How much does Utility Access matter for the Performance of Micro and Small Enterprises?

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November 2012

Abstract
The empirical evidence of the economic benefits of different utilities such as electricity, telecommunications and water is mixed and, in the case of micro and small enterprises, relatively thin. This paper therefore revisits this issue. Based on a unique, albeit cross-sectional, micro data set of informal firms in West-Africa, we find hardly any evidence for a significant contribution of access to different infrastructure services on enterprise performance. This absence of a systematic influence is attributed to the large heterogeneity of activities, motives and resources with which these informal firms operate. However, concentrating on a more homogenous sample of tailors in Ouagadougou, we find that their performance is positively influenced by access to electricity. In conclusion, our findings stress the heterogeneity of the informal sector, implying that a 'one-size-fits all' approach to the development of this sector is of little help. We also call for more disaggregated analysis in identifying key constraints.

Keywords: Utilities, informal sector, firm growth, West-Africa.

JEL codes: D22, O17.

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Acknowledgements

This research is part of a project entitled "Unlocking potential: Tackling economic, institutional and social constraints of informal entrepreneurship in Sub-Saharan Africa" (http://www.iss.nl/informality) funded by the Austrian, German, Norwegian, Korean and Swiss Government through the World Bank's Multi Donor Trust Fund Project: "Labor Markets, Job Creation, and Economic Growth, Scaling up Research, Capacity Building, and Action on the Ground". The financial support is gratefully acknowledged. The project is led by the International Institute of Social Studies of Erasmus University Rotterdam, The Hague, The Netherlands. The other members of the research consortium are: AFRISTAT, Bamako, Mali, DIAL-IRD, Paris, France, the German Institute of Global and Area Studies, Hamburg, Germany and the Kiel Institute for the World Economy, Kiel, Germany.

This paper has greatly benefited from comments by participants of the CERES Annual Meeting 2011 in Utrecht. Any errors or omissions are solely the responsibility of the authors.

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1. Introduction

In recent years, the provisioning of infrastructure in the form of improved road, energy and telecommunication networks has been seen as a priority by many international organizations, donors and recipient countries as a way to promote business development and economic growth. The empirical evidence presented to support this policy is based mainly on either cross-country growth regressions or on country-specific studies that typically focus on the rural agricultural sector or larger, mainly formal, firms in the manufacturing sector.[i] Much less is known about the relevance of infrastructure services for the performance of micro and small enterprises (MSE) in the informal sector. A better understanding of the drivers and limitations of growth in this sector however should be of interest particularly when considering that informal MSEs provide between 50% to 80% of the total urban employment in most low income countries and thus clearly outweigh the formal sector, at least in this aspect.[ii] Investigating the importance of utility access for MSEs in the informal sector is not only important for a better understanding of the potential bottlenecks for their performance, but delivering better quality public services may also provide an incentive for micro and small firms to formalize.

So far, the debate on the barriers to growth for these production units has very much centred on capital market constraints and the role of micro-credit in this context. Given the gaps in knowledge, this paper therefore aims to shift the focus somewhat towards the infrastructure aspects. More specifically, this paper concentrates on the importance of access to standard utilities such as water, electricity and telecommunications for MSE performance. In particular, we investigate the extent to which informal enterprises use utilities and how access to these influences their economic performance. Even though we consider the relevance of access to water and telecommunications, the paper discusses primarily the role of electricity utilization. This focus was chosen, on the one hand, because of the importance attributed to electricity access as a pre-condition for modernization and the use of more

technologically-advanced production methods and, on the other hand, because most of the literature on public and infrastructure services centres on this aspect.

The empirical analysis presented in this paper is based on a unique, albeit cross-sectional, micro data set (hereafter referred to as '1-2-3 surveys') on informal production units (IPUs) operating in seven West African capital cities. The data on these IPUs was collected in 2001/02. In order to deepen the analysis, this paper also uses data from a more recent survey among tailors in Ouagadougou conducted in 2011 (hereafter referred to as 'tailor survey'). In both surveys, an informal enterprise is defined as one that is not registered with the tax administration, irrespective of its size.

On the basis of the 1-2-3 survey data, we do not find any systematic, significant influence of utility access on enterprise performance, irrespective of whether our results are disaggregated by country or by business sector. We attribute this finding to the high degree of heterogeneity in our sample. However, when considering the specific situation of tailors informally operating in Ouagadougou, we find that access to electricity exerts a positive and statistically significant influence on their performance. Further analysis suggests that this positive influence is derived through both extended working hours and the use of modern machinery in the production process.

The remainder of our paper is structured as follows. Section 2 provides a short overview of the main arguments and findings in the literature. Section 3 presents the econometric strategy. Section 4 briefly describes the data used for analysis. The results are discussed in Section 5 and Section 6 concludes.

2. Literature Review

The literature on this subject to date has mainly focused on access to electricity. The roles of water and telecommunication services have been investigated much less. Thus, the following discussion will largely draw on work carried out in relation to energy services. As a further

qualification, it should also be mentioned that most of the studies presented below discuss the importance of access to electricity for enterprise development in rural areas in contrast to the focus of this paper which concentrates on the performance of informal firms in urban areas.

While there is agreement that in principle infrastructure and public services are important for the performance of firms, the debate tends to centre on the question whether utility access, particularly electricity, is only one of many inputs firms need in order to develop or whether it is the most important bottleneck and precondition for everything else. The proponents of this latter opinion are of the view that the access and use of modern energy independently acts as stimulus for enterprise growth.[iii] Fakira (1994) argues for instance that energy is crucial to liberating microenterprises from low value, low productivity and low income activities. This point of view is supported by findings from a range of studies, although these are often rather descriptive and not based on the identification of causal relationships. Owners of small and medium enterprises (SMEs) in rural South Africa, for example, indicate that insufficient capital and the lack of electricity are major limitations to their competitiveness, while those with access to electricity report it to be their main benefit (Rogerson, 1997). Likewise, recent work by Goedhuys and Sleuwaegen (2010) aiming to identify entrepreneur and firm characteristics associated with high growth firms show that electricity was considered to be a major constraint to growth in six out of the 11 countries studied. They further find that a grid connection complemented by a generator to cope with electricity cuts results in an increase in mean growth by about 2% per year. However, this contribution is no longer significant once firms reach a particular size (80% quintile). Gulyani and Talukdar (2010) analyse the links between poverty, micro-entrepreneurship and living conditions in Nairobi's slums. They also report that informal enterprise success is strongly influenced by residential tenure and access to infrastructure such as electricity and water. The authors further conclude, without, however, explicitly dealing with the implied endogeneity issues that households with access to electricity are more likely to own an enterprise and are less likely to be poor. Considering the

transmission channels between energy access and firm performance, Khan (2001) highlights the positive influence of better lighting on income generation due to extended business hours in the evenings. For tailors in Bangladesh this resulted in, on average, a 30% higher turnover (Kahn, 2001).[iv] Also in Bangladesh, repair shops with access to electricity reported earning USD 25 more per day (Meadows et al., 2003). However, electricity in these contexts is still quite expensive. Gitonga (1999) points out that in Nairobi, for example, small and medium informal enterprises tend to spend quite high amounts on energy services: 20% of the owners reported spending up to 50% of their revenue on energy; another 40% used 10-20% of their revenue on energy.

