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Electricity Reliability and Intra-Sectoral Structural Change in Sub-Saharan Africa

Evidence from Medium-Sized Manufacturing Firms

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Abstract

Although access to reliable electricity enables manufacturing companies to increase their output, there have been few studies of the distribution of output growth between export and domestic markets. Although some papers have examined the impact of electricity reliability on exports (in volume terms or dummy terms), little is known about the way electricity reliability can push existing manufacturing firms more into the export market. Using the World Bank Enterprise Surveys, this paper examines a sample of 13,025 manufacturing firms surveyed in 39 Sub-Saharan African countries between 2006 and 2022. The paper employs the entropy balancing approach to examine how access to reliable electricity affects the distribution of manufacturing firms' sales between export and domestic markets. The results show that for medium-sized manufacturing firms, electricity access increases the share of exports in total sales at the expense of the share of domestic sales. However, the results for small and large manufacturing companies are not statistically significant. Among medium-sized manufacturing enterprises, domestic companies improve their exports relative to domestic sales when they have access to electricity, with mixed results for foreign companies. Even in resource-intensive countries, electricity access enhances the share of exports relative to domestic sales. The intra-sectoral structural change induced by power access is not limited to medium-sized companies in the manufacturing sector; the same pattern is observed in the service sector with mixed findings.

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Electricity Reliability and Intra-Sectoral Structural Change in Sub-Saharan Africa: Evidence from Medium-Sized Manufacturing Firms

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1. Introduction

Power outages cause productivity losses in manufacturing companies. Hence, improving electricity access leads to gains in competition that increase the overall output of manufacturing firms in Sub-Saharan Africa (SSA). [3] However, it is not clear which market benefits most from these productivity gains. By becoming more competitive, do manufacturing companies increasingly sell in export markets at the expense of domestic markets? Access to reliable electricity can enable non-existing companies – firms not previously involved in the export market – to enter the export market (extensive margin). With a good quality of electricity supply and a substantial margin on export markets, existing manufacturing firms – firms in both export and domestic markets – may decide to focus more on export markets to capture additional margins (intensive margin). This is an intra-sectoral structural change (ISSC) that we define as the increase in the share of exports in total sales at the expense of domestic sales by firms in the same sector. It is thus measured by the percentage of manufacturing firms' exports and that of their domestic sales in total sales. ISSC is therefore a structural transformation within the same sector, in this case the manufacturing sector. It is different from inter-sectoral structural change, which is the movement of firms or resources between two different sectors, for instance a structural transformation between the agriculture and manufacturing sectors.

Like structural change between the agriculture and manufacturing sectors, increasing the extensive and intensive margins is important for sustaining growth and economic development for two reasons. First, self-selection ensures that only the best-performing companies enter export markets (Camino-Mogro et al., 2023; Fafchamps et al., 2008; Van Biesebroeck, 2005; Bernard and Jensen, 1999). Because of entry costs and strong competition in export markets, firms wishing to export considerably improve their productivity before entering export markets. Second, in some cases, there is a learning-by-exporting process thanks to which feedback from foreign buyers and competitors helps to improve the performance of exporting companies after export (Camino-Mogro et al., 2023; Greenaway et al., 2002; Bigsten et al., 2000). Whether the improvement in firms' performance is ex-ante or ex-post, entering export markets is associated with better productivity which can improve wages and therefore the standard of living.

Hence, it becomes important to understand how electricity access, which is one of the main obstacles to firms' growth in SSA, helps manufacturing companies to move from domestic to export markets.[4] As such, this paper examines the role that access to reliable electricity could play in the orientation of manufacturing companies towards export markets at the expense of domestic markets. Using the World Bank Enterprise Surveys (WBES), we explore a sample of 13,025 manufacturing firms in 39 SSA countries surveyed between 2006 and 2022. We consider a treatment variable describing whether a firm has access to reliable electricity or not. We then assess how this treatment – a dummy taking 1 if the firm declares not experiencing power outages and 0 otherwise – affects our two measures of ISSC.

By using the entropy balancing method, we first create a counterfactual group containing firms experiencing power outages but as similar as possible to those in the treated group (the group of companies not experiencing power outages). Then, in a second step, we determine the difference in terms of ISSC between the two groups, which difference is attributed to electricity access. Compared to other

[3] In this paper, the term output corresponds to companies' sales, since the database we use approximates production to sales.
[4] In this paper, the word "electricity access" refers to the availability of reliable electricity.

impact assessment approaches like propensity score matching and difference-in-difference, entropy balancing is better for three main reasons. First, it is a non-parametric technique, it does not impose a specific functional form on the matching or estimation process, which enables to deal with specification errors. Second, the entropy balancing method balances pre-treatment characteristics even in the context of a small control group, which improves the quality of the matching through a good counterfactual. However, in this paper, the number of untreated units is sufficiently large to provide an accurate coverage of treated units. Third, entropy balancing permits the introduction of individual and time fixed effects, this allows to control for potential omitted variable biases.

The issue of the link between the ISSC and electricity access can be placed within the growing body of research focusing on the link between electricity shortages and firms' exports. Starting from the assumption that electricity is an input for firms, particularly for manufacturing companies, this strand of literature shows that power outages lead to production, productivity and competitivity losses that harm firms' output, employment and thus their exports (Cole et al., 2018; Mensah, 2018; Allcott, 2016; Alam, 2013; Moyo, 2013). Although these papers have explored the effect of power outages on firms' output, to the best of our knowledge, this paper is the first to: i) examine the impact of power access on the ISSC involving domestic and export markets; ii) assess the role of domestic and foreign companies in this transformation process and iii) disaggregate companies by size to understand which of small-sized, medium-sized, and large-sized companies benefit most from the ISSC-effect of electricity access. These three contributions are important for two main reasons. First, since the inter-sectoral structural change (structural change between agriculture and manufacturing) has failed to be a good engine of growth and sometimes has been growth-reducing in SSA (see for example McMillan, 2011), it is crucial to determine drivers of the ISSC which are simultaneously growth and development drivers too. Second, analyses by size and ownership type help to understand heterogeneities in the ISSC-effect of electricity access, which will enable to focus policy implications on firms with a large ISSC-effect.

We find that the access to reliable electricity increases the intensive margin by allowing some existing firms to export more than selling locally. More specifically, medium-sized manufacturing companies, which have access to electricity, see an increase in the share of their exports, hence a decrease of their share of domestic sales in total sales. The share of exports rises between 4.67 and 12.51 percentage points (pp) depending on the model considered. For the overall sample and small-sized as well as large-sized firms, we did not find any significant effect of electricity access on the ISSC in the manufacturing sector. The ISSC-effect only occurs in the sample of medium-sized companies because of specific differences between these companies and the other two groups of firms. Compared to small-sized firms, medium-sized ones are mature and face fewer internal distortions; this enables them to pay the entering cost of export markets when they have access to electricity. Relative to large-sized companies, medium-sized firms are less integrated into export markets, as a result, in the context of power access, there can be a catch-up process that could accelerate the orientation of medium-sized firms towards export markets relative to large-sized ones. For instance, based on our study sample, we find that large firms export 24% of their total sales, while medium-sized firms export only 10%. On the regional level, large companies account for 61% of SSA's manufacturing exports, whereas medium-sized companies account for 25%.[5] Another explanation that needs to be empirically proved is related to the fact that medium-sized firms may have a great growth potential relative to large-sized firms; this encourages them to significantly move

[5] Exports at the regional level are total exports for each company category in Sub-Saharan Africa.

into export markets in the context of a business-friendly environment compared to large-sized firms. As a result, obtaining an input such as reliable electricity (public electricity or investment self-generation) gives medium-sized manufacturing firms a competitivity edge, enabling them to sell more abroad.

As in the case of the intensive margin, electricity access positively impacts the extensive margin. It therefore positively affects the decision to export in the case of medium-sized firms, whereas the effect is not statistically significant for small- and large-sized firms.

Access to reliable electricity thus affects both the orientation of firms already in the market and the entry of new firms into the export market. However, the effects on the intensive margin are much greater than those on the extensive margin. Thus, the results below only refer to the ISSC from the intensive margin.

We find evidence of ISSC for domestic medium-sized manufacturing firms, but mixed-results for foreign firms. We argue that this is because foreign direct investments (FDIs) in SSA are market-seeking rather than efficiency-seeking (see Farole, 2011). The reality of market-seeking's FDIs in SSA is also confirmed by the fact that most FDIs in SSA are concentrated in the natural resources sector (see Asiedu, 2006). It is also because foreign firms are much more export-oriented than domestic firms. Therefore, having access to reliable electricity could be more attractive to firms with a limited presence in the export market than those with a significant presence.

