Exports Promotion Policies for African Manufacturing Firms: Does electricity infrastructure matter more than exchange rate undervaluation?

Kabinet KABA*

Preliminary version, please do not quote or share

Abstract

This paper studies the effects of power outages and exchange rate undervaluation on the allocation of manufacturing firms between the domestic and the exports market. I apply the instrumental variables approach to a sample of 12,062 manufacturing firms located in 33 Sub-Saharan African countries. The main results show that a 1% increase in the length of power outages reduces the share of exports in total sales by 0.94%. An undervaluation of 1% leads to an increase in the share of exports by 0.54%. The collateral damage effects show a negative impact of power outages and undervaluation on the share of foreign inputs and a positive effect on the share of domestic input in the total purchase of inputs. Moreover, power outages and exchange rate undervaluation affect more the share of exports in countries with poor access to electricity (-1.19% for power outages and 1.31% for undervaluation) than those with better access to electricity (-0.45% for power outages and 0.31% for undervaluation). The length of power outages has a greater effect on the share of exports in non-innovative firms compared to innovative firms (-1.46% for non-innovative firms and -0.59% for innovative firms). The undervaluation allows for offsetting the negative impact of power outages on the share of exports in non resources-rich countries. The exclusion of firms from the top exporters countries reduces the effects of power outages and exchange rate undervaluation on the share of exports compared to the overall sample. The previous results are confirmed by some robustness tests in connection with the change in the variables of interest and estimation method.

Keywords: Power outages, Exchange rate, Manufacturing firms, Exports, Domestic sales, Africa.
JEL Classification : D22, F15, F40, H54, L94

Acknowledgment: I thank Annie Krautkraemer and Ablam Estel APETI for the proofreading and valuable suggestions that are contributed to improve the paper.

*Corresponding author: kabinet.kaba@uca.fr; CERDI, University Clermont Auvergne.

1 Introduction

The allocation of resources from the informal to the manufacturing sector is viewed as a natural path to economic development (Murphy et al., 1989*b*; Lewis, 1954). The inter-sectoral movement of resources to manufacturing firms increases total factor productivity. A rise of productivity causes wage growth and therefore an improvement in the standard of living (McMillan et al., 2014; McMillan & Headey, 2014). Nevertheless, this process of structural change has failed to occur in Sub-Saharan Africa (SSA). In some cases, resources move from the manufacturing to the informal sector (McMillan et al., 2014).

The intra-sectoral allocation of resources is also an important factor for economic growth and improves the standard of living. Indeed, a movement of manufacturing firms from the domestic to the export market is seen as source of income growth in small countries.[1] This is explained by the fact that, exporters are more productive than non-exporters, allowing them to have: an efficient production structure, more jobs, better jobs, better wages, and rapid growth (Bernard, 1995).[2] Specifically, entering the export market improves the productivity of new entrants (Aw et al., 2000).[3] Although exporting firms perform better than non-exporting firms, SSA is the worst performing region in the world in terms of manufacturing exports (Figure 1). Its manufacturing exports are 95 times less than Asia, 82 times less than Europe, 19 times less than North America, and 8 times less than Latin America.

As manufacturing exports are important to improve the standard of living, some studies advocate the exchange rate undervaluation policies as tool for exports expansion and economic growth in developing countries.[4] According to Rodrik (2016) and Johnson et al. (2010), the undervaluation of the exchange rate, as a substitute for industrial policy, could be the most effective tool to boost industrialization and thus growth in Africa. For Rodrik (2016), a correct exchange rate can allow African manufacturing firms to compete with Chinese and Vietnamese exporters both in domestic and exports markets. Moreover, Freund et al. (2012) show that, an undervaluation of real exchange rate by about 25% should give a large and immediate boost to manufacturing exporters in developing countries. In summary, the exchange rate undervaluation would give a competitiveness advantage to manufacturing firms located in small countries like those in SSA. The competitive gain for firms would be explained by the fact that undervaluation acts as a subsidy to manufacturing firms, reducing or eliminating the effects of some barriers, constraints, and distortions associated with manufacturing firms' activities. For example, Freund et al. (2012) explain the effectiveness of exchange rate depreciation in developing countries compared to developed countries by the existence of some distortions or constraints in the first group of economies. The depreciation would thus reduce the effects of these distortions, allowing new firms to enter the export market of developing countries. For Rodrik (2016), an undervaluation of 20% represents a 20% subsidy to industries. In the case of SSA, there are some infrastructural constraints that could lead to productivity loss and then to competitiveness loss in manufacturing enterprises. From the above analyses, five interesting facts arise. First, exchange rate undervaluation would improve the performance of firms in countries with strong distortions, while it could be inefficient in countries where these constraints are weak or do not exist. Second, if the effects of obstacles to business are so severe that firms experience high productivity losses, the exchange rate must be deeply depreciated to enhance the competitiveness of firms in export markets. Third, the constraints related to infrastructure are structural problems, while an exchange rate policy can, at best, be a short-term solution. Fourth, a wave of undervaluation could lead to exchange rate competition among SSA countries, which could reduce the expected effect of undervaluations. Fifth, an undervaluation could have a collateral damage by discouraging the imports of inputs, and thus eliminate

[1] The terms firms, enterprises and companies have the same sense in this paper, so they are used alternately.
[2] See also: Bernard & Jensen (1999) and Schank et al. (2007).
[3] See also: Fafchamps et al. (2007), Van Biesebroeck (2005), Greenaway et al. (2002), Bigsten et al. (2000).
[4] For the sake of simplicity, we use in some cases the term "undervaluation" without accompanying it with "real exchange rate", but undervaluation clearly concerns the real exchange rate.

this important source of productivity for manufacturing firms.

This paper make comparative study between the effects of the quality of infrastructure (electricity infrastructure) and those of undervaluation on the allocation of firms across domestic and exports markets. Specifically, it studies the effects of power outages and exchange rate undervaluation on the share of manufacturing exports in total sales and that of domestic sales. I also examine the impacts of power outages and exchange rate undervaluation on the possibility to be an exporter and on that to be a domestic seller. For this purpose, the country and industry fixed-effects instrumental variables (IV) approach and probit IV method are applied on a sample of 12,062 manufacturing firms in 33 SSA countries between 2006-2019. There are four main reasons for choosing to analyze the effects of electricity infrastructure rather than other infrastructure. First, SSA is the region of the world with the lowest access to electricity per population (Figure 2).[5] Second, it has the most unequal access to electricity between the rural and urban populations (Figure 3 & 4).[6] Third, power outages are considered by manufacturing firms in SSA to be the most significant barrier to their business (Figure 5). Fourth, the services of infrastructure like electricity enter in manufacturing production as inputs, therefore, as source of productivity. Thus, a poor quality of these services could cause a productivity loss, and then a competitiveness loss in manufacturing firms. I assume that the competition should be tougher in the export market than the domestic markets in developing economies like those in SSA.[7] Hence, the loss of competitiveness could lead some manufacturing companies to focus more on the domestic market at the expense of the export market. Therefore, in the context of exchange rate undervaluation, the policymakers have to ensure that the competitiveness losses due to the poor quality of electricity services is offset by the competitive gain due to the undervaluation. The effectiveness of exchange rate undervaluation should, therefore, depend on its ability to remove the negative effect of the poor quality of electricity service.

To the best of my knowledge, there is no article simultaneously studying the effects of power outages and exchange rate undervaluation on firms' allocation between the export and the domestic market. The existing literature focuses on the individual effects of these two variables. The first wave includes a set of papers examining the impact of power outages on enterprises' performances like productivity, sales, investment and employment (Cole et al. 2018; Mensah, 2018; Allcott et al. 2016; Fisher-Vanden et al., 2015; Alam 2013; Steinbuks & Foster, 2010; Reinikka & Svensson, 2002). The second wave concerns a number of papers investigating the role of exchange rate depreciation or undervaluation in export and economic growth (Freund et al.; Freund et al.; Eichengreen, 2007; Rodrik, 2007; Hausmann et al., 2005; Bernard & Jensen, 2004; Dooley et al., 2004; Arslan & Van Wijnbergen, 1993; Bayoumi, 1999). The contribution of this article is threefold. First, I examine the effects of power outages and exchange rate undervaluation simultaneously on the intra-sectoral allocation of manufacturing firms. This enables a comparison between the effects of policies that promote manufacturing exports and the impacts of domestic constraints that discourage them. Second, the literature on the effects of exchange rate undervaluation focuses on aggregate exports, which may mask some heterogeneities across firms and industries. To avoid this issue, the empirical approach combines the country (undervaluation variable) and firm-level data (export variable). Third, I determine two measures of shock in temperature and precipitation and use them simultaneously as instruments to consider the issue of endogeneity in power outages. The link between weather and electricity consumption is richly illustrated in the literature, which is mainly organized in two waves. The first group of papers reveals that temperature is the most important determinant of electricity consumption (Eskeland & Mideksa 2009; De Cian et al. 2007; Scott & Huang 2007; Pardo et al. 2002; Li & Sailor 1995; Li & Sailor 1995; Al-Zayer & Al-Ibrahim 1996;

[5]The term SSA refers to Sub-Saharan Africa, but we sometimes use it to say SSA countries i.e., Sub-Saharan African countries.

[6]For more explanation, see the next section.

[7]See: The section about theoretical framework

Bolzern et al. 1982; Ayyash et al. 1985)[8] while the second wave emphasizes the effect of precipitation (Cole et al. 2018; Bye, 2008; Beldring et al. 2006; Demers & Roy 2006).[9] However, these studies show that temperature affects electricity demand while precipitation influences electricity supply. Contrary to the literature and for the sake of comprehensiveness and relevance, this study determines temperature and precipitation shocks and uses them simultaneously as instruments.

The results on the overall sample suggest that power outages negatively affect the share of exports in total sales while the impact on the share of domestic sales is not significant (intensive margins). More specifically, a 1% increase in the length of power outages reduces the share of exports by 0.94%. For exchange rate undervaluation, it positively impacts the share of exports while its effect on the share of domestic sales is not significant. An undervaluation of 1% leads to an increase in the share of exports by 0.54%. The results on the overall sample show that the poor quality of electricity service discourages manufacturing firms from selling their products abroad while the undervaluation encourages them to export more. However, the positive effect of undervaluation is apparently offset by the negative effect of power outages. Indeed, the effect of power outages on the share of exports (-0.94%) is approximately two times higher than that of exchange rate undervaluation (0.54%). In addition, power outages negatively affect the exporters dummy while they positively impact the domestic sellers dummy. Concerning the exchange rate undervaluation, it positively affects the exporters dummy and negatively impacts the domestic sellers dummy. The collateral damage effects show a negative impact of power outages and undervaluation on the share of foreign inputs and a positive effect on the share of domestic input in the total purchase of inputs. A 1% increase in power outages and exchange rate undervaluation reduces the share of foreign inputs by 0.79% and 0.36%, respectively while it increases the share of domestic inputs by 0.64% and 0.33%, respectively.

The effects of power outages and the undervaluation increase drastically in countries with poor access to electricity compared to those with better access to electricity. Indeed, a 1% increase in the length of power outages reduces the share of exports by 1.66% while it rises the share of domestic sales by 1.19% in countries with poor access to electricity. For countries with better access to electricity, an augmentation of the length of power outages by 1% decreases the share of exports by 0.45% while it rises the share of domestic sales by 0.31%. An undervaluation of 1% increases the share of exports by 1.31% and reduces that of domestic sales by 0.51% in countries with poor access to electricity while these effects are 0.31% and -0.40%, respectively for countries with better access to electricity. The electricity shortages have a greater effect on non-innovative firms than innovative firms. More precisely, an augmentation of power outages by 1% reduces the share of exports by 1.46% in non-innovative firms while this effect is -0.59% in innovative firms. The undervaluation allows for offsetting the negative impact of power outages on the share of exports in non resources-rich countries, because its coefficients are approximately the same to those of power outages. In the sample without top exporters, a 1% augmentation of power outages reduces the share of exports by 0.75% while an undervaluation of exchange rate by 1% increases it by 0.45. The exclusion of firms from the top exporters countries reduces the effects of power outages and exchange rate undervaluation on the share of exports compared to the overall sample. The macroeconomic measure of electricity service quality confirms the previous results. Indeed, a 1% increase in the proportion of the population with access to electricity increases the share of exports by 0.58%. Considering the interaction variable, a 1% improvement in electricity access per population reduces the impact of undervaluation and exchange rate depreciation on the share of exports by 0.17% and 0.58%, respectively. Hence, the result of the interaction variable shows that the exchange rate undervaluation policy and the electricity service quality are substitutable. The number of power outages, as the alternative firm-level measure of electricity service reduces the share of exports while it increases the share of domestic sales. However,

[8] See Pardo et al. (2002) and Li & Sailor (1995) For the discussion on the predominance of temperature.
[9] See Mideksa & Kallbekken (2010) for the literature about the link weather and electricity.

the impact of the number of power outages on the share of exports (-0.37%) is low compared to the effect of the length of power outages (-0.94%).

The rest of the paper is organized as follows: Section 2 presents the issues of: electricity access, power outages and exporters/non-exporters performance in Sub-Saharan Africa. Section 3 explains how power outages and exchange rate undervaluation theoretically affect the allocation of manufacturing firms between the export and domestic market. Section 4 describes the variables and data used in the paper. Section 5 presents the specification approach. The main results are presented in Section 6. Section 7 and 8 concern the sensitivity tests and robustness. Finally, Section 9 concludes.

2 Background: Exporters and non-exporters, access to electricity and power outages in Sub-Saharan Africa

This section can be organized into two main parts. First, it focus on the issue of manufacturing exports in Africa. Second, it provides a statistical analysis of the availability and the quality of electricity service in SSA.

Table 1 presents a comparative analysis between exporting and non-exporting firms. Exporters in SSA perform better than non-exporters. In terms of sales, exporting firms sell about 8 times more than non-exporting firms. The average total sales of firms that export is about $38.5 million while this amount is $4.85 million for non-exporters. The average number of workers in exporting firms (248.43) is 4 times more than that in non-exporting firms (60.62). In terms of employment structure, both exporters and non-exporters employ more production workers than non-production employees. The average number of production workers in exporting firms is 208.85 while that of non-production employees is 44.22. Similarly, in non-exporting firms, the average number of production employees is 44.77 while that of non-production workers is 14.11. Nevertheless, the production and non-production workforce in exporting firms are 4 and 3 times higher than those in non-exporting firms, respectively. With 151.87 skilled workers on average, the exporters employ 5 times more skilled employees than non-exporters. The exporters also employ more unskilled workers and more women than non-exporters. Finally, the average number of workers that the firms would like to hire is about 8 times greater for exporters (47.11) than non-exporters (5.47). Although exporting firms perform better than non-exporting firms, SSA is the worst performing region in the world in terms of manufacturing export (Figure 1). Indeed, it exports 95 times less than Asia, 82 times less than Europe, 19 times less than North America, and 8 times less than Latin America.

In all regions of the world except SSA, more than 90% of the population has access to electricity (Figure 2). Specifically, 100% of the population in North America, 99.99% in Europe and Central Asia... and 94.40% in South Asia have access to electricity. This proportion is only 46.75% in SSA making it the region where the population has limited access to electricity. For SSA, Figure 2 hides an unequal access to electricity between the rural and urban populations. Indeed, 77.86% of the urban population has access to electricity (Figure 3), compared to only 28.06% of the rural population (Figure 4). Such an inequality is not visible in the rest of the world. In other regions, more than 90% of the rural and urban populations have access to electricity (Figures 3 & 4). From the previous stylized facts, SSA is the most unequal region in terms of access to electricity between the urban and the rural populations. It is also the region with the lowest rate of electricity access per population. In addition to the lack and the inequality of electricity access, the poor quality of electricity service is a severe constraint for manufacturing firms in SSA. Among the biggest obstacles to the operations of manufacturing firms in SSA, electricity is the most important (Figure 5).

