GRÉDI

Groupe de Recherche en Économie et Développement International

Cahier de recherche / Working Paper
07-15

What Determines Productivity in Senegal?
Sectoral Disparities and the Dual Labor Market

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What Determines Productivity in Senegal? Sectoral Disparities and the Dual Labor Market[*]

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June 14, 2007
This version: July 10, 2008

Abstract

Growth of the informal sector of the Senegalese economy may result in a productivity slow-down and could induce a surge in inequality and poverty. The production process is similar for some subsectors of the informal sector and those of the formal one. But there is evidence that the economy is deeply cleaved, between productive and non productive firms in the informal sector and voluntary and involuntary jobs on the labor market that proves to be dual. Education externalities are significant in the informal sector. The differences in human and physical capital account for about two thirds of the output gap.

Keywords: formal and informal sectors; productivity; output gap; dual labor market; externalities; Senegal.

JEL Numbers: O17; O47; J24.

1 Introduction

Analyzing the informal sector as opposed to the formal sector is one of the most challenging issues concerning economic development. Indeed, the informal sector has significant impact on developing economies, so that many studies can be consulted on that topic[1]. Informal work is characterized by low levels of skills and productivity, low and irregular earnings, long working hours, small and undefined workplace, unsafe and unhealthy working conditions, and lack of access to information, markets, finance, training and technology (ILO (2002)). De Soto (1989)'s works have pioneered the analysis of the informal sector and have forcefully advocated for the formalization of developing economies. He mainly described small informal firms in the peruvian economy as being led by entrepreneurs who wished to enter the formal sector but could not. In that perspective, the fact that the informal sector is not chosen voluntarily could be added to the definition of informal work, as the situation faced by those firms is not desirable in a perspective of economic development. This reflects the view of a deeply cleaved society, a society that is polarized between two work and consumption patterns, and in which both the states and the market appear to be weak. Hence, on the one hand, the informal sector can be viewed as a buffer against formal sector-based depression –enabling some activities to survive, although with low-paid jobs and bad working conditions. But whether the informal sector grows in a procyclical or contracyclical manner is still under debate so far[2]. It is thus an empirical question to know if the informal sector is either totally inefficient, as many global indicators seem to suggest it, or it could be, on the other hand, a lever for growth.

Focusing on Senegal proves to be a stimulating way to start analyzing these issues. In this low-income country, average work productivity is relatively high when compared with other African countries. Yet, this average figure conceals strong discrepancies between the formal and informal sectors. Indeed, the productivity gaps prove to be considerable –the formal sector being almost six times as productive as the informal one in Dakar. The pay gaps appear just as significant, although they are not as big. The median pay gap shows that salaries in formal firms are three times as high as in their

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[1]See, among others, literature reviews by De Soto (1989), Charmes (1991), Swaminathan (1991), Schneider and Enste (2003), Gërxhani (2004).

[2]See for instance Loayza and Rigolini (2006).

informal counterparts in urban areas. Consequently, despite the fact that the average productivity rate in Senegal ranks among the top ones in Western Africa, this country appears to be relatively uncompetitive. Indeed, it is dependant on high unitary costs (salaries) in both the formal and the informal sectors.

Furthermore, in that country, the size of the public sector has been kept stable for years, while the formal private sector has only expanded very slowly. Therefore, a majority of jobs are provided within the informal sector. It has notably been boosted by two factors: the 1994 devaluation and the fact that more and more people have been drifting from the land as a result of the groundnut crisis. As rural areas in Senegal got poorer, people have moved to urban areas and have become underpaid workers in the informal urban sector, especially in Dakar. Yet, although this sector has become crucial, funding sources are scarce, even though decentralized financial systems have been developing. Trade makes up for both the main activity in that sector and the main work provider in urban areas, especially for women and urban newcomers. Little education and funding being required for that type of activities, it is valued by Senegalese people.

In order to assess the gap between the relative performance of the formal and informal sectors in terms of productivity, allocation and return to factors such as physical and human capital, we propose to use an original matched employer-employee dataset. Those data allow us to analyze productivity determinants both at the firm and individual levels.

On the one hand, one can consider that these gaps could be partly accounted for by technological and institutional factors which differ sector-wise, and show what types of interaction take place between the firms and their environment. As shown by Cohen and Soto (2007), workers migrating to countries with solid institutions will have, all things equal, higher productivity rates than their fellow citizens who stayed in their country of origin; hence, the same could hold for workers shifting from the informal to the formal sector.

On the other hand, although the part played by the economic, social and institutional context should not be overlooked, our point here is rather to point again that work productivity also depends on the firms' production function and constraints they have to face. Such interconnections are at

the core of some authors' work: according to Acemoglu and Zilibotti (2001), the main factor that accounts for the productivity gap between developed and developing countries lies in the unability of the workforce to adapt to the import of new technologies. A significant chapter in economic literature has also established that the worker's output depends on the firm's size, location, degree of openness and complementarity with other production factors.

Consequently, in order to characterize the firms' production process we have to take care of potential endogeneity biases. In particular, we have to consider that the gaps in output for these production factors may be explained by selection effects, depending on the voluntary or unvoluntary nature of informal work. From a methodological point of view, Fields (2005) and Maloney (2004) recently proposed to categorize those firms as voluntary or unvoluntary players in the informal sector (according to whether their situation in this sector resulted from a deliberate choice or otherwise). Fields' multisector-based approach is mostly inspired by the theoretical background proposed by Lewis (1954). It is an innovative and interesting perspective in order to understand informality since more attention is thus paid to disparities within the informal sector. Indeed, the idea that the firms and workers in that sector wish to join the formal sector but cannot because of rationing or other sources of discrimination is still debated theoretically as well as empirically. Hence, beside the segmented view of the job market, some authors have developed the idea of a competition between the two sectors: in that perspective, the pay gaps concerning production factors result from a selection process[3]. Comparing both views, the evidence derived from empirical tests reveals a low level of competition on the labor market (Magnac (1991) and Gindling (1991)). In other words, these results support the view that informal work could be, to a large extent, disguised formal work, which is not contradictory with the multisector-based types of approach developed more recently.

Taking into account those methodological issues, our strategy is, at the firm level, to propose a detailed decomposition pattern for the informal sector: sub-sectors are taken into account as well as some of the characteristics of the firms (size and age of the firm, etc.). In our analysis, we find much heterogeneity across various activities within each sector. In the formal one, the textile and

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[3]Heckman and Hotz (1986), Magnac (1991), etc.

paper industries are characterized by considerable labor elasticity, making this activity an attractive lever for development. In the informal one, we find that trade and services activities are comparable to formal firms in terms of capital, labor and human capital elasticity. Among them, older firms boast very high capital elasticity, making them a potential source of growth. What is more, following Cunningham and Maloney (2001) and others, we propose to treat heterogeneity in the informal sector and to create homogeneous groups of firms using cluster analysis. In this perspective, the richness of the data is taken into consideration to show how different sector-based returns could be according to the characteristics of the firms and of their employees.

Probing further, we use our matched employer-employee database to explore dual labor market issues and to further test for the existence of human capital externalities on the individual level, those externalities potentially deriving from schooling, experience or gender. Using methods that correct for selectivity biases, we find evidence of a dual labor market on the one hand and, on the other hand, of education externalities in the informal sector.

Finally, global output gaps can be decomposed into return discrepancies and differences in input factors (mostly capital, labor and human capital). That output gap between the formal and informal sectors can be further analyzed using the Oaxaca-Blinder methodology.

The paper is organized as follows. After presenting the economic framework in section two and then the data in section three, we will assess the productivity gap in section four. Section five refines the latter analysis by exploring dual labor market issues and testing for the existence of human capital externalities and offers a final decomposition of the productivity gap. The last section summarizes our main findings and concludes.

2   Economic framework

This section provides a simple framework that accounts for both the macro and micro determinants of productivity. We assume a Cobb-Douglas production function of firm j:

$$Y_j = A_j K_j^{\alpha} (h_j N_j)^{\beta} \tag{1}$$

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where Y_j is output, A_j is a firm specific effect, K_j is physical capital, N_j is labor and h_j is human capital.