Our findings show that even in resource intensive countries, electricity reliability increases the share of exports in total sales, despite the crowding-out effect of natural resource exports on the manufacturing sector. Electricity access can thus be a solution to reduce the crowding-out of manufacturing firms in a context of resource dependence in general and of Dutch disease (DD) in particular. Indeed, in a DD situation, firms in the tradable sector (manufacturing sector in this case) experience price competitivity losses due to their inability to modify international prices. Therefore, by improving access to electricity for manufacturing firms, especially for medium-sized ones, policy makers provide a non-price competitivity advantage that will enable firms to be more competitive, especially on export markets. This is especially relevant as the intensity of power outages is higher in resource intensive countries than in non-resource intensive ones.[6]

Our baseline results are confirmed when we use an alternative estimate approach and two other explanatory variables. The ISSC induced by electricity access is not limited to manufacturing firms, the same pattern is observed in the service sector, but it is less statistically significant.

The rest of this paper is organized as follows: section 2 discusses the theoretical hypotheses of the effect of electricity access on ISSC; section 3 presents the data, variables, and statistics; section 4 presents the empirical strategy; section 5 explores the baseline results and the robustness check; and section 6 concludes.

2. Theoretical hypothesis: Electricity access and intra-sectoral structural change

[6] The average power outages in resource-intensive countries is 20, while the average in non-resource intensive countries is 8.

Theoretically, electricity access affects the ISSC in two steps: input-effect and production distribution-decision.

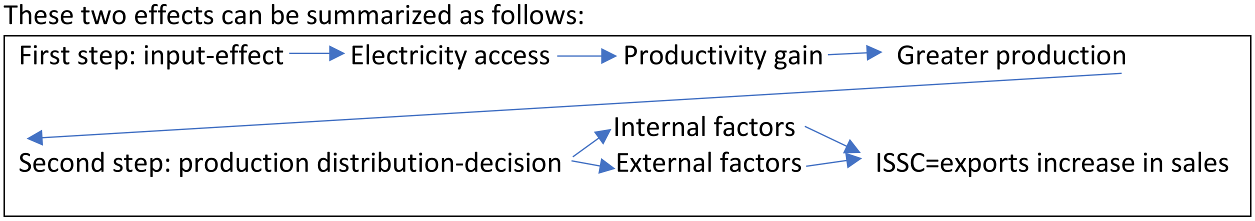
First step: input-effect

As mentioned in the literature, since electricity is an essential input for the industrial production of manufacturing firms, it provides a productivity gain to companies, which increases their overall performance - output, employment, exports.[7] More precisely, these productivity gains, by making firms more competitive, would lead to an increase in the level of exports. However, this input-effect does not tell exactly how firms reorganize their sales between the domestic and export markets. Do firms export more than they sell on the domestic market when they have access to electricity? Understanding this reorganization of sales between markets is crucial to assess whether electricity access contributes to changing the structure of SSA's economy. Analyzing the effect of electricity access on exports in level form or as a dummy - like in the existing literature - does not allow to understand such structural change dynamics.

Step two: production distribution-decision

Once firms' competitiveness has increased thanks to electricity access, companies decide to produce more. However, they may decide to sell much more on the export market at the expense of the domestic market, or they may do the opposite. But the decision to sell more on the export market than on the domestic market will depend both on internal and external factors to the firm. Regarding internal factors, a company's willingness to export instead of selling on the domestic market depends on firm's age, firm's size, ownership type, being a subsidiary of a parent company, the firm's development strategy, the marketing strategy and any other firm-specific factors that may explain the firm's motivation to export. Concerning external factors, they are related to factors external to the company that highlight the economic opportunities for the firm if it starts exporting. These factors include: the existence of large economic margins in export markets; export facilitation measures in export markets; export incentives offered to firms by foreign authorities; the size of foreign market; the degree of openness of the foreign economy; the comparative advantage of foreign countries; and any other factor external to the company that offers economic opportunities for export activity.

These two effects can be summarized as follows:



However, the empirical study of these transmission channels is not the subject of this paper and can be the topic of another research paper.

3. Data, variables, and statistics

3.1. Data

Firm-level data are from WBES, which provides nationally representative data on companies in a set of countries, using stratified random sampling with replacement methodology. The population units are

[7] See for example: Cole et al., 2018; Mensah, 2018; Allcott, 2016; Alam, 2013; Moyo, 2013.

grouped into homogeneous groups, and simple random samples are selected from each group. Individual observations are then weighed using sampling weights that consider the selection probabilities in strata (firm size, business sector, and geographic region), enabling companies to be representative within countries.

The paper uses the most recent standardized data set for the period 2006-2022, which includes 67 surveys. After processing the database, 13,025 manufacturing firms in 39 SSA countries remained. The database provides information on companies' perception regarding the business environment and on their characteristics as well as their performances. The distribution of surveyed firms is unbalanced among industries. The food industry accounts for 26.46% of the surveyed firms (Table A.1), followed by the wearing apparel industry (13.79%), the furniture industry (11.14%) and the metal industry (9.00%). These four industries represent more than half of the surveyed manufacturing firms (60.39%). In addition, some countries have many more companies surveyed than others (Table B.1 & Table B.2). Nigeria, Kenya, South Africa, and Zambia are countries whose firms are the most represented in the database. The survey waves in Nigeria (2017 and 2014) alone represent 16.82% of interviewed firms. Surveys conducted in Kenya (2007, 2013 and 2018) represent 9.39% of the total sample. In South Africa (2007) and Zambia (2007 and 2013), firms interviewed represent 5.03% and 4.98% of the total sample, respectively.

3.2. Variables

Six groups of variables are used in this paper: ISSC's measures, electricity access measure, firm-level, and country-level control variables, as well as covariates (at country- and firm-level).

1. Intra-Sectoral Structural Change Measures

- *Intra-sectoral allocation of firms:* The ISSC is measured in this paper by the ability of existing firms to move across export and domestic markets. It is thus measured by two variables: the share of exports and that of domestic sales in total sales.

2. Electricity Access Measure

- *Treatment=Not experiencing power outages:* Our treatment is a dummy variable that indicates whether or not a company has experienced power outages in the last fiscal year. It is therefore 1 if the company declares not suffering from power outages, and 0 otherwise. It is thus the electricity access measure at the firm-level.

3. Firm-level control variables

- *Firms' age:* Age is measured in this paper by the gap between the year of survey and the year the firm began its activity. Since age is associated with the firm's experience in its field, it is often considered as a key determinant of firms' performances. According to the literature on learning by doing, the longer a firm operates in a market, the more it learns about that environment. However, some studies shed light on the adverse effects of age on firms' performances (Hannan and Freeman, 1984; Leonard-Barton, 1992).
- *Legal status and gender:* The performance gap between firms is often attributed to differences in management quality. Because of the managerial expertise of the parent from which they benefit, foreign firms would be well managed compared to domestic ones (Bellak, 2004). In the absence

of such a proxy, we use the legal status of firms and the gender of the top manager. These two variables are certainly not proxies for the quality and the system of management, but they can impact them. The legal status is captured by an ordinal qualitative variable (Sole proprietorship=1; Limited partnership=2; Partnership=3; Shareholding company with nontraded shares or shares traded privately=4; Shareholding company with shares trade in the stock market=5). The gender variable is a dummy that takes 1 if the top manager is a woman and 0 otherwise.

- *Transport:* This variable controls for the effects of constraints related to access to transport infrastructure. This constraint is measured by the subjective response given by a firm to the following question: to what extent is transport an obstacle to this establishment's activity? The response is: 0 for no barrier, 1 for minor barrier, 2 for moderate barrier, 3 for major barrier, and 4 for very major barrier.
- *Backward-looking variables:* They represent total sales and total employment over the three years prior to the survey. As in growth models, the use of these variables makes it possible to control for initial performance and catch-up effects.

4. Country-level control variables

- *Trade openness$_{(t-1)}$:* This variable considers the degree to which countries are oriented towards foreign trade. We consider the KOF trade globalization index. It is the weighted average of the de facto and de jure indices. The relevance of this measure lies in the fact that we have both trade volume and trade policy dimensions.
- *Real exchange rate growth$_{(t-1)}$:* This variable tracks the effect of non-price determinants of competitivity. A body of research shows that depreciating or undervaluing the real exchange rate is an effective way of promoting manufacturing exports (Rodrik, 2018; Freund and Pierola, 2012; Bernard and Jensen, 2004). According to the authors, exchange rate depreciation is an indirect subsidy. Reducing distortions faced by manufacturing firms, the depreciation gives manufacturing firms a competitive advantage. However, it is not clear if this competitive advantage increases exports more than domestic sales. The real exchange rate is from Penn World Table 10.1.

5. Firm-level covariates

Covariates are variables used in both the first and second stages of entropy balancing. They are the determinants of the treatment's occurrence (access to electricity). Company-level covariates are therefore company's characteristics that can explain a specific company's access to electricity.