3 Theoretical framework

Power outages and exchange rate undervaluation affect the allocation of firms through the intensive and the extensive margins of markets. The intensive margin is defined as the expansion of existing firms in terms of sale in the export and the domestic market. For the extensive margin, it refers to the entry of firms in the two markets.

3.1 Power outages and the allocation of manufacturing firms between the export and the domestic market

As electricity is an input for manufacturing production, its services may contribute to productivity growth. The poor quality of these services, measuring by the length and number of power outages, could reduce firms' productivity.[10] The productivity loss due to power outages would decrease firms' sales and the possibility for new enterprises to enter in manufacturing sector. The productivity loss may be an incentive for firms to move from one market to another. Indeed, the decrease of productivity reduces the competitiveness of manufacturing firms both in the exports and the domestic market. However, for small economies like those in SSA, the extent of competitiveness in exports market should be more important than that in domestic market. Thus, the productivity loss due to power outages would make it more difficult to participate in export market than domestic market. Therefore, the companies that exist in the two markets would tend to sell more in domestic markets at the expense of export markets (intensive margins). In certain cases, some firms could exit the export market to enter into the domestic market (extensive margins). For firms selling all of their products on the domestic market, power outages could prevent them from entering the exports market. Thus, even if a firm sells 100% of its products in the domestic market, power outages could be an incentive to stay there instead of exporting. The variables of power outages should positively affect the share of domestic sales and negatively impact the share of exports in total sales.

In addition to encouraging firms to stay or to move towards domestic market, power outages can have collateral damage on the demand for foreign inputs. Indeed, electricity shortages impose transaction costs on businesses, which could lead to some reductions in spending. Assuming that foreign inputs would be more technological and thus more expensive than domestic ones in developing countries like SSA, firms could replace the imports of foreign inputs with the purchases of domestic inputs. Hence, power outages may reduce the share of foreign inputs and increase that of domestic ones in the total purchase of inputs. It should be noted that, the intermediate inputs, especially those imported, are an important source of productivity for manufacturing firms (Grossman & Helpman, 1991; Markusen, 1989; Romer, 1987; Ethier, 1982; Halpern et al., 2015; Goldberg et al., 2010; Amiti & Konings; Amiti & Konings. According to Halpern et al. (2015), the imports of intermediate inputs accounted for 30% of total factor productivity growth in Hungary and about 50% of this effect was due to importers. Moreover, the reduction of trade tariffs has led to higher imports of new varieties of inputs in India, which in turn have accounted for 31% of new varieties of finished goods (Goldberg et al., 2010).

3.2 Real exchange rate undervaluation and the allocation of manufacturing firms between the export and domestic market

Theoretically, a depreciation, more strongly, an undervaluation of exchange rate positively impacts manufacturing firms because it improves the competitiveness of manufacturing firms - through low prices - in developing countries (Rodrik, 2016; Freund et al., 2012; Rodrik, 2008; Hausmann et al., 2005). Specif-

[10] See for example Cole et al. (2018)).

ically, it moves resources from nontradables to tradables sectors. Thus, it would increase the amount of manufacturing sales in both domestic and export markets. In terms of proportion, Freund et al. (2012) argue that, an undervalued exchange rate shifts resources to the export sector. Therefore, when the exchange rate is undervalued, I can expect an increase in the share of exports in total sales relative to that of domestic sales. Furthermore, I might also expect that the undervaluation allows domestic manufacturing firms to enter export markets or allows entrepreneurs outside of markets to enter the export market. According to Freund et al. (2012) and Rodrik (2016), an undervaluation reduces the distortions and constraints related to the business climate that manufacturing firms face in developing economies. Hence, three interesting facts arise from the above analysis. First, exchange rate undervaluation would improve the performance of firms in countries with strong distortions, while it could be inefficient in countries where these constraints are weak or do not exist. Second, if the effects of obstacles to business are so severe that firms experience high productivity losses, the exchange rate must be deeply depreciated to enhance the competitiveness of firms in export markets. Third, the constraints related to electricity infrastructure are structural problems, while an exchange rate policy can, at best, be a short-term solution. According to Rodrik (2016), maintaining an undervalued exchange rate requires an appropriate monetary/fiscal policy framework. In most SSA countries, deep institutional reforms would be required to achieve such a macroeconomic framework. However, even if these economies were able to have the institutions allowing them to maintain the exchange rate undervalued, this would not solve the problems of infrastructure, which remains structural. Moreover, if all African countries implement an undervaluation policy, it would result in real exchange rate competition among them (Freund et al., 2012). This type of competition would, at best, ensure the success of a select number of countries. In addition, an undervaluation could have a collateral damage by discouraging the imports of inputs, and thus eliminate this important source of productivity for manufacturing firms.

4 Variables and data description

This paper focuses on both company and country specific data. The firm-level data are from the World Bank Enterprise Surveys (WBES). The macroeconomic variables are from Penn World Table 10.1, KOF globalization database and World Development Indicators (WDI).[11] Specifically, 12,062 manufacturing firms in 33 SSA countries are studied between 2006-2019. The WBES concern the issues related to the business environment in developing countries, they allow for identifying the determinants of firms' performance. The stratification is based on three dimensions: sector, size, and the geographical location of firms. The surveys are carried out with the cooperation of the statistical office in each country covered.

4.1 Variable description

The variables description is mainly organized in two parts: firm's variables and macroeconomic variables.

4.1.1 Firm's variables

The present subsection exhibits the set of firms' variables used in this paper.

The share of exports in total sales (%): The exports refer to the sales of manufactured goods whose immediate recipients are located outside the borders of country. The first dependent variable is the share of exports in total sales. This variable corresponds to the intensive margin of exports.

The share of domestic sales in total sales (%): The domestic sales concern the sales of manufactured products whose recipients are inside the country's borders. The second dependent variable is

[11] For the contributions relating to the KOF trade globalization index see Gygli et al. (2019) and Dreher (2006).

the share of domestic sales in total sales. This variable corresponds to the intensive margin of domestic sales.

Exporters dummy: The exporters dummy is a dummy variable taking 1 if the share of exports in total sales is more than 0 and 0 otherwise. This variable allows to study the possibility for manufacturing firms to be in the export market or not. Thus, the exporters dummy will represent the extensive margin of exports.

Domestic sellers dummy: The domestic sellers dummy is a dummy variable taking 1 if the share of domestic sales in total sales is 1 while the share of exports is nil and 0 otherwise. Hence, the domestic sellers dummy represents the extensive margin of domestic sales. It allows to study the possibility for manufacturing firms to be in the domestic market or not.

The measures of the quality of electricity service: Two variables of interest at firm-level, corresponding to two measures of the quality of electricity service are used in this paper. The main variable is the length of power outages experienced in each firm. Initially, this variable is monthly, I convert it to annual because the dependent variables are annual. For robustness, the number of power outages measures the electricity service quality and is used as variable of interest. The length of power outages is considered as key measure of electricity service because it matters more than the number of outages. The extent of the impact of power outages on the manufacturing production depends on their duration not on its number. An outage lasting a few minutes would have a negligible effect on manufacturing production compared to an outage lasting several hours.

Capital ownership: This firm characteristic measures the distribution of the company's ownership among the economic agents. I consider in this paper the share of capital that is held by: domestic economic agents (share owned by nationals), foreigners (share owned by foreigners) and Government/State (share owned by Government/State).

Firms' size: Three dimensions represent the size of companies, namely small, medium and large. Small-sized and medium-sized firms employ 1 to 19 and 20 to 99 employees, respectively. Large-sized firms are those with 100 or more employees.

Firms' locality: This variable shows the size of the city in which a firm is located. It is a dummy variable taking 1 if one firm is located in large city and 0 otherwise. This dummy allows for controlling the agglomeration effect.

Sales 3 years ago: This variable represents the amount of firms' sales three years ago. It allows to controlled the initial situation of firms. Indeed, the increase in sales three years ago could be used to improve the competitiveness of companies to participate in the export market.

4.1.2 Macroeconomics variables

This subsection presents the macroeconomic variables from Penn World 10.0 database, WDI and KOF Globalization Index database.

Exchange rate undervaluation: The exchange rate undervaluation is the macroeconomic variable of interest. To determine this variable, I use the method of Rodrik (2008), which is summarized in three steps. First, I collect data on the variable "price level" of GDP from the Penn World table 10.0 as the measure of real exchange rate. According to Rodrik (2008), this variable is equivalent to the real exchange rate, also, it is expressed as one unit of local currency against an amount of dollars. Thus, the inverse of this variable named: RER is used allowing to study the impact of the undervaluation rather than the overvaluation. Indeed, an increase in RER indicates that local currency is more depreciated while a decrease in RER means that the value of national currency is more appreciated compared to what is recommended by the purchasing power parity.

Second, in order to take into account the Ballassa-Samuelson effect, I regress the RER on the level of

economic development (GDP per capita), allowing to take into account the purchasing power parity.

$$RER_{i,t} = \beta GDPC_{i,t} + \delta_c + \Delta_t + U_{i,t} \tag{1}$$

With: δ_c, Δ_t, $GDP_{C\,i,t}$, $U_{i,t}$ corresponding to the country and year fixed effects, GDP per capita and the error term, respectively.

In the final step, I calculate the measure of exchange rate undervaluation as the difference between the RER and its estimated value obtained from equation 1 ($\hat{RER}_{i,t}$).

$$Undervaluation_{i,t} = RER_{i,t} - \hat{RER}_{i,t} \tag{2}$$

With: $Undervaluation_{i,t}$ corresponding to the undervaluation index of the real exchange rate.

When the undervaluation measure is greater than 1, it indicates that the exchange rate is such that goods produced in the country are relatively cheap in dollar terms. Otherwise, the currency is overvalued. An increase in the undervaluation variable shows a trend to undervaluation, otherwise, there is a trend to overvaluation. For robustness, the RER is used as variable of interest instead of the undervaluation measure.

Access to electricity (%): This variable is the percentage of population with access to electricity. It represents the alternative macroeconomic measure of the electricity service quality used in the robustness model.

Households and government consumption: One of the main determinants of firms' sales is the domestic demand. If the increase in manufacturing goods consumed by households and government is made up of domestic goods, the domestic sales rise. Hence, the shares of households consumption and government consumption in GDP are controlled. These variables are all from Penn World 10.0 database.

Domestic investment: The effect of domestic investment measured by the share of gross fixed capital formation in GDP is controlled. The investment in inputs by one firm is the final sale of other enterprises. So, I expect a positive impact of investment on the sales of manufacturing firms. However, the effect on the share of exports and that of domestic sales could be mitigated.

GDP per capita growth: The growth of GDP per capita, from WDI, can measure both the gowth of income per capita and that of market size. As with income per capita, the expansion of GDP per capita could lead to an increase in the demand for domestic manufacturing products. As with market size, its growth offers opportunities for new firms to enter in the manufacturing sector.

GDP growth rate: This variable measures the effect of the dynamism of an economy.

Trade openness: The country's outward orientation is controlled. The assumption is: the countries that are more outward-oriented allows firms to export and import more. The outward-orientation of countries is measured by the De facto KOF trade globalization indicator.

The quality of institutions: According to Azomahou et al. (2021), the quality of domestic institutions is an important determinant for the intensive and extensive margins of exports. I try to control for this effect. The quality of institutions is measured by the rule of law variable from WDI. It ranges from -2.5 (low rule of law) to 2.5 (high rule of law).

4.2 Data description

This subsection presents the summaries for industries and countries.

Table A.1 & A.2 show the representation of industries in the overall sample. The non-manufacturing and manufacturing industries represent 45.17% and 54.83% of the overall sample, respectively. The industry of wholesale and retail trade and that of food are the most represented in the total sample. In the specific case of the manufacturing sector, the labor-intensive industries tend to be more represented

than capital-intensive industries. The food industry is the largest with 2,957 firms, which accounts for 24.52% of manufacturing sample. Moreover, the wearing apparel and dressing industries represent 13.73% of manufacturing sample. The capital-intensive industry like manufacture of office and computing machinery is the least represented, accounting for 0.07% of the sample.

Table A.4 shows the representation of countries in terms of firms surveyed. Two countries, namely Nigeria and Kenya are the most represented in the manufacturing sample. In total, 4,198 Nigerian firms are considered, this represent 16.98% of the manufacturing sample. The number of Kenyan firms is 2,220 manufacturing firms, representing 8.98% of the sample. The least represented countries are Gabon, Guinea-Bissau, and Togo with 0.56%, 0.63%, 0.93% of manufacturing firms, respectively.

Table A.3, presents the aggregate statistics. It is organized into two parts namely enterprises and macroeconomic variables. On average, the enterprises in the sample tend to sell more in domestic country rather than foreign country. Indeed, the average share of exports in total sales is 12.07% while that of domestic sales is 83.02%. The average annual length of power outages is 82.01 hours while the average number of power outages is 85.61. The firms tend to be, on average, domestic rather than foreign firms. The average share of capital held by nationals is 88.28% while that held by foreigners is 8.24%. The locality dummy is, on average, 0.38, showing that the firms tend to not be located in large cities. The undervaluation measure (-.09), is on average, overvalued in SSA countries.

Table A.5 presents the statistics of the dependent variables by couple (country, year). In all couples (country, year) except (Ethiopia, 2019), the share of domestic sales in total sales is considerably higher than that of exports (direct exports). Moreover, in most countries with at least two years of surveys, the export share tends to decline over time. For example, in Botswana, the share of direct exports declined by 233% from 2009 (26.89% of total sales) to 2017 (8.07% of total sales). For Madagascar, this reduction is 795% from 2009 (30.51% of total sales) to 2017 (3.41% of total sales). In the same time, the share of domestic sales in total sales has increased from 66.79% to 90.63% in Botswana and from 64.03% to 94.71% in Madagascar between 2009 and 2017.

Table A.6 presents the summaries about the variables of interest by couple (country, year). Regarding the variables of power outages (in columns 1 & 2), there is heterogeneity between the couples (country, year). Some couples record a significant number of power outages while having a relatively short duration of outages (Liberia2013; Lesotho2013; Nigeria2009; Nigeria2013; Cameroon2014; Malawi2009; Namibia2009). Moreover, other couples have long length of outages with low number of outages (Angola2006; Zimbabwe2015; Mauritius2010; Mozambique2019, Mali2015; Mauritania2015; Ghana2008; Angola2010; Zambia2009; Rwanda2012; Kenya2010; Senegal2019; Senegal2012). With the exception of the couple (Togo, 2008), all the couples (country, year) in the sample have strongly overvalued exchange rates. Indeed, the undervaluation indicator is significantly lower than 1 in all of these couples.

5 Empirical specification

I estimate the effect of power outages and exchange rate undervaluation on the allocation of firms between the export and the domestic market. The basic econometric model is:

$$Y_{fct} = \alpha + \beta P_{fct} + \sigma E_{ct} + \mu F_{fct} + \gamma X_{ct} + \delta_c + \theta i + \epsilon_{fct} \tag{3}$$

Where Y_{fct} represents either the share of exports in total sales (in logarithm) or the share of domestic sales in total sales (in logarithm) for firm f in country c at time t (intensive margins). It can also represent the dummy variable for exporting firms or dummy variable for domestic sellers in country c at time t (extensive margins). P_{fct} and E_{ct} are the variables of interest. P_{fct} represents the enterprise's variables of interest, either the logarithm of the length of power outages and the logarithm of the number of power

outages in firm f, country c at time t. E_{ct} is the macroeconomic variable of interest corresponding to the logarithm of real exchange rate undervaluation in country c at time t. F_{fct} is the vector of firm control variables for company f in country c at time t. X_{ct} is the vector of macroeconomic control variables for country c at time t. δ_c and θi are the country and the industry fixed effects, respectively. ϵ_{fct} is an idiosyncratic error term. For the intensive margins, the ordinary least squares (OLS) approach is applied while the probit approach is performed for the extensive margins.

However, a major concern emerges from the previous specification. Indeed, the OLS and probit with country and industry fixed effects do not take into account a possible endogeneity bias in the variables of interest. Thus, the challenge is to deal this issue in the firm-level variables of interest and in the macroeconomic variable of interest.