Following the recent developments in the macroeconomic literature[4], we specify human capital in firms with a Mincerian functional form. We also account for the possibility of human capital externalities at the level of firms. Although Acemoglu and Angrist (2000) and Ciccone and Peri (2005) find little evidence for the existence of such externalities, these authors focus on developed countries. It might well be the case that, in developing countries, human capital externalities are more important, merely because education is very unevenly distributed[5]. To our knowledge, this study is the first one that assesses such externalities in a developing country. Formally, we define human capital for individual i in country j as

$$h_{i,j} = \exp(rS_{i,j} + \gamma \bar{X}_j) \tag{2}$$

where r is the return to schooling, $S_{i,j}$ years of schooling of worker i in firm j, $\bar{X}_j$ a vector of average characteristics of employees in firm j (such as average years of schooling), and γ the extent of human capital externality[6]. Averaging over individuals from firm j and making the additional assumption that the mean of the exponential is the exponential of the mean[7], one derives human capital in firm j

$$h_j = \exp(r\bar{S}_j + \gamma \bar{X}_j) \tag{3}$$

A case for intra-firms externality can be that, especially in smaller firms, the presence of experimented and educated co-workers can favor apprenticeship and, hence, productivity. Besides, in a production line where high-skilled workers and low-skilled workers collaborate, the improvements in

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[4]See for instance Hall and Jones (1999) or Cohen and Soto (2007).

[5]Intuitively, it may be that the larger the educational gap between individuals, the more profitable the positive externality for the less educated. On the other hand, Bénabou (1996) argues that inequality in education has a detrimental effect. If this is true, then the negative externality of education should be bigger in developing countries, as education is distributed more unequally there.

[6]A simple way to interpret the latter specification is to write formula as follow: $h_{i,j} = \exp(rS_{i,j})(\exp(r\bar{X}_j))^{\gamma/r}$. Hence, γ/r is equal to the elasticity of individual human capital with respect to other employees' human capital.

[7]This assumption is implicitly made in all macroeconomic studies that use the Mincer functional form to proxy human capital; this approximation is valid given that the product $rS_{i,j}$ spans over a small interval over which second-order terms are negligeable.

productivity of some particular workers can impact on other workers' productivity by improving the quality of the final product.

For firm j we obtain by adding an error term:

$$\ln Y_j = \ln A_j + \alpha \ln K_j + \beta \ln N_j + \beta r \bar{S}_j + \beta \gamma \bar{X}_j + \varepsilon_j \tag{4}$$

Assume that we know the values of all the coefficients. Then the output gap between the formal and informal sectors will be naturally explained by the gaps in the various input factors –total factor productivity, labor, physical and human capital as well as within-firms externalities– weighted by their corresponding coefficient. It is the goal of this paper to assess the respective contributions of each input factor in the final output gap.

However, in the above specification[8], the coefficient γ cannot be identified at the aggregate level due to colinearity. Assume for instance that characteristics $\bar{X}_j$ are reduced to schooling $\bar{S}_j$. The estimate for the years of schooling variable in the production function equation is thus equal to $\beta(\gamma + r)$. In order to estimate separately coefficients γ and r we have to work at an individual level. This is why we will use a matched employer-employee database in what follows. More precisely, we consider the following Mincer equation where we include schooling externalities and a vector $Z_{i,j}$ of other individual characteristics

$$\ln w_{i,j} = \mu + r S_{i,j} + \gamma \bar{S}_j + \delta Z_{i,j} + u_{i,j} \tag{5}$$

Two types of biases can arise from our approach. The first bias is an aggregation bias: the γ and r coefficients estimated from the latter two equations should match if wages are equal to marginal products, which is not necessarily true, especially in case of discrimination in the labor market. Another potential source of bias is that education does not have a causal effect on productivity but other unobserved skills are correlated with education. A huge and still unconclusive literature exists on this

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[8]Following Hellerstein, Neumark, and Troske (1999), we will test for non-linear effects or interaction effects in the production function.

issue[9]. The endogeneity of education could be accounted for with consistent instrumental variables. As the scope of the paper is a broad analysis of productivity gaps in the Senegalese economy rather than a focus on education and labor market issues, it is reasonable to abstract from this potential problem. Its impact on our results will however be discussed subsequently.

3 Data

3.1 Main issues and available data on the labor market

The first set of statistics that enables us to describe the firms' productivity and work patterns in the formal and informal sectors derive from national accounting and census.

Upon examining these statistics, it appears that the productivity of Senegalese firms in the formal sector is relatively low when compared with that in most emerging countries (China, Latin America...). Above all, in a dynamic perspective, yearly productivity gains are minimal as they rarely exceed 2% a year, which widens the gap between Senegal and countries that do well and hinders the emergence of firms that are truly competitive firms on a national level.

In the informal sector, the situation is even more a cause for concern: compared to the formal sector, its average productivity is between 3 and 10 times inferior, while its share in the labor market has drastically increased over the last decade -up to 97% of new jobs between 1995 and 2004 according to national accounting figures. In 10 years, employment has increased by 3% in the informal sector and only by 1% in the formal one (World Bank (2007)).

Thus, the informal sector appears to be by far the first work provider in Senegal, including in urban areas and during periods of more sustained economic growth (on average, economic growth in Senegal has been about 5% a year since 2000).

The point is thus to know whether such an influx of labor force in an economy where surplus labor force is a basic fact (due to high population growth, almost half of the Senegalese people are currently under 20, which means that 100 000 youths enter the job market every year[10]) may result

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[9]See Card (2001) for a review.

[10]Note that in the Dakar area -where nearly 18% of people are new migrants- the demographic pressure is even

in a productivity slowdown (even as productivity is already very weak), and could induce a surge in inequalities and poverty. Indeed, public decision-makers have to be concerned with the problems people experience to get a decent job and salary, as this is a necessity to preserve social and political balance in Senegal and help towards the country's emergence.

This first economic picture of Senegal may be completed thanks to microeconomic data. Yet, the microeconomic information available concerning the labor market in Western Africa is very incomplete. Data sources are scarce and often disparate. They hardly say anything about the dynamics of employment and, in principle, do not allow comparisons between the formal and informal sectors. These shortcomings of statistical systems in Subsaharian Africa have led Afristat and the World Bank to conduct separate surveys on employment and the labor market in these countries: that is namely, the 1-2-3 survey, conducted in 2003, on employment and the informal sector in Dakar on the one hand, and, on the other hand, the Dakar-based[11] survey conducted in 2003/2004 with firms from the formal sector in parallel with the Investment Climate Assessment (ICA).

The information collected during the second stage of the 1-2-3 survey is focused, on the one hand, on the firms, with a large number of characteristics filled in concerning their workforce, production, expenditure, clients/providers and competitors, investments/equipment and funding, problems and perspectives, etc.. On the other hand, the employee-related information provided is about their demographic characteristics, education, salary, job seniority, etc..

The data collected in the ICA survey deal with the firms' and their employees's characteristics, as well as with the opinion of entrepreneurs on the ways to improve the context for private firms and increase investment and employment. The data collected at firm level have to do with technology, trading activities, business environment, work force, capital, etc.. The employee-related information provides such variables as occupation, education, salary, etc..

With these two surveys, both the salaries and the mean levels of work productivity can be further investigated in terms of the firms' and workers' features –keeping in mind, though, that they hardly cover any area beyond the Dakar area. The advantage of these data is that they provide a wide range

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stronger.

[11]96% of the firms are located in Dakar, 2% in Saint-Louis and the rest in Ziguinchor, Kaolack and Thies.

of information concerning both the firms and their employees. Moreover, as similar surveys were conducted in other countries, our findings for Senegal can be compared with those for other Western African countries.

3.2 Informal work in Dakar

Informal work is often first defined by the size of the firms. Indeed, upon examining the 1-2-3 survey data, it appears that formal work in Senegal tends to be found more in relatively large firms, while over 80% of informal work is concentrated among firms with fewer than 10 employees. Yet, the data enable us to investigate informal work in Dakar in more details. First, the workers from the informal sector are generally considered to be less productive than those from the formal sector: given their chronic lack of qualifications and complementarity with other production factors, their pay is lower. It thus appears essential to characterize the firms' production process by analyzing the determinants of both productivity and salaries, as we are going to do it in this paper. Secondly, informal workers do not have access to official social welfare systems and may not have a written contract. Finally, informal workers work in firms that are rarely registered with the Chamber of commerce.

What can first be stated when examining these surveys is that the majority of jobs in urban areas are informal insofar as almost 95% of workers are not covered by any formal welfare system. This can be partly accounted for by the fact that a relatively small number of people work in formal firms, as almost 2/3 of workers are self-employed or work in some kind of family business which are rarely officially registered. It is interesting to note that those workers employed in a firm registered with the chamber of commerce are extremely likely (about 90%) to have a contract in due form, and thus also have some kind of social welfare. Yet, they only have a one-in-five chance to be affiliated with a welfare center (CSS).