- *Firms' size:* It is reasonable to say that the ability of firms to respond to challenges in access to electricity is strongly correlated with their size. Thus, the difference in terms of size can explain the fact that some companies have access to electricity whereas others may not. Since firms' size can explain the occurrence of electricity access, it is among the covariates in the first stage of entropy balancing, and a control variable in the second stage. It is important to note that the size in covariate and control variable only in the overall sample. In the WBES, small-sized companies are those employing no more than 19 people, medium-sized companies are defined as those employing between 20 and 99 people, while large-sized companies are classified as having more than 100 employees.

- *Generator use:* The alternative response to the absence of public electricity often sought by businesses is the use of generators. Therefore, at the firm level, self-generation may explain why some firms experience power outages and others do not. To capture this effect, we include a dummy variable in the covariates that takes 1 if the firm uses a generator, and 0 otherwise.

6. Country-level covariates

- *Country-level variables:* We control for the effect of several macroeconomic variables. These variables first serve as covariates, making treated and untreated companies comparable. Then they are introduced in the second stage to study their effect on dependent variables. These variables come from the World Bank and WDI databases: GDP per capita$_{(t-1)}$, GDP growth$_{(t-1)}$, electricity losses during transmission and transport$_{(t-1)}$, and the rule of law growth$_{(t-1)}$.

3.3. Statistics

Table 1 summarizes statistics for the variables described above. Regarding dependent variables, it appears that the bulk of SSA manufacturing firms' sales is made on domestic markets. Overall, 90% of manufacturing company sales are within the domestic economy, with the remaining 10% being exported. This highlights the poor export performance of SSA manufacturing firms. In the case of the main variable of interest, only 19% of manufacturing companies declare not experiencing power outages, revealing the poor access to electricity by this group of firms in SSA. On average, the companies considered are 17 years old, the average status being a shareholding company with non-traded shares or shares traded privately, and only 12% of managers are women. The SSA manufacturing sector employed, on average 78 people and sold thirteen billion one hundred million products three years ago (US $). Most of the manufacturing firms in SSA consider access to transport a moderate obstacle. For firm-level covariates, we have: 54%, 31% and 15% of companies that are small-sized, medium- and large-sized firms, respectively; around half of them are generator users. Power losses during transmission and transport (electricity grid quality), accounts for around 17% of electricity production. The mean of GDP per capita and that of GDP growth in the sample are $1,693 and 5.58%, respectively. On average, the growth rate of the rule of law is negative (-3.59%) showing an average deterioration of institutional quality in our sample.

Table 1: Variables

Variable	Obs	Mean	Std. dev.	Min	Max
Dependent variables					
Exports % total sales	12,812	9.70	24.07	0	100
Domestic sales % total sales	12,812	90.30	24.07	0	100
Variables of interest					
Firms having access to electricity (dummy, 0-1)	12,909	0.19	0.40	0	1
Control variables					
Firms' age (years)	13,025	16.78	14.15	0	90
Firms' status (qualitative variable, 1-5)	13,025	2.11	1.37	1	5
Gender (M=1, F=0)	7,860	0.12	0.32	0	1
Labor 3 years ago (number of workers)	11,685	77.69	1590.714	0	170000
Output 3 year ago (US$)	9,694	1.33E+10	1.30E+12	0	1.28E+14
Transport (qualitative variable, 1-5)	12,908	1.47	1.27	0	4.00

Real exchange rate growth$_{(t-1)}$ (%)	11,677	5.17	10.73	-20.65	31.42
Trade openness$_{(t-1)}$ (% GDP)	13,025	43.62	13.19	15.32	79.46
Covariates					
Small-sized firms (labor<20)	13,025	0.54	0.50	0	1
Medium-sized firms (20<labor<99)	13,025	0.31	0.46	0	1
Large-sized firms (labor>99)	13,025	0.15	0.35	0	1
Generator use (dummy, 0-1)	12,818	0.50	0.50	0.00	1.00
Electricity losses$_{(t-1)}$ (% total power production)	8,574	17.07	9.61	5.37	71.03
GDP per capita $_{(t-1)}$ (US$)	11,617	1693.08	1478.72	319.40	6938.85
GDP growth$_{(t-1)}$ (%)	11,617	5.58	4.11	-20.60	15.17
Rule of law growth$_{(t-1)}$ (%)	8,204	-3.59	26.51	-82.63	91.82

Source: WBES, WDI, KOF data, PWT.

4. Empirical strategy

Using a firm-level treatment variable, we carry out an impact assessment method to understand how access to electricity leads manufacturing firms to become more export-oriented. We consider a binary variable that takes the value 1 if the company did not experience power outages in the last fiscal year, and 0 otherwise. To investigate the exposure of domestic firms to the treatment, we construct the interaction variable between the treatment and the dummy, which is 1 if the company is domestic and 0 otherwise (Treatment#Domestic_Firm). For foreign firms, we construct another dummy that is 1 if the company is foreign and 0 otherwise and we determine the interactive variable between the dummy and the treatment variable (Treatment#Foreign_Firm).

The initial idea of our impact assessment is to compare the export or domestic sales' performance of manufacturing firms before (Y^0) and after (Y^1) receiving the treatment. Thus, the effect of the treatment would be determined by the difference between the outcomes Y^1 and Y^0. Since we do not have information on the same firms before and after the treatment, we look for a counterfactual of our treated firms before the treatment. This counterfactual is therefore made up of firms that were not assigned to the treatment, i.e., that have experienced power outages during the last fiscal year. Hence, if the treatment was randomly assigned, then its effect would be determined by the difference between the outcomes of treated and untreated firms. Nevertheless, electricity access is not random, it is linked to certain characteristics and performances at the country and firm-level. The macroeconomic performances, the economic development, institutions, and the quality of electricity service provided by the country, can affect the occurrence of power outages. For instance, countries with good quality of institutions and high level of economic development may have good electricity infrastructure, which can limit power shortages. At the firm level, some features such as firms' size and the use of generators can explain why some companies experience power shortages while others do not. Given that these macroeconomic and microeconomic variables are also associated to the export and domestic sales' performance, the occurrence of power outages is not random.

To deal with the selection bias linked to the treatment, we apply a matching method that consists in making the counterfactual as comparable as possible to the treated firms. Hence, treated units are matched to the untreated ones based on their observable pre-treatment characteristics. The average treatment effect of the treatment (ATT) conditional on pre-treatment characteristics is thereore determined as follows:

$$ATT(\chi) = E[Y_{f1}|T_f = 1,\ X = \chi] - E[Y_{f0}|T_f = 0,\ X = \chi]\ (1)$$

Where χ is the set of country and firm pre-treatment characteristics that should be correlated to the occurrence of the treatment. χ is thus made up of variables measuring the economic performance (GDP growth, GDP per capita), the quality of institutions (rule of law), firms' characteristics (firms' size, generator use) and variables measuring the quality of electricity infrastructure at the country level (electricity losses during transmission and transport). These variables explaining the occurrence of power shortages are also called: covariates. $E[Y_{f1}|T_f = 1,\ X = \chi]$ is the expected outcome of treated firms while $E[Y_{f0}|T_f = 0,\ X = \chi]$ is that of untreated ones. To match treated and untreated companies, we apply the entropy balancing method.[8] This method is performed in two main steps. First, using the above-mentioned pre-treatment characteristics, a weight is created which is applied to the untreated companies. This first step makes the average of the counterfactual's pretreatment characteristics statistically comparable to that of treated companies, thereby obtaining the most accurate counterfactual possible. The second step aims to study the effects of our treatment on the ability of firms to be export- or domestic sale-oriented by using the weighted ordinary least squares method. It is important to note that we include the weights of the first stage in estimates. This makes it possible to deal with the potential effect of pre-treatment differences on the treatment's impacts. Like in the literature, we only include year fixed effects in the first stage, moreover, we take covariates into account in the second step (estimate process). Since covariates are also correlated with dependent variables, their inclusion in estimates is like introducing control variables in a randomized experiment (Neuenkirch et al., 2016; Balima, 2017).

As mentioned by Bambe et al. (2022), Neuenkirch et al. (2016), and Balima (2017) some features of entropy balancing method make it a better matching technique compared to propensity score matching and difference-in-difference. First, it is a non-parametric technique, allowing to not impose a specific functional form on the matching or estimation process, which enables to deal with specification errors. Second, this method balances pre-treatment characteristics even in the context of small control group, which improves the quality of the matching through a good counterfactual. However, in this paper, the number of untreated units is sufficiently large to provide an accurate coverage of treated units. Third, entropy balancing permits the introduction of individual and time fixed effects allowing to control for potential omitted variable biases. By implementing Monte Carlo simulations and empirical analyses, Hainmueller (2012) shows that entropy balancing outperforms alternative matching techniques, such as propensity score matching and nearest neighbor matching.