The alternative position in the literature is that electricity is just one of many critical factors that have to interact in order to create a positive business environment. This position is largely based on observations in areas where access to electricity is accompanied by higher access to finance and markets (see Barnes, 1988). Kirubi (2006), for example, finds that access to electricity contributes to the robust growth of micro enterprises in rural Kenya only in combination with other infrastructure services and markets. The study shows that productivity per worker and gross revenues per day increased by around 200% for both carpentry and tailoring microenterprises following the introduction of a rural electrification and extension project. Motta and Reiche (2001) also emphasize the importance of complementary services like telecommunications and transport in conjunction with electrification for SME development in off-grid areas in Nicaragua. Peters et al. (2009) point out that economic infrastructure is important to enable enterprise growth; they highlight that, in the case of rural Benin, users of electricity are often not aware of its economic potential. Their observations show that firms connected to the electricity network work longer hours. However, only a few of those enterprises that could use machinery in their production process do in fact have electricity access. Among those firms connected to electricity, they found that not a single one uses modern machinery yet. One explanation put forward is that firms that are

inherently credit constrained might have electricity but not the financial means to buy a machine, the acquisition costs of which are much higher than the cost of electricity. Hence, credits would be needed to unlock the potential inherent in electricity access. Providing even more critique of the sole importance of electricity access to enterprise growth, Rogerson (1997), studying MSEs in rural South Africa, concludes that access to electricity encourages the modernization of MSEs but only exerts a modest stimulus on revenue growth due to a myriad of constraints that these microenterprises are confronted with, including further infrastructure limitations (e.g. market access). This is also in line with Wamaykonya and Davis (2001) who state that rural electrification does not have a significant impact on income growth and the general activity level in Namibia.

If we were to take these two points of view at face value, two distinct expectations for our empirical analysis could be drawn. Following the first line of argument, we would expect to find a positive and statistically significant influence of electricity on enterprise performance, while the more moderate position would find such effects only conditional on other factors.

Moving from the more qualitative case studies to studies with a more quantitative angle and using larger, representative data sets, we identify a few papers that have actually attempted to address the issues of concern for this paper in the Sub-Sahara African context. Most of these papers deal, in one way or another, with the question of why firms chose to locate in the informal sector and thus consider utility access as only one factor among many. The majority of these papers rely on the World Bank Enterprise Surveys, which consist, in most countries, of a cross-sectional data set, though in a few cases panel data is available.[v] Obviously cross-sectional data restricts the analysis and the findings to associations only but does not allow drawing causal conclusions – a problem that we are also faced with in this paper. In addition, the World Bank Enterprise Surveys, particularly in the earlier rounds, largely gather only perception-based data which further limits the econometric analysis and interpretation of results.[vi]

Complementing the qualitative work by Rogerson (1997), Ingram et al. (2007), using data from the World Bank Enterprise surveys, document that firms from Senegal, Kenya, Uganda, Tanzania, Zambia, and South Africa rank the lack of access to and unreliable provisioning of electricity and telecommunications among the major constraints to their operation. In addition, they find that more firms are likely to be located in the formal sector when access and supply of electricity are perceived to be less constraining. Even though their analysis does provide some interesting insights, their findings are still drawn from descriptive statistical analysis where informal firms are defined only based on the size of the enterprise (<10 workers). A more recent and more detailed analysis by Gelb et al. (2009) comparing formal and informal firms in Eastern and Southern Africa, also using cross-sectional data from the World Bank Enterprise Surveys, finds no difference in labour productivity between formal and informal firms in East Africa, but a significant difference in Southern Africa. The disparity in Southern Africa is explained by the authors as being due to the better enforcement of laws and service provisioning compared to the situation prevailing in the East African region. Thus, access to public services is identified as an important determinant for formalization in Botswana, Namibia and South Africa. However, in East Africa, where service provisioning is still found to be weak, even for formal firms, utility access does not explain the formal-informal divide. Geographically complementary to Gelb et al. (2009), Benjamin and Mbaye (2010) analyse a sample drawn from the World Bank Enterprise Surveys covering 900 formal and informal businesses in Benin, Burkina Faso, and Senegal and find that formal firms show higher productivity than informal firms in this context. But, the productivity gap is smaller when comparing only the larger firms in both sectors. Similar to Gelb et al. (2009), they also highlight that the quality of public service provisioning seems to be an important factor explaining productivity differentials; however, their argument here is only based on statements from a few in-depth interviews which, again, mainly report the subjective

perceptions of the interviewee. Similar evidence is also reported in La Porta and Shleifer (2011). Overall, we see that work in this area is rather suggestive and still scattered.

3. Empirical Strategy

In order to assess the influence of utility access on enterprise performance we start from a basic Cobb-Douglas production function of the form:

$$Y_{ic} = A_{ic} K^{\alpha}_{ic} L^{\beta}_{ic} \qquad [1]$$

where Y_{ic} represents the value-added of firm i in country c; A_{ic} is the total factor productivity (TFP), K_{ic} is the capital stock and L_{ic} the labour efforts. If we assume that TFP depends on a firm level component V_{ic} and its immediate environment in terms of access to utilities U_{ic} then TFP can also be represented as:

$$A_{ic} = e^{\delta Uic} V_{ic}. \qquad [2]$$

Replacing A_{ic}, log-linearizing the production function and adding controls for firm, country and sector specific characteristics (partly replacing $ln(V_{ic})$), the basic estimation equation becomes:

$$\ln Y_{ic} = \alpha \ln K_{ic} + \beta \ln L_{ic} + U_{ic}^{'}\delta + X_{ic}^{'}\gamma + p^{'}\eta + s^{'}\mu + \nu_{ic}, \qquad [3]$$

where X_{ic} represents a vector of firm-specific characteristics, including the age of the enterprise and the gender, age and education level of the entrepreneur, p represents a vector of country dummies and s a vector of sector dummies. Access to utilities, U_{ic}, which is access to electricity, water, and telecommunication, is represented through a vector of binary variables,

which take the value one if the firm has access to the respective utility and zero if not. Given our research question the outcome of interest is the vector of coefficients δ.

If we assume that all variables on the right-hand side of the equation are at least weakly exogenous and can be observed in the data, the model can be estimated using a standard OLS approach. However, the exogeneity assumption is unlikely to hold in the present case, leaving the obtained coefficients from the OLS estimation subject to bias. This bias is expected to stem largely from two concerns – unobserved heterogeneity and reverse causality.