Table 1 presents the characteristics of workers in the labor market. It shows significant disparities in wages and education between the manufacturing sector and the informal one. The ratio of average (resp. median) wages is equal to 2.1 (resp. 2.9) across the two sectors, while wages inequality given by the ratio between the percentiles 75 and 25 is much higher in the informal sector with a ratio of 5.1

versus 2.6 in the formal sector. Most of the skilled workers are concentrated in the formal sector, with an average level of schooling three times as high in terms of years of schooling; only 10% of workers have had no schooling in the formal sector versus 53% in the informal; in contrast, 40% have entered University in the formal sector versus 3% in the informal sector. Those figures are not a composition bias since the distribution of age is more or less the same across the two sectors.

3.3 A first assessment of the productivity gap

In Table 2, we turn to the characteristics of firms. Wages are on average 2.7 times higher in the formal sector, while years of schooling is on average 3.3 times as high in the formal sector when compared with the informal one[12].

Firms employ on average 122.4 workers in the formal sector and only 1.7 in the informal one. In the informal sector the vast majority of firms employ one single worker/entrepreneur (72% of informal firms are individual firms), while 80% of formal firms employ more than 10 workers. As a consequence of their smaller size –and of their great number– informal firms use permanent workers more intensively than formal ones: 87% of permanent workers versus 69%.

Then, in formal firms, the capital per worker is on average 47 times as high as in informal ones. The ratio of the median capital per worker is 60. Those gaps logically bring about significant disparities in terms of productivity, when proxied by the ratio of output per hour worked. This ratio is on average 6.8 and quite the same for any part of the distribution of productivity: the ratio of percentiles 25 (resp. 50 and 75) is 7.0 (resp. 5.8 and 5.5). Interestingly, the ratio across both sectors is approximately the same if we consider the output per worker: it amounts to 6.1 for the ratio of average values. This similitude means that the distribution of hours worked per worker should be the same across both sectors.

Output accounting shows that sector-based differences in inputs can explain a large fraction of differences in labor productivity. Assume that in equation (4) $\alpha = 1 - \beta = 0.25, \gamma = 0, r = 0.10$, hence that returns to scale are constant and that there is no human capital externality. Assume further

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[12] Average wages in Table 2 are very similar to those depicted in Table 1. This means data at individual and firm levels are fully compatible. But they do not match exactly because of differences in firm sizes.

that the ratio of output per worker is equal to 6.1, that of physical capital is equal to 47.4 and the difference in average years of schooling is equal to 6.5. Then we have the following decomposition of the productivity gap:

$$\underset{\ln(6.1)=1.81}{\Delta \ln Y/N} = \underset{0.36}{\Delta \ln(A)} + \underset{0.25\times\ln(47.4)=0.96}{\alpha\Delta \ln(K/N)} + \underset{0.75\times0.1\times6.5=0.49}{(1-\alpha)r\Delta S}$$

This suggests as a preliminary conclusion that differences in observed factors account for 80% of observed differences in average productivity. In other words, the informal sector mostly suffers from a lack of capital and education. Of course, this is only a preliminary conclusion since capital elasticities are not necessarily equal to 0.25 and may differ across sectors, the return to schooling may not be equal to 10% and so forth. Consequently, differences in technological and in institutional environments as well as education externalities could also matter.

To further document the data, we draw two figures (one for the formal sector and the other for the informal one) by crossing value added per worker with capital per worker in the various sectors. Figure 1 shows that value added is an increasing function of capital per worker in the formal sector but a decreasing function of capital per worker in the informal one. These discrepancies are further discussed in the following sections where the analysis is now focused on sector-based differences in productivity.

4 Assessing the production functions of the formal and informal sectors

In this section, we examine how the production function varies across the formal and informal sectors, as well as within those sectors.

Figure 1: Sector-based disparities in value added per worker and capital per worker
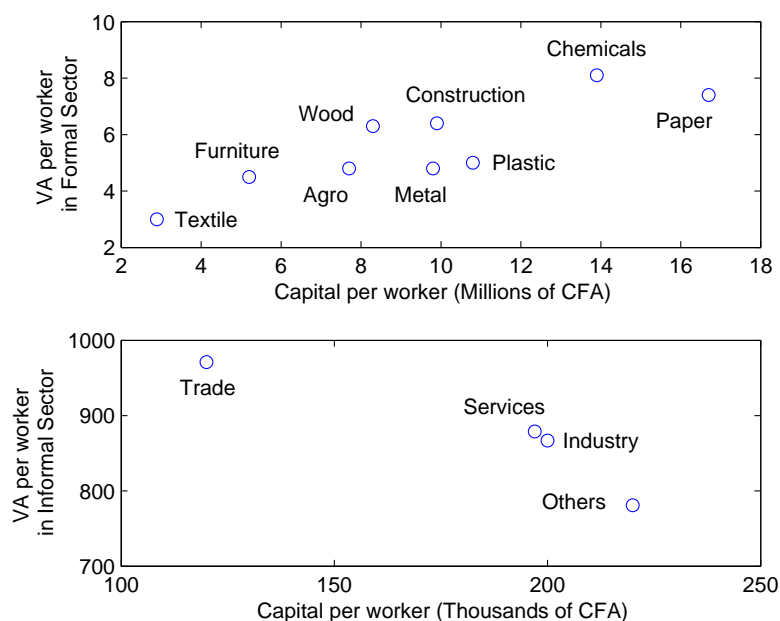
4.1 Basic results

Table 3 reports a manifold of regressions across both sectors. In columns (I), we regress the logarithm of value added on the logarithm of capital and on the logarithm of the number of workers. We find that capital elasticity amounts to 0.32 (resp. 0.17) in the formal (resp. informal) sector, and labor elasticity amounts to 1.00 (resp. 0.65). This basic regression thus shows increasing returns to scale for the formal sector (the sum of the coefficients on capital and labor being 1.32) and decreasing returns to scale for the informal sector (the sum of the coefficients on capital and labor being 0.82). Hence, these preliminary estimates imply that large firms (in the formal sector) are too small and small firms (in the informal sector) are too large and that factors elasticities may differ significantly across the two sectors.

Columns (II) moderate the latter conclusion: once we control for a quadric in average age, the percentage of female workers and average schooling, capital elasticities reach a similar value at around 0.15. It was overestimated in the previous regression for the formal sector because of the positive correlation between capital and schooling[13]. Similarly, labor elasticity was underestimated in the

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[13]Experience (or age) is not correlated with capital.

previous regression because of the positive correlation between the number of workers and the percentage of female workers, as well as the negative impact of the latter on production. Interestingly, average schooling within firm has a coefficient of 0.07, in tune with usual values for private returns in the formal sector, and is not significant in the informal sector. It suggests that schooling is indeed a productive input in the formal sector but does not display large externalities –otherwise this coefficient would have been much larger–, and is not productive in the informal sector.

In columns (III), we introduce a cubic in log-capital and log-labor in order to detect non-linear effects. These are negligible in the formal sector since one term over six is significant, but do exist in the informal sector for capital. The magnitude and the sign of those coefficients suggests that this effect is strong: doubling the median capital per worker of 156,000 entails an increase of 22 percentage points of capital elasticity. Hence, it appears from these results that some significant gains of productivity may be realized in the informal sector by augmenting capitalistic concentration, and all the more so when firms are small. However, a question is how factor markets operate that prevent this happening?

Columns (IV) test the idea that there might be a series of interactions between capital, labor, schooling and experience. Some positive ones are brought to light for capital and schooling in the formal sector, while negative ones appear in the informal sector, which suggests that those inputs are complementary in the former and substitute in the latter. On the other hand, we find negative interaction effects for labor and schooling in the formal sector and positive ones in the informal sector. But overall, a large fraction of these non-linear and interaction effects are found to be insignificant. Although we do not probe much further on this issue here, it could be investigated more thoroughly with a larger set of data.

Next, we examine whether there are significant differences across the sub-sectors that make up respectively the informal and the formal sectors.