Finally, the effect of our treatment is assessed by using it as an explanatory variable in an econometric model estimated from weighted ordinary least squares (2). The subscribs i and t correspond to the designation of firm and year, with m referring to markets (foreign and domestic markets). $Y_{i,t}^{m}$ is therefore either the share of exports in total sales of firm i in year t or the share of domestic sales in total sales. $Treatment_{i,t}$ is the electricity access variable and β the coefficient measuring its impact on the two outcomes. $X_{i,t}\ and\ Z_{c,t}$ are respectively the vectors of the firm- and country-level control variables, while $L_{i,t}, and\ R_{c,t}$ are the firm- and country-level covariates, respectively. $[Weight]$ is the weight resulting

[8] For more details about entropy balacing, see e.g. Hainmueller, 2012.

from the first stage of entropy balancing, helping to match treated and untreated firms. Finally, $\sigma_i \; and \; \varphi_t$ represent the country and year fixed effects, respectively, $\varepsilon_{i,t}$ being the idiosyncratic error terms.

$$Y_{i,t}^{m} = \beta Treatment_{i,t} + \alpha X_{i,t} + \delta Z_{c,t} + \gamma L_{i,t} + \theta R_{c,t} + [Weight] + \sigma_{i+} + \varphi_t + \varepsilon_{i,t} \; (2)$$

5. Results

5.1. Baseline Results

First, we present the results of the matching procedure and discuss findings in line with the effect of access to electricity on exports and domestic sales in percentage of total sales. Table 2 reports statistics of covariates before and after the matching for all the manufacturing firms. On average, firms with access to electricity are less likely to report using generators and are less likely to be large compared to untreated firms. Electricity losses during transmission and transport are lower in countries where treated firms are on average (15.77% of total electricity production). The GDP per capita and the growth rate of the rule of law are higher in countries where firms have great access to electricity. However, GDP growth rate is higher in countries where firms have less access to electricity.[9] After implementing the matching process of entropy balancing, all these significant differences disappear, so that covariates for the two groups of firms become identical.

Second, we present the results of the impact of access to electricity on ISSC by considering both the intensive and extensive margins. Table 3 reports the results of the treatment effect on the intensive margin – exports and domestic sales (% total sales) – in the overall sample and then by size. It presents four specifications with the full set of variables (control variables, covariates, and country as well as year fixed effects). The results relative to the effects on exports are in columns 1 to 4 while those relative to domestic sales are in columns 5 to 8. The results for the: (i) overall sample are in columns 1 and 5, (ii) the sample of small-sized firms in columns 2 and 6, and (iii) large-sized companies are in columns 4 and 8. For these samples, the impacts of power access on exports and domestic sales are not significant. However, considering the sample of medium-sized firms, we find that a 1% increase in electricity access rises the share of exports by 6.32 pp while decreasing that of domestic sales by the same proportion (-6.32 pp). In the specific case of medium-sized companies, it thus appears that power availability is a source of ISSC within the manufacturing sector between the domestic and foreign markets. Once they have access to electricity, medium-sized manufacturing firms focus more on export markets at the expense of domestic markets.

Table 4 reports the impact of access to reliable electricity on the dummy taking 1 if the manufacturing firm is an exporter and 0 otherwise (extensive margin). This dummy is therefore an approximation of the measure of manufacturing firms' entry into the export market. As in the case of the intensive margin, access to electricity is positively associated with the decision to export in the case of medium-sized firms, whereas the effect is not statistically significant for small- and large-sized firms. Access to reliable electricity thus affects both the orientation of firms already on the market and the entry of new firms into

[9] National covariates have no real impact on companies in the same country. In fact, these companies will have the same values. The advantage of country covariates lies in the fact that they make it possible to control for differences between treated and untreated companies in different countries, and to consider differences between treated companies between these countries. This latter point is relevant for capturing an additional source of endogeneity.

the export market. However, the effects on the intensive margin are much greater than those on the extensive margin. Thus, throughout this paper, we will focus solely on the ISSC from the intensive margin.

Focus on medium-sized companies

The ISSC-effect only occurs in the sample of medium-sized companies because of specific differences between these companies and the other two groups of firms. Compared to small-sized firms, medium-sized ones are mature and face fewer internal distortions; this enables them to pay the entering cost of export markets when they have access to electricity. The ISSC-effect only occurs in the sample of medium-sized companies because of specific differences between these companies and the other two groups of firms. Compared to small-sized firms, medium-sized ones are mature and face fewer internal distortions; this enables them to pay the entering cost of export markets when they have access to electricity. Relative to large-sized companies, medium-sized firms are less integrated into export markets, as a result, in the context of power access, there can be a catch-up process that could accelerate the orientation of medium-sized firms towards export markets relative to large-sized ones. For instance, based on our study sample, we find that large firms export 24% of their total sales, while medium-sized firms export only 10%. On the regional level, large companies account for 61% of SSA's manufacturing exports, whereas medium-sized companies account for 25%. Another explanation that needs to be empirically proved is related to the fact that medium-sized firms may have a great growth potential relative to large-sized firms; this encourages them to significantly move into export markets in the context of a business-friendly environment compared to large-sized firms. As a result, obtaining an input such as reliable electricity (public electricity or investment self-generation) gives medium-sized manufacturing firms a competitivity edge, enabling them to sell more abroad.

To further examine results from medium-sized firms, control variables and covariates as well as country and year fixed effects are gradually introduced into the estimates through Table 5. Since the coefficients are the same with different signs, Table 5 only displays results related to the share of exports in total sales. We first introduce the treatment variable into the model (column 1), followed by control variables (column 2), then covariates (column 3), and finally the country and year fixed effects (column 4). The effect of electricity access is sensitive to the various control variables, covariates, and fixed effects. The impact changes from 12.51 pp to 7.37 pp when control variables are introduced, then to 5.59 pp following the inclusion of covariates, while stabilizing at 6.32 pp in the full specification with fixed effects. Although sensitive to the above variables, the ISSC-effect of electricity access remains statistically significant regardless of the model specification.

Given that our results are only significant for medium-sized firms, we will now consider this group of companies in the rest of our estimates.

Focus on medium-sized companies in domestic and foreign firms

Table 6 compares the ISSC-effect between treated domestic and foreign medium-sized manufacturing firms. To do so, we determine the interaction variables between the treatment, domestic, and foreign firms' dummies. The ISSC-effects for treated domestic firms are summarized in columns 1 to 4, while those for foreign treated firms are shown in columns 5 to 8. Considering the complete specification, we find that the ISSC-effects are much more statistically significant for domestic firms compared to foreign ones.

The low statistical significance of the impact of electricity access on foreign firms can be partly explained by the fact that foreign direct investments (FDIs) in SSA are market-seeking rather than efficiency-seeking (see Farole, 2011). FDIs with a market-seeking objective are certainly impacted by the business climate, but their main determinants are market size and market opportunities. Efficiency-seeking FDIs, on the other hand, are primarily concerned with competitiveness and are therefore influenced by the business climate, in this case, access to electricity. This could thus explain why the effect of our electricity access variable is less statistically significant for foreign firms than it is for domestic ones. The reality of market-seeking FDIs in SSA is also confirmed by the fact that most FDIs in SSA are concentrated in the natural resources sector (see Asiedu, 2006). The other explanation is related to the fact that foreign manufacturing firms are much more export-oriented – especially for FDIs concentrated in natural resources sector – than domestic firms. Therefore, having access to reliable electricity could be more attractive to firms with a limited presence on the export market than those with a significant presence. As previously, electricity access may allow domestic firms to catch up in terms of exports.

Focus on natural resource intensive countries

It is well known that many SSA countries are heavily dependent on natural resource exports, which often have deleterious impacts on the development of manufacturing companies, notably through the DD. We, therefore, analyze the sensitivity of our results by considering both resource intensive and non-resource intensive countries. Our samples of resource intensive and non-resource intensive countries are from the International Monetary Fund's (IMF's) Regional Economic Outlook (REO).[10] The REO of October 2024 classification is based on the following criteria: a country is considered intensive in natural resources if these resources account for at least 25% of total exports otherwise it is a non-resource intensive country.

Table 7 summarizes the results of these sensitivity tests. Whatever sample we consider, we find that electricity access increases the share of exports of medium-sized manufacturing companies in both resource intensive and non-resource intensive countries. Although the impact is unsurprisingly stronger in non-resource intensive countries, the effect of electricity access in resource-intensive countries is not negligible. These results have strong policy implications, as they suggest that even for resource intensive countries, measures to improve access to electricity can boost the export performance of medium-sized manufacturing companies. Electricity access can therefore be a solution to reduce the crowding-out of manufacturing companies in a context of resource dependence in general, and DD in particular. Indeed, in a DD situation, companies in the tradable sector (manufacturing companies in this case) experience price competitivity losses due to their inability to modify international prices. Therefore, by improving electricity access for manufacturing companies, especially for the medium-sized ones, policy makers provide a non-price competitiveness advantage to the non-resource sector that will enable firms to be more competitive, especially in export markets.