Concerning the endogeneity in the undervaluation measure, it could be explained by the existence of the reverse causality. I assume in equation 8 that, the real exchange rate undervaluation in time t makes the manufacturing firms in SSA more competitive in time t. This would increase the share of exports in total sales relative to the share of domestic sales. However, one may argue that, the increase in manufacturing export in country c at time t could lead to an overvaluation of the real exchange rate. To deal with this, I use the one-period lag of the undervaluation measure. I assume that the performance of firms in terms of exports and domestic sales in country c at time t does not impact the real exchange rate in t-1.

There are two main reasons that may explain the endogeneity of the firm-level variables of interest. First, although I control for country and industry fixed effects, there could be unobserved time-varying characteristics that I would omit. These omitted variables will end up in the error term, creating a correlation between the residual and the firm-level variables of interest. Second, there may be a reverse causality between the power outages variables and the dependent variables. I assume in equation 3 that an increase in the power outages' variables causes a productivity loss and then a competitiveness loss in manufacturing firms. These losses would encourage manufacturing enterprises to turn more toward domestic market at the expense of export market. However, one can argue that the good performance of firms in terms of both exports and domestic sales provide incentive for states to improve the quality of electricity service reducing the length or number of power outages.

To deal this type of endogeneity, I perform the country and industry fixed effects instrumental variables (IV) approach by using two instruments namely: the shock of temperature and the shock of precipitation. The instruments may affect the length and number of power outages in two main ways. First, a rise of temperature should increase the demand of households for electricity (De Cian et al. 2007; Eskeland & Mideksa 2009; Scott & Huang 2007; Pardo et al. 2002; Li & Sailor 1995; Li & Sailor 1995; Al-Zayer & Al-Ibrahim 1996; Bolzern et al. 1982; Ayyash et al. 1985). The increase in electricity demand passes through the use of household appliances such as air conditioners, fans, freezers, refrigerators... Since the supply of electricity is limited, an increase in the demand should increase the length and number of power outages. For example, an additional 1°C of temperature increases the demand for electricity by 2 kWh per year and per capita in European countries (Eskeland & Mideksa 2009). Second, in countries with hydro-electric dams, the dry season which is characterized by low precipitation - a rainfall decrease - leads to a reduction in the water flow in the river feeding a hydro-electric dam (Cole et al. 2018; Mideksa & Kallbekken 2010; Demers & Roy 2006; Beldring et al. 2006; Bye, 2008). The reduction in water flow, by decreasing electrical production will lead to power outages if the demand for electricity does not decrease. I therefore expect that the shock of temperature positively affects the length and number of power outages while the shock of precipitation negatively affects them. These instruments, being shock variables, are exogenous by nature. Moreover, it could be argued that they might not satisfy the exclusion restriction condition if their effects on the dependent variables pass through other channels. For example, a flood shock may affect the aggregate level of economic activity, thus inhibiting the output of firms. In addition,

extreme heat or heavy rain may affect the income level of households by reducing their consumption of manufactured goods and thus impacting the sales of firms. These issues are addressed by including macroeconomic control variables such as GDP growth, GDP per capita growth, household consumption and government consumption. These variables and other macroeconomic variables control for the effects of temperature and precipitation shocks that pass through the level of economic activity. The shock of temperature or the shock of precipitation for each couple (country, year) are determined as the deviation of annual temperature or annual precipitation from the historical average:

$$Shock\_Temperature_{c,t} = \frac{T_{c,t} - \bar{T}_{c,t}}{T^{SD}_{c}} \tag{4}$$

$$Shock\_Precipitation_{c,t} = \frac{Pr_{c,t} - \bar{Pr}_{c,t}}{Pr^{SD}_{c}} \tag{5}$$

$T_{c,t}$ and $Pr_{c,t}$ represent the annual temperature and the annual precipitation for country c at year t, respectively. $\bar{T}_{c,t}$ and $\bar{Pr}_{c,t}$ are the historical annual averages of temperature and precipitation in country c at year t (1961 is the historical year), respectively. Finally, T^{SD}_{c} and Pr^{SD}_{c} are the standard deviations of annual temperature and annual precipitation from 1961 to 2019 in county c. Thus, the country and industry fixed-effects IV is used for the intensive margins and the country and industry fixed-effects probit IV is applied for the extensive margins. In the first step, the impact of temperature and precipitation shocks on power outages variables is estimated.

$$P_{fct} = \alpha + \beta Shock\_Temperature_{ct} + \Gamma Shock\_Precipitation_{ct} + \sigma E_{ct-1} + \mu F_{fct} + \gamma X_{ct} + \delta_c + \theta i + \nu_{fct} \tag{6}$$

Where P_{fct} represents the set of endogenous firm-level variables in country c and time t (the logarithm of the length or number of power outages). E_{ct-1} is the lag (1) of the real exchange rate undervaluation. Figures **??** show the relationship between the instruments and the variables of interest. As expected, the graphs show a positive correlation between the shock of temperature and power outages variables. In addition, the shock of precipitation is negatively correlated to the previous variables (Figures **??**).

The equation of the second step is :

$$Y_{fct} = \alpha + \beta \widehat{P}_{fct} + \sigma E_{ct-1} + + \mu F_{fct} + \gamma X_{ct} + \delta_c + \theta i + \Gamma_{ict} \tag{7}$$

Where $\widehat{P}_{fct}$ is the fitted values of power outages variables from the first stage.

As expected, the three firm-level variables of interest are negatively correlated to the share of exports in total sales and positively correlated to that of domestic sales (Figures 6, 7, **??**). However, the exchange rate undervaluation is positively correlated to the share of exports and negatively correlated to that of domestic sales in total sales (Figures 8). Moreover, the length of power outages is negatively correlated to the share of foreign inputs and positively correlated to the share of domestic inputs in total purchase of inputs (Figures 9). Concerning the exchange rate undervaluation, it is negatively correlated to the share of foreign inputs and positively correlated to the share of domestic inputs in total purchase of inputs (Figures 10).

6 Results

This section presents the main results.

Table 2 presents the impacts of power outages and exchange rate undervaluation on the share of exports and that of domestic sales in total sales (intensive margins). The results of the OLS are reported

in the two first columns. From column 3 to 6, the IV approach is performed to consider the issue of endogeneity in power outages. I begin by presenting the results related to the effects of power outages and then I examine the impacts of exchange rate undervaluation. The columns 3 and 4 concern the IV model in which the length of power outages is endogenous and affects the share of exports in total sales. The first stage equation of this model is reported in column 3. As expected, the shock of temperature positively and significantly affects the length of power outages while the shock of precipitation negatively and significantly impacts it (column 3). In addition, the shock of temperature and precipitation are relevant as instruments because they passe the weak identification and under-identification tests (column 4). Indeed, the Kleibergen-Paap F statistics for weak identification and Kleibergen-Paap LM rk statistics for under-identification are both significant. In column 4, an increase in the length of power outages by 1% causes a decline in the share of exports by 0.94%. The columns 5 and 6 show the results of the model in which the length of power outages is endogenous and affects the share of domestic sales in total sales. The first stage equation of this model is reported in column 5. The annual shock of temperature positively and significantly impacts the length of power outages while the annual shock of precipitation negatively affects it (column 5). Also, the instruments passe the validity tests (column 6). In column 6, although the sign of power outages' effect is positive, its impact on the share of domestic sales is not significant. For undervaluation, it positively and significantly impacts the share of exports (column 4) while it has no significant impact on the share of domestic sales (column 5). An undervaluation of 1% leads to an increase in the share of exports by 0.54%. Table 2 shows that the poor quality of electricity service discourages manufacturing firms from selling their products abroad while the undervaluation encourages them to export more. However, the positive effect of undervaluation is apparently offset by the negative effect of power outages. Indeed, the effect of power outages on the share of exports (-0.94%) is approximately two times higher than that of exchange rate undervaluation (0.54%). Table 3 presents the effects of power outages and the undervaluation on the exporters and domestic sellers dummies. The first two columns present the results of the probit model with fixed effects. The results of the fixed effects probit IV are reported in columns 3 and 4. The expected effects of the instruments are verified (column 3 & 4). The third column reveals a negative and significant effect of power outages on the exporters dummy. Nevertheless, an increase in the length of power outages positively impacts the domestic seller dummy (column 4). Concerning the exchange rate undervaluation, it positively and significantly affects the exporters dummy (column 3) while it negatively and significantly impacts the domestic sellers dummy (column 4). Also, the effects of power outages on the dependent variables remain higher than those of exchange rate undervaluation. Table 3 exhibits that, the poor quality of electricity service increases the possibility of manufacturing firms to be an exporter and decreases that to be a domestic seller (extensive margins). Table 4 & Table 5 present the collateral damage effects of power outages and exchange rate undervaluation. From Table 4, it appears that the length of power outages and exchange rate undervaluation negatively affect the share of foreign inputs and positively impact the share of domestic inputs in the total purchase of inputs. A 1% increase in power outages and exchange rate undervaluation reduces the share of foreign inputs by 0.79% and 0.36%, respectively (column 3) while it increases the share of domestic inputs by 0.64% and 0.33%, respectively. For the extensive margins, the same results can be seen in Table 5 although the effects of exchange rate undervaluation are no longer significant.

7 Sensitivity tests

The section considers three sensitivity tests concerning: countries with poor access to electricity vs countries with better access to electricity, innovative firms vs non-innovative firms, excluding resources-rich countries, excluding the most represented countries and industries, excluding the top exporters

countries in SSA.

7.1 Countries with poor access to electricity vs countries with better access to electricity

The role of exchange rate undervaluation is to make firms more competitive by reducing or eliminating the barriers/constraints related to their activities. However, the undervaluation of exchange rate could fail to achieve this goal if the obstacles - poor quality of electricity services - are less deep or severe. According to Freund et al. (2012), exchange rate depreciation allows to alleviate the distortions experienced by firms. The authors argue that exchange rate depreciation is effective in developing countries with high distortions contrary to developed countries. This hypothesis is tested by applying the estimates to both the sample of countries with better access to electricity per capita and the sample of countries with poor access to electricity per population. The sample of countries with better access to electricity is made up of the 50% of countries with a high value of the variable: access to electricity by population (WDI). Likewise, the sample of countries with poor access to electricity is made up of the 50% of countries with a low value of the same variable. Obviously, the effects of power outages should be more important and significant in countries with poor access to electricity than countries with better access to electricity. Table 6 & Table 7 report the results of the present sensitivity test by considering the intensive margins. Table 6 presents the results for countries with poor access to electricity per population; the effects of exchange rate undervaluation increase drastically. Indeed, an undervaluation of 1% increases the share of exports by 1.31% and reduces that of domestic sales by 0.51%. In countries with better access to electricity (Table 7), a 1% undervaluation increases the share of exports by 0.31% (column 4) and reduces the share of domestic sales by 0.40% (column 6). For electricity shortages, a 1% increase in the length of power outages reduces the share of exports by 1.66% (column 4) while it raises the share of domestic sales by 1.19% (column 6) in countries with poor access to electricity (Table 7). However, an augmentation of the length of power outages by 1% reduces the share of exports by 0.45% (column 4) while it increases the share of domestic sales by 0.31% (column 6) in countries with better access to electricity. From the previous sensitivity test, it appears that the effects of power outages and the undervaluation on the share of exports are three times higher in countries with poor access to electricity than countries with better access to electricity. Concerning the extensive margins, Table 8 & Table 9 show the same results as in Table 6 & Table 7. The effects of exchange rate undervaluation on the exporters and domestic sellers dummies are more important and significant in countries with poor access to electricity (Table 8 columns 3 & 4) than countries with a better access to electricity (Table 9 columns 3 & 4). As expected, the impacts of power outages and exchange rate undervaluation on the dummies are more important in countries with poor access to electricity (Table 8 columns 3 & 4) than those with better access to electricity (Table 9 columns 3 & 4).

7.2 Innovative firms vs non-innovative firms

According to Van Beveren & Vandenbussche (2010), innovation increases the probability for firms to be exporters. Hence, there could be a correlation between innovation and the share of exports and that of domestic sales. If we define innovation as the introduction of new production processes, it can play a role in reducing the effect of power outages if the new technique makes the production structure less dependent on electricity. So, the negative impact of power outages on the share of exports should be lower and less significant in innovative firms compared to non-innovative firms. The innovative firms represent all firms introducing a new process of production. Table 10 reports this sensitivity test and shows that an augmentation of power outages by 1% reduces the share of exports by 0.59% in innovative firms (column 2) while this effect is -1.46% in non-innovative firms (column 5). Thus, the effect of power outages on the

share of exports in non-innovative firms is two times higher than that on the share of exports in innovative firms. Table 10 also shows that exchange rate undervaluation has a positive impact on the export share of non-innovative firms, whereas this effect is not significant for innovative firms. An undervaluation of 1% increases the export share by 0.78% non-innovative firms (column 5). Undervaluation would thus be an effective subsidy to make non-innovative firms more competitive by eliminating internal distortions in these enterprises. As in Table 10 and concerning the extensive margins, the length of power outages and undervaluation affect non-innovative firms more than innovative firms (Table 11).

7.3 Excluding resources-rich countries

According to the model of Corden (1984), the main characteristic of the Dutch disease phenomenon is exchange rate appreciation. In such a context, an undervaluation may fail to rise the competitiveness of manufacturing firms. I expect that the undervaluation should be more significant with high elasticities if the resources-rich countries are excluded. Furthermore, in resource-rich countries, the industrial base being weak, a depreciation or undervaluation of the exchange rate would act more as a policy to promote exports of raw materials in contrast to non-resource-rich countries. Following the criteria of the World Bank, I consider as resource-rich all countries whose rents from the exploitation of natural resources are higher than 10% of GDP and I exclude them. Table 12 & 13 present the main estimations by excluding the resources-rich countries. Contrary to Table 2, the coefficients and significance of the undervaluation increase in Table 12. The undervaluation of 1% rises the share of exports by 0.72% (column 4) and reduces the share of domestic sales by 0.38% (column 6). It is important to note that in non resources-rich countries, the coefficients of the undervaluation are approximately the same to those of power outages. Thus, the undervaluation of exchange rate allows to offset the negative impact of power outages on the share of exports in non resources-rich countries. The same evidence appears in the case of the extensive margins (Table 13).

7.4 Excluding the top exporters

The SSA top exporters of manufacturing goods such as South Africa and Mauritius are present in the overall sample. Therefore, the main results could be drawn by firms from these countries. To check this, I carry out the estimates on the main models by excluding firms from South Africa and Mauritius. Hence, the results without South Africa and Mauritius are reported in Table 14. In the sample without top exporters, a 1% augmentation of power outages reduces the share of exports by 0.75% while an undervaluation of exchange rate by 1% increases it by 0.45. The same conclusions emerge in the case of the extensive margin (Table 15). The exclusion of the top exporters countries reduces the effects of power outages and exchange rate undervaluation on the share of exports compared to the overall sample (column 4). Although the magnitude of power outages' effect on the share of exports changes after excluding the above mentioned firms, the significance remains unchanged.

8 Robustness check

The present robustness check examines the effects of alternative measures of power outages and exchange rate on the dependent variables. First, I use a macroeconomic measure of the electricity service quality, which is the percentage of the population that has access to electricity and its interaction with real exchange rate variables. Moreover, a measure of exchange rate depreciation is used rather. OLS with country and industry fixed effects are applied with the lag of the electricity access variable. The purpose of this second estimation technique is to ensure that the IV results are valid even when correcting for endogeneity bias in the quality of electricity service by another method. The model is written as follows:

$$Y_{fct} = \alpha + \beta A_{ct-1} + \sigma E_{ct-1} + \mu F_{fct} + \gamma X_{ct} + \delta_c + \theta i + \epsilon_{fct} \quad (8)$$

With A_{ct-1}, the lag (1) of the percentage of population that has access to electricity.