In order to reduce the endogeneity bias, at least with respect to the influence of utility access, we use an instrumental variable (IV) approach, where we instrument utility access with the predicted probability of having access to a given utility. This probability is obtained from estimating the following equation:

$$Pr\,(U_{ic}=1) = \theta\,(\gamma_0+\gamma_1 A_{ic}+\gamma_2 R_{ic}+v_{ic}), \qquad [4]$$

where A_{ic} represents the average access rate to the service in question in the neighbourhood. R_{ic} represents a dummy variable taking the value one if the enterprise incurred renovation costs when it started out. The rationale for using the latter variable is that enterprises that have renovated their business location might, in the course of those activities, also have made an effort to obtain access to utilities. Considering that access to each utility is represented by a binary variable, the above equation is estimated using a probit model.

The estimation strategy outlined above will be applied to both the data from the 1-2-3 survey and the tailor survey. Both data sources are presented in detail below in Section 4. In order to address potential heterogeneity aspects we also present the results disaggregated by country and sector and by further limiting the sample to IPUs that operate from fixed locations only. The rationale here is that the role and cost of utility access is different for firms operating without a fixed location compared to firms with fixed business installations.

To save space we only report IV regression results for electricity access by firms operating from fixed locations.

The tailor survey also allows us to examine some of the underlying transmission channels between electricity access and firm performance. More specifically, we can assess whether electricity access is linked to longer working hours and the use of more modern machinery. Hence, we analyse the influence of electricity access, E_{ic} by estimating the following two equations:

$$\text{Ln}L_{ic} = \gamma_{0L} + \gamma_{1L}E_{ic} + X_{ic}'\gamma_{2L} + \nu_{icL} \quad [5]$$

$$\Pr(M_{ic}=1) = \theta(\gamma_{0M} + \gamma_{1M}E_{ic} + X_{ic}'\gamma_{2M} + \nu_{icM}) \quad [6]$$

L_{ic} stands for the total labour hours worked. X_{ic} represents a vector of enterprise and owner characteristics including the number of staff, the capital endowment and age of the enterprise, and the gender, age and education level of the owner. While Equation [5] is estimated using OLS, Equation [6] is estimated using a probit model in which M_{ic} is a binary variable indicating whether the tailor uses electrical machinery (i.e. an electric sewing machine) for the production process or not. Both Equations can be directly related to Equation [3]. Equation [5] explains how electricity can alter the quantity of labour, L_{ic}, used, or, if we think of utility access influencing the TFP as argued above, we can interpret the availability of light as a factor that allows using all production factors more efficiently during the night. Equation [6] also reflects the idea that access to a utility can alter the TFP; now by switching from the use of a mechanical sewing machine to the use of an electrical sewing machine. Equations [5] and [6] obviously entail the same endogeneity problems as Equation [3]. To deal with this issue, we experiment with the same type of instrument as outlined above. This is discussed in detail below in Section 5.

4. The Data

The analysis of this paper draws on two distinct data sources. First, we use cross-sectional data from the 1-2-3 surveys conducted in the capital cities of Benin, Burkina Faso, Côte d'Ivoire (CDI), Mali, Niger, Senegal and Togo between 2001 and 2002. This survey was specially designed to study issues in the informal sector and, as suggested by its name, was conducted in three stages – a labour force survey (stage 1), an IPU survey (stage 2) and a household expenditure survey (stage 3).[vii] The main advantage of this survey approach, compared to the enterprise-based sampling frame employed by the World Bank Enterprise Surveys, is that a more representative picture of the informal sector is obtained as the 1-2-3 approach is not limited to firms operating from fixed locations only but also factors in units that operate from home or which are fully mobile and which are likely to be overlooked in alternative surveys. An additional plus of the 1-2-3 survey lies in the detailed level of information collected, allowing for control for a significant degree of heterogeneity within each country. However, unlike the World Bank surveys which collect information on both formal and informal enterprises, the 1-2-3 survey is limited to informal business operations only and thus does not allow for a direct comparison of the role of utilities for informal and formal firms.

Based on the sampling frame, our analysis uses information mainly collected in the second phase. The total sample covers 5,409 observations. The basic characteristics describing this sample are presented in Table A1 in the Appendix.

The second data set used for analysis is based on a more recent survey that we undertook jointly with the University of Frankfurt and a local survey firm among tailors in Ouagadougou, the capital of Burkina Faso, from January to March 2011. The tailor survey comprises detailed information on 248 informal, i.e. non-registered, tailors. The basic characteristics describing the sample of informal tailors are presented in Table A2 in the

Appendix. The data collected in the tailor survey is comparable to the information collected in phase 2 of the 1-2-3 survey, since we used an extended version of the phase 2 questionnaire when conducting the interviews. Thus, the key variables used for analysis are measured in exactly the same way. In both surveys, information on utility access is obtained by asking whether water, electricity or telephone access is present at the business location. Following the response (yes/no), respective dummy variables representing the access are coded. The capital stock currently used by the firm is measured at replacement value and labour efforts are represented by the total number of hours worked at the establishment. In the case of the 1-2-3 survey, firm performance is measured by value added generated. However, in the case of the tailor survey, we prefer to work with turnover.[viii] We had tried to collect very accurate, detailed information on all input factors used; however, it turned out that the more detailed information collected, the higher its total sum, which in the end lead to unrealistic estimates of value added. Hence, we agree with the conclusion in De Mel et al. (2009) that simply asking entrepreneurs to report the profits (or turnover) is a more accurate measure of firm performance than detailed questions on revenues and expenses.

Based on the two data sources, a good start is to look at informal firms' access to utilities. Considering the figures presented in Table 1, it can be seen that the large majority of IPUs (70.3%) sampled in 2001/02 do not have access to any type of utility. Among the different utilities, electricity is most common with 24.3% of the informal enterprises reporting access; for water and telecommunications it is 9.8% and 8.3% respectively. The figures presented in Table 1 not only document quite low access rates but also some variation in access rates across countries, with the highest utility access rates found in Benin, Côte d'Ivoire and Senegal. With respect to the latter two, this is less surprising given that they were also the most important economies of the sample at the time. Burkina Faso and Mali, in contrast, report the lowest utility access rates, i.e. the highest percentage of IPUs without any access (81.3% resp. 86.7%). If we consider utility access not at the country but the sector level

(Table 2), the lowest access rates are shown to be in the petty trade, construction and transport businesses. This is expected, as the majority of activities in these sectors are carried out in a fully mobile manner or at client sites in the case of construction enterprises, and do not actually require utility access. In contrast, the clothing and apparel, wholesale/retail and repair services sectors report comparatively higher utility access rates, particularly with respect to electricity use. This is also in line with expectations considering the nature of the business in these areas. Concerning the situation of tailors in Ouagadougou, back in 2001/02 (presented at the bottom of Table 2) it can be seen that their average electricity access rates were clearly above the national average and, at 28.6%, also just above the average for the entire sample. Taking a leap in time, the descriptive statistics on the tailors in Ouagadougou in 2011 (Table A2) show that the situation for tailors improved significantly over the ten year period with average electricity access rates now reported to be around 89%. However, with respect to water or telephone land lines, access rates remain low and have even declined. Concerning access to land lines, this is of course expected given the high penetration of mobile phones nowadays with almost all tailors (98%) owning a mobile phone.