5.2. Robustness Check

[10] The list of resource intensive countries according to the IMF'S REO is Angola, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Gabon, Ghana, Guinea, Liberia, Mali, Namibia, Niger, Nigeria, Sierra Leone, South Africa, Zambia, Zimbabwe.
The list of non-resource intensive countries according to the IMF'S REO is Benin, Burundi, Cabo Verde, Côte d'Ivoire, Djibouti, Ethiopia, The Gambia, Kenya, Lesotho, Madagascar, Mauritania, Mauritius, Mozambique, Rwanda, Senegal, Sudan, Eswatini, Togo, Uganda.

We apply three robustness techniques: (i) the use of a new estimation technique; (ii) the use of new explanatory variables; (iv) the change of sample. For the new regression approach, we estimate the effect of our treatment by using the ordinary least squares method (Tables 9). We reach the same conclusion, i.e., the ISSC-effect is more important and significant for medium-sized manufacturing firms (columns 1 to 4). In columns 5 to 8, we examine the effect of an electricity access indicator at country level. In fact, we use the variable measuring the number of people with access to electricity (% total population) as explanatory variable. Although the effect is small compared to our treatment variable and the entropy balancing method, we find that electricity access at country level increases the share of exports in total sales at the expense of domestic sales. A 1% increase in the number of people with access to electricity (% total population) increases the share of exports by 0.89 pp.

For the other robustness in terms of change in the explanatory variable, we examine the impact of power outages (at the country level) on the share of exports in total sales (Table 10). Contrary to the electricity access variables, it appears that power outages encourage medium-sized manufacturing firms to focus more on domestic markets at the expense of export markets (column 3). This result can be explained by an assumption: in developing countries such as those in SSA, competition is more likely to be tougher on export markets than on domestic ones. Since power outages lead to productivity losses and therefore to competitivity losses, it is quite normal that in a country where power outages are frequent, manufacturing firms focus more on home markets.

For the last robustness check, we consider the sample of service companies instead of manufacturing firms. Our main objective is to understand whether the ISSC-effect of electricity access is specific to the manufacturing sector, or if it occurs in other sectors such as services. Table 11 answers this question by reporting the results of the effect of access to electricity on exports in the different samples. As in the manufacturing sector, we find that the ISSC-effect of electricity access appears only in medium-sized service's firms. However, the ISSC-effect is more statistically significant in manufacturing than in services.

6. Conclusion

This paper defines the dynamic of manufacturing companies between foreign and domestic markets as intra-sectoral structural change (ISSC). It is measured by the share of exports and domestic sales in total sales. Since exports are known to be a source of growth, this paper focuses on how access to electricity can enable manufacturing firms to sell more in foreign markets at the expense of domestic ones. The paper also investigates how the effect of electricity access varies between domestic and foreign firms and between small-sized, medium-sized, and large-sized manufacturing firms. It finds that access to power enables medium-sized domestic manufacturing firms to focus more on export markets at the expense of domestic markets. This effect of structural change due to electricity access is specific only to medium-sized manufacturing firms, as it does not appear in small or large firms. These results are confirmed even in resource-intensive countries.

These results highlight some policy implications, particularly in terms of structural transformation. The inter-sectoral structural change which take places between two different sectors has failed to be a fundamental driver of economic growth and development in SSA. Policy makers should, therefore, explore the growth potential of ISSC by implementing targeted measures to improve access to electricity for medium-sized domestic manufacturing companies. Since a greater level of exports raises firms' productivity and competitiveness, these measures can boost growth and economic development in SSA.

In addition, improving the availability of electricity could reduce the crowding-out effect of resource dependence for medium-sized manufacturing companies. Access to electricity will thus help manufacturing firms in natural resource-intensive countries to be less affected by the crowding-out effect of Dutch disease.

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Table 2. Descriptive statistics before and after matching for manufacturing firms.

	Before				
	[1]	[2]	[3]= [1]-[2]	[4]	[5]
	Treated	Untreated	Difference	t-Test	p-Val.
Generator use	0.368	0.596	-0.228	24.81	0.000
Firms' size	1.499	1.655	-0.156	5.97	0.000
Electricity losses during transmission	15.870	16.900	-1.030	16.59	0.000
GDP growth	2266.00	1622.00	644.00	8.87	0.000
GDP per capita	5.292	6.394	-1.102	-20.43	0.000
Rule of law growth	4.192	-8.818	13.010	-10.3	0.000
	After				
	[1]	[2]	[3]= [1]-[2]	[4]	[5]
	Treated	Untreated	Difference	t-Test	p-Val.
Generator use	0.368	0.368	0.000	0.000	1.000
Firms' size	1.499	1.499	0.000	0.000	1.000
Electricity losses during transmission	15.870	15.870	0.000	0.000	1.000
GDP growth	2266.00	2266.00	0.000	0.000	1.000
GDP per capita	5.292	5.293	0.001	0.000	1.000
Rule of law	4.192	4.191	0.001	0.000	1.000

Table 3. The effect of electricity access on manufacturing firms' exports and domestic sales (% total sales), by size (intensive margin).

	Exports				Domestic Sales			
	Overall Sample	Small Firms	Medium Firms	Large Firms	Overall Sample	Small Firms	Medium Firms	Large Firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	3.64	3.98	6.32	-2.59	-3.64	-3.98	-6.32	2.59
	(2.69)	(3.74)	(1.88)***	(3.80)	(2.69)	(3.74)	(1.88)***	(3.80)
Firms' age	0.01	-0.01	0.05	-0.07	-0.01	0.01	-0.05	0.07
	(0.05)	(0.08)	(0.08)	(0.16)	(0.05)	(0.08)	(0.08)	(0.16)
Firms' status	3.24	4.49	1.80	-0.21	-3.24	-4.49	-1.80	0.21
	(1.36)**	(1.74)**	(1.17)	(1.96)	(1.36)**	(1.74)**	(1.17)	(1.96)
Gender	-2.90	-3.92	2.17	-9.11	2.90	3.92	-2.17	9.11
	(1.91)	(2.59)	(6.50)	(7.05)	(1.91)	(2.59)	(6.50)	(7.05)
Log($Labor_{(t-3)}$ + 1)	1.65	1.39	1.23	-1.36	-1.65	-1.39	-1.23	1.36
	(1.33)	(1.28)	(2.31)	(0.87)	(1.33)	(1.28)	(2.31)	(0.87)
Log($Output_{(t-3)}$ + 1)	-1.07	-1.09	-2.08	0.98	1.07	1.09	2.08	-0.98
	(0.47)**	(0.30)***	(0.68)***	(0.53)*	(0.47)**	(0.30)***	(0.68)***	(0.53)*
Transport	0.49	0.41	0.43	1.56	-0.49	-0.41	-0.43	-1.56
	(0.71)	(0.76)	(1.51)	(1.61)	(0.71)	(0.76)	(1.51)	(1.61)
Exchange rate $growth_{(t-1)}$	-0.08	0.14	-0.15	-0.88	0.19	-0.03	0.26	0.99
	(0.02)***	(0.03)***	(0.03)***	(0.05)***	(0.02)***	(0.03)	(0.03)***	(0.05)***
Trade $openness_{(t-1)}$	0.15	0.13	0.86	0.24	0.13	0.15	-0.58	0.04
	(0.09)*	(0.08)	(0.23)***	(0.34)	(0.09)	(0.08)*	(0.23)**	(0.34)
Size	2.30				-2.30			
	(1.13)*				(1.13)*			
Generator use	-0.07	-3.02	3.35	-7.85	0.07	3.02	-3.35	7.85
	(1.25)	(1.16)**	(2.70)	(6.91)	(1.25)	(1.16)**	(2.70)	(6.91)
Electricity $losses_{(t-1)}$	-0.73	-0.78	-0.68	-2.49	0.99	1.04	0.93	2.75
	(0.05)***	(0.07)***	(0.17)***	(0.28)***	(0.05)***	(0.07)***	(0.17)***	(0.28)***
GDP per $capita_{(t-1)}$	-0.00	-0.00	-0.01	0.02	0.03	0.02	0.03	0.01
	(0.00)	(0.00)	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)
GDP $growth_{(t-1)}$	-0.10	-0.08	-0.28	-0.65	1.03	1.02	1.21	1.59
	(0.10)	(0.09)	(0.18)	(0.34)*	(0.10)***	(0.09)***	(0.18)***	(0.34)***
Rule of law $growth_{(t-1)}$	-0.20	-0.04	-0.41	-0.44	0.52	0.36	0.73	0.75
	(0.04)***	(0.01)***	(0.05)***	(0.05)***	(0.04)***	(0.01)***	(0.05)***	(0.05)***
R2	0.30	0.31	0.30	0.54	0.91	0.92	0.93	0.87
N	3,206	1,651	995	560	3,206	1,651	995	560
# Countries	39	39	39	39	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. Dependent variables are the companies' share of exports and domestic sales in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. Small companies are those employing fewer than 20 workers, medium-sized companies employ between 20 and 99 workers, while the number of workers in large companies is greater than 99. * p<0.1; ** p<0.05; *** p<0.01.