4.2 Heterogeneity within formal and informal sectors

Table 4 reports differences across sub-sectors. In the formal sector, we have built three sub-sectors of comparable size: the agro-industry, the "Metal sub-sector" –made up of the sub-sectors "Metallic products", "Materials for construction", "Chemicals", "Plastic"– and the "Textile sub-sector" –made up of the sub-sectors "Textile", "Industry of paper", "Furniture", "Wood". In the informal sector, we have built a classification "Primary and Others", "Industry", "Trade" and "Services" following the original features.

We first consider the formal sector. It turns out that the relatively low elasticity of capital in Table 3 (0.18 in column (II)) can be explained by the low elasticity in the agro sub-sector. In both the "Metal" and the "Textile" sub-sectors, capital elasticity is close to 0.3 (though not significant for the latter sub-sector). Moreover, labor elasticity is large in all sub-sectors, especially in the "Textile" sub-sector.

Turning to the informal sector, it is striking that capital elasticity differs largely across sub-sectors: capital does not matter in the "Industry" sub-sector, while it has an elasticity of respectively 0.18 and 0.24 in the "Trade" and "Services" sub-sectors. These are almost equal to the levels of the best sectors in the formal industry. Also, schooling becomes significant in the "Services" sub-sector. Given that the informal sector employs a large part of the population, we believe that this result is important: it shows that some activities from the informal sector use factors in an efficient way. The informal sector is therefore not uniformly low-productive. Trade and services activities in particular display very similar structure of production as formal firms, especially in the "Service" sub-sector that exhibits increasing returns to scale and positive returns of schooling.

However, those findings constitute an apparent paradox: although several informal sub-sectors display constant (for trade) or increasing returns to scale (for services), the average size of firms is low and so are their mean levels of productivity, education and capital per capita when compared with the various sub-sectors of the formal economy. Table 5 presents the variables for each sub-sector. It appears that the informal sub-sectors are almost only local (around 2% are exporting firms), and that the proportion of female workers is about two to five times as high as in the formal sector. On these

points, the formal sub-sectors appear to be quite homogeneous: a comparable proportion of women (around 13%) and about one third of these firms are exporters. Note finally that in the informal sector, firms are on average 9.4 years old, with very little variation across sub-sectors (among the sub-sectors, trade has the shortest length of existence, while industry appears to have the longest one). These relatively young firms are characteristic of a sector where workers are largely self-employed. However, much heterogeneity should be observed regarding the firm's length of existence since the difference between percentiles 75 and 25 is 10 years, the difference between percentiles 90 and 10 is 20 years, etc..

One theoretical approach of the influence of experience on firms' selection is the one of Jovanovic (1982) who considers that myopic agents may not anticipate the optimal size of the firm. In this view, older firms are considered to have joined there optimal size and factors composition, while younger firms may not. Then, as we observed, among the informal firms the optimal size appears to be very low though much heterogeneity can be observed among firms concerning physical and human capital composition. This heterogeneity among firms could be an indication of myopic behavior, as opposed to market failures. Hence, looking at older firms may give some information on optimality while not viable firms will disappear. In particular, it is possible to document a positive correlation between the year an informal firm was funded and their capital elasticity, as given by equation (II) in table 3. Year of creation can be interpreted as a proxy for the unobserved ability of the owner, since a firm's survival depends on the latter ability[14]. Therefore, the oldest the vintage, the most efficient the use of capital. And indeed, we find that the oldest the vintage, the highest the capital elasticity, particularly in the sub-sector of trade. As shown in Figure 2, we do find such a result for "Trade" and, to a lesser extent, for "Services" sub-sectors. This figure plots capital elasticity for all firms existing in the mentioned year on the horizontal axis. We do not find such a correlation for labor elasticity.

We now have to regard the choice of the firms' production factors as being potentially endogenous. Indeed, performance may depend not only on the firm's length of existence, but also on its capital level, size, workforce's education level, etc.. Yet, the selection of instrumental variables appears to

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[14]Ability encompasses here information on the market, networks, managerial practices and so forth.

Figure 2: Capital elasticity and year of creation of informal firms
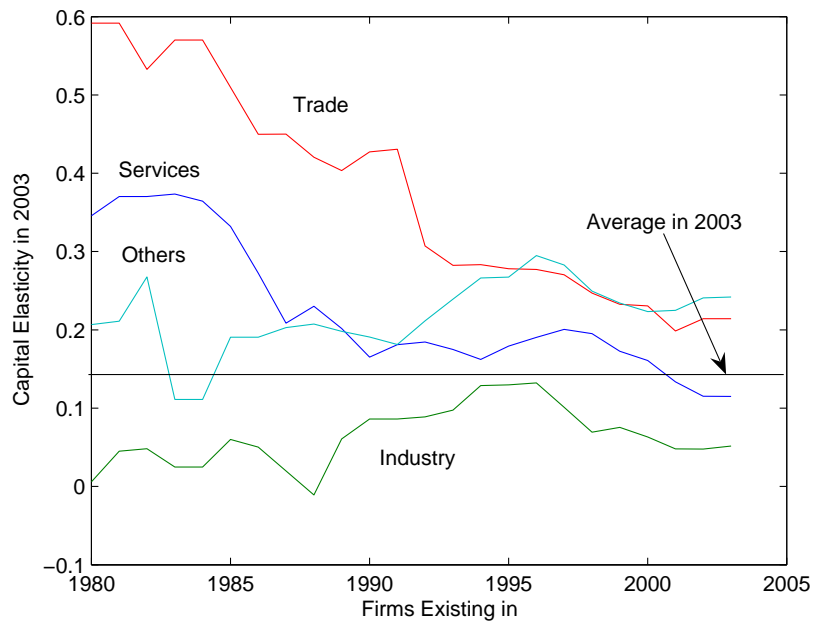
be a problem in connection with a rigorous analysis of this issue. For instance, if selecting a certain level of capital for the firm depends on the experience or skills of an entrepreneur with more or less knowledge of the market conditions, these very experience or skills may also be correlated with the return on this capital. In that case, the entrepreneur's experience or, alternatively, the firm's length of existence do not appear to be valid instruments in order to correct the endogeneity bias in the production equation.

Consequently, to probe further in the analysis and describe heterogeneity in the informal sector, we propose to use a descriptive approach similar to that advocated by Cunningham and Maloney (2001). We analyze "upper" and "lower" tiers of informal firms using cluster analysis. For this classification-based analysis, we adopted the variables of equation (II) in table 3, on top of the firm's length of existence. Three distinct clusters were retained as a result of this process. In order to characterize these clusters, we included them into the regressions. Increasing the number of clusters only improves adjusted R-squared marginally and provides very small clusters from the 4th one on. Thus, as mentioned in table 6, adding two dummies for clusters 2 and 3 (the first cluster being used as the benchmark) enables us to explain the extra 31 percentage points variance, while adding a fourth

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cluster would have accounted for one extra percentage point (on its own). Each dummy appears to be very significant in the regression. Moreover, the firms in the second cluster appear to perform better in terms of productivity than those in the first one, while the firms in the third cluster perform better than those in the first two ones. Table 7 presents each cluster with mean values for the active variables in the analysis: clusters 2 and 3 are more productive and capitalistic than cluster 1 which comprises about 82% of the informal firms. The latter firms, which do not perform as well, also appear to be younger and smaller than those in the other two clusters.

Moreover, it should be noted that the results of the classification remain almost unchanged whatever the extra variables introduced in the analysis (they remain practically unchanged when all of them are used). The variables that were introduced in the classification deal with the firms' environment, workforce, access to infrastructures and degree of formalization. Although these variables were not retained in the classification, they enable us to characterize the clusters as presented in table 8. Average salaries for clusters 1 and 2 range from 5 to 14 times as high as in the first cluster; a lesser proportion of women work there, yet they are not concentrated within one particular sub-sector (they appear to be a little more numerous in the primary sector, mostly in cluster 2). What's more, the proportion of firms whose head is a woman is lower in clusters 2 and 3 (resp. 30.8% and 13.6%) than in cluster 1 (resp. 53.8%), the proportion of permanent workers is respectively 92.1% and 97.3% in clusters 2 and 3 while it is 85.6% in the first cluster. A lesser proportion of employees belong to the firm's head family in clusters 2 and 3. Concerning the access to infrastructures, a greater proportion of firms (resp. 42.1% and 63.6%) have a professional office in clusters 2 and 3, when compared with cluster 1 (14.5%); access to water, electricity and telecommunications is also easier for firms in the last two clusters.