[please insert Tables 1 and 2]

Taking a sneak preview at potential findings by considering the descriptive statistics on the average firm from the 1-2-3 survey (Table A1) and distinguishing between the ones that have access to utilities and the ones that have no access to at least one public service, it can be seen that firms with access generate, on average, a higher value added and have a capital endowment which is almost three times as large as that of firms without utility access. In addition, they also employ more labour. These first figures could suggest that utility access exerts a positive influence on enterprise performance and growth. However, the comparatively better performance could also be driven by other factors, as we discussed above, including reverse causality of course. Thus, considering more substantive evidence we move on to the multivariate analysis as presented in Section 3.

5. Estimation Results and Discussion

5.1 Using the 1-2-3 Survey Data

The descriptive statistics that we briefly discussed in the previous section suggest a positive relationship between access to utilities and enterprise performance as measured by the value added they generate. However, it remains to be seen whether this conclusion can be upheld when considering the results from a more in-depth regression analysis. The estimation results obtained based on the 1-2-3 survey data are presented below in Tables 3 to 6. We proceed by considering the influence of electricity first, before moving on to discuss findings on water and telecommunication access. The results are presented starting from the overall sample, disaggregated by country and then by sector before presenting the estimations on the sub-sample of IPUs operating from fixed business installations only split by sector.[ix]

[please insert Table 3]

Electricity

The estimation results of the influence of electricity access on enterprise performance are presented in Tables 3 to 6 (Lines 3). On the basis of the total sample, estimation results suggest that electricity access actually exerts a negative influence on value added (Table 3), with firms with access to electricity achieving a 27.3% lower value added compared to firms without any utility access. We find a negative effect of electricity access as soon as we introduce capital stock in the regression. The negative result is quite counter intuitive and when disaggregating the results by country, it actually shows that it is in fact largely driven by three countries - Benin, Senegal and Togo - where the correlation between electricity and value added is negative. If the results are disaggregated by economic sector (Table 4) the negative influence is found to be driven by the manufacturing, wholesale/retail, petty trade, repair, and transport sectors. If we concentrate the analysis on IPUs operating from fixed

business establishments only (Table 5), the picture changes, with electricity found to exert a positive and statistically significant influence on value added generated in the clothing sector, where firms with electricity access achieve 44.4% higher value added than firms without utility access at their establishment. However, as already indicated in Section 3, the results obtained by OLS might be biased. Therefore, we have re-assessed our central research question using an IV approach (Table 6). As outlined in Section 3, we instrument utility access with the predicted probability of having access conditional on the average access rate in the firm's neighbourhood and the renovation efforts at start-up. However, the IV approach does not work equally well across all sub-samples. The *F*-test indicates, for instance, that in most cases the instrument has not enough power and hence the results have to be interpreted with caution. Thus, by and large, the regression results suggest that there is no systematic and uniform influence of electricity access on enterprise performance.

[please insert Tables 4 to 6]

Water and Telephone

The estimation results concerning the influence of water access on firm performance are also presented in Tables 3 to 5 (Lines 4). On the basis of these results, no significant and uniform contribution can be identified. The results for telephone (land line) access (Tables 3 to 5, Lines 5), however, portray a different picture. Here at least it seems that the presence of land line phone access – in the years 2001/2002, before mobile phones became common – is uniformly positively linked to enterprise performance and also statistically significant at the country level, the only exceptions being Benin and Burkina Faso (Table 3). With respect to the magnitude of the influence of fixed phone access on value added, we see considerable variation ranging from a potential increase of 39 up to 96%. If we split the sample by sectors (Table 4) we find an almost uniformly positive relation between access to telecommunications

and performance, in particular in the manufacturing, wholesale/retail, petty trade, and transport sectors. However, the sector regressions suggest that access to a telephone does not matter that much overall. The mixed evidence on access to telecommunications implies that the bias due to omitted factors might be particularly large and that the results are possibly driven by a small number of units that actually have a fixed phone line. From Table 1 above, it can be seen that only 8% of the enterprises in our sample have fixed connections. With a mean value added of 955, these few units seem to clearly perform better than the average firm with utility access (see Table A1).

Thus, based on the 1-2-3 survey data we do not find any clear evidence that utility access increases, at least in general, the performance of micro and small firms. To better understand the results we carried out an in-depth analysis of each sector to see how firms are organized in that sector, what kind of activities they cover and to what extent electricity and other utilities could, in principle, be helpful. This assessment also includes the most important constraints as reported by the interviewed entrepreneurs themselves. This analysis can be found in an online appendix to this paper. Based on this analysis, we conclude that it is actually not surprising and rather plausible that we cannot identify a uniform picture, as the vast majority of IPUs do not seem to see a lack of public service provisioning as a major impediment to their operations. More often it is rather the lack of demand and credit that seems to be a constraining factor. Access to modern machinery, which would imply having access to electricity, was only of concern in the clothing and apparel, repair services and construction sectors. In other sectors like in transport, taking motorcycle taxis or minibuses as examples, having a fixed water or electricity installation does not matter much for their business operations as their 'production process' is not dependent on these factors. The same applies to a large number of petty traders re-selling all sorts of things ranging from sweets and chewing gum to handbags. Even if the merchandise business is conducted in a less mobile manner, operating from some sort of stall at the side of a larger road or the central neighbourhood

square, access to electricity might not be as important as roadside lighting might suffice to enable trade even later in the evening. Before thinking about electricity, such units might first think about actually having a shop. This however could also be considered a disadvantage, as it could also be seen a limitation to their operations, creating a greater physical distance from their potential customers and limiting the number of casual passers-by who may be persuaded to give custom. Moreover, we find that a large share of informal activities carried out by women at home might actually not be driven by profit-maximising behaviour in the first place. In sum the in depth-analysis shows that even within sectors there is a high degree of heterogeneity which cannot be sufficiently accounted for by country and sector-fixed effects only. Bearing in mind the business specificities in each sector, a more detailed analysis of a more homogenous group might actually yield further insights.

5.2. Using the tailor survey

Considering the potentially high degree of heterogeneity in the informal sector which cannot be sufficiently addressed with the 1-2-3 survey data, the second part of our empirical analysis takes a more detailed view, concentrating on the situation of one profession – tailors – in one location – Ouagadougou. We follow the same econometric approach as above. The results of our analysis are presented below in Table 7. Contrary to what we saw in the 1-2-3 survey data and in line with expectations, we now see that access to electricity, water and a telephone are all positively related to enterprise performance.[x] However, only electricity seems to exert a statistically significant influence. This is reasonable considering that access to water does not have much of a role for tailoring activities. Also, with the high penetration of mobile phones nowadays, having fixed phones is rather redundant (98% of all tailors report having a mobile phone). With respect to electricity access, the results obtained indicate that tailors with access to electricity actually have 51% higher revenue compared to firms without access (when considering the IV results this figure is over 82%, so almost double the revenue figures).