Table 4. The effect of electricity access on export dummy (extensive margin), by size.

	Export dummy			
	Overall Sample	Small Firms	Medium Firms	Large Firms
	(1)	(2)	(3)	(4)
Treatment	0.04	0.04	0.10	-0.01
	(0.04)	(0.06)	(0.04)**	(0.04)
Firms' age	0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Firms' status	0.09	0.09	0.08	0.06
	(0.02)***	(0.02)***	(0.02)***	(0.03)**
Gender	-0.00	-0.01	-0.00	-0.11
	(0.03)	(0.02)	(0.09)	(0.10)
Log(Labor$_{(t-3)}$ + 1)	0.04	0.01	0.04	0.02
	(0.01)***	(0.01)	(0.04)	(0.02)
Log(Output$_{(t-3)}$ + 1)	-0.01	-0.02	-0.02	0.01
	(0.01)**	(0.00)***	(0.01)**	(0.01)
Transport	0.01	0.01	0.02	-0.01
	(0.01)	(0.01)	(0.01)	(0.02)
Exchange rate growth$_{(t-1)}$	-0.00	0.00	-0.01	-0.00
	(0.00)***	(0.00)	(0.00)***	(0.00)***
Trade openness$_{(t-1)}$	-0.00	-0.00	0.00	0.02
	(0.00)	(0.00)	(0.00)	(0.00)***
Size	0.04			
	(0.04)			
Generator use	0.05	0.00	0.08	-0.01
	(0.02)**	(0.02)	(0.06)	(0.06)
Electricity losses$_{(t-1)}$	-0.01	-0.01	-0.03	-0.01
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
GDP per capita$_{(t-1)}$	-0.00	0.00	-0.00	-0.00
	(0.00)**	(0.00)**	(0.00)*	(0.00)**
GDP growth$_{(t-1)}$	-0.00	-0.00	0.00	-0.01
	(0.00)*	(0.00)	(0.00)	(0.00)***
Rule of law growth$_{(t-1)}$	-0.00	-0.00	-0.01	-0.00
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
R2	0.43	0.39	0.42	0.67
N	3,246	1,680	1,003	563
# Countries	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. The dependent variable is an export dummy taking 1 if the firm is an exporter and 0 otherwise. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. Small companies are those employing fewer than 20 workers, medium-sized companies employ between 20 and 99 workers, while the number of workers in large companies is greater than 99. * *p*<0.1; ** *p*<0.05; *** *p*<0.01.

Table 5. The effect of electricity access on medium-sized manufacturing firms' exports (% total sales).

Dependent variable: **Exports % total sales**	(1)	(2)	(3)	(4)
Treatment	12.51	5.95	4.67	6.32
	(3.04)***	(2.18)**	(1.95)**	(1.88)***
Firms' age		0.09	0.04	0.05
		(0.10)	(0.09)	(0.08)
Firms' status		0.78	0.68	1.80
		(.40)	(1.35)	(1.17)
Gender		1.95	0.44	2.17
		(6.24)	(6.48)	(6.50)
Log($Labor_{(t-3)}$ + 1)		1.04	0.22	1.23
		(1.13)	(1.42)	(2.31)
Log($Output_{(t-3)}$ +1)		-1.20	-1.51	-2.08
		(0.68)*	(0.75)*	(0.68)***
Transport		1.14	0.62	0.43
		(1.38)	(1.36)	(1.51)
Exchange rate $growth_{(t-1)}$		0.36	0.27	-0.15
		(0.28)	(0.27)	(0.03)***
Trade $openness_{(t-1)}$		0.32	0.65	0.86
		(0.20)	(0.40)	(0.23)***
Generator use			3.85	3.35
			(2.35)	(2.70)
Electricity $losses_{(t-1)}$			0.03	-0.68
			(0.15)	(0.17)***
GDP per $capita_{(t-1)}$			-0.00	-0.01
			(0.00)	(0.00)***
GDP $growth_{(t-1)}$			0.20	-0.28
			(0.50)	(0.18)
Rule of law $growth_{(t-1)}$			-0.04	-0.41
			(0.05)	(0.05)***
R2	0.10	0.23	0.25	0.30
N	1,570	995	995	995
# Countries	39	39	39	39
- Fixed Effects: Country, Year	No	No	No	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. The dependent variable is the companies' share of exports in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. This table considers only medium-sized companies employing between 20 and 99 workers. * *p*<0.1; ** *p*<0.05; *** *p*<0.01.

Table 6. The effect of electricity access on medium-sized manufacturing firms' exports (% total sales): Local versus foreign firms.

Dependent variable: **Exports % total sales**

	Domestic Firms				Foreign Firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment#Local_Firm	12.67	6.00	4.61	5.87				
	(2.86)***	(2.17)**	(1.96)**	(1.89)***				
Firms' age		0.11	0.07	0.07		0.05	0.01	0.02
		(0.12)	(0.11)	(0.09)		(0.09)	(0.11)	(0.09)
Firms' status		0.35	0.02	1.30		3.24	3.14	3.28
		(1.71)	(1.67)	(1.53)		(1.22)**	(1.26)**	(1.03)***
Gender		1.83	-0.62	1.85		-1.39	-0.42	1.24
		(6.78)	(6.97)	(7.29)		(7.41)	(5.36)	(4.65)
(Log+1)Labor$_{(t-3)}$		1.46	0.83	1.84		-2.66	-2.14	-3.64
		(1.14)	(1.49)	(2.35)		(2.63)	(4.57)	(4.46)
(Log+1)Output$_{(t-3)}$		-1.28	-1.61	-2.30		-0.64	-0.97	-0.82
		(0.72)*	(0.76)**	(0.65)***		(0.48)	(0.61)	(0.77)
Transport		1.04	0.56	0.43		2.54	0.93	0.93
		(1.52)	(1.50)	(1.69)		(1.02)**	(1.10)	(0.99)
Exchange rate growth$_{(t-1)}$		0.30	0.20	-0.16		0.64	0.58	-0.18
		(0.29)	(0.28)	(0.04)***		(0.23)***	(0.30)*	(0.09)*
Trade openness$_{(t-1)}$		0.33	0.58	0.76		0.29	0.91	-0.18
		(0.19)*	(0.39)	(0.28)**		(0.34)	(0.67)	(0.11)
Generator Use			3.86	4.01			0.48	-2.71
			(2.73)	(3.19)			(5.92)	(7.75)
Electricity losses$_{(t-1)}$			0.12	-0.67			-0.43	0.11
			(0.16)	(0.17)***			(0.22)*	(0.18)
GDP per capita$_{(t-1)}$			-0.00	-0.01			-0.01	0.01
			(0.00)	(0.00)***			(0.00)	(0.01)
GDP growth$_{(t-1)}$			0.27	-0.28			-0.31	-0.99
			(0.52)	(0.27)			(0.52)	(0.52)*
Rule of law growth$_{(t-1)}$			-0.08	-0.42			0.07	0.23
			(0.06)	(0.06)***			(0.10)	(0.10)**
Treatment#Foreign_Firm					11.35	5.40	3.92	7.24
					(5.12)**	(4.86)	(4.01)	(3.81)*
R2	0.10	0.23	0.26	0.30	0.11	0.31	0.33	0.37
N	1,544	978	978	978	1,374	887	887	887
# Countries	39	39	39	39	39	39	39	39
- Fixed Effects: Country, Year	No	No	No	Yes	No	No	No	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. The dependent variable is the companies' share of exports in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. This table considers only medium-sized companies employing between 20 and 99 workers. Foreign firms are those in which the share of capital held by foreigners is over 50%, otherwise the companies are considered local. * p<0.1; ** p<0.05; *** p<0.01.

Table 7. The effect of electricity access on medium-sized manufacturing firms' exports (% total sales): Sensitivity tests to natural resources.

Dependent variable: **Exports % total sales**

	Resource intensive countries	Non-resource intensive countries
	(1)	(2)
Treatment	5.81	8.55
	(1.91)**	(4.65)*
Firms' age	0.15	-0.23
	(0.10)	(0.13)
Firms' status	1.98	-0.73
	(1.46)	(1.32)
Gender	-3.72	17.28
	(6.00)	(11.48)
Log ($Labor_{(t-3)}$ + 1)	-0.15	3.30
	(1.89)	(4.21)
Log($Output_{(t-3)}$ +1)	-2.40	1.41
	(0.51)***	(1.12)
Transport	0.31	0.58
	(2.03)	(1.09)
Exchange rate $growth_{(t-1)}$	2.42	-0.24
	(0.49)***	(0.06)***
Trade openness $growth_{(t-1)}$	6.41	1.47
	(0.88)***	(0.36)***
Generator use	1.56	5.69
	(2.70)	(4.33)
Electricity $losses_{(t-1)}$	-4.03	-0.80
	(0.97)***	(0.26)**
GDP per $capita_{(t-1)}$	-0.11	-0.01
	(0.02)***	(0.00)***
GDP $growth_{(t-1)}$	-0.97	-0.41
	(0.38)**	(0.41)
Rule of law $growth_{(t-1)}$	0.02	-0.35
	(0.27)	(0.10)***
R2	0.32	0.35
N	623	372
# Countries	39	39
- Fixed Effects: Country, Year	Yes	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. The dependent variable is the companies' share of exports in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. This table considers only medium-sized companies employing between 20 and 99 workers and the dependent variable is the exports in total sales. Resources intensity's classification is from the IMF's REO. A country is considered as resource intensive if it natural resources represent more than 25% of its total exports. * p<0.1; ** p<0.05; *** p<0.01.

