlation coefficient observed does not exceed 0.22, associated with informal competition and access to finance.

The relationship between informal competition and the labor productivity of formal firms is examined based on the results of models 1-4 presented in Table 4. The findings demonstrate a significant and negative impact of informal sector competition on the labor productivity of formal firms. In the absence of country fixed effects specification, the coefficient associated with informal competition is -0.325, indicating that firms facing informal competition experience 28 percent[8] lower labor productivity, on average, compared to those not encountering such competition within the country sample. However, when controlling for the country fixed effect, the coefficient increases to -0.126, narrowing the productivity gap between the two types of firms to 12 percent.[9]

These results suggest that the negative association between productivity and informal competition is influenced more by the disparities between countries rather than the inherent characteristics of each individual country. In other words, the differences in labor productivity between formal firms facing and not facing informal competition can be partly attributed to the varying environments and contexts in which these firms operate.

The introduction of the firm-specific variables and those related to the business environment, do not significantly change the model results. The labor productivity gap with firm and country-specific variables is 15 percent. The significance and sign of the main explanatory variable remain unchanged in this specification (see column 3 of Table 4).

Results in column 3 of Table 4 show that firm age and size play a substantial role in determining productivity levels, with young and small firms exhibiting significantly lower labor productivity. This disparity in productivity can be attributed to various factors. Small firms often face constraints in accessing advanced technologies and implementing efficient production processes, which limits their overall productivity. On the other hand, young firms lack experience and accumulated knowledge, further impeding their productivity potential.

Conversely, increased levels of exports and foreign ownership are associated with higher labor productivity in formal firms. This positive relationship suggests that engaging in export activities and attracting foreign ownership can enhance firms' productivity levels. Furthermore, the results reveal a positive association between labor productivity and managerial experience. Specifically, a higher number of years of managerial experience is associated with higher labor

[8] The productivity gap is equal to the exponential of the coefficient related to the explanatory variable minus one. $(e^{-0.325} - 1) * 100 = -28\%$. See Halvorsen and Palmquist (1980) for a demonstration.
[9] This value is obtained by: $(e^{-0.126} - 1) * 100 = -12\%$.

productivity within formal firms, highlighting the importance of human capital and managerial expertise in driving productivity growth.

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. Column 4 of Table 4 presents intuitive results for these variables that are significantly associated (at the one percent level) with the labor productivity of formal firms. It is shown that higher labor mobility and high productivity-related pay have a positive impact on a formal firm's labor productivity. In addition, economies with enhanced human development index, political stability, and low levels of economic vulnerability have higher labor productivity in the formal sector.

To assess the robustness of our findings, we conduct an alternative analysis by substituting the "Informal Competition" explanatory variable derived from the Probit model with the share of the informal sector in the overall economy. This substitution is presented in Table 5, specifically in columns 1 and 2. The results indicate that an increase in the share of the informal sector in the GDP has a detrimental impact on the labor productivity of the formal sector. In other words, an increase of one percentage point in the informal sector's share of GDP is associated with a three percent decrease in labor productivity within the formal sector. This finding highlights the significant decline in productivity following the expansion of informal activities in African countries. Furthermore, when we introduce control variables, the significance of the primary explanatory variable remains unchanged, and the pattern aligns with the findings from the initial regressions (models 1-4).

The findings of our study regarding the relationship between informal competition and labor productivity align with previous research conducted by Kosta and Williams (2020) for the case of Italy, Beltrán (2019) for a sample of firms from 127 countries, and Amin et al. (2019) in the context of developing countries. Moreover, and similar to the 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, a study by Ali and Najman (2015) for a sample of Sub-Saharan countries reveals a positive effect of regional informal competition on formal sector productivity. Although their analysis focuses on a regional informality indicator which may explain the differences in the results, 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. This 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.

6. Conclusion

This paper examines the impact of informal sector competition on the 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 formal firms' productivity. To do so, we use WBES data administered between 2009 and 2020 for a pooled sample of 27,939 formal firms from 36 Sub-Saharan and North African countries.

The results reveal a negative relationship between the labor productivity of formal firms and informal sector competition, where the productivity gap is estimated to be 28 percent in the

disadvantage of firms facing this competition. This coefficient remains stable after testing various specifications using firm-specific and macroeconomic context-specific control variables. The robustness tests of these relationships show the existence of a negative effect of informality on formal sector labor productivity. The results also reveal that large and old firms, as well as exporting firms, have higher productivity. Moreover, it improves in favorable economic and institutional contexts.

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 "formalizing" the informal sector, on the one hand, and by ensuring that formal enterprises grow and reach critical sizes that would allow them to be more productive, on the other hand.

This study also reveals that the informal sector, through competition, affects the performance of the formal sector at the aggregate level, in our case via labor productivity. However, a more profound analysis disaggregated by firm size or by industry and interactions may reveal more facts.

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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 variables CI (Sp. Nar) and CI (Sp. Broad) refer to the narrow and broad specification of informal sector competition where the first includes two modalities of the variable e30 from the WBES database (major and severe barriers) and the second includes three modalities (moderate, major, and severe barriers).

Table 3: Determinants of informal competition (marginal effect)

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	Yes	Yes
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 of formal firms

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 year	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 (Robustness check)

Labor productivity	**MOD5**	**MOD6**
Informal (% du PIB)	-3.528***	-1.658***
	(0,486)	(0,162)
Age (young)		-0.244***
		(0,03)
Size (small)		-0.240***
		(0,03)
Manager experience		0.148***
		(0,022)
Share foreign cap		0.389***
		(0,046)
Export		0.209***
		(0,041)
Labor mobility		-0.202*
		(0,082)
Business dynamic		0.377***
		(0,09)
Productivity related pay		-1.122***
		(0,08)
Economic vulnerability		0,137
		(0,107)
HDI		-0.445***
		(0,107)
Political stability		-0.425**
		(0,129)
Constante	10.805***	8.416***
	(0,266)	(0,111)
Country, sector, and year	Yes	Yes
Nbre of Observ	20807	16451
R-squared	0,393	0,244

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

Table 6: Variables used from WBES database

Variable	Name of the variable in the regression	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 manager 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 and 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 USD 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		Measures how well workers' pay is linked to their productivity.
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

Countries	Informal (% GDP) en 2015	Informal competition	Labor productivity*	Nbre. Of observations	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 the overall labor productivity of the country's economy.