Table 16 presents the results for intensive margins when the measure of electricity access (lag 1) and those of real exchange rate (lag 1) are the variables of interest as well as their interactions. The effects of electricity access and undervaluation as well as their interaction are reported in columns 1-4, those of electricity access and exchange rate depreciation are in columns 5-8 with their interaction. For the same dependent variable, the first column corresponds to the model without the interacting variable while the second column takes it into account. In column 1, a 1% increase in the proportion of the population with access to electricity increases the export share by 0.58%, while the effect of undervaluation is not significant. When controlling for the interaction variable, the impact of electricity access increases and the effect of undervaluation becomes significant (column 2). Furthermore, the interaction variable negatively affects the exports share, showing a substitutability between the improvement of electricity service quality and undervaluation. In column 2, a 1% improvement in electricity access per population reduces the impact of undervaluation on the share of exports by 0.17%. Columns 3 and 4 correspond to models in which the share of domestic sales in total sales is the dependent variable, the same conclusions as above can be drawn but in the opposite direction. In column 5, the access to electricity positively impacts the exports share while the effect of exchange rate depreciation is not significant. Controlling for the interaction variable, the impact of electricity access increases drastically, the effect of exchange rate depreciation becomes significant. As before, the effect of the interaction variable is negative; an increase in the proportion of people with access to electricity of 1% leads to a decrease in the effect of exchange rate depreciation of 0.58% on the share of exports. The same conclusions can be drawn in the last two columns, but in the opposite direction. Table 17 present results for extensive margins, the same conclusions as in Table 16 can be drawn.

Second, another firm-level measure of electricity service quality is used, namely the number of electricity shortages. Table 18 shows how the number of power outages and the exchange rate undervaluation affect the share of exports and that of domestic sales. An augmentation of the number of power outages by 1% reduces the share of exports by 0.37% (column 4) while this effect is 0.084% for the share of domestic sales (column 6). Concerning the exchange rate undervaluation, its augmentation by 1% increases the share of exports by 0.52% (column 4) and reduces that of domestic sales by -0.14% (column 6). From the previous findings, one point has to be noted. The effect of the number of power outages on the share of exports (-0.37%) is low compared to that of the length of power outages (-0.94%). The same results can be seen in Table 19 for the extensive margins.

9 Concluding remarks

In the present paper, I study the allocation of manufacturing firms' sales between the domestic and the exports markets in 33 Sub-Saharan African countries. The effects of power outages and exchange rate undervaluation are examined on the share of domestic sales and that of exports in total sales as well as on the exporters and domestic sellers dummies.

The main results suggest that power outages negatively affect the share of exports in total sales while the impact on the share of domestic sales is not significant (intensive margins). More specifically, a 1% increase in the length of power outages reduces the share of exports by 0.94%. For exchange rate undervaluation, it positively impacts the share of exports while its effect on the share of domestic sales is not significant. An undervaluation of 1% leads to an increase in the share of exports by 0.54%. The main results show that the poor quality of electricity service discourages manufacturing firms from selling their

products abroad while the undervaluation encourages them to export more. However, the positive effect of undervaluation is apparently offset by the negative effect of power outages. Indeed, the effect of power outages on the share of exports (-0.94%) is approximately two times higher than that of exchange rate undervaluation (0.54%). In addition, power outages negatively affect the exporters dummy while they positively impact the domestic sellers dummy. Concerning the exchange rate undervaluation, it positively affects the exporters dummy and negatively impacts the domestic sellers dummy. The collateral damage effects show a negative impact of power outages and undervaluation on the share of foreign inputs and a positive effect on the share of domestic input in the total purchase of inputs. A 1% increase in power outages and exchange rate undervaluation reduces the share of foreign inputs by 0.79% and 0.36%, respectively while it increases the share of domestic inputs by 0.64% and 0.33%, respectively.

The effects of power outages and the undervaluation increase drastically in countries with poor access to electricity compared to those with better access to electricity. Indeed, a 1% increase in the length of power outages reduces the share of exports by 1.66% while it raises the share of domestic sales by 1.19% in countries with poor access to electricity. For countries with better access to electricity, an augmentation of the length of power outages by 1% decreases the share of exports by 0.45% while it rises the share of domestic sales by 0.31%. An undervaluation of 1% increases the share of exports by 1.31% and reduces that of domestic sales by 0.51% in countries with poor access to electricity while these effects are 0.31% and -0.40%, respectively for countries with better access to electricity. The electricity shortages and undervaluation affect non-innovative firms more than innovative firms. More precisely, an augmentation of power outages by 1% reduces the share of exports by 1.46% in non-innovative firms while this effect is -0.59% in innovative firms. An undervaluation of 1% increases the share of exports by 0.78% in non-innovative firms (column 5) while the effect in innovative firms is not significant. Undervaluation would thus be an effective subsidy to make non-innovative firms more competitive by eliminating internal distortions in these enterprises. The undervaluation allows to offset the negative impact of power outages on the share of exports in non resources-rich countries, because its coefficients are approximately the same to those of power outages.

The macroeconomic measure of electricity service quality confirms the previous results. Indeed, a 1% increase in the proportion of the population with access to electricity increases the share of exports by 0.58%. Considering the interaction variable, a 1% improvement in electricity access per population reduces the impact of undervaluation and exchange rate depreciation on the share of exports by 0.17% and 0.58%, respectively. Hence, the result of the interaction variable shows that the exchange rate undervaluation policy and the electricity service quality are substitutable. The number of power outages, as the alternative firm-level measure of electricity service reduces the share of exports while it increases the share of domestic sales. However, the impact of the number of power outages on the share of exports (-0.37%) is low compared to the effect of the length of power outages (-0.94%).

In summary, I find that the issue of electricity infrastructure must be considered in the exports promotion policies for manufacturing firms in Sub-Saharan Africa. Specifically, in the overall sample, the export promotion policies have to also pass through the improvement of the electricity infrastructure in Sub-Saharan Africa. As the effect of exchange rate undervaluation is important in countries with poor access to electricity and non resources-rich countries, it could be recommended for these groups of countries. However, the priority in these countries should be the improvement of electricity infrastructure rather than exchange rate undervaluation. Indeed, as undervaluation is a short-term solution because of the exchange rate competition and its difficulty to be maintained in the long term, it can be substituted by policies improving the quality of electricity service, which is a more sustainable solution. Finally, the undervaluation of exchange rate has collateral damage effects on the import of inputs which represents an important source of productivity for manufacturing firms.

References

Al-Zayer, J. & Al-Ibrahim, A. A. (1996), 'Modelling the impact of temperature on electricity consumption in the eastern province of saudi arabia', *Journal of Forecasting* **15**(2), 97–106.

Alam, M. (2013), 'Coping with blackouts: Power outages and firm choices', *Department of Economics, Yale University* .

Allcott, H., Collard-Wexler, A. & O'Connell, S. D. (2016), 'How do electricity shortages affect industry? evidence from india', *American Economic Review* **106**(3), 587–624.

Amiti, M. & Konings, J. (2007), 'Trade liberalization, intermediate inputs, and productivity: Evidence from indonesia', *American Economic Review* **97**(5), 1611–1638.

Arslan, I. & Van Wijnbergen, S. (1993), 'Export incentives, exchange rate policy and export growth in turkey', *The review of Economics and Statistics* pp. 128–133.

Aw, B. Y., Chung, S. & Roberts, M. J. (2000), 'Productivity and turnover in the export market: micro-level evidence from the republic of korea and taiwan (china)', *The World Bank Economic Review* **14**(1), 65–90.

Ayyash, S., Salman, M. & Al-Hafi, N. (1985), 'Modelling the impact of temperature on summer electricity consumption in kuwait', *Energy* **10**(8), 941–949.

Azomahou, T. T., Maemir, H. & Wako, H. A. (2021), 'Contractual frictions and margins of trade', *Journal of Comparative Economics* .

Bayoumi, M. T. (1999), *Estimating trade equations from aggregate bilateral data*, International Monetary Fund.

Beldring, S., Andréasson, J., Bergström, S., Jónsdóttir, J., Rogozova, S., Rosberg, J., Suomalainen, M., Tonning, T., Vehviläinen, B. & Veijalainen, N. (2006), Hydrological climate change maps of the nordic region, *in* 'European Conference on Impacts of Climate Change on Renewable Energy Sources, Iceland, June'.

Bernard, A. B. (1995), Exporters and trade liberalization in mexico: Production structure and performance, Technical report, MIT mimeo, February.

Bernard, A. B. & Jensen, J. B. (1999), 'Exceptional exporter performance: cause, effect, or both?', *Journal of international economics* **47**(1), 1–25.

Bernard, A. B. & Jensen, J. B. (2004), 'Entry, expansion, and intensity in the us export boom, 1987–1992', *Review of International Economics* **12**(4), 662–675.

Bigsten, A., Collier, P., Dercon, S., Fafchamps, M., Gauthier, B., Gunning, J. W., Habarurema, J., Oduro, A., Oostendorp, R., Pattillo, C. et al. (2000), *Exports and firm-level efficiency in African manufacturing*, University of Oxford, Institute of Economics and Statistics, Centre for the ….

Bolzern, P., Fronza, G. & Brusasca, G. (1982), 'Temperature effects on the winter daily electric load', *Journal of Applied Meteorology* **21**(2), 241–243.

Bye, T. (2008), 'The electricity market and climate change–or vice versa', *CELECT deliverable* .

Cole, M. A., Elliott, R. J., Occhiali, G. & Strobl, E. (2018), 'Power outages and firm performance in sub-saharan africa', *Journal of development economics* **134**, 150–159.

Corden, W. M. (1984), 'Booming sector and dutch disease economics: survey and consolidation', *oxford economic Papers* **36**(3), 359–380.

De Cian, E., Lanzi, E. & Roson, R. (2007), 'The impact of temperature change on energy demand: a dynamic panel analysis'.

Demers, D. & Roy, R. (2006), Impacts of climate change on a hydrological regime and effects on hydroelectricity production in the province of quebec, canada, *in* 'European Conference on Impacts of Climate Change on Renewable Energy Sources, Iceland, June'.

Dooley, M. P., Folkerts-Landau, D. & Garber, P. (2004), 'The revived bretton woods system', *International Journal of Finance & Economics* **9**(4), 307–313.

Dreher, A. (2006), 'Does globalization affect growth? evidence from a new index of globalization', *Applied economics* **38**(10), 1091–1110.

Eichengreen, B. (2007), 'The real exchange rate and economic growth', *Social and Economic Studies* pp. 7–20.

Eskeland, G. S. & Mideksa, T. K. (2009), 'Climate change adaptation and residential electricity demand in europe', *CICERO Working Paper* .

Ethier, W. J. (1982), 'National and international returns to scale in the modern theory of international trade', *The American Economic Review* **72**(3), 389–405.

Fafchamps, M., El Hamine, S. & Zeufack, A. (2007), 'Learning to export: Evidence from moroccan manufacturing', *Journal of African Economies* **17**(2), 305–355.

Fisher-Vanden, K., Mansur, E. T. & Wang, Q. J. (2015), 'Electricity shortages and firm productivity: evidence from china's industrial firms', *Journal of Development Economics* **114**, 172–188.

Freund, C., Pierola, M. D. et al. (2012), 'Export surges', *Journal of Development Economics* **97**(2), 387–395.

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N. & Topalova, P. (2010), 'Imported intermediate inputs and domestic product growth: Evidence from india', *The Quarterly journal of economics* **125**(4), 1727–1767.

Greenaway, D., Girma, S. & Kneller, R. (2002), 'Does exporting lead to better performance? a microeconometric analysis of matched firms', *University of Nottingham, GEP Working Paper* (2002/09).

Grossman, G. M. & Helpman, E. (1991), 'Trade, knowledge spillovers, and growth', *European economic review* **35**(2-3), 517–526.

Gygli, S., Haelg, F., Potrafke, N. & Sturm, J.-E. (2019), 'The kof globalisation index–revisited', *The Review of International Organizations* **14**(3), 543–574.

Halpern, L., Koren, M. & Szeidl, A. (2015), 'Imported inputs and productivity', *American Economic Review* **105**(12), 3660–3703.

Hausmann, R., Pritchett, L. & Rodrik, D. (2005), 'Growth accelerations', *Journal of economic growth* **10**(4), 303–329.

Johnson, S., Ostry, J. D. & Subramanian, A. (2010), 'Prospects for sustained growth in africa: Benchmarking the constraints', *IMF Staff Papers* **57**(1), 119–171.

Lewis, W. A. (1954), 'Economic development with unlimited supplies of labour', *The manchester school* **22**(2), 139–191.

Li, X. & Sailor, D. (1995), 'Electricity use sensitivity to climate and climate change', *World Resource Review* **7**(3).

Markusen, J. R. (1989), 'Trade in producer services and in other specialized intermediate inputs', *The American Economic Review* pp. 85–95.

McMillan, M. & Headey, D. (2014), 'Introduction–understanding structural transformation in africa', *World Development* (63), 1–10.

McMillan, M., Rodrik, D. & Verduzco-Gallo, Í. (2014), 'Globalization, structural change, and productivity growth, with an update on africa', *World Development* (63), 11–32.

Mensah, J. T. (2018), *Jobs! Electricity shortages and unemployment in Africa*, The World Bank.

Mideksa, T. K. & Kallbekken, S. (2010), 'The impact of climate change on the electricity market: A review', *Energy policy* **38**(7), 3579–3585.

Murphy, K. M., Shleifer, A. & Vishny, R. (1989*a*), 'Income distribution, market size, and industrialization', *The Quarterly Journal of Economics* **104**(3), 537–564.

Murphy, K. M., Shleifer, A. & Vishny, R. W. (1989*b*), 'Industrialization and the big push', *Journal of political economy* **97**(5), 1003–1026.

Pardo, A., Meneu, V. & Valor, E. (2002), 'Temperature and seasonality influences on spanish electricity load', *Energy Economics* **24**(1), 55–70.

Reinikka, R. & Svensson, J. (2002), 'Coping with poor public capital', *Journal of development economics* **69**(1), 51–69.

Rodrik, D. (2007), 'The real exchange rate and economic growth: theory and evidence'.

Rodrik, D. (2008), 'The real exchange rate and economic growth', *Brookings papers on economic activity* **2008**(2), 365–412.

Rodrik, D. (2016), 'An african growth miracle?', *Journal of African Economies* **27**(1), 10–27.

Romer, P. M. (1987), 'Growth based on increasing returns due to specialization', *The American Economic Review* **77**(2), 56–62.

Schank, T., Schnabel, C. & Wagner, J. (2007), 'Do exporters really pay higher wages? first evidence from german linked employer–employee data', *Journal of international Economics* **72**(1), 52–74.

Scott, M. J. & Huang, Y. J. (2007), 'Effects of climate change on energy use in the united states', *Effects of Climate Change on Energy Production and Use in the United States* pp. 8–44.

Steinbuks, J. & Foster, V. (2010), 'When do firms generate? evidence on in-house electricity supply in africa', *Energy Economics* **32**(3), 505–514.

Van Beveren, I. & Vandenbussche, H. (2010), 'Product and process innovation and firms' decision to export', *Journal of economic policy reform* **13**(1), 3–24.

Van Biesebroeck, J. (2005), 'Exporting raises productivity in sub-saharan african manufacturing firms', *Journal of International economics* **67**(2), 373–391.