[please insert Table 7]

Running quintile regressions (Table 8) to account for variation in the distributions actually indicates that electricity access only exerts a significantly positive influence at higher revenue quintiles, implying that a significant influence is only obtained once a critical performance threshold has been passed. Considering that electricity might not be the most eminent constraint, we have further disaggregated our sample into credit and non-credit constrained businesses[xi] in order to obtain more insights into a potential interaction of access to credit and electricity use (Table 9). The results indicate that access to electricity only exerts a positive significant influence when firms are not credit-constrained. We get back to this finding below.

[please insert Tables 8 and 9]

Considering that access to electricity is commonly associated with extended business and working hours due to better lighting and increased employment of modern machinery, we also verified whether there is evidence for these propositions. The estimation results are presented in Tables 10 and 11 below. Concerning longer working hours our results indeed suggest that having access to electricity increases working hours. Tailors with access to electricity work around 17%, or four labour hours, more per day than firms without this access. Concerning the use of modern equipment (Table 11), firms with access to electricity are more likely to operate more sophisticated machinery. Conversely, having electricity access also reduces the likelihood of employing mechanical sewing machines by about 30%. Electricity thus seems to be beneficial for modernization which in turn is expected to positively influence productivity. That this effect is particularly strong for firms that are not credit-constrained suggests that access to credit facilitates access to modern machinery to be used with electricity.[xii] Obviously, with the data at hand and lacking any better instruments, we cannot fully rule out that unobserved heterogeneity does not introduce a bias here.

[please insert Tables 10 and 11]

If we accept the finding that there is a positive effect of electricity on enterprise performance for the sample of tailors interviewed in Ouagadougou, further questions arise, for instance regarding the quality and reliability of the electricity service. Fluctuations in voltage, for example, can cause severe damage to the machinery, leading to high repair costs. Moreover, frequent power cuts are often associated with significant revenue losses. Informal sector entrepreneurs interviewed in the World Bank Enterprise Surveys in Burkina Faso in 2009 report, for example, an average monthly loss of sales of 5% due to power outages. While it is commonly assumed that fluctuations in power supplies will be addressed through the use of generators, this does not seem to be common for informal firms in Burkina Faso. In the World Bank Enterprise Survey less than one per cent of the interviewed informal units reported having a generator. In our sample of tailors, 10% have a generator, but only 3% actually report using it. Following work by Alby et al. (2010), one reason for the low penetration of generators could be a lack of capital or the high cost of operating them. This links back to the results presented above regarding the role of credit.

6. Conclusion

While infrastructure undoubtedly plays an important role for overall growth and development, the specific role for the performance of micro and small, and particularly informal, firms is less clear. The two main views found in the literature either see access to infrastructure services, and here particularly electricity, as an independently important factor for enterprise growth or as a necessary but not sufficient condition for performance. The latter means that unless other inputs such as credit are also available, electricity alone does not have much effect. The empirical evidence supporting one or the other proposition is relatively thin. The purpose of this paper therefore was to shed more light on the influence of infrastructure services for the performance of informal MSEs. We were particularly interested in the role played by access to utilities i.e. electricity, water and telecommunications. Our analysis is

based on micro data of informal firms in seven West African capitals collected in 2001/02 and a more recent sample of tailors in Ouagadougou collected in 2011. Based on our findings we cannot conclude that access to these utilities per se has a positive effect on performance. Hence, this would support the proposition that utility access is a necessary but not a sufficient condition for enterprise performance. Many informal activities do not require electricity or other utilities. In other cases such utilities could be useful in principle but other constraints, such as, for example, capital market constraints and risk, need to be tackled to allow entrepreneurs to acquire sophisticated technologies requiring electricity and other inputs.

However, we also argue that these results have to be considered in the light of the heterogeneity of the informal sector and thus advocate for a more detailed analysis of specific sectors, particularly in the absence of panel data. An example of such a detailed analysis is our study of the role of utility access for a randomly selected sample of tailors. In this case, given the nature of the business and the high penetration of mobile phones, we do not find a significant influence of access to water and fixed phone connection on enterprise performance. However, electricity does seem to play an important role, positively contributing to revenue generation by allowing for longer working hours and enabling a higher penetration of modern equipment such as electric sewing machines. The analysis also suggests that electricity access matters only once a critical size has been passed.

In conclusion, improving access to public services and in particular electricity may make a significant contribution in some sectors and some types of firms but is not a magic wand for the informal sector as a whole. Hence, as is so often the case, a 'one-size-fits-all' approach is of little help. To be effective, the design of policies for the informal sector has to be carried out with a lot of care and requires rigorous evaluation, including targeting. It is also evident that firms usually do not suffer from one single constraint but are typically confronted with a set of inter-dependent constraints that need to be unlocked jointly.

Notes

[i] See e.g. Sanchez-Robles (1998) or Canning and Pedroni (1999) for examples of cross-country studies or Rijkers et al. (2010) for a recent study on manufacturing firms in rural and urban Ethiopia. Lipscomb et al. (2010) also provide an innovative study on the developmental effects of electrification in Brazil with some more discussion on this issue.

[ii]As we will explain below, we focus on capital cities in West-Africa, where more than 70% of the workforce is employed in the informal sector (see Brilleau, Roubaud and Torelli, 2005).

[iii] See e.g. Foley (1990) or Karekezi and Majoro (2002).

[iv] The study further shows that in certain sectors, such as garment manufacturing, the availability of electricity determines the level of technology and has a strong influence on the cost and level of production.

[v] See Gelb et al. (2007) for a more detailed discussion of these surveys.

[vi] See Hausman, Rodrik and Velasco (2005) for a more detailed discussion on the issues arising from the use of perception-based data and more recently Clarke (2010) who is applying an experimental design to assess the quality of this data type.

[vii] For a detailed description of the data and sampling method see Brilleau, Ouedraogo and Roubaud, 2005.

[viii] The implicit assumption here is that input costs evolve in proportion to sales.

[ix] Further estimation results can be obtained from the authors upon request. We have also estimated the model presented in Section 3 (Equations [3] and [4]) with panel data from Peru allowing us to compare estimates with and without fixed-effects. The results of this analysis do not change the basic notion of our arguments put forward here.

[x] Fixed phone access becomes an exception when further covariates are included.

[xi] As in Grimm, Lay and Lange (2011), the tailors are considered not to be credit constrained if any investment was financed by family or external sources or if they have obtained a micro- or bank credit in the past 12 months.

[xii] Although the IV results would suggest that there is no effect, we have more confidence in the OLS results, given that the instruments do not have much power (very low *F*-statistic).