In order to show how close firms from the formal and informal sectors are, we describe in table 9 the various clusters according to their degree of formalization and official registration: a greater proportion of firms from clusters 2 and 3 have a taxpayer code (resp. 1.3% and 4.5% against 0.4% in cluster 1), are commercially registred (resp. 11.3% and 9.1% against 2.7% in cluster 1), display a professional card (resp. 13.2% and 27.3% against 2.0% in cluster 1) or have a license (resp. 6.9% and

9.1% against 1.2% in cluster 1). Moreover, the firms in clusters 2 and 3 tend to register more often their firms with the administration (resp. 68.6% and 59.1% against 38.5% in cluster 1), or to pay taxes in connection with their business (resp. 70.4% and 81.8% against 42.9% in cluster 1). The firms are also described according to the size of their main clients, providers or competitors: in clusters 2 and 3, the proportion of firms dealing with larger or public firms from the formal sector appear to be greater than in cluster 1.

Other variables are used in order to study whether their situation in this sector results from a deliberate choice or otherwise. Table 9 thus charts the reasons of informal work by firms and clusters. To some extent, this enables us to answer a fundamental question: why entrepreneurs form small firms rather than work as employees in larger ones? The reasons usually given in clusters 2 and 3 are: a better income (31.8% in cluster 3, against 20.1% in cluster 1 and 25.8% in cluster 2) or self-employment (40.3% in cluster 2 against 31.9% in cluster 1 and 27.3% in cluster 3); less often, the lack of jobs (18.9% in cluster 2 and 13.6% in cluster 3 against 30.9% in cluster 1).

All in all, these results show that the overall performance of some sub-sectors should be put into perspective. If some firms perform well in each sector, it cannot be argued that this is because they belong to one sector rather than to the other. This is evidence that inter-firm heterogeneity is more important than inter-sector heterogeneity to characterize performance disparities in the informal sector. For lack of instruments to predict the choice of factors or sectors, we are unable to test this hypothesis in a more formal way, but the cluster analysis yields interesting results: the capitalistic intensity and productivity being higher in clusters 2 and 3 than in cluster 1 coincides with their closeness to the firms in the formal sector. For those firms, the choice of informality appears to be more often a voluntary one, and there are fewer problems in connection with the access to infrastructures.

5 Microeconomic determinants of productivity in the formal and informal sectors

We turn to the analysis of productivity differences between the formal and informal sectors at the individual level. First, we describe returns to schooling by sub-sector, and, second, we explore dual labor market issues. We also investigate the existence of externalities. Finally, we decompose the output gap between formal and informal sectors with respect to the underlying discrepancies in input factors and their estimated returns.

5.1 Human capital and returns to education

Table 10 reports the wage-related effect of schooling in the formal sector and its sub-sectors. What we call "wage effect" will be called "return to schooling" in the following, which might be an improper term because a return includes the cost of education in the forms of tuition and opportunity cost as well as the effect of taxes as documented in Heckman, Lochner, and Todd (2005). We find that in the formal sector, returns to schooling seem to be stable across sub-sectors and amounts to 7%. In contrast, in the informal sector there is a significant difference between Trade and Services sub-sectors and the other ones: in those sub-sectors the return to schooling is significant and amounts to 6% while in the others it is null.

5.2 Exploring dual labor market issues

Arguably, an educational policy that would lower the costs and improve the level and quality of education could bring about a better-qualified workforce and in an improved productivity for Senegalese firms. However, no educational policy can yield good results as long as the differences in earnings due to human capital are mainly caused by institutional rigidities or discrimination. Such rigidities stop part of the workforce to work in the formal sector, either for lack of qualifications, or for other reasons linked to gender, age, etc.. Indeed, in terms of human capital, anyone faced with no choice but to work in the informal sector is less valued than if he/she worked in the formal sector. If such constraints

were removed, the return to education should be the same, whatever sector people choose to work in. In that case, the observed differences in output could be the result of an actual selection process –people select the sector with the best return in terms of their unobserved individual characteristics–, a process that appears necessary to take into account when estimating the returns to education.

Consequently, when the labor market is dual, workers with the same characteristics have drastically different wages and working conditions according to whether they work in the informal or in the formal sector. In that case, employment policies should focus on the convergence of working conditions for both informal and formal workers: that is, more security for the former, and more flexibility for the latter.

In Senegal, the 1994 CFAF devaluation caused costs to decrease sharply in the formal and public sectors; moreover, it also brought about more favorable conditions for investments in the informal sector (Azam (2004)). Yet, its impact on poverty remains equivocal; the growth of business and of the informal sector in connection with the demographic surge in Senegal eases the situation of families on the one hand, but also worsens the lack of job security. All in all, although official statistics tend to show that poverty has decreased over the last decade, working conditions remain a problem for informal workers.

Examining how jobs are chosen on the labor market enables us to shed new light on this issue. In that perspective, several types of workers may be considered: wage-earners in the formal sector, wage-earners in the informal sector and self-employed in the informal sector. Table 11 compares mean earnings, age, education and gender of this three categories of workers.

We then add controls for sample selection in the earnings equations previously estimated. As in Lee (1983) or Saavedra and Chong (1999) we use a two stage method for the estimation of occupational choices and earnings equations for each category of workers to correct for selection bias. Following recommendation by Bourguignon, Fournier, and Gurgand (2007) we also provide estimates for two alternative approaches of selectivity correction proposed by Dubin and McFadden (1984) and Dahl (2002) and compare the estimates with the ones obtain with the Lee (1983)'s method that is the most commonly used in empirical works. The three estimation procedures state as follows. In a first

step, we estimate a multinomial logit model in order to determine the probabibity that a person is occupied in one of the three categories. In a second step, we estimate earnings equations for each categories of workers. Selectivity bias is accounted for using Mills' ratio (or correction term) variables calculated from the first stage in the second stage of the estimation.

Results from the multinomial logit model are presented in table 12 using wage-earners of the formal sector as the reference category. Marginal effects and their standard errors are reported below in table 13. The probability to join one of the three categories of workers depends on schooling, age and age squared, gender and a family dummy variable that values 1 if the informal (resp. formal) worker belongs to the same family of the creator (resp. owner) of the firm and 0 otherwise. This latter variable has a positive and significative effect for predicting selection in the informal sector, especially as self-employed worker. We also find significative effect of schooling, age and gender: less educated worker have greater probability to be in the informal sector, while older worker have greater probability to be in the formal sector or self-employed in the informal sector. Women mostly self-select in the informal sector as self-employed workers.

Results from the estimates of the earnings equations for each category of workers are presented in table 14. Selectivity corrected estimates are compared with OLS estimates. The significativity of the correction terms in the equations inform us about whether there are selection bias or not in the OLS estimates. For instance, in the basic Lee's selectivity correction estimates we find that Mills' ratio is positive and significantly different from zero at five per cent for the wage-earners in the informal sector. For those workers correcting for selection bias leads to high and significant returns to education and increases the estimated coefficient for age and lowers the estimated female specific effect. Returns to schooling get higher for wage-earner in the formal sector and are still not significant for self-employed in the informal sector. Estimates from the Dahl's method of selectivity correction lead to approximately the same conclusions. However, estimates from the Dubin-McFadden's method does not yield to a significative coefficient for schooling for wage-earner in the informal sector. Thus correcting for selectivity bias with those methods put some doubts on the robustness on the schooling coefficient estimates.

As the return to education could be non-existent in the informal sector, especially for self-employed workers, and substantial in the formal one, we have an interesting indication of the extent to which the labor market is segmented. To complete our exploration of the dual labor market, we further document the earnings-generating process by investigating the part played by experience and education externalities.

5.3 Looking for externalities

Investigating externalities –i.e. positive or negative side-effects due to interactions between agents– is an interesting issue in the literature: for instance, small externalities linked to education have been put forward by Acemoglu and Angrist (2000), while peer effects in the classroom are still a debated topics. We examine the existence of externalities within the firm by including some firm-based variables in micro regressions. We test the existence of externalities for schooling, experience, gender, and family membership. We only reports in table 15 the results for education externalities since they are the most prominent ones. We find small externalities derived from the average schooling level within the firm in the formal sector, and a major externality of the boss' schooling level in the informal sector either with OLS estimates and selectivity corrected estimates (the table only presents estimates from the Lee's method since the others are very similar). In fact, boss' schooling carries all the effect of education on earnings since individual schooling and average schooling within informal firms are not significant when one controls for boss' schooling. As a result, there are indeed externalities linked to education both in the formal and informal sectors, but these are moderate in the former and central in the latter.