Figure 1: Manufacturing exports by world bank regions classification (UNCTAD)

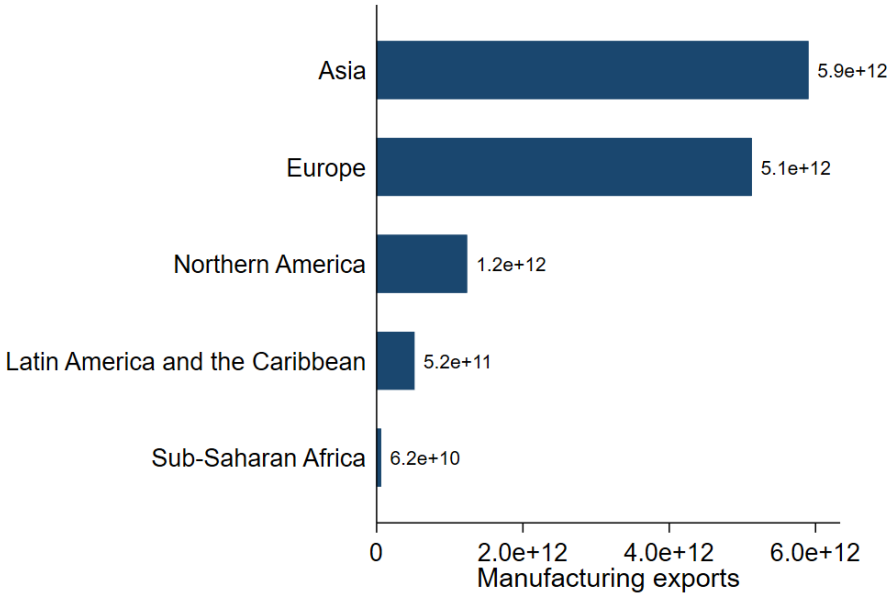
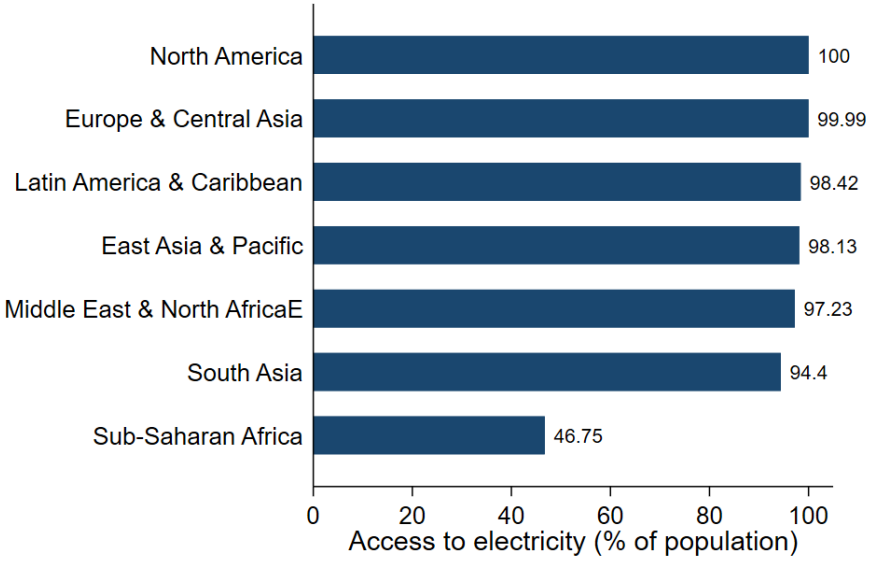
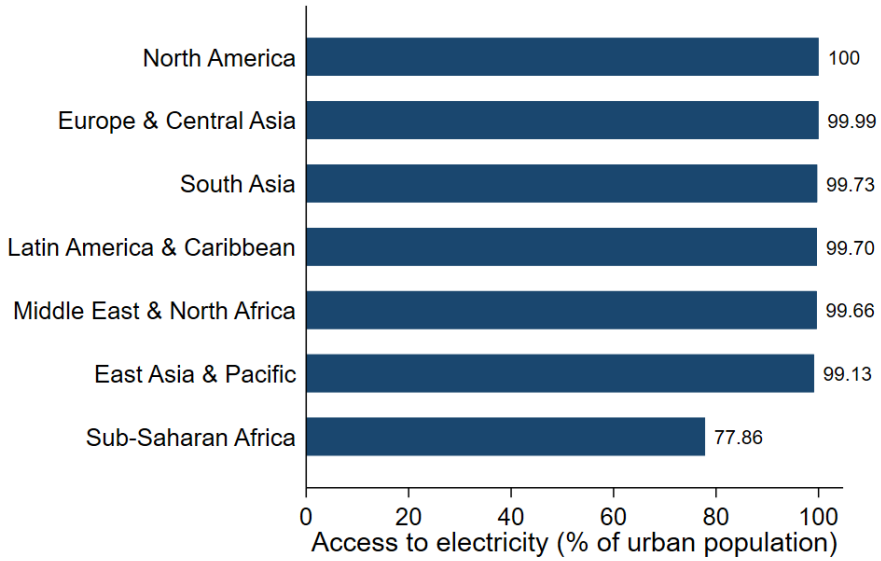


Figure 2: Access to electricity (% of population) by world bank regions classification



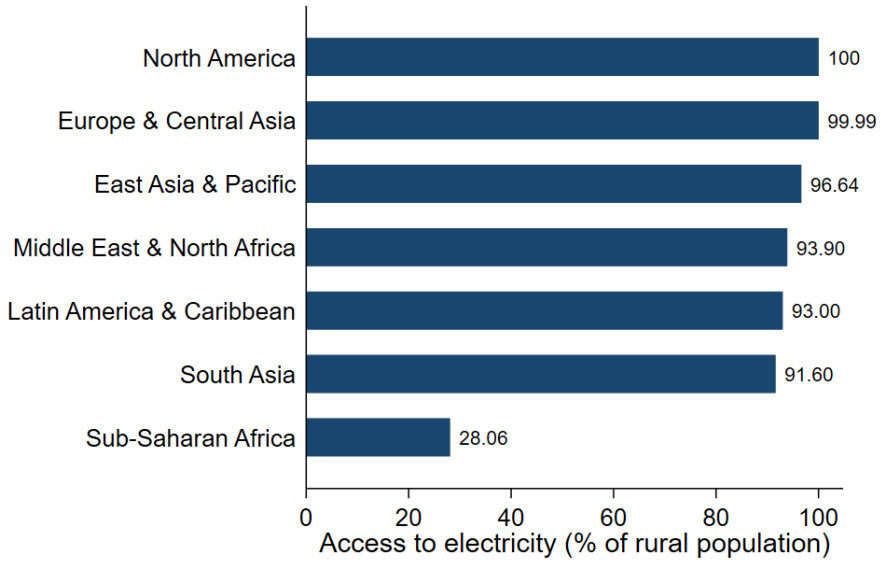
Source: Authors using WDI data

Figure 3: Access to electricity (% of urban population) by world bank regions classification



Source: Authors using WDI data

Figure 4: Access to electricity (% of rural population) by world bank regions classification



Source: Authors using WDI data

Figure 5: Biggest obstacle affecting the operations of firms

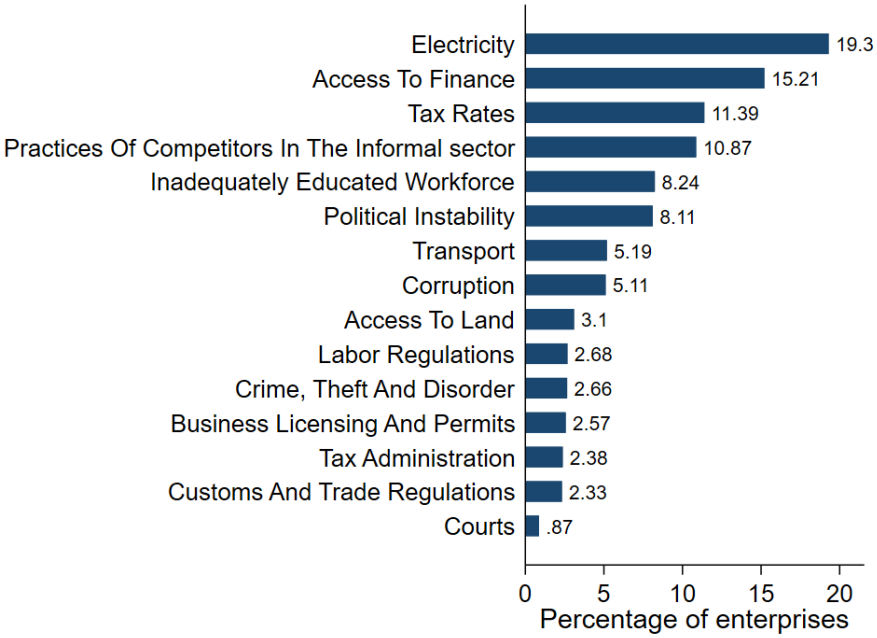


Figure 6: Correlation between the length of power outages and the allocation of manufacturing firms between the exports and the domestic market

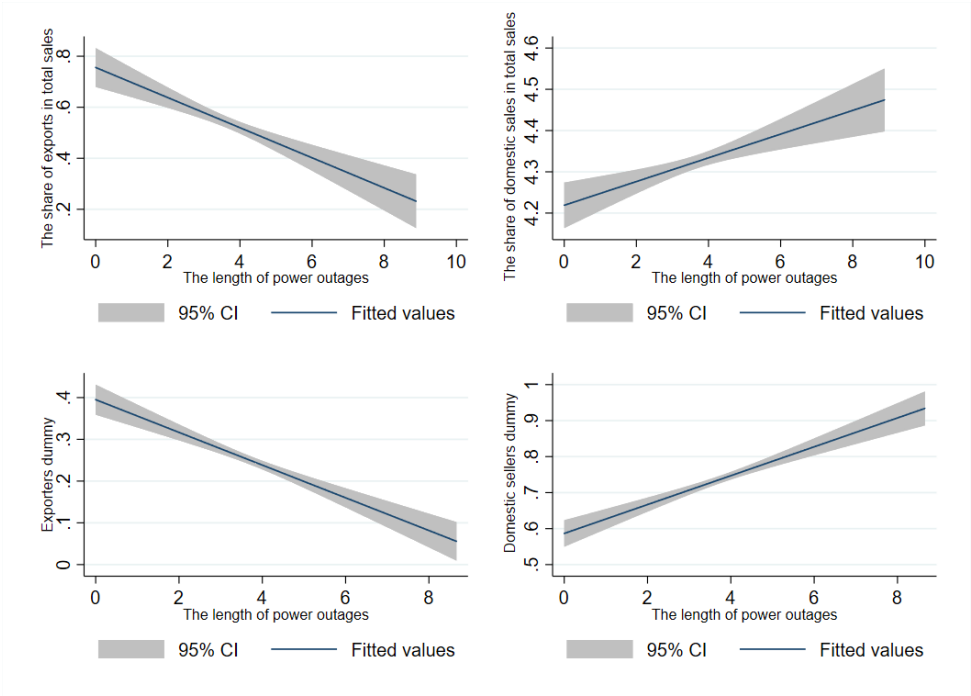


Figure 7: Correlation between the number of power outages and the allocation of manufacturing firms between the exports and the domestic market

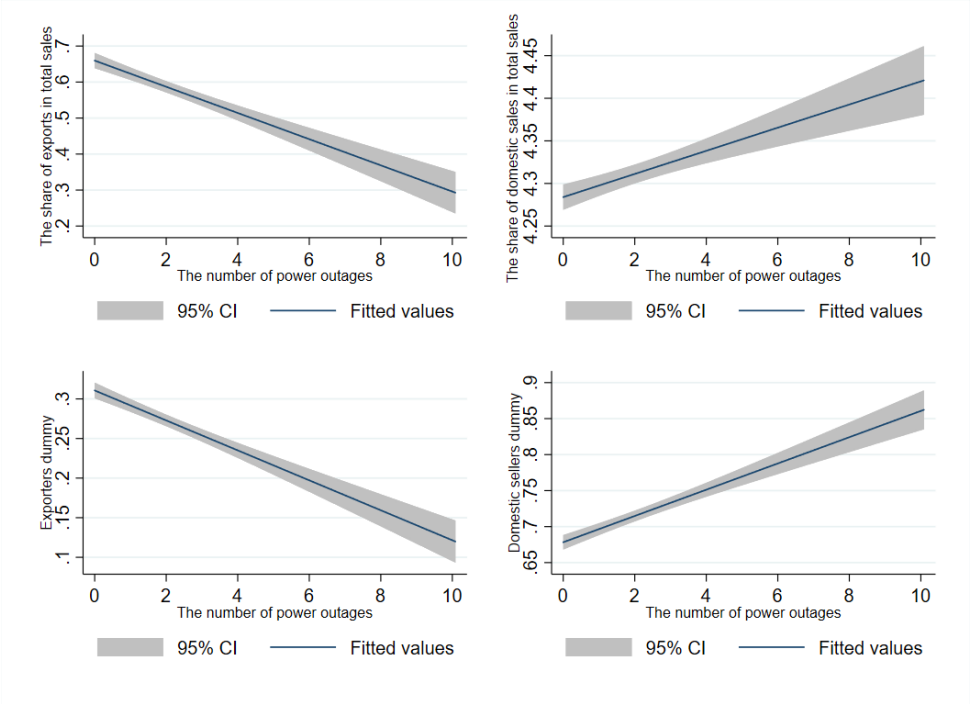


Figure 8: Correlation between the exchange rate undervaluation and the allocation of manufacturing firms between the exports and the domestic market

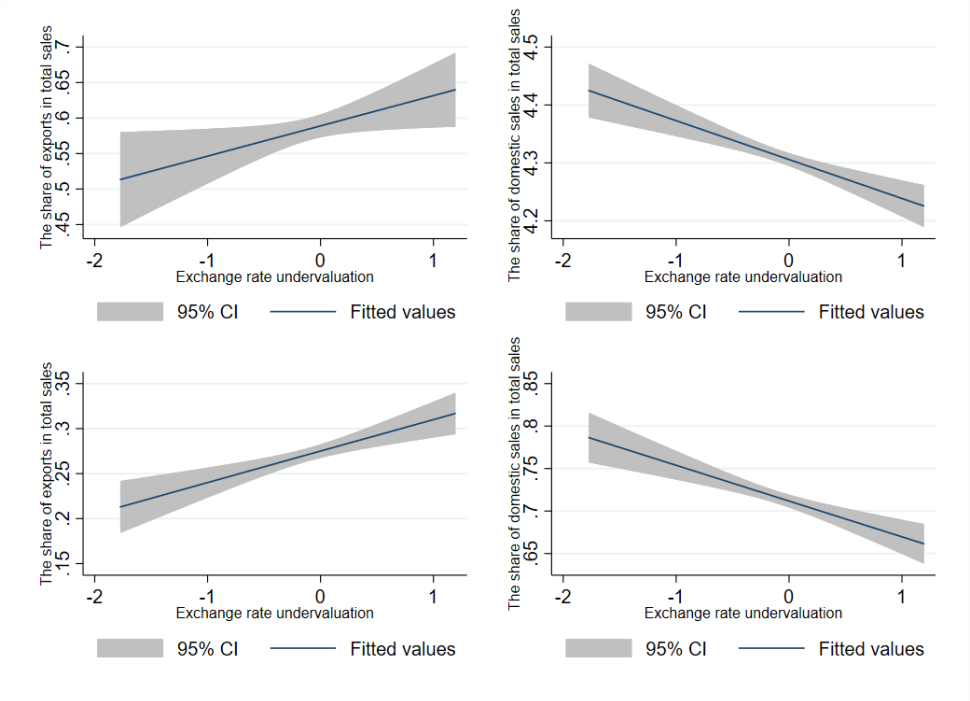


Figure 9: Correlation between the length of power outages and the allocation of manufacturing firms between the imports and the domestic market