References

Alby, P., J.-J. Dethier, and S. Straub (2010) Firms operating under Infrastructure and Credit Constraints in Developing Countries: The Case of Power Generators. Policy Research Working Paper 5497. World Bank.

Barnes, D. F. (1988) *Electric Power for Rural Growth: How Electricity Affects Life in Developing Countries.* Boulder: Westview Press.

Brilleau, A., E. Ouedraogo, and F. Roubaud (2005) L'Enquête 1-2-3 dans les Principales Agglomerérations de l'UEMOA: la Consolidation d'une Méthode. *Stateco* 99: 15-19.

Brilleau, A., F. Roubaud, and C. Torelli (2005) L'emploi, le chômage et les conditions d'activité, Enquête 1-2-3, phase 2. *Stateco* 99: 54-84.

Benjamin, N. C., and A. A. Mbaye (2010) Informality, productivity and enforcement in West Africa: A firm level analysis. IPC Working Paper No. 100. International Policy Centre.

Canning, D. and P. Pedroni (1999) Infrastructure and Long Run Economic Growth. Discussion Paper 57. Consulting Assistance on Economic Reform II. USAID.

Clarke, G. R. G. (2010) Are Managers' Perceptions of Constraints to Growth Reliable? Evidence from a Natural Experiment in South Africa. Mimeo. Sanchez School of Business, Texas A&M International University.

De Mel, S., D. J. McKenzie, and C. Woodruff (2009). Measuring microenterprise profits: Must we ask how the sausage is made. *Journal of Development Economics*, 88: 19-31.

Fakira, H. (1994) Energy for micro-enterprises. Energy Policy Research and Training Project. Energy and Development Research Centre. University of Cape Town. Paper No. 12: 16-25.

Foley, G. (1990) *Electricity for rural people*. London: Panos Publications Ltd.

Gelb, A. V. Ramachandaran, M. K. Shah, and G. Turner (2007) What Matters to African Firms: The Relevance of Perceptions Data. Policy Research Working Paper 4446. World Bank.

Gelb, A., T. Mengistae, V. Ramachandran, and M. K. Shah (2009) To Formalize or Not to Formalize? Comparisons of Microenterprise Data from Southern and East Africa. Working Paper No. 175. Center for Global Development.

Gitonga, S. (1999) Energy Services for the Urban Poor: The Kenya Country Study. IT Kenya Energy Programme. Study for the UK Department for International Development (DFID).

Goedhuys, M. and L. Sleuwaegen (2010) High-growth entrepreneurial firms in Africa: a quantile regression approach. *Small Business Economics* 34:31-51.

Grimm, M., S. Lange, and J. Lay (2011) Credit-constrained in risky activities? An analysis of the determinants of capital stocks of micro and small firms in Western Africa. Mimeo. Erasmus University Rotterdam.

Gulyani, S. and D. Talukdar (2010) Inside Informality: The Links between Poverty, Microenterprises, and Living Conditions in Nairobi's Slums. *World Development* 38(12):1710-1726.

Hausmann, R., D. Rodrik, and A. Velsasco (2005) Growth Diagnostics. Mimeo. Harvard Kennedy School of Governance. Harvard University.

Ingram, M., V. Ramachandran, and V. Desai (2007). Why Do Firms Choose to be Informal? Evidence from Enterprise Surveys in Africa. Mimeo. World Bank.

Karekezi, S. and L. Majoro (2002) Improving modern energy services for Africa's urban poor. *Energy Policy* 30: 1015-1028.

Khan, H. J. (2001) Battery-operated lamps produced by rural women. In: S. Misana and G. V. Karlsson (eds.) *Generating opportunities: case studies on energy and women*. United Nations Development Programme, Sustainable Energy. New York: UNDP.

Kirubi, C. (2006) How important is modern energy for micro-enterprises? Evidence from rural Kenya. Mimeo. University of Berkley.

La Porta, R. and A. Shleifer (2011) The unofficial economy in Africa. NBER Working Paper #16821. NBER.

Lipscomb, M., A. M. Mobarak, and T. Barham (2010) Development Effects of Electrification: Evidence from Geologic Placement of Hydropower Plants in Brazil. Mimeo. University of Colorado.

Meadows, K., C. Riley, G. Rao, and P. Harris (2003) Modern Energy Impacts on Micro-enterprises. Report produced for UK Department for International Development.

Motta, M. and K. Reiche (2001) Rural electrification, micro-finance and micro and small business development: Lessons for the Nicaragua off-grid rural electrification project. Mimeo. World Bank.

Peters, J., M. Harsdorff, and F. Ziegler (2009). Rural electrification: Accelerating impacts with complementary services. *Energy for Sustainable Development* 12: 38-42.

Rijkers, B., M. Söderbom, and J. L. Loening (2010) A Rural-Urban Comparison of Manufacturing Enterprise Performance in Ethiopia. *World Development* 38(9): 1278-1296.

Rogerson, C. M. (1997) Rural electrification and the SMME economy in South Africa. Mimeo. University of Cape Town.

Sanchez-Robles, B. (1998) Infrastructure Investment and Growth: Some Empirical Evidence. *Contemporary Economic Policy* 16:98-108.

Wmaykonya, L. and M. Davis (2001) Socio-economic impacts of rural electrification in Namibia: comparisons between grid, solar and unelectrified households. *Energy for Sustainable Development* 5(3): 6-11.

Appendix

[please insert Tables A1 and A2]

Tables and Figures

Table 1: IPU Utility Access by Country (Total sample (N=5,409))

	No Utility Access	Access to Electricity	Access to Water	Access to Phone
Benin	51.0	38.1	21.8	20.2
Burkina	81.3	15.5	7.7	3.9
CDI	62.9	33.4	8.7	8.3
Mali	86.7	12.6	1.7	1.7
Niger	70.8	24.2	14.1	4.7
Senegal	67.5	24.8	9.6	10.2
Togo	77.0	17.6	4.9	5.8
TOTAL	**70.3**	**24.3**	**9.8**	**8.3**

Source: Authors' computations based on 1-2-3 surveys, WAEMU, 2001.

Table 2: IPU Utility Access by Sector (Total sample (N=5,409))

	No Utility Access	Access to Electricity	Access to Water	Access to Phone
Clothing & apparel	51.2	46.0	8.9	7.1
Other manufacturing	69.4	24.8	13.8	6.5
Construction	84.5	7.1	3.3	11.1
Wholesale/retail	60.5	35.2	9.4	12.9
Petty trade	85.2	11.4	6.4	3.0
Hotel/Restaurant	63.5	26.7	22.9	2.8
Repair Services	59.1	35.6	8.9	17.2
Transport	76.2	10.1	1.3	20.7
Other Services	61.4	33.7	13.3	12.8
TOTAL	**70.3**	**24.3**	**9.8**	**8.3**
Burkina – Clothes-producing IPUs (N=35)	***71.4***	***28.6***	***5.7***	***8.6***

Source: Authors' computation based on 1-2-3 survey, WAEMU, 2001.