Table 8. The effect of electricity access on manufacturing firms' exports (% total sales), by size (intensive margin): Other regions.

	Panel 1: Asia			
	Overall Sample	Small Firms	Medium Firms	Large Firms
	(1)	(2)	(3)	(4)
Treatment	-0.07	0.10	0.33	-3.12
	(1.02)	(0.85)	(1.12)	(1.88)
R2	0.37	0.13	0.23	0.53
N	9,989	3,018	3,752	3,219
# Countries	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes
	Panel 2: Middle East			
	Overall Sample	Small Firms	Medium Firms	Large Firms
	(1)	(2)	(3)	(4)
Treatment	-0.48	-0.15	0.53	-0.33
	(0.95)	(1.01)	(1.77)	(1.92)
R2	0.42	0.23	0.37	0.55
N	4,463	1,731	1,600	1,132
# Countries	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes
	Panel 3: Latin America			
	Overall Sample	Small Firms	Medium Firms	Large Firms
	(1)	(2)	(3)	(4)
Treatment	-0.72	-0.25	-0.01	-2.10
	(0.64)	(0.96)	(1.12)	(1.54)
R2	0.34	0.11	0.25	0.49
N	5,510	1,838	2,089	1,583
# Countries	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. Dependent variables are the companies' share of exports and domestic sales in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. Small companies are those employing fewer than 20 workers, medium-sized companies employ between 20 and 99 workers, while the number of workers in large companies is greater than 99. * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 9. Robustness: Ordinary Least Square and electricity access by the population (% total population).

Dependent variable: **Exports % total sales**

	Power access by firms				Power access % population			
	Overall Sample	Small Firms	Medium Firms	Large Firms	Overall Sample	Small Firms	Medium Firms	Large Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Power Access by Firms	4.84	5.22	6.71	-1.06				
	(2.03)**	(2.80)*	(1.91)***	(2.33)				
Firms' age	-0.01	0.07	-0.01	-0.09	-0.01	0.07	-0.01	-0.09
	(0.05)	(0.06)	(0.06)	(0.05)*	(0.05)	(0.07)	(0.06)	(0.05)*
Firms' Status	2.71	3.76	2.20	-0.38	2.78	3.81	2.25	-0.42
	(0.95)***	(1.60)**	(0.83)**	(0.72)	(1.00)**	(1.68)**	(0.83)**	(0.71)
Gender	-0.83	-0.93	1.53	-1.90	-0.97	-1.13	1.48	-1.90
	(1.86)	(1.82)	(3.22)	(4.48)	(1.94)	(1.91)	(3.25)	(4.47)
Log(Labor$_{(t-3)}$ + 1)	3.36	0.89	0.76	3.97	3.35	0.77	0.39	3.94
	(0.81)***	(0.75)	(1.35)	(1.59)**	(0.81)***	(0.74)	(1.42)	(1.58)**
Log(Output$_{()t-3)}$ +1)	-0.62	-0.79	-0.76	-0.47	-0.63	-0.78	-0.79	-0.47
	(0.51)	(0.43)*	(0.88)	(0.55)	(0.50)	(0.41)*	(0.89)	(0.55)
Transport	0.62	0.83	0.57	0.26	0.61	0.87	0.49	0.27
	(0.38)	(0.35)**	(0.50)	(1.14)	(0.37)	(0.37)**	(0.50)	(1.13)
Exchange rate growth$_{(t-1)}$	-0.17	0.16	-0.12	-0.48	-0.18	0.18	-0.08	-0.49
	(0.02)***	(0.01)***	(0.03)***	(0.04)***	(0.02)***	(0.01)***	(0.03)***	(0.05)***
Trade openness$_{(t-1)}$	-0.15	0.32	0.65	-1.22	0.07	0.17	0.11	-1.13
	(0.08)*	(0.06)***	(0.09)***	(0.13)***	(0.03)**	(0.04)***	(0.07)	(0.11)***
Generator use	1.86	-0.65	4.13	1.68	1.25	-1.44	3.56	1.81
	(0.74)**	(0.81)	(1.66)**	(3.67)	(0.92)	(1.20)	(1.65)**	(3.65)
Electricity losses$_{(t-1)}$	-0.85	-0.95	-0.14	-1.38	-0.65	-1.12	-0.62	-1.29
	(0.03)***	(0.08)***	(0.04)***	(0.07)***	(0.05)***	(0.09)***	(0.13)***	(0.15)***
GDP per capita$_{(t-1)}$	0.00	-0.00	-0.01	0.02	0.00	-0.00	-0.01	0.02
	(0.00)	(0.00)**	(0.00)**	(0.00)***	(0.00)	(0.00)**	(0.00)*	(0.00)***
GDP growth$_{(t-1)}$	0.18	-0.12	-0.84	1.42	0.26	-0.37	-1.44	1.51
	(0.17)	(0.09)	(0.11)***	(0.23)***	(0.20)	(0.07)***	(0.21)***	(0.32)***
Rule of law growth$_{(t-1)}$	-0.15	-0.10	-0.25	-0.06	-0.21	-0.04	-0.04	-0.09
	(0.04)***	(0.01)***	(0.04)***	(0.05)	(0.02)***	(0.01)***	(0.02)**	(0.06)
Power Access by Population$_{(t-1)}$					-0.28	0.27	0.89	-0.14
					(0.10)**	(0.05)***	(0.18)***	(0.29)
R2	0.31	0.27	0.27	0.52	0.31	0.26	0.27	0.52
N	3,206	1,651	995	560	3,206	1,651	995	560
# Countries	39	39	39	39	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The variable **Power Access by Firms** corresponds to the treatment variable in the entropy balancing approach which is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. The variable **Power Access by Population** is a country-level variable that designates the percentage of population with access to electricity (% total population). The dependent variable is the companies' share of exports in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index, firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level variables are lagged by one year to avoid reverse causality between them and the dependent variables. Country and year fixed effects are introduced in all the estimates. Small companies: workers fewer than 20; medium-sized companies: workers between 20 and 99 workers; large companies: workers greater than 99 * p<0.1; ** p<0.05; *** p<0.01.

Table 10. Robustness: Power outages (country-level).

Dependent variable: **Exports % total sales**				
	Overall Sample	Small Firms	Medium Firms	Large Firms

	(1)	(2)	(3)	(4)
Power Outages (country-level)	0.31	-0.27	-0.92	0.38
	(0.11)**	(0.05)***	(0.20)***	(0.26)
Firms' age	-0.01	0.07	-0.01	-0.08
	(0.05)	(0.06)	(0.06)	(0.05)*
Firms' Status	2.79	3.81	2.26	-0.33
	(1.00)**	(1.68)**	(0.83)**	(0.70)
Gender	-0.95	-1.14	1.50	-1.78
	(1.94)	(1.90)	(3.24)	(4.49)
Log(Labor$_{(t-3)}$ +1)	3.31	0.68	0.40	3.94
	(0.81)***	(0.72)	(1.42)	(1.59)**
Log(Output$_{(t-3)}$ +1)	-0.62	-0.76	-0.79	-0.45
	(0.49)	(0.40)*	(0.89)	(0.55)
Transport	0.60	0.87	0.47	0.27
	(0.37)	(0.37)**	(0.50)	(1.14)
Exchange rate growth$_{(t-1)}$	-0.21	0.19	-0.02	-0.54
	(0.01)***	(0.02)***	(0.02)	(0.06)***
Trade openness$_{(t-1)}$	-0.03	0.28	0.44	-1.11
	(0.04)	(0.03)***	(0.05)***	(0.07)***
Generator Use	1.26	-1.42	3.54	1.96
	(0.91)	(1.18)	(1.66)**	(3.58)
Electricity losses$_{(t-1)}$	-0.88	-0.91	0.06	-1.44
	(0.04)***	(0.09)***	(0.05)	(0.09)***
GDP per capita$_{(t-1)}$	0.00	-0.00	-0.01	0.02
	(0.00)	(0.00)**	(0.00)*	(0.00)***
GDP growth$_{(t-1)}$	-0.11	-0.04	-0.33	1.15
	(0.08)	(0.04)	(0.04)***	(0.25)***
Rule of law growth$_{(t-1)}$	-0.17	-0.08	-0.17	-0.10
	(0.03)***	(0.01)***	(0.03)***	(0.04)**
R2	0.31	0.26	0.27	0.52
N	3,218	1,656	999	563
# Countries	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes

Ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The variable **Power Outages (country-level)** corresponds to the number of outages in a typical month at the country level. The dependent variable is the companies' share of exports in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate, trade openness index, firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level variables are lagged by one year to avoid reverse causality between them and the dependent variables. Country and year fixed effects are introduced in all the estimates. Small companies are those employing fewer than 20 workers, medium-sized companies employ between 20 and 99 workers, while the number of workers in large companies is greater than 99. * *p*<0.1; ** *p*<0.05; *** *p*<0.01.