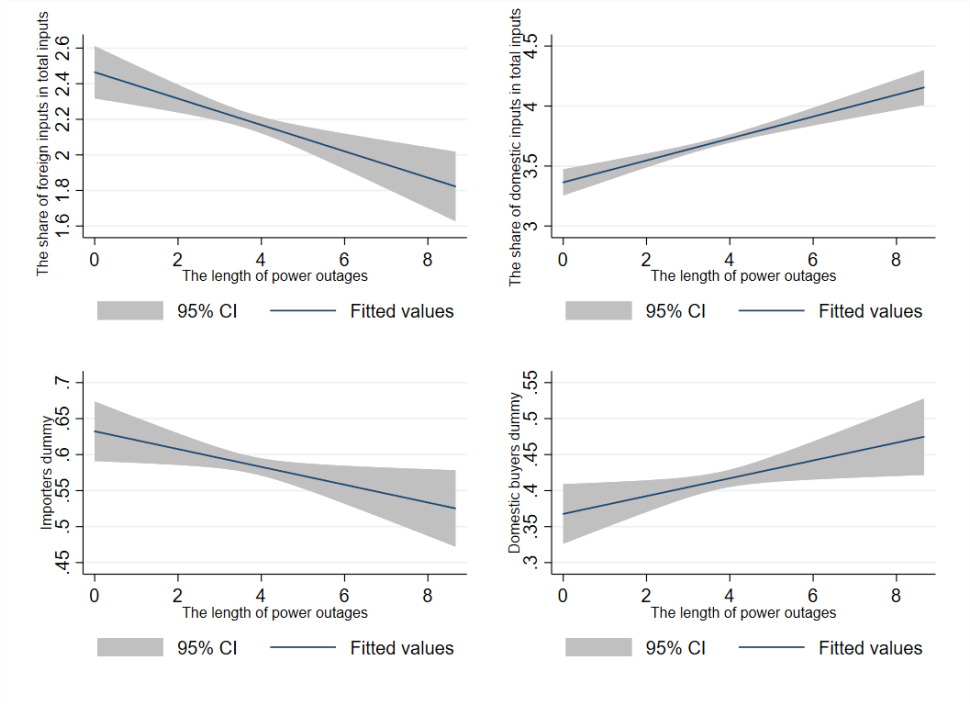


Figure 10: Correlation between the exchange rate undervaluation and the allocation of manufacturing firms between the imports and the domestic market

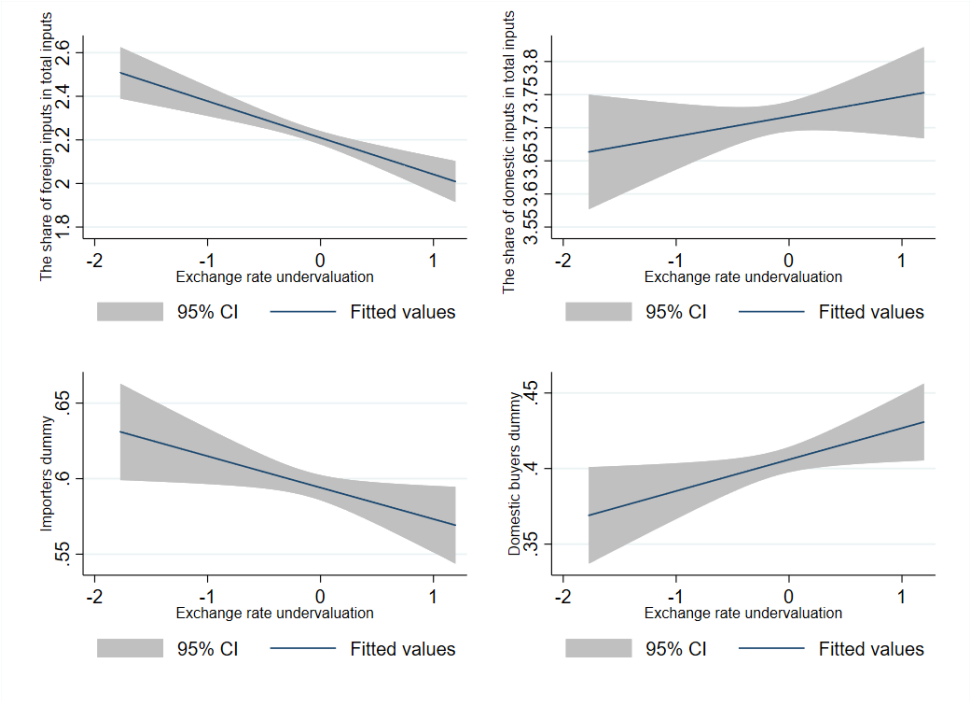


Table 1: The performance of exporters and non-exporters

Performance	Exporters	Non-exporters
Total sales	3.85e+07	4855553
Total employment	248.433	60.617
Number of Production workers	208.845	44.771
Number of Non-Production workers	44.228	14.110
Number of skilled workers	151.874	28.907
Number of unskilled workers	65.543	13.594
Number of female workers	35.13	10.87
Number of workers that the firm would have hired	47.11	5.47

Table 2: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins)

	Dependant variable : Share of sales directly exported and domestically sold by firms (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Sales exported	Domestic sales	Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Length of power outages (log)	0.004	-0.016		-0.939***		0.165
	(0.018)	(0.014)		(0.203)		(0.135)
l.Undervaluation (log)	0.013	0.070	0.359***	0.540***	0.359***	-0.031
	(0.081)	(0.061)	(0.063)	(0.146)	(0.063)	(0.095)
Nationals share of capital (log)	-0.011	0.090***	-0.026	-0.035	-0.026	0.095***
	(0.028)	(0.021)	(0.018)	(0.033)	(0.018)	(0.021)
Foreign share of capital (log)	0.157***	-0.038**	-0.031*	0.128***	-0.031*	-0.033*
	(0.026)	(0.018)	(0.016)	(0.031)	(0.016)	(0.019)
Government share of capital (log)	0.058	0.014	0.004	0.064	0.004	0.013
	(0.049)	(0.033)	(0.034)	(0.060)	(0.034)	(0.034)
Medium size	0.350***	-0.154***	0.011	0.349***	0.008	-0.153***
	(0.038)	(0.027)	(0.029)	(0.046)	(0.029)	(0.028)
Large size	1.259***	-0.709***	0.029	1.276***	0.026	-0.711***
	(0.063)	(0.050)	(0.040)	(0.074)	(0.040)	(0.051)
Location (= large city)	-0.156***	0.055	0.024	-0.122*	0.026	0.048
	(0.050)	(0.037)	(0.037)	(0.063)	(0.037)	(0.039)
Households consumption (log)	1.103***	-0.830***	-1.648***	-0.011	-1.657***	-0.613***
	(0.209)	(0.158)	(0.191)	(0.360)	(0.191)	(0.238)
Government consumption (log)	-0.284	0.108	-0.903***	-1.401***	-0.909***	0.323
	(0.209)	(0.153)	(0.167)	(0.348)	(0.167)	(0.215)
Investment	-0.003	-0.002	-0.016**	-0.018*	-0.015**	0.001
	(0.007)	(0.005)	(0.006)	(0.009)	(0.006)	(0.006)
Sales 3 years ago (log)	0.030***	-0.004	-0.022***	0.011	-0.022***	-0.001
	(0.006)	(0.005)	(0.004)	(0.008)	(0.004)	(0.006)
Trade openness (log)	0.234	-0.204	-0.590**	-0.881**	-0.591**	0.010
	(0.293)	(0.201)	(0.248)	(0.433)	(0.248)	(0.272)
GDP per capita growth (log)	-0.032	0.069	-0.234	-0.178	-0.228	0.096
	(0.216)	(0.134)	(0.163)	(0.264)	(0.163)	(0.137)
GDP growth (log)	0.044	-0.072	0.207	0.188	0.200	-0.099
	(0.213)	(0.132)	(0.160)	(0.260)	(0.160)	(0.135)
Rule of Law	-0.364	-0.303	-0.120	-1.164***	-0.123	-0.149
	(0.301)	(0.236)	(0.279)	(0.414)	(0.279)	(0.282)
Instruments						
Shock Temperature			0.270***		0.271***	
			(0.050)		(0.050)	
Shock Precipitation			-0.254***		-0.251***	
			(0.048)		(0.047)	
Observation	6089.000	6085.000	6089.000	6089.000	6085.000	6085.000
F-stats	58.413	27.051		41.590		26.466
Kleibergen-Paap rk Wald F statistic				32.205		31.935
Kleibergen-Paap rk LM statistic				62.438		61.937
Chi-sq(2) P-value				0.000		0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins)

	Dependant variable : Share of sales directly exported by manufacturing firms (log)			
	Probit models		Probit IV models	
	Exporters	Domestic sellers	Exporters	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Length of power outages (log)	0.009	-0.016	-0.780***	0.797***
	(0.022)	(0.022)	(0.064)	(0.062)
l.Undervaluation (log)	-0.023	-0.026	0.421***	-0.464***
	(0.093)	(0.093)	(0.084)	(0.081)
Nationals share of capital (log)	0.023	-0.015	-0.004	0.011
	(0.027)	(0.027)	(0.024)	(0.023)
Foreign share of capital (log)	0.150***	-0.145***	0.080***	-0.073***
	(0.024)	(0.024)	(0.024)	(0.024)
Government share of capital (log)	0.100**	-0.111**	0.064	-0.069*
	(0.043)	(0.043)	(0.041)	(0.041)
Medium size	0.546***	-0.514***	0.383***	-0.349***
	(0.052)	(0.051)	(0.054)	(0.053)
Large size	1.278***	-1.289***	0.902***	-0.880***
	(0.063)	(0.062)	(0.095)	(0.096)
Location (= large city)	-0.113**	0.125**	-0.044	0.049
	(0.055)	(0.055)	(0.050)	(0.050)
Households consumption (log)	2.391***	-2.839***	0.419	-0.628
	(0.323)	(0.319)	(0.366)	(0.382)
Government consumption (log)	-0.026	-0.089	-1.095***	1.038***
	(0.285)	(0.282)	(0.247)	(0.245)
Investment	-0.008	-0.003	-0.031***	0.024**
	(0.012)	(0.012)	(0.010)	(0.010)
Sales 3 years ago (log)	0.037***	-0.034***	0.007	-0.004
	(0.007)	(0.007)	(0.007)	(0.007)
Trade openness (log)	0.351	-0.402	-0.638**	0.641**
	(0.351)	(0.346)	(0.305)	(0.302)
GDP per capita growth (log)	-0.267	0.345	-0.274	0.325
	(0.258)	(0.261)	(0.215)	(0.215)
GDP growth (log)	0.276	-0.339	0.291	-0.332
	(0.252)	(0.255)	(0.211)	(0.210)
Rule of Law	-0.556*	0.533*	-0.953***	0.953***
	(0.293)	(0.291)	(0.269)	(0.267)
Instruments				
Shock Temperature			0.447***	0.458***
			(0.046)	(0.046)
Shock Precipitation			-0.204***	-0.178***
			(0.044)	(0.045)
Observation	5879.000	5879.000	5879.000	5879.000
Model Wald chi-squared	1373.824	1482.512	3039.583	3316.451
Wald chi-squared test of exogeneity			56.109	57.583
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: The effects of power outages (length of outages) and real exchange rate undervaluation on the purchase of foreign and domestic inputs (intensive margins)

	Dependent variable : Share of foreign and domestic inputs (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Foreign Inputs	Domestic inputs	Foreign Inputs		Domestic inputs	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Length of power outages (log)	0.055**	0.022		-0.793***		0.638***
	(0.024)	(0.020)		(0.276)		(0.239)
l.Undervaluation (log)	-0.780***	0.639***	0.331***	-0.357**	0.332***	0.332**
	(0.116)	(0.101)	(0.063)	(0.178)	(0.063)	(0.156)
Nationals share of capital (log)	0.063**	0.055**	-0.023	0.043	-0.024	0.070**
	(0.030)	(0.026)	(0.019)	(0.035)	(0.019)	(0.028)
Foreign share of capital (log)	0.232***	-0.098***	-0.030*	0.207***	-0.030*	-0.079***
	(0.027)	(0.023)	(0.017)	(0.032)	(0.017)	(0.026)
Government share of capital (log)	-0.072	0.162***	0.002	-0.069	0.002	0.160***
	(0.053)	(0.031)	(0.036)	(0.060)	(0.036)	(0.037)
Medium size	0.332***	-0.142***	-0.001	0.321***	-0.001	-0.134***
	(0.057)	(0.042)	(0.029)	(0.061)	(0.029)	(0.045)
Large size	0.941***	-0.303***	0.018	0.946***	0.018	-0.306***
	(0.073)	(0.057)	(0.041)	(0.081)	(0.041)	(0.062)
Location (= large city)	0.223***	-0.096*	0.023	0.252***	0.023	-0.117**
	(0.064)	(0.049)	(0.038)	(0.072)	(0.038)	(0.056)
Households consumption (log)	1.221***	0.016	-1.732***	0.036	-1.729***	0.875**
	(0.322)	(0.254)	(0.195)	(0.513)	(0.195)	(0.419)
Government consumption (log)	0.829***	-1.296***	-0.880***	-0.104	-0.880***	-0.619
	(0.315)	(0.279)	(0.174)	(0.447)	(0.174)	(0.393)
Investment	-0.024**	0.028***	-0.018***	-0.038***	-0.017***	0.038***
	(0.010)	(0.008)	(0.006)	(0.012)	(0.006)	(0.010)
Sales 3 years ago (log)	0.018**	-0.008	-0.019***	0.004	-0.019***	0.002
	(0.008)	(0.007)	(0.005)	(0.010)	(0.005)	(0.008)
Trade openness (log)	-0.032	-0.897**	-0.432*	-0.869*	-0.433*	-0.291
	(0.409)	(0.376)	(0.253)	(0.516)	(0.253)	(0.455)
GDP per capita growth (log)	1.514***	-0.440*	-0.223	1.392***	-0.221	-0.353
	(0.295)	(0.256)	(0.167)	(0.335)	(0.167)	(0.290)
GDP growth (log)	-1.418***	0.396	0.193	-1.302***	0.192	0.313
	(0.290)	(0.251)	(0.163)	(0.329)	(0.163)	(0.284)
Rule of Law	-0.718*	-0.045	-0.060	-1.383***	-0.063	0.439
	(0.372)	(0.323)	(0.284)	(0.454)	(0.284)	(0.394)
Instruments						
Shock Temperature			0.272***		0.272***	
			(0.051)		(0.051)	
Shock Precipitation			-0.206***		-0.206***	
			(0.048)		(0.048)	
Observation	5794.000	5793.000	5794.000	5794.000	5793.000	5793.000
F-stats	52.477	24.196		41.919		20.494
Kleibergen-Paap rk Wald F statistic				26.102		26.021
Kleibergen-Paap rk LM statistic				51.211		51.053
Chi-sq(2) P-value				0.000		0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: The effects of power outages (length of outages) and real exchange rate undervaluation on the importers and domestics buyers dummies (extensive margins)

	Dependant variable : Importers and Domestic buyers dummies (log)			
	Probit model		Probit IV models	
	Importers	Domestic buyers	Importers	Domestic buyers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Length of power outages (log)	0.067***	-0.067***	-0.560***	0.560***
	(0.019)	(0.019)	(0.134)	(0.134)
l.Undervaluation (log)	-0.503***	0.503***	-0.071	0.071
	(0.085)	(0.085)	(0.133)	(0.133)
Nationals share of capital (log)	0.037	-0.037	0.014	-0.014
	(0.024)	(0.024)	(0.023)	(0.023)
Foreign share of capital (log)	0.182***	-0.182***	0.129***	-0.129***
	(0.023)	(0.023)	(0.029)	(0.029)
Government share of capital (log)	-0.030	0.030	-0.019	0.019
	(0.043)	(0.043)	(0.039)	(0.039)
Medium size	0.216***	-0.216***	0.181***	-0.181***
	(0.041)	(0.041)	(0.041)	(0.041)
Large size	0.749***	-0.749***	0.624***	-0.624***
	(0.060)	(0.060)	(0.082)	(0.082)
Location (= large city)	0.174***	-0.174***	0.164***	-0.164***
	(0.049)	(0.049)	(0.046)	(0.046)
Households consumption (log)	1.182***	-1.182***	0.233	-0.233
	(0.228)	(0.228)	(0.325)	(0.325)
Government consumption (log)	0.659***	-0.659***	-0.202	0.202
	(0.212)	(0.212)	(0.283)	(0.283)
Investment	-0.021***	0.021***	-0.028***	0.028***
	(0.008)	(0.008)	(0.007)	(0.007)
Sales 3 years ago (log)	0.011*	-0.011*	-0.004	0.004
	(0.006)	(0.006)	(0.007)	(0.007)
Trade openness (log)	-0.003	0.003	-0.711**	0.711**
	(0.293)	(0.293)	(0.312)	(0.312)
GDP per capita growth (log)	1.124***	-1.124***	0.833***	-0.833***
	(0.232)	(0.232)	(0.248)	(0.248)
GDP growth (log)	-1.057***	1.057***	-0.779***	0.779***
	(0.228)	(0.228)	(0.242)	(0.242)
Rule of Law	-0.464	0.464	-0.886***	0.886***
	(0.283)	(0.283)	(0.266)	(0.266)
Instruments				
Shock Temperature			0.209***	0.209***
			(0.057)	(0.057)
Shock Precipitation			-0.301***	-0.301***
			(0.041)	(0.041)
Observation	6127.000	6127.000	6127.000	6127.000
Model Wald chi-squared	1173.209	1173.209	1761.488	1761.488
Wald chi-squared test of exogeneity			13.323	13.323
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins): country with bad access to electricity