Finally, using previous aggregate and individual estimates, we can test their consistency by comparing coefficient of average schooling in the production equation with those in the wage equation. As discussed in section 2, the coefficient estimate for the schooling variable in the production function equation (given in table 4) is a composite coefficient $\beta(r + \gamma)$ whose value is 0.07 in the formal sector and 0.01 but non significantly different from 0 in the informal sector. Taking estimates of labor elasticity β (1.16 for the formal sector and 0.71 in the informal one) and comparing with co-

efficient estimates γ (0.01 for the formal sector and 0.03 in the informal one) and r (0.07 for the formal sector and 0 in the informal one) in table 15, we show that our estimates are consistent since $1.16 \times (0.07+0.01) \approx 0.09$ in the formal sector and $0.71 \times (0+0.03) \approx 0.02$ in the informal sector.

As a conclusion, estimates of earnings equation show that the returns to education and experience (tenure) are positive and substantial in the formal sector while null in the informal sector. This is typically the way the dual labor market is exemplified in economic theory. However, findings of positive externalities of education in the informal sector qualify that result. That is why we think that the issue of externality represents much of a concern for future investigations on the functioning of the Senegalese labor market.

5.4 Assessing the output gap

This leads us to an assessment of the output gap that takes into account education externalities at the individual level. Recalling equation 4, it becomes clear that the output gap derives from differences in both inputs and inputs returns. As benchmark values, we choose capital and labor elasticities given by columns (II) in table 3. We use microeconomic estimates of returns to education and education externalities from table 14.

Following the usual Oaxaca-Blinder methodology, we can decompose the output gap with respect to differences in inputs and differences in returns of these inputs. Noticing $\Delta X = X - X^*$ where X corresponds to the formal sector and X^* to the informal one, and $\lambda = \beta(r + \gamma)$, equation 4 can be rewritten as

$$\Delta \ln(Y) = \Delta \ln(A) + \alpha \Delta \ln(K) + (\Delta \alpha) \ln(K^*)$$
$$+ \beta \Delta \ln(N) + (\Delta \beta) \ln(N^*)$$
$$+ \lambda \Delta S + (\Delta \lambda) S^*$$

Table 16 provides the respective contributions of each of these terms using data-based estimates. As a matter of fact, the gap in inputs across formal and informal sectors contributes for 59% of the

gap in output while the gap in inputs returns contributes for only 5%. Redoing the estimates with the average productivity gap shows that total factor productivity contributes for about one half of this gap.

6   Conclusion

The expansion of the informal sector in Senegal over the last decade puts forward the question of its sustainability. Indeed, the influx of low-skilled, badly paid and precarious workers is a problem for the economic growth of the country, but also in terms of poverty. The informal sector already makes up for most jobs, including in urban areas as in Dakar, and it keeps expanding.

In this paper we have explained the output gap between Senegalese formal and informal sectors in terms of allocations and returns of factors. We have shown that the ratio in the output gap across both sectors could mostly be accounted for by differences in human and physical capital. Differences in inputs and differences in inputs' returns explain about two thirds of the output gap. Hence, policy makers may want to increase the quantity of capital and improve workers' education in the informal sector in order to augment total output and productivity. However, even correctly estimated, the gap in the inputs elasticities could reflect self-selection of most productive agents in most productive sectors. For instance, any policy aiming at fostering trade informal activities on the basis of the latter results might be subject to disappointing outcomes if the current good performance of this sector is explained by its higher skill intensity, which might decrease if this sector grows in size.

More generally, any public policy modifying the distribution of inputs in one sector might entail general equilibrium effects such as labor and capital reallocations, which in turn might modify the estimated elasticities and the outcome of reforms. However, having a better vision of the current productivity gaps across formal and informal sectors is certainly very useful. In that respect, we found quite striking that some subsets of the informal sector can sustain the comparison with formal firms, and display somewhat high levels of productivity.

However, we also find that the Senegalese economy is deeply cleaved, between productive and

non productive firms in the informal sector and voluntary and involuntary jobs on the labor market that proves to be dual. Indeed, the return to education for employees in the formal sector is about 7%, while it is negligible for workers in the informal sector. Likewise, the return on experience is positive in the formal sector, while it is non-existent in the informal one. Yet, one note of hope can be derived from the education externalities that we could assess: in the informal sector, it appears that the boss's education level has a positive and significant impact on her employees' wages.

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Table 1: Characteristics of workers in formal and informal sectors

		Formal	Informal
Number of observations		1 488	1 349
Wages			
(thousands of CFAF)	Average	1 962	937
	P25	840	192
	P50	1 200	420
	P75	2 218	984
Schooling (in %)			
	Average (years)	10.3	2.9
	P25	6	0
	P50	10	0
	P75	15	6
	No schooling	9.6	52.9
	Primary (1-6 years)	20.4	35.5
	Secondary (7-12 years)	29.8	8.9
	College (>12)	40.2	2.7
Age			
	Average	37.6	35.3
	P25	30.0	25.0
	P50	37.0	33.0
	P75	45.0	43.0
% of female workers		17.2	40.7

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).

Table 2: Characteristics of firms in formal and informal sectors

		Formal	Informal
Number of observations		250	1 024
Firm size			
	Average	122.4	1.7
	P25	12	1
	P50	30	1
	P75	77	2
Permanent workers			
(in %)	Average	69.0	86.8
	P25	44.2	100.0
	P50	73.4	100.0
	P75	100.0	100.0
Labor productivity			
(thousands of CFAF)	Average	6.1	0.9
(output per hour worked)	P25	1.4	0.2
	P50	2.9	0.5
	P75	5.5	1.0
Output per worker			
(thousands of CFAF)	Average	10 500	1 723
	P25	2 100	488
	P50	4 835	884
	P75	9 293	1 968
Capital per worker			
(thousands of CFAF)	Average	70 900	1 497
	P25	3 008	53
	P50	9 310	156
	P75	23 800	828
Wages per worker			
(thousands of CFAF)	Average	1996	740
	P25	728	204
	P50	1 207	396
	P75	2 178	817
Average schooling			
in firms (in %)	Average (years)	9.3	2.8
	No schooling	0	48.8
	Primary (1-6 years)	12.0	38.1
	Secondary (7-12 years)	54.8	10.8
	College (>12)	33.2	2.3

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).

Table 3: OLS estimates of the production function in formal and informal sectors

	Formal				Informal			
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
$\ln K$	0.32**	0.18**	-2.54	-6.31	0.17**	0.14**	1.00**	1.10**
	0.07	*0.07*	*8.33*	*9.56*	*0.02*	*0.02*	*0.32*	*0.33*
$(\ln K)^2$			0.14	0.33			-0.14**	-0.15**
			0.45	*0.51*			*0.05*	*0.05*
$(\ln K)^3$			-0.002	-0.006			0.007**	0.008**
			0.008	*0.009*			*0.003*	*0.003*
$\ln N$	1.00**	1.16**	-0.42	-1.68	0.65**	0.71**	0.62	0.37
	0.11	*0.12*	*1.79*	*2.54*	*0.06*	*0.07*	*0.44*	*0.52*
$(\ln N)^2$			0.55	0.60			0.23	0.21
			0.51	*0.57*			*0.60*	*0.61*
$(\ln N)^3$			-0.06	-0.07			-0.10	-0.07
			0.05	*0.03*			*0.19*	*0.19*
% of Females		-1.35**	-1.52**	-1.83**		-0.22**	-0.22**	-0.21**
		0.68	*0.71*	*0.78*		*0.07*	*0.07*	*0.07*
Age		0.44**	0.44**	0.42**		0.06**	0.06**	0.06**
		0.18	*0.18*	*0.22*		*0.01*	*0.01*	*0.02*
Age^2		-0.005**	-0.005**	-0.007**		-0.001**	-0.001**	0.001**
		0.002	*0.002*	*0.003*		*0.000*	*0.000*	*0.000*
Schooling		0.07**	0.07*	-0.21		0.01	0.01	0.05
		0.04	*0.04*	*0.46*		*0.01*	*0.01*	*0.04*
$\ln K$.Schooling				0.04				-0.01**
				0.03				*0.005*
$\ln N$.Schooling				-0.06				0.04*
				0.04				*0.02*
$\ln K$.Age				0.006				-0.002
				0.012				*0.001*
$\ln N$.Age				0.03				0.012*
				0.02				*0.007*
Schooling.Age				-0.006				0.001
				0.008				*0.001*
$\ln K$.$\ln N$				0.05				-0.04
				0.11				*0.04*
Adjusted R^2	0.67	0.68	0.68	0.68	0.25	0.27	0.28	0.28
Number of observations	126	111	111	111	926	926	926	926

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).