Table 3: Influence of Utility Access on Value Added (Ln) by Country– OLS Results (Total sample)

	Total	Benin	Burkina	CDI	Mali	Niger	Senegal	Togo
Ln(K)	0.154	0.162	0.170	0.124	0.165	0.185	0.117	0.166
	(0.013)*	(0.036)*	(0.030)*	(0.036)*	(0.034)*	(0.045)*	(0.031)*	(0.033)*
Ln(L)	0.485	0.468	0.538	0.376	0.653	0.582	0.468	0.339
	(0.025)*	(0.071)*	(0.065)*	(0.054)*	(0.053)*	(0.077)*	(0.068)*	(0.067)*
Electricity	-0.273	-0.370	-0.202	-0.077	-0.058	-0.172	-0.368	-0.311
	(0.049)*	(0.132)*	(0.143)	(0.108)	(0.165)	(0.181)	(0.124)*	(0.118)*
Water	-0.048	0.042	0.239	-0.501	0.235	-0.247	0.204	0.002
	(0.074)	(0.175)	(0.133)***	(0.199)**	(0.320)	(0.179)	(0.161)	(0.205)
Telephone	0.388	0.120	0.127	0.490	0.957	0.853	0.481	0.543
	(0.083)*	(0.153)	(0.199)	(0.261)***	(0.310)*	(0.310)*	(0.153)*	(0.129)*
Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N	*5,208*	*735*	*719*	*892*	*691*	*554*	*875*	*742*
R^2	*0.335*	*0.331*	*0.382*	*0.195*	*0.416*	*0.310*	*0.319*	*0.290*

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; *significant at 1%.

Source: Authors' computations based on 1-2-3 survey, WAEMU, 2001.

Table 4: Influence of Utility Access on Value Added (Ln) by Sector – OLS Results (Total sample)

	Cloth.	Manu.	Constr.	WS/R	Petty	Hotel	Repair	Trans.	Other
Ln(K)	0.130	0.132	0.223	0.148	0.204	0.285	0.097	0.138	0.095
	(0.035)*	(0.031)*	(0.047)*	(0.041)*	(0.027)*	(0.056)*	(0.048)**	(0.055)**	(0.030)*
Ln(L)	0.450	0.452	0.676	0.504	0.307	0.466	0.555	0.766	0.367
	(0.066)*	(0.059)*	(0.054)*	(0.114)*	(0.061)*	(0.114)*	(0.073)*	(0.129)*	(0.068)*
Electricity	-0.017	-0.451	0.426	-0.352	-0.288	-0.002	-0.289	-0.625	-0.106
	(0.119)	(0.126)*	(0.371)	(0.160)**	(0.145)**	(0.196)	(0.147)***	(0.337)***	(0.134)
Water	0.282	-0.123	-0.816	0.288	-0.130	-0.004	-0.066	-0.206	-0.043
	(0.220)	(0.138)	(0.526)	(0.281)	(0.215)	(0.166)	(0.248)	(0.394)	(0.181)
Telephone	0.012	0.500	-0.017	0.483	0.641	-0.545	0.195	0.916	0.432
	(0.293)	(0.224)**	(0.181)	(0.210)**	(0.268)**	(0.482)	(0.203)	(0.198)*	(0.184)**
Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N	603	912	442	451	1358	367	323	220	532
R^2	0.334	0.325	0.549	0.300	0.212	0.306	0.381	0.429	0.350

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

Source: Authors' computations based on 1-2-3 survey, WAEMU, 2001.

Table 5: Influence of Utility Access on Value Added (Ln) by Sector – OLS Results (IPUs with fixed business location only)

	Cloth.	Manu.	Constr.	WS/R	Petty	Hotel	Repair	Trans.	Other
Ln(K)	0.220	0.133	0.114	-0.038	0.083	0.262	0.076	0.098	0.074
	(0.092)**	(0.067)**	(0.258)	(0.072)	(0.063)	(0.148)***	(0.083)	(0.292)	(0.068)
Ln(L)	0.396	0.399	0.299	0.571	0.624	0.140	0.545	1.228	0.536
	(0.139)*	(0.174)**	(0.663)	(0.187)*	(0.221)*	(0.296)	(0.145)*	(0.648)***	(0.137)*
Electricity	0.444	-0.393	-1.001	-0.297	0.073	0.358	-0.198	-0.191	-0.208
	(0.212)**	(0.255)	(1.255)	(0.239)	(0.276)	(0.442)	(0.235)	(1.348)	(0.329)
Water	-0.246	-0.122	0.323	0.365	0.058	0.104	-0.262	-3.435	-0.101
	(0.420)	(0.356)	(1.579)	(0.365)	(0.387)	(0.327)	(0.342)	(1.906)***	(0.302)
Telephone	0.358	0.365	1.857	0.486	0.893	-0.763	0.276	0.825	0.859
	(0.319)	(0.387)	(1.381)	(0.311)	(0.497)***	(0.624)	(0.270)	(0.516)	(0.312)*
Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N	*217*	*180*	*29*	*198*	*193*	*91*	*135*	*24*	*128*
R^2	*0.320*	*0.206*	*0.771*	*0.207*	*0.297*	*0.317*	*0.348*	*0.847*	*0.356*

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

Source: Authors' computations based on 1-2-3 survey, WAEMU, 2001.

Table 6: Influence of Electricity Access on Value Added (Ln) by Sector – IV Results (IPUs with fixed business location only)

	Total	Cloth.	Manu.	Constr.	WS/R	Petty	Hotel	Repair	Trans.	Other
Electricity	-0.950	0.426	-4.575	-16.266	0.708	-0.715	-5.635	-0.970	-6.566	-0.104
	(1.130)	(3.860)	(3.971)	(8.858)	(1.705)	(1.293)	(7.100)	(1.916)	(3.812)	(1.824)
Controls[1)]	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N	*1,195*	*217*	*180*	*29*	*198*	*193*	*91*	*135*	*24*	*128*
1st Stage F	*8.82*	*0.48*	*1.64*	*1.48*	*0.00*	*10.10*	*0.76*	*1.92*	*0.36*	*4.94*

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

1) The covariates also include access to water and telephone.

Source: Authors' computations based on 1-2-3 survey, WAEMU, 2001.