	Dependant variable : Share of sales directly exported and domestically sold by firms (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Sales exported	Domestic sales	Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Length of power outages (log)	-0.005	-0.007		-1.664**		1.186**
	(0.028)	(0.020)		(0.697)		(0.475)
l.Undervaluation (log)	0.992***	-0.283*	0.031	1.311***	0.031	-0.513**
	(0.212)	(0.169)	(0.178)	(0.400)	(0.178)	(0.254)
Nationals share of capital (log)	0.023	0.085***	-0.012	0.003	-0.012	0.099**
	(0.041)	(0.029)	(0.028)	(0.062)	(0.028)	(0.044)
Foreign share of capital (log)	0.141***	-0.040*	-0.011	0.123**	-0.011	-0.027
	(0.036)	(0.024)	(0.025)	(0.055)	(0.025)	(0.037)
Government share of capital (log)	-0.039	0.058	0.001	-0.032	0.001	0.052
	(0.063)	(0.036)	(0.047)	(0.107)	(0.047)	(0.073)
Medium size	0.482***	-0.191***	0.036	0.535***	0.035	-0.228***
	(0.064)	(0.044)	(0.044)	(0.100)	(0.044)	(0.069)
Large size	1.369***	-0.643***	0.037	1.417***	0.037	-0.677***
	(0.087)	(0.063)	(0.053)	(0.123)	(0.053)	(0.090)
Location (= large city)	-0.302***	0.151**	0.056	-0.220	0.054	0.094
	(0.093)	(0.069)	(0.058)	(0.139)	(0.058)	(0.100)
Households consumption (log)	5.589***	-1.910**	-0.563	3.479*	-0.576	-0.376
	(1.143)	(0.875)	(0.854)	(1.979)	(0.856)	(1.430)
Government consumption (log)	-0.246	0.727*	-0.296	-0.800	-0.302	1.135**
	(0.491)	(0.391)	(0.433)	(0.724)	(0.433)	(0.560)
Investment	0.149***	-0.048***	0.016	0.102**	0.016	-0.015
	(0.025)	(0.018)	(0.022)	(0.041)	(0.022)	(0.028)
Sales 3 years ago (log)	0.062***	-0.019***	-0.010	0.048***	-0.010	-0.009
	(0.011)	(0.007)	(0.007)	(0.016)	(0.007)	(0.011)
Trade openness (log)	-0.779	-0.993	-0.944*	-2.866**	-0.947*	0.512
	(0.780)	(0.616)	(0.545)	(1.440)	(0.545)	(1.091)
GDP per capita growth (log)	0.959***	0.022	-0.135	0.699	-0.132	0.204
	(0.366)	(0.209)	(0.256)	(0.556)	(0.256)	(0.349)
GDP growth (log)	-0.785**	-0.075	0.127	-0.545	0.123	-0.243
	(0.365)	(0.216)	(0.253)	(0.543)	(0.253)	(0.347)
Rule of Law	-5.681***	1.456**	-1.569**	-6.698***	-1.566**	2.182**
	(0.830)	(0.594)	(0.716)	(1.336)	(0.716)	(0.922)
Instruments						
Shock Temperature			0.294**		0.293**	
			(0.117)		(0.117)	
Shock Precipitation			-0.190		-0.190	
			(0.144)		(0.144)	
Observation	2728.000	2725.000	2728.000	2728.000	2725.000	2725.000
F-stats	39.979	16.616		16.905		7.831
Kleibergen-Paap rk Wald F statistic				6.767		6.756
Kleibergen-Paap rk LM statistic				12.753		12.735
Chi-sq(2) P-value				0.002		0.002
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 7: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins): country with better access to electricity

	Dependant variable : Share of sales directly exported and domestically sold by firms (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Sales exported	Domestic sales	Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Hour of power outages (log)	-0.001	-0.027		-0.453***		0.311***
	(0.023)	(0.019)		(0.107)		(0.071)
l.Undervaluation (log)	-0.142	-0.061	-0.060	0.312*	-0.060	-0.398***
	(0.126)	(0.085)	(0.145)	(0.173)	(0.145)	(0.117)
Nationals share of capital (log)	-0.039	0.091***	-0.045**	-0.058	-0.046**	0.106***
	(0.035)	(0.028)	(0.022)	(0.037)	(0.022)	(0.030)
Foreign share of capital (log)	0.177***	-0.038	-0.052**	0.157***	-0.051**	-0.023
	(0.035)	(0.027)	(0.021)	(0.037)	(0.021)	(0.028)
Government share of capital (log)	0.114	-0.019	-0.028	0.107	-0.027	-0.014
	(0.070)	(0.054)	(0.049)	(0.071)	(0.049)	(0.056)
Medium size	0.210***	-0.094***	0.020	0.198***	0.016	-0.084**
	(0.045)	(0.035)	(0.039)	(0.048)	(0.038)	(0.037)
Large size	1.055***	-0.752***	0.051	1.045***	0.047	-0.743***
	(0.095)	(0.080)	(0.059)	(0.100)	(0.059)	(0.083)
Location (= large city)	-0.040	0.065	-0.003	-0.019	0.003	0.047
	(0.060)	(0.050)	(0.052)	(0.066)	(0.052)	(0.054)
Households consumption (log)	1.388***	-1.529***	-3.221***	0.507	-3.220***	-0.867***
	(0.336)	(0.260)	(0.294)	(0.402)	(0.294)	(0.294)
Government consumption (log)	-0.361	-0.161	-1.924***	-0.924***	-1.919***	0.258
	(0.300)	(0.206)	(0.227)	(0.338)	(0.227)	(0.234)
Investment	0.023*	-0.043***	-0.090***	0.011	-0.089***	-0.034***
	(0.014)	(0.010)	(0.013)	(0.014)	(0.013)	(0.011)
Sales 3 years ago (log)	0.016**	0.002	-0.024***	0.007	-0.023***	0.008
	(0.007)	(0.006)	(0.006)	(0.008)	(0.006)	(0.007)
Trade openness (log)	0.107	0.739**	1.157*	-1.462**	1.148*	1.904***
	(0.551)	(0.341)	(0.610)	(0.672)	(0.609)	(0.430)
GDP per capita growth (log)	-1.798***	1.369***	-0.914**	-2.037***	-0.917**	1.550***
	(0.570)	(0.429)	(0.460)	(0.621)	(0.460)	(0.462)
GDP growth (log)	1.790***	-1.368***	0.915**	2.059***	0.917**	-1.569***
	(0.558)	(0.418)	(0.450)	(0.609)	(0.450)	(0.451)
Rule of Law	0.778	-0.002	2.937***	-0.514	2.928***	0.956*
	(0.595)	(0.440)	(0.790)	(0.714)	(0.789)	(0.506)
Instruments						
Shock Temperature			0.929***		0.927***	
			(0.090)		(0.090)	
Shock Precipitation			-0.446***		-0.439***	
			(0.065)		(0.064)	
Observation	3344.000	3343.000	3344.000	3344.000	3343.000	3343.000
F-stats	23.947	14.023		23.040		13.894
Kleibergen-Paap rk Wald F statistic				68.038		67.530
Kleibergen-Paap rk LM statistic				84.151		83.663
Chi-sq(2) P-value				0.000		0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 8: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins): country with bad access to electricity

	Dependant variable : Share of sales directly exported by manufacturing firms (log)			
	Probit models		Probit IV models	
	Exporters dummy	Domestic sellers	Exporters dummy	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Length of power outages (log)	0.009	-0.010	-1.038***	1.039***
	(0.032)	(0.032)	(0.077)	(0.075)
l.Undervaluation (log)	1.349***	-1.291***	0.545*	-0.504*
	(0.290)	(0.274)	(0.313)	(0.293)
Nationals share of capital (log)	0.050	-0.038	0.008	-0.004
	(0.042)	(0.042)	(0.037)	(0.037)
Foreign share of capital (log)	0.130***	-0.131***	0.039	-0.039
	(0.038)	(0.038)	(0.038)	(0.038)
Government share of capital (log)	-0.013	0.003	-0.033	0.029
	(0.059)	(0.059)	(0.058)	(0.058)
Medium size	0.622***	-0.624***	0.288**	-0.288***
	(0.078)	(0.077)	(0.112)	(0.109)
Large size	1.356***	-1.400***	0.581***	-0.595***
	(0.091)	(0.090)	(0.223)	(0.223)
Location (= large city)	-0.148	0.162*	-0.063	0.069
	(0.095)	(0.094)	(0.075)	(0.076)
Households consumption (log)	8.636***	-8.383***	-0.549	0.729
	(1.770)	(1.727)	(2.292)	(2.188)
Government consumption (log)	1.284	-0.775	-0.870	1.102*
	(0.810)	(0.759)	(0.709)	(0.644)
Investment	0.227***	-0.241***	0.013	-0.016
	(0.038)	(0.039)	(0.050)	(0.051)
Sales 3 years ago (log)	0.077***	-0.068***	0.011	-0.008
	(0.013)	(0.013)	(0.015)	(0.014)
Trade openness (log)	-2.174**	1.403*	-1.674**	1.308*
	(0.965)	(0.831)	(0.828)	(0.738)
GDP per capita growth (log)	1.653***	-1.549***	0.485	-0.426
	(0.430)	(0.427)	(0.389)	(0.369)
GDP growth (log)	-1.530***	1.415***	-0.404	0.339
	(0.417)	(0.413)	(0.375)	(0.354)
Rule of Law	-6.671***	7.041***	-2.745**	2.867**
	(0.983)	(1.014)	(1.173)	(1.204)
Instruments				
Shock Temperature			0.136	0.143
			(0.104)	(0.102)
Shock Precipitation			-0.271***	-0.270***
			(0.093)	(0.091)
Observation	2496.000	2496.000	2496.000	2496.000
Model Wald chi-squared	589.006	631.924	2334.189	2385.294
Wald chi-squared test of exogeneity			12.657	13.475
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 9: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins): excluding countries with better access to electricity

	Dependant variable : Share of sales directly exported by manufacturing firms (log)			
	Probit models		Probit IV models	
	Exporters	Domestic sellers	Exporters	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Length of power outages (log)	-0.015	0.005	-0.520***	0.524***
	(0.031)	(0.030)	(0.109)	(0.112)
l.Undervaluation (log)	-0.316*	0.258	0.250	-0.316
	(0.191)	(0.191)	(0.208)	(0.206)
Nationals share of capital (log)	-0.010	0.014	-0.029	0.034
	(0.035)	(0.033)	(0.033)	(0.032)
Foreign share of capital (log)	0.179***	-0.168***	0.137***	-0.126***
	(0.032)	(0.032)	(0.034)	(0.034)
Government share of capital (log)	0.143**	-0.147**	0.122**	-0.125**
	(0.057)	(0.058)	(0.055)	(0.056)
Medium size	0.425***	-0.375***	0.363***	-0.317***
	(0.075)	(0.073)	(0.073)	(0.072)
Large size	1.161***	-1.182***	1.010***	-1.020***
	(0.094)	(0.093)	(0.112)	(0.114)
Location (= large city)	-0.072	0.140*	-0.036	0.096
	(0.079)	(0.078)	(0.077)	(0.076)
Households consumption (log)	2.477***	-3.000***	1.136**	-1.538***
	(0.457)	(0.452)	(0.540)	(0.571)
Government consumption (log)	-0.129	-0.013	-0.741*	0.616
	(0.416)	(0.419)	(0.389)	(0.387)
Investment	0.001	-0.012	-0.015	0.006
	(0.018)	(0.017)	(0.016)	(0.016)
Sales 3 years ago (log)	0.024***	-0.026***	0.011	-0.012
	(0.009)	(0.009)	(0.009)	(0.009)
Trade openness (log)	0.426	-0.124	-1.393*	1.712**
	(0.863)	(0.876)	(0.839)	(0.843)
GDP per capita growth (log)	-2.422***	2.989***	-2.338***	2.825***
	(0.590)	(0.586)	(0.572)	(0.571)
GDP growth (log)	2.421***	-2.975***	2.370***	-2.847***
	(0.575)	(0.572)	(0.558)	(0.557)
Rule of Law	0.866	-0.705	-0.750	0.955
	(0.831)	(0.834)	(0.811)	(0.814)
Instruments				
Shock Temperature			0.952***	0.960***
			(0.087)	(0.086)
Shock Precipitation			-0.416***	-0.400***
			(0.066)	(0.068)
Observation	3361.000	3361.000	3361.000	3361.000
Model Wald chi-squared	706.613	750.591	960.265	1016.768
Wald chi-squared test of exogeneity			15.541	15.301
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 10: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins): innovative firms vs non-innovative firms

	Dependent variable : Share of sales directly exported and domestically sold by firms (log)					
	Innovative firms			Non-innovative firms		
	Sales exported		Domestic sales	Sales exported		Domestic sales
	(1)	(2)	(3)	(4)	(5)	(6)
	First Stage	Model 1	Model 2	First Stage	Model 3	Model 4
Length of power outages (log)		-0.587**	0.315*		-1.455***	0.240
		(0.283)	(0.181)		(0.380)	(0.217)
l.Undervaluation (log)	0.054	0.351	-0.230	0.330***	0.779***	-0.011
	(0.200)	(0.345)	(0.249)	(0.084)	(0.232)	(0.128)
Nationals share of capital (log)	-0.040	-0.066	0.137***	-0.002	-0.004	0.074***
	(0.027)	(0.051)	(0.043)	(0.024)	(0.047)	(0.022)
Foreign share of capital (log)	-0.053**	0.122**	0.011	-0.007	0.142***	-0.050***
	(0.026)	(0.052)	(0.040)	(0.020)	(0.042)	(0.019)
Government share of capital (log)	-0.004	0.243***	-0.042	0.001	-0.057	0.048
	(0.042)	(0.087)	(0.064)	(0.048)	(0.088)	(0.042)
Medium size	0.082	0.439***	-0.057	-0.001	0.293***	-0.171***
	(0.064)	(0.099)	(0.075)	(0.032)	(0.063)	(0.029)
Large size	0.089	1.236***	-0.582***	-0.009	1.201***	-0.738***
	(0.080)	(0.134)	(0.105)	(0.046)	(0.100)	(0.058)
Location (= large city)	0.017	-0.110	0.266***	0.048	-0.054	-0.051
	(0.075)	(0.103)	(0.080)	(0.045)	(0.092)	(0.049)
Households consumption (log)	-1.516**	-1.931	-1.369	-1.766***	-1.090	-0.305
	(0.758)	(1.342)	(0.861)	(0.224)	(0.687)	(0.386)
Government consumption (log)	-2.908***	-2.074*	0.138	-0.733***	-1.658***	0.525**
	(0.524)	(1.182)	(0.754)	(0.186)	(0.479)	(0.248)
Investment	-0.116***	-0.036	-0.019	-0.009	-0.012	-0.003
	(0.030)	(0.030)	(0.019)	(0.007)	(0.013)	(0.007)
Sales 3 years ago (log)	-0.032***	0.007	0.017	-0.015***	0.018	-0.006
	(0.009)	(0.017)	(0.012)	(0.005)	(0.011)	(0.006)
Trade openness (log)	0.538	-2.349**	0.661	-0.953***	-2.055***	0.355
	(0.670)	(0.912)	(0.498)	(0.296)	(0.753)	(0.440)
GDP per capita growth (log)	-1.103	-3.607***	1.406*	-0.103	-0.040	0.082
	(1.026)	(1.337)	(0.793)	(0.179)	(0.340)	(0.139)
GDP growth (log)	1.118	3.664***	-1.351*	0.086	0.063	-0.102
	(1.018)	(1.322)	(0.780)	(0.176)	(0.335)	(0.137)
Rule of Law	1.756**	-0.025	0.608	-0.653*	-2.170***	-0.167
	(0.705)	(0.972)	(0.610)	(0.337)	(0.746)	(0.447)
Instruments						
Shock Temperature	0.778***			0.224***		
	(0.180)			(0.060)		
Shock Precipitation	-0.155			-0.169***		
	(0.109)			(0.062)		
Observation	1476.000	1476.000	1473.000	4610.000	4610.000	4609.000
Kleibergen-Paap rk Wald F statistic		11.442	11.481		12.723	12.591
Kleibergen-Paap rk LM statistic		20.760	20.821		24.868	24.641
Chi-sq(2) P-value		0.000	0.000		0.000	0.000
Country fixed effect		0.000	0.000		0.000	0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 11: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins): innovative firms vs non-innovative firms