Notes: Dependent variable is log value added at firm level. ** significant at 5% level. * significant at 10% level. Standard errors are in italics.

Table 4: Regression of log value added on human and physical capital across sectors

	Formal				Informal				
	(Overall)	(Agro)	(Metal)	(Text)	(Overall)	(Others)	(Indus)	(Trade)	(Services)
ln K	0.18**	0.15	0.28**	0.26	0.14**	0.12**	0.05	0.18**	0.24**
	0.07	*0.10*	*0.11*	*0.18*	*0.02*	*0.03*	*0.05*	*0.04*	*0.03*
ln N	1.16**	0.95**	0.84**	1.78**	0.71**	0.66**	0.83**	0.73**	0.89**
	0.12	*0.13*	*0.21*	*0.29*	*0.07*	*0.11*	*0.12*	*0.22*	*0.13*
% of Females	-1.35**	-1.35**	-3.47*	-1.46	-0.22**	-0.26**	-0.47**	-0.36**	0.18
	0.68	*0.68*	*1.92*	*1.52*	*0.07*	*0.13*	*0.17*	*0.15*	*0.15*
Age	0.44**	0.29	-0.30	0.93**	0.06**	0.07**	0.07**	0.06**	0.10**
	0.18	*0.19*	*0.37*	*0.39*	*0.01*	*0.03*	*0.03*	*0.03*	*0.04*
Age^2	-0.005**	-0.003	0.004	-0.012**	-0.001**	-0.001**	-0.001**	-0.001*	-0.001**
	0.002	*0.003*	*0.005*	*0.005*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Schooling	0.07**	0.08**	0.08	0.05	0.01	-0.01	0.01	0.01	0.03**
	0.04	*0.04*	*0.06*	*0.08*	*0.01*	*0.02*	*0.02*	*0.02*	*0.01*
Adjusted R^2	0.67	0.82	0.69	0.65	0.27	0.25	0.30	0.21	0.48
N	111	40	36	35	926	308	170	263	185

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).
Notes: ** significant at 5% level. * significant at 10% level. Standard errors are in italics.

Table 5: Characteristics of firms and their employees across sectors (mean values)

	Formal				Informal				
	(Overall)	(Agro)	(Metal)	(Text)	(Overall)	(Others)	(Indus)	(Trade)	(Services)
Number of firms	249	89	88	72	1024	343	178	290	213
Output per worker ('000 CFAF)	10495	6962	17098	7451	1723	1839	1325	2046	1432
Capital per worker ('000 CFAF)	70863	18890	28068	178639	1497	1841	1019	994	2056
Firm size	122.5	181.1	114.1	60.4	1.7	1.7	2.3	1.2	1.8
Export	0.347	0.318	0.352	0.375	0.022	0.021	0.040	0.010	0.024
Firm life	-	-	-	-	9.4	9.5	10.7	8.6	9.1
Age of worker	37.2	36.8	37.4	37.3	35.6	35.0	33.1	38.5	34.8
Schooling of worker	9.9	10.6	9.3	9.6	2.8	2.6	3.1	2.5	3.3
Wage per worker ('000 CFAF)	1996	1439	2486	2014	1258	1429	1717	722	1322
Female worker	0.126	0.141	0.111	0.125	0.484	0.426	0.260	0.665	0.519

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).

Table 6: Regression of log value added on human and physical capital across the informal sector

	(Overall)	(Overall)	(Others)	(Indus)	(Trade)	(Services)
$\ln K$	0.13**	0.03*	0.03	-0.00	0.05	0.09**
	0.02	*0.02*	*0.03*	*0.04*	*0.03*	*0.04*
$\ln N$	0.73**	0.47**	0.47**	0.47**	0.44**	0.69**
	0.07	*0.05*	*0.09*	*0.10*	*0.18*	*0.12*
% of Females	-0.23**	-0.15**	-0.10	-0.32**	-0.23*	0.06*
	0.07	*0.06*	*0.10*	*0.14*	*0.12*	*0.13*
Age	0.06**	0.03**	0.04*	0.05**	0.02	0.05
	0.01	*0.01*	*0.02*	*0.02*	*0.02*	*0.03*
Age^2	-0.001**	-0.000**	-0.000**	-0.001**	-0.000	-0.001*
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Schooling	0.01	0.01	-0.00	-0.00	0.02	0.03*
	0.01	*0.01*	*0.01*	*0.02*	*0.01*	*0.02*
Cluster 2		1.62**	1.57**	1.51**	1.85**	1.29**
		0.07	*0.11*	*0.19*	*0.16*	*0.18*
Cluster 3		2.59**	2.78**	2.45**	2.64**	2.04**
		0.17	*0.33*	*0.32*	*0.35*	*0.40*
Adjusted R^2	0.25	0.56	0.59	0.56	0.51	0.59
N	894	894	294	166	261	173

Sources: 1-2-3 survey.

Table 7: Human and physical capital (mean values)

	Overall	Cluster 1	Cluster 2	Cluster 3
Number of firms	992	811	159	22
%	100.0	81.8	16.0	2.2
Output ('000 CFAF)	2463	1218	6405	19725
Capital per worker ('000 CFAF)	852	505	2494	1360
Firm size	1.6	1.5	2.3	3.4
Firm life	9.4	8.9	11.0	12.5
Age of worker	35.7	36.0	34.4	33.2
Schooling of worker	2.8	2.7	2.9	4.3

Sources: 1-2-3 survey.

Table 8: Wages, sectoral characteristics, human resources and infrastructures (mean values)

	Overall	Cluster 1	Cluster 2	Cluster 3
Number of firms	992	811	159	22
%	100.0	81.8	16.0	2.2
Wages	1167.0	607.9	2985.9	8541.8
Sectoral characteristics				
Export	0.022	0.019	0.044	0.000
Others	0.332	0.314	0.434	0.227
Trade	0.290	0.300	0.245	0.273
Services	0.203	0.205	0.189	0.227
Indus	0.175	0.181	0.132	0.273
Human Resources				
Female worker	0.495	0.538	0.327	0.132
FemaleBoss	0.492	0.538	0.308	0.136
AgeBoss	37.9	37.6	39.6	38.4
SchoolingBoss	2.8	2.8	2.8	3.5
Tenure	7.7	7.7	7.5	9.7
PW	86.9	85.6	92.1	97.3
Family member worker	0.925	0.943	0.864	0.728
Infrastructures				
Street vendor	0.082	0.089	0.050	0.045
Improvised workstation public highway	0.089	0.106	0.013	0.000
Fixed workstation public highway	0.116	0.122	0.094	0.045
Vehicle	0.019	0.007	0.075	0.045
Customers' home	0.143	0.144	0.151	0.045
Home not installed	0.177	0.203	0.063	0.045
Home installed	0.098	0.099	0.101	0.045
Public market	0.073	0.080	0.031	0.091
Professional office	0.201	0.145	0.421	0.636
Water	0.089	0.079	0.126	0.182
Elec	0.223	0.194	0.333	0.500
Tele	0.088	0.074	0.132	0.273

Sources: 1-2-3 survey.

Table 9: Degree of formalization and motivations for entering the informal sector (mean values)

	Overall	Cluster 1	Cluster 2	Cluster 3
Number of firms	992	811	159	22
%	100.0	81.8	16.0	2.2
Administrative registration				
having a taxpayer code	0.006	0.004	0.013	0.045
being commercially registered	0.042	0.027	0.113	0.091
displaying a professional card	0.043	0.020	0.132	0.273
having a license	0.023	0.012	0.069	0.091
ready to be registered	0.438	0.385	0.686	0.591
in favor of taxes	0.482	0.429	0.704	0.818
Proportion of big firms and public firms of the formal sector among				
clients	0.035	0.028	0.057	0.136
competitors	0.596	0.571	0.673	0.955
providers	0.194	0.147	0.377	0.591
Why entrepreneurs form small firms rather than work as employees in larger ones?				
no job in big firms	0.114	0.121	0.082	0.091
no job in small firms	0.172	0.189	0.107	0.045
higher income	0.213	0.201	0.258	0.318
being an independent worker	0.332	0.319	0.403	0.273
family tradition	0.090	0.085	0.113	0.091
other reason	0.069	0.072	0.038	0.182

Sources: 1-2-3 survey.