Table 7: Influence of Utility Access on Revenue (Ln) (Tailor sample)

	OLS			OLS				IV
	Electricity	**Water**	**Phone**	**Electricity**	**Water**	**Phone**	**Utilities**	**Electricity**
Ln(K)	0.120	0.119	0.125	0.094	0.094	0.099	0.090	0.088
	(0.058)***	(0.057)***	(0.061)***	(0.074)	(0.073)	(0.079)	(0.072)	(0.054)
Ln(L)	0.411	0.508	0.503	0.379	0.464	0.456	0.389	0.318
	(0.117)*	(0.117)*	(0.126)*	(0.130)*	(0.121)*	(0.136)*	(0.138)**	(0.151)**
Electricity	0.597			0.543			0.513	0.828
	(0.262)**			(0.250)***			(0.251)***	(0.416)***
Water		0.414			0.539		0.453	
		(0.315)			(0.366)		(0.369)	
Phone			0.019			-0.038	-0.008	
			(0.268)			(0.235)	(0.250)	
Controls	*No*	*No*	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*[1)]
N	*233*	*230*	*232*	*233*	*230*	*232*	*230*	*222*
R^2	*0.159*	*0.135*	*0.129*	*0.193*	*0.182*	*0.169*	*0.202*	
1st Stage F								*29.23*

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

1) The covariates also include access to water and telephone.

Source: Authors' computations based on tailor survey, Burkina Faso, 2011.

Table 8: Influence of Electricity Access on Revenue (Ln) (Tailor sample)

	Quantile Regression			
	20	**40**	**60**	**80**
Ln(K)	0.248	0.108	0.115	0.0.142
	(0.097)**	(0.062)**	(0.065)***	(0.084)***
Ln(L)	0.193	0.556	0.524	0.496
	(0.222)	(0.176)*	(0.177)*	(0.156)*
Electricity	0.466	0.478	0.595	0.617
	(0.397)	(0.235)	(0.302)***	(0.296)**
Controls	*Yes*	*Yes*	*Yes*	*Yes*
N	*230*	*230*	*230*	*230*
R^2	*0.153*	*0.140*	*0.122*	*0.147*

Note: Bootstrapped (rep=100) standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

Source: Authors' computations based on tailor survey, Burkina Faso, 2011.

Table 9: Influence of Electricity Access on Revenue (Ln) (Tailor sample)

	OLS	
	Credit constraint	**Non-credit constraint**
Ln(K)	0.180	0.080
	(0.137)	(0.051)
Ln(L)	0.033	0.382
	(0.366)	(0.096)*
Electricity	0.583	0.380
	(0.392)	(0.189)***
Controls	*Yes*	*Yes*
N	*62*	*171*
R^2	*0.218*	*0.179*

Note: Bootstrapped (rep=100) standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

Source: Authors' computations based on tailor survey, Burkina Faso, 2011.

Table 10: Influence of Electricity Access on Total Labour Hours (Ln) (Tailor sample)

	OLS		IV
	(1)	(2)	
Electricity	0.529	0.167	0.008
	(0.108)*	(0.090)***	(0.169)
No. Staff		0.272	0.280
		(0.025)*	(0.023)*
Low capital		Ref.	Ref.
Medium capital		0.123	0.073
		(0.045)**	(0.053)
High capital		0.111	0.085
		(0.050)**	(0.045)***
Controls	*No*	*Yes*	*Yes*
N	*241*	*241*	*229*
R^2	*0.090*	*0.740*	
1st Stage F			*35.95*

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

Source: Authors' computations based on tailor survey, Burkina Faso, 2011.

Table 11: Influence of Electricity Access on Machine Use (Tailor sample)

	Probit (Marginal effects reported)				IV (marginal effect)
	Electric Machinery		Mechanic Machinery		
	(1)	(2)	(3)	(4)	Electric machinery
Electricity	0.585	0.573	-0.245	-0.244	0.216
	(0.067)*	(0.108)*	(0.061)*	(0.070)*	(0.202)
No. Staff		0.051		-0.034	0.049
		(0.038)		(0.014)**	(0.164)*
Low capital		Ref.	Ref.	Ref.	Ref.
Medium capital		0.368		0.230	0.247
		(0.094)*		(0.086)*	(0.057)*
High capital		0.420		0.173	0.269
		(0.072)*		(0.087)**	(0.058)*
Controls	*No*	*Yes*	*No*	*Yes*	*Yes*
N	*249*	*249*	*249*	*249*	*237*
R^2	*0.132*	*0.366*	*0.048*	*0.127*	
1st Stage F					*1.14*

Note: Robust, clustered standard errors in parentheses; *** significant at 10%; ** significant at 5%; * significant at 1%.

Source: Authors' computations based on tailor survey, Burkina Faso, 2011.

Table A1: Descriptive Statistics

	Firms without access (n=3,801)		Firms with access to at least one utility (n=1,608)	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Value added (in 2001 Fcfa)	300.00	780.98	536.89	1,481.56
Capital (in 2001 Fcfa)	416.34	1,105.02	1,225.96	1,795.51
No. of Staff (incl. owner)	1.50	1.13	2.18	1.64
Female owner	0.55	0.50	0.42	0.49
Age owner	36.28	11.69	36.48	10.66
Yrs. of Edu. owner	3.02	3.71	4.98	4.46
Wealth quintile 1	0.26	0.44	0.06	0.24
Wealth quintile 2	0.23	0.42	0.13	0.33
Wealth quintile 3	0.20	0.40	0.21	0.40
Wealth quintile 4	0.17	0.38	0.27	0.44
Wealth quintile 5	0.14	0.35	0.34	0.47
Clothing & apparel	0.08	0.28	0.19	0.39
Other manufacturing	0.17	0.38	0.18	0.38
Construction	0.10	0.30	0.04	0.20
Wholesale/retail	0.08	0.27	0.12	0.33
Petty trade	0.31	0.46	0.13	0.34
Hotel/restaurant	0.06	0.25	0.09	0.28
Repair services	0.05	0.22	0.09	0.28
Transport	0.05	0.21	0.03	0.18
Other services	0.09	0.29	0.13	0.34
Benin	0.11	0.32	0.26	0.44
Burkina Faso	0.16	0.37	0.09	0.28
Côte d'Ivoire	0.15	0.35	0.21	0.41
Mali	0.16	0.37	0.06	0.24
Niger	0.10	0.31	0.10	0.30
Senegal	0.16	0.36	0.18	0.38
Togo	0.15	0.36	0.11	0.31

Source: Authors' computations based on 1-2-3 survey, WAEMU, 2001.

Table A2: Descriptive Statistics – Tailors (n=248)

	Mean	Std. Dev.
Revenue[1)] (in 2011 Fcfa)	162.88	257.67
Capital (in 2011 Fcfa)	443.79	998.86
No. of Staff	3.56	1.83
Enterprise age	7.15	6.69
Electricity	0.86	0.34
Water	0.06	0.23
Phone	0.07	0.26
Mobile	0.98	0.14
Cost electricity	6.12	7.70
Cost water	0.90	4.69
Cost telephone	8.00	9.97
Male	0.79	0.41
Age	34.62	9.46
No education	0.21	0.41
Primary started	0.45	0.50
Primary completed	0.35	0.48
Secondary completed	0.12	0.33
Years managing	6.98	6.58

Note: 1) Due to the quality of the production costs reported we resort to using revenue instead of value added in our estimation. This is also explained in Section 4.

Source: Authors' computations based on tailor survey, Burkina Faso, 2011.