Table 11. The effect of electricity access on service firms' exports (% total sales) by size.

Dependent variable: **Exports % total sales**				
	Overall Sample	Small Firms	Medium Firms	Large Firms
	(1)	(2)	(3)	(4)
Treatment	2.74	2.69	6.81	-7.26

	(2.30)	(2.44)	(3.63)*	(4.27)
Firms' age	0.07	-0.02	0.08	0.50
	(0.05)	(0.08)	(0.08)	(0.17)***
Firms' status	1.53	1.30	3.07	0.56
	(1.11)	(0.87)	(1.86)	(0.85)
Gender	0.64	-0.12	8.95	-6.63
	(1.65)	(1.39)	(6.09)	(4.61)
Log($Labor_{(t-3)}$ + 1)	-0.31	0.41	1.55	-5.11
	(0.88)	(0.74)	(2.23)	(1.88)**
Log($Output_{(t-3)}$ +1)	-0.84	-0.89	-0.88	-0.30
	(0.60)	(0.69)	(0.50)*	(0.24)
Transport	0.42	0.23	0.40	2.30
	(0.41)	(0.49)	(1.63)	(1.79)
Exchange rate $growth_{(t-1)}$	0.57	0.01	0.49	0.60
	(0.06)***	(0.01)	(0.08)***	(0.06)***
Trade openness	0.46	-0.42	0.60	1.30
	(0.14)***	(0.15)**	(0.24)**	(0.23)***
Size	3.78			
	(1.71)**			
Generator use	-0.86	-1.20	-3.04	-0.85
	(1.56)	(1.05)	(3.13)	(4.01)
Electricity $losses_{(t-1)}$	0.17	-0.97	-0.66	1.40
	(0.10)	(0.22)***	(0.14)***	(0.30)***
GDP per $capita_{(t-1)}$	-0.01	0.01	-0.01	-0.02
	(0.00)***	(0.00)**	(0.00)**	(0.01)**
GDP $growth_{(t-1)}$	0.42	1.02	0.49	-1.42
	(0.14)***	(0.16)***	(0.31)	(0.23)***
Rule of law $growth_{(t-1)}$	-0.26	-0.60	-0.52	0.70
	(0.05)***	(0.09)***	(0.10)***	(0.05)***
R2	0.23	0.23	0.29	0.45
N	3,629	2,335	980	314
# Countries	39	39	39	39
- Fixed Effects: Country, Year	Yes	Yes	Yes	Yes

Weighted ordinary least squares regression is the estimation approach, with standard errors clustered at country-level in parentheses. The treatment variable is a dummy variable taking 1 if the company declares not suffering from power outages and 0 otherwise. The dependent variable is the companies' share of exports in total sales. We include control variables (firms' age, firms' status, manager gender, labor and sales three years ago, the quality of transport service, the real exchange rate growth, trade openness index) and covariates (firms' use of generators, firms' size, electricity losses during transmission and transport, GDP per capita, GDP growth, rule of law growth). Country-level covariates are lagged by one year to avoid reverse causality between them and the occurrence of electricity access in the first stage of the entropy balancing method. Country and year fixed effects are introduced in all full estimates. Small companies are those employing fewer than 20 workers, medium-sized companies employ between 20 and 99 workers, while the number of workers in large companies is greater than 99. * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Appendix A. Total number of firms and share of industry in the overall manufacturing sample.

Table A.1. Manufacturing industries in the overall sample.

	Overall Sample: Manufacturing sector			
Industry	ISIC Code 3.1	Freq.	Percentage	Cum.

Food products and beverages	15	3,446	26.46	26.46
Tobacco products	16	24	0.18	26.64
Textiles	17	488	3.75	30.39
Wearing apparel; dressing and dyeing of fur	18	1,796	13.79	44.18
Tanning and dressing of leather	19	257	1.97	46.15
Wood and of products of wood	20	585	4.49	50.64
Paper and paper products	21	143	1.1	51.74
Publishing, printing and reproduction	22	899	6.9	58.64
Coke, refined petroleum products	23	45	0.35	58.99
Chemicals and chemical products	24	753	5.78	64.77
Rubber and plastics products	25	438	3.36	68.13
Other non-metallic mineral products	26	677	5.2	73.33
Basic metals	27	245	1.88	75.21
Fabricated metal products, except machinery	28	1,172	9	84.21
Machinery and equipment n.e.c.	29	258	1.98	86.19
Office, accounting and computing machinery	30	5	0.04	86.23
Electrical machinery and apparatus n.e.c.	31	147	1.13	87.36
Radio, television and communication equipment	32	26	0.2	87.55
Medical, precision and optical instruments	33	21	0.16	87.72
Motor vehicles, trailers and semi-trailers	34	86	0.66	88.38
Other transport equipment	35	34	0.26	88.64
Furniture; manufacturing n.e.c.	36	1,451	11.14	99.78
Recycling	37	29	0.22	100
Total	13,025			

Appendix B. List of survey waves in the WBES' standardized data set for the period 2006-2022

Table B.1. List of survey waves.

Country	Freq.	Percent	Cum.	Country	Freq.	Percent	Cum.
Angola 2006	212	1.63	1.63	Ethiopia 2011	258	1.98	19.29
Angola 2010	71	0.55	2.17	Ethiopia 2015	335	2.57	21.86
Benin 2009	71	0.55	2.72	Gambia, The 2006	32	0.25	22.1
Benin 2016	63	0.48	3.2	Gambia, The 2018	72	0.55	22.66
Botswana 2006	114	0.88	4.08	Ghana 2007	284	2.18	24.84
Botswana 2010	85	0.65	4.73	Ghana 2013	371	2.85	27.69
Burkina Faso 2009	82	0.63	5.36	Guinea 2006	130	1	28.68
Burundi 2006	98	0.75	6.11	Guinea 2016	24	0.18	28.87
Burundi 2014	59	0.45	6.56	Kenya 2007	390	2.99	31.86
Cameroon 2009	97	0.74	7.31	Kenya 2013	383	2.94	34.8
Cameroon 2016	97	0.74	8.05	Kenya 2018	451	3.46	38.26
Cabo Verde 2009	56	0.43	8.48	Lesotho 2016	74	0.57	38.83
Central African Republic 2011	36	0.28	8.76	Liberia 2017	75	0.58	39.41
Chad 2009	60	0.46	9.22	Madagascar 2009	199	1.53	40.94
Chad 2018	73	0.56	9.78	Madagascar 2013	251	1.93	42.86
Côte d'Ivoire 2009	170	1.31	11.09	Mali 2007	301	2.31	45.17
Côte d'Ivoire 2016	103	0.79	11.88	Mali 2010	154	1.18	46.36
Congo, Dem. Rep. 2006	149	1.14	13.02	Mali 2016	92	0.71	47.06
Congo, Dem. Rep. 2010	123	0.94	13.97	Mauritania 2006	80	0.61	47.68
Congo, Dem. Rep. 2013	234	1.80	15.76	Mauritania 2014	28	0.21	47.89
Djibouti 2013	60	0.46	16.22	Mauritius 2009	203	1.56	49.45
Eswatini 2006	68	0.52	16.74	Mozambique 2007	340	2.61	52.06
Eswatini 2016	73	0.56	17.31	Mozambique 2018	285	2.19	54.25

Table B.2. List of survey waves (Continued).

Country	Freq.	Percent	Cum.	Country	Freq.	Percent	Cum.
Namibia 2006	104	0.8	55.05	South Africa 2007	655	5.03	84.16
Namibia 2014	165	1.27	56.31	Sudan 2014	80	0.61	84.78
Niger 2009	42	0.32	56.64	Togo 2009	29	0.22	85
Niger 2017	41	0.31	56.95	Togo 2016	45	0.35	85.34
Nigeria 2007	946	7.26	64.21	Uganda 2006	305	2.34	87.69
Nigeria 2014	1,245	9.56	73.77	Uganda 2013	338	2.6	90.28
Rwanda 2006	56	0.43	74.2	Zambia 2007	298	2.29	92.57
Rwanda 2011	80	0.61	74.82	Zambia 2013	350	2.69	95.26
Senegal 2007	259	1.99	76.81	Zimbabwe 2011	348	2.67	97.93
Senegal 2014	227	1.74	78.55	Zimbabwe 2016	270	2.07	100
Sierra Leone 2017	76	0.58	79.13				