Table 10: Earnings equation estimates across sectors

	Formal				Informal				
	(Overall)	(Agro)	(Metal)	(Text)	(Overall)	(Others)	(Indus)	(Trade)	(Services)
Schooling	0.07**	0.08**	0.07**	0.07**	0.03**	-0.01	0.002	0.06**	0.06**
	0.00	*0.00*	*0.01*	*0.01*	*0.01*	*0.02*	*0.02*	*0.02*	*0.02*
Age	0.10**	0.10**	0.12**	0.09**	0.12**	0.16**	0.12**	0.08**	0.13**
	0.01	*0.02*	*0.02*	*0.02*	*0.01*	*0.03*	*0.03*	*0.03*	*0.04*
Age^2	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.002**	-0.001**	-0.001**	-0.001**
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Female	-0.03	-0.14**	-0.16**	-0.04	-0.69**	-0.77**	-0.78**	-0.54**	-0.39**
	0.04	*0.07*	*0.08*	*0.08*	*0.07*	*0.12*	*0.18*	*0.15*	*0.15*
Adjusted R^2	0.41	0.46	0.43	0.35	0.13	0.15	0.12	0.09	0.16
N	1488	519	515	454	1349	456	309	309	275

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).
Notes: ** significant at 5% level. * significant at 10% level. Standard errors are in italics.

Table 11: Characteristics of workers by category

	Wage-earner Formal		Self-employed Informal		Wage-earner Informal	
	Mean	Std	Mean	Std	Mean	Std
Earnings	1962	2569	1105	1909	438	530
Age	37.6	9.8	38.4	12.2	26.3	9.1
Schooling	10.3	5.5	2.9	4.0	2.9	3.5
Female	0.172	0.378	0.487	0.500	0.173	0.379
Family creator/owner	0.117	0.321	0.980	0.139	0.405	0.492
Number of observations	1488		1009		340	

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).

Table 12: Multinomial logit estimates

	Self-employed Informal	Wage-earner Informal
Constant	-2.97**	6.54**
	0.78	*0.69*
Schooling	-0.29**	-0.32**
	0.02	*0.02*
Age	0.03	-0.28**
	0.04	*0.04*
Age^2	-0.0004	0.002**
	0.0005	*0.0005*
Female	1.42**	0.16
	0.19	*0.21*
Family creator/owner	5.71**	1.36**
	0.26	*0.19*
LogL	-1088.3	
Chi-squared (10)	3272.8	
Pseudo R^2	0.60	
Number of observations	2837	

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector). **Note:** Wage-earner in the formal sector is the reference category.

Table 13: Marginal effects

	Wage-earner Formal	Self-employed Informal	Wage-earner Informal
Schooling	0.06**	-0.03**	-0.03**
	0.00	*0.00*	*0.00*
Age	0.02**	0.01*	-0.03**
	0.01	*0.00*	*0.004*
Age^2	-0.0001	-0.0001*	0.0002**
	0.0001	*0.00005*	*0.00005*
Female	-0.20**	0.22**	-0.01
	0.04	*0.03*	*0.02*
Family creator/owner	-0.74**	0.76**	-0.02*
	0.02	*0.02*	*0.01*

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector). **Notes:** Marginal effects are based on results from table 12.

Table 14: Wage effect corrected for selection bias

	OLS			Selectivity corrected (Lee 1983)		
	Wage-earner Formal	Self-employed Informal	Wage-earner Informal	Wage-earner Formal	Self-employed Informal	Wage-earner Informal
Schooling	0.07**	0.02	0.02	0.08**	0.02	0.08**
	0.00	*0.01*	*0.02*	*0.00*	*0.01*	*0.02*
Age	0.10**	0.07**	0.17**	0.10**	0.07**	0.22**
	0.01	*0.02*	*0.03*	*0.01*	*0.02*	*0.03*
Age^2	-0.001**	-0.001**	-0.002**	-0.001**	-0.001**	-0.002**
	0.0001	*0.0002*	*0.0004*	*0.0001*	*0.0002*	*0.0004*
Female	-0.03	-0.84**	-0.56**	-0.03	-0.81**	-0.38**
	0.04	*0.08*	*0.16*	*0.04*	*0.09*	*0.16*
correction term				-0.05	-0.11	0.66**
				0.05	*0.14*	*0.20*
Adjusted R^2	0.41	0.12	0.17	0.41	0.12	0.19
Number of observations	1488	1009	340	1488	1009	340

	Selectivity corrected (Dubin-McFadden 1984)			Selectivity corrected (Dahl 2002)		
	Wage-earner Formal	Self-employed Informal	Wage-earner Informal	Wage-earner Formal	Self-employed Informal	Wage-earner Informal
Schooling	0.09**	0.01	0.02	0.07**	-0.00	0.08**
	0.00	*0.02*	*0.03*	*0.01*	*0.02*	*0.02*
Age	0.13**	0.06*	0.17**	0.10**	0.10**	0.25**
	0.01	*0.03*	*0.04*	*0.01*	*0.03*	*0.04*
Age^2	-0.001**	-0.001**	-0.002**	-0.001**	-0.001**	-0.003**
	0.0001	*0.0003*	*0.0004*	*0.0001*	*0.0003*	*0.0005*
Female	0.00	-0.82**	-0.39**	-0.04	-0.62**	-0.36**
	0.04	*0.08*	*0.17*	*0.04*	*0.14*	*0.17*
correction term 1	0.40**	0.17	0.35**	-5.22**	-8.81*	6.81*
	0.09	*0.51*	*0.11*	*2.39*	*5.33*	*4.13*
correction term 2	-0.59**	-0.20	-0.28	21.57**	29.75	-15.85
	0.12	*0.47*	*0.22*	*8.19*	*19.50*	*16.86*
correction term 3				-30.99**	-34.76**	15.99
				10.84	*26.45*	*26.58*
correction term 4				14.33**	12.64	-4.68
				4.86	*12.06*	*13.86*
Adjusted R^2	0.42	0.12	0.19	0.42	0.12	0.19
Number of observations	1488	1009	340	1488	1009	340

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).
Notes: ** significant at 5% level. * significant at 10% level. Standard errors are in italics.

Table 15: Testing for schooling externalities in earnings equation

	OLS		Selectivity corrected (Lee 1983)	
	Wage-earner Formal	Wage-earner Informal	Wage-earner Formal	Wage-earner Informal
Schooling	0.07**	-0.01	0.07**	0.05
	0.00	*0.03*	*0.00*	*0.03*
Age	0.09**	0.16**	0.09**	0.20**
	0.01	*0.03*	*0.01*	*0.03*
Age^2	-0.001**	-0.002**	-0.001**	-0.002**
	0.0001	*0.0004*	*0.0002*	*0.0004*
Female	-0.04	-0.60**	-0.04	-0.41**
	0.05	*0.16*	*0.05*	*0.17*
Tenure	0.03**	0.01	0.03**	0.03
	0.01	*0.03*	*0.01*	*0.03*
Tenure^2	-0.0004	-0.0001	-0.0004	-0.0008
	0.0003	*0.001*	*0.0003*	*0.001*
SchoolingFirm	0.01**	0.05	0.01**	0.04
	0.006	*0.04*	*0.006*	*0.04*
SchoolingBoss		0.03**		0.03**
		0.015		*0.015*
correction term			-0.40**	0.63**
			0.10	*0.21*
Adjusted R^2	0.41	0.19	0.41	0.21
Number of observations	1197	335	1197	335

Sources: 1-2-3 survey (informal sector) and Investment climate survey (formal sector).
Notes: ** significant at 5% level. * significant at 10% level. Standard errors are in italics.

Table 16: Decomposition of the output gap across sectors

	Absolute Gap	Relative Gap (%)
$\Delta \ln(Y)$	11.7	100.0
Explanatory Variables		
$\Delta \ln(A)$	4.3	36.4
$\alpha \Delta \ln(K)$	2.5	21.1
$(\Delta \alpha) \ln(K^*)$	0.2	2.0
$\beta \Delta \ln(N)$	3.8	32.4
$(\Delta \beta) \ln(N^*)$	0.1	1.2
$\lambda \Delta S$	0.6	5.2
$(\Delta \lambda) S^*$	0.2	1.7