	Dependent variable : Share of sales directly exported by manufacturing firms (log)			
	Innovative firms		Non-innovative firms	
	Exporters	Domestic sellers	Exporters	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Length of power outages (log)	-0.560***	0.631***	-0.936***	0.928***
	(0.163)	(0.140)	(0.059)	(0.061)
l.Undervaluation (log)	0.319	-0.465**	0.546***	-0.508***
	(0.239)	(0.217)	(0.104)	(0.103)
Nationals share of capital (log)	-0.036	0.049	0.027	-0.027
	(0.038)	(0.035)	(0.030)	(0.030)
Foreign share of capital (log)	0.085*	-0.067	0.090***	-0.093***
	(0.044)	(0.042)	(0.029)	(0.029)
Government share of capital (log)	0.185***	-0.159**	-0.041	0.018
	(0.067)	(0.065)	(0.055)	(0.057)
Medium size	0.440***	-0.350***	0.311***	-0.314***
	(0.098)	(0.092)	(0.063)	(0.063)
Large size	0.982***	-0.892***	0.739***	-0.770***
	(0.165)	(0.162)	(0.114)	(0.118)
Location (= large city)	-0.074	0.170*	-0.003	-0.018
	(0.098)	(0.101)	(0.060)	(0.059)
Households consumption (log)	-1.660	0.700	-0.518	0.408
	(1.114)	(1.044)	(0.431)	(0.444)
Government consumption (log)	-2.064***	1.947***	-1.306***	1.287***
	(0.767)	(0.718)	(0.278)	(0.280)
Investment	-0.050**	0.029	-0.043***	0.037***
	(0.024)	(0.023)	(0.012)	(0.012)
Sales 3 years ago (log)	0.004	0.005	0.015*	-0.013
	(0.014)	(0.013)	(0.009)	(0.008)
Trade openness (log)	-1.660**	1.722**	-1.192***	1.130***
	(0.679)	(0.676)	(0.385)	(0.391)
GDP per capita growth (log)	-2.830**	2.994***	-0.118	0.166
	(1.105)	(1.078)	(0.234)	(0.235)
GDP growth (log)	2.880***	-3.010***	0.165	-0.208
	(1.095)	(1.066)	(0.230)	(0.231)
Rule of Law	0.080	0.074	-1.284***	1.243***
	(0.749)	(0.727)	(0.348)	(0.348)
Instruments				
Shock Temperature	0.765***	0.788***	0.381***	0.385***
	(0.180)	(0.172)	(0.054)	(0.054)
Shock Precipitation	-0.191*	-0.159	-0.143***	-0.130***
	(0.101)	(0.098)	(0.045)	(0.046)
Observation	1491.000	1491.000	4366.000	4387.000
Wald chi-squared test of exogeneity	8.513	11.822	53.870	51.536
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 12: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins): excluding natural resources-rich countries

	Dependent variable : Share of sales directly exported and domestically sold by firms (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Sales exported	Domestic sales	Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Length of power outages (log)	-0.004	-0.007		-0.705***		0.376**
	(0.027)	(0.020)		(0.242)		(0.162)
l.Undervaluation (log)	0.851***	-0.447***	-0.370	0.702***	-0.370	-0.365**
	(0.205)	(0.160)	(0.235)	(0.266)	(0.235)	(0.172)
Nationals share of capital (log)	-0.011	0.092***	-0.053*	-0.049	-0.053*	0.113***
	(0.042)	(0.031)	(0.030)	(0.050)	(0.030)	(0.035)
Foreign share of capital (log)	0.125***	-0.014	-0.053**	0.086*	-0.053**	0.007
	(0.039)	(0.028)	(0.027)	(0.046)	(0.027)	(0.032)
Government share of capital (log)	-0.035	-0.030	-0.059	-0.073	-0.059	-0.009
	(0.067)	(0.060)	(0.046)	(0.081)	(0.046)	(0.067)
Medium size	0.464***	-0.185***	0.101*	0.521***	0.101*	-0.216***
	(0.063)	(0.049)	(0.052)	(0.075)	(0.052)	(0.053)
Large size	1.434***	-0.798***	0.065	1.469***	0.065	-0.817***
	(0.091)	(0.075)	(0.060)	(0.103)	(0.060)	(0.079)
Location (= large city)	-0.122*	0.024	0.090	-0.048	0.090	-0.016
	(0.067)	(0.052)	(0.058)	(0.084)	(0.058)	(0.058)
Households consumption (log)	2.006	-1.023	-2.027*	0.617	-2.027*	-0.264
	(1.454)	(1.132)	(1.129)	(1.729)	(1.129)	(1.183)
Government consumption (log)	-3.316***	-0.391	-1.584	-3.727***	-1.584	-0.167
	(0.892)	(0.690)	(0.983)	(1.022)	(0.983)	(0.704)
Sales 3 years ago (log)	0.036***	-0.002	-0.022***	0.023*	-0.022***	0.005
	(0.010)	(0.008)	(0.007)	(0.012)	(0.007)	(0.009)
Investment	0.049**	-0.047***	-0.056***	0.023	-0.056***	-0.033*
	(0.020)	(0.016)	(0.017)	(0.025)	(0.017)	(0.017)
Trade openness (log)	-1.070**	0.174	0.263	-1.553**	0.263	0.438
	(0.542)	(0.281)	(0.434)	(0.620)	(0.434)	(0.319)
GDP per capita growth (log)	1.238**	0.286	-0.597	0.807	-0.597	0.522
	(0.558)	(0.368)	(0.558)	(0.638)	(0.558)	(0.393)
GDP growth (log)	-1.180**	-0.261	0.611	-0.750	0.611	-0.496
	(0.541)	(0.355)	(0.544)	(0.621)	(0.544)	(0.380)
Rule of Law	0.569	-0.313	1.420**	-0.071	1.420**	0.037
	(0.500)	(0.356)	(0.605)	(0.609)	(0.605)	(0.390)
Instruments						
Shock Temperature			0.579***		0.579***	
			(0.112)		(0.112)	
Shock Precipitation			-0.243**		-0.243**	
			(0.116)		(0.116)	
Observation	2443.000	2443.000	2443.000	2443.000	2443.000	2443.000
F-stats	35.493	14.811		27.932		13.508
Kleibergen-Paap rk Wald F statistic				16.380		16.380
Kleibergen-Paap rk LM statistic				28.997		28.997
Chi-sq(2) P-value				0.000		0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 13: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins): excluding natural resources-rich countries

	Dependant variable : Exporters dummy and domestic sellers			
	Probit models		Probit IV models	
	Exporters	Domestic sellers	Exporters	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Length of power outages (log)	-0.018	0.017	-0.734***	0.762***
	(0.031)	(0.030)	(0.092)	(0.084)
l.Undervaluation (log)	1.066***	-1.210***	0.744**	-0.770**
	(0.304)	(0.299)	(0.317)	(0.317)
Nationals share of capital (log)	0.025	-0.029	-0.024	0.024
	(0.043)	(0.043)	(0.039)	(0.038)
Foreign share of capital (log)	0.127***	-0.123***	0.044	-0.035
	(0.039)	(0.039)	(0.038)	(0.037)
Government share of capital (log)	-0.037	-0.019	-0.065	0.029
	(0.060)	(0.063)	(0.057)	(0.059)
Medium size	0.632***	-0.574***	0.486***	-0.428***
	(0.087)	(0.085)	(0.089)	(0.084)
Large size	1.451***	-1.445***	1.012***	-0.958***
	(0.097)	(0.095)	(0.166)	(0.164)
Location (= large city)	-0.099	0.176**	0.007	0.035
	(0.090)	(0.087)	(0.079)	(0.077)
Households consumption (log)	1.771	-2.402*	-0.192	-0.073
	(1.435)	(1.394)	(1.340)	(1.319)
Government consumption (log)	-4.418***	3.523***	-3.364***	2.640***
	(1.112)	(1.058)	(1.055)	(0.978)
Investment	0.045**	-0.068***	0.003	-0.015
	(0.021)	(0.021)	(0.020)	(0.021)
Sales 3 years ago (log)	0.044***	-0.040***	0.016	-0.011
	(0.011)	(0.010)	(0.011)	(0.010)
Trade openness (log)	-0.731	0.540	-1.101**	0.964*
	(0.717)	(0.657)	(0.557)	(0.512)
Gdp_Growth	1.649**	-1.208*	0.667	-0.299
	(0.757)	(0.692)	(0.678)	(0.608)
GDP growth (log)	-1.570**	1.165*	-0.613	0.272
	(0.737)	(0.673)	(0.659)	(0.591)
Rule of Law	1.068*	-1.114*	0.073	-0.033
	(0.634)	(0.598)	(0.532)	(0.506)
Instruments				
Shock Temperature			0.587***	0.604***
			(0.105)	(0.104)
Shock Precipitation			-0.216**	-0.162*
			(0.095)	(0.095)
Observation	2450.000	2450.000	2450.000	2450.000
Model Wald chi-squared	598.346	648.843	1383.396	1578.137
Wald chi-squared test of exogeneity			21.104	23.842
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 14: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins): excluding the top exporters countries

	Dependent variable : Share of sales directly exported and domestically sold by firms (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Sales exported	Domestic sales	Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Hour of power outages (log)	0.016	-0.026*		-0.745***		-0.060
	(0.019)	(0.015)		(0.248)		(0.175)
l.Undervaluation (log)	0.023	0.081	0.403***	0.447***	0.404***	0.100
	(0.082)	(0.062)	(0.063)	(0.161)	(0.063)	(0.112)
Nationals share of capital (log)	-0.015	0.092***	-0.024	-0.034	-0.024	0.091***
	(0.028)	(0.021)	(0.018)	(0.032)	(0.018)	(0.021)
Foreign share of capital (log)	0.151***	-0.034*	-0.034**	0.126***	-0.034**	-0.035*
	(0.026)	(0.018)	(0.016)	(0.031)	(0.017)	(0.019)
Government share of capital (log)	0.041	0.017	-0.002	0.042	-0.001	0.017
	(0.050)	(0.034)	(0.034)	(0.056)	(0.034)	(0.034)
Medium size	0.334***	-0.144***	0.018	0.342***	0.014	-0.144***
	(0.038)	(0.028)	(0.029)	(0.044)	(0.029)	(0.028)
Large size	1.251***	-0.691***	0.054	1.288***	0.051	-0.690***
	(0.064)	(0.051)	(0.041)	(0.073)	(0.041)	(0.051)
Location (= large city)	-0.172***	0.060	0.018	-0.153**	0.019	0.061
	(0.053)	(0.040)	(0.038)	(0.062)	(0.038)	(0.040)
Households consumption (log)	1.094***	-0.815***	-1.630***	0.228	-1.639***	-0.854***
	(0.211)	(0.159)	(0.191)	(0.378)	(0.191)	(0.269)
Government consumption (log)	-0.061	-0.021	-0.973***	-1.041***	-0.980***	-0.065
	(0.212)	(0.154)	(0.166)	(0.398)	(0.166)	(0.262)
Investment	-0.003	-0.001	-0.013**	-0.014	-0.013**	-0.002
	(0.007)	(0.005)	(0.006)	(0.009)	(0.006)	(0.006)
Sales 3 years ago (log)	0.032***	-0.006	-0.022***	0.016*	-0.021***	-0.007
	(0.006)	(0.005)	(0.005)	(0.009)	(0.005)	(0.006)
Trade openness (log)	0.153	-0.191	-0.857***	-0.743*	-0.858***	-0.231
	(0.294)	(0.205)	(0.245)	(0.441)	(0.245)	(0.297)
GDP per capita growth (log)	-0.065	0.140	-0.119	-0.129	-0.112	0.137
	(0.218)	(0.132)	(0.163)	(0.252)	(0.163)	(0.133)
GDP growth (log)	0.071	-0.138	0.102	0.137	0.094	-0.135
	(0.215)	(0.130)	(0.159)	(0.248)	(0.159)	(0.131)
Rule of Law	-0.491	-0.292	-0.527*	-1.148***	-0.531*	-0.322
	(0.307)	(0.243)	(0.272)	(0.414)	(0.272)	(0.302)
Instruments						
Shock Temperature			0.141***		0.141***	
			(0.051)		(0.051)	
Shock Precipitation			-0.261***		-0.258***	
			(0.047)		(0.047)	
Observation	5809.000	5805.000	5809.000	5809.000	5805.000	5805.000
F-stats	56.644	26.061		44.110		26.029
Kleibergen-Paap rk Wald F statistic				19.900		19.615
Kleibergen-Paap rk LM statistic				38.252		37.747
Chi-sq(2) P-value				0.000		0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 15: The effects of power outages (length of outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins): excluding the top exporters countries

	Dependent variable : Exporters dummy and domestic sellers			
	Probit models		Probit IV models	
	Exporters	Domestic sellers	Exporters	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Hour of power outages (log)	0.023	-0.031	-0.785***	0.811***
	(0.023)	(0.022)	(0.094)	(0.095)
l.Undervaluation (log)	0.010	-0.059	0.446***	-0.491***
	(0.094)	(0.094)	(0.089)	(0.085)
Nationals share of capital (log)	0.020	-0.013	-0.005	0.012
	(0.028)	(0.027)	(0.025)	(0.024)
Foreign share of capital (log)	0.147***	-0.142***	0.075***	-0.066**
	(0.025)	(0.025)	(0.027)	(0.027)
Government share of capital (log)	0.088**	-0.099**	0.051	-0.055
	(0.044)	(0.044)	(0.042)	(0.042)
Medium size	0.534***	-0.499***	0.381***	-0.342***
	(0.054)	(0.052)	(0.064)	(0.064)
Large size	1.266***	-1.277***	0.916***	-0.884***
	(0.064)	(0.064)	(0.123)	(0.133)
Location (= large city)	-0.125**	0.139**	-0.061	0.065
	(0.057)	(0.057)	(0.053)	(0.053)
Households consumption (log)	2.483***	-2.934***	0.423	-0.591
	(0.324)	(0.321)	(0.460)	(0.509)
Government consumption (log)	0.232	-0.355	-1.068***	1.032***
	(0.290)	(0.288)	(0.290)	(0.295)
Investment	-0.003	-0.008	-0.030***	0.023**
	(0.012)	(0.012)	(0.010)	(0.010)
Sales 3 years ago (log)	0.041***	-0.037***	0.007	-0.003
	(0.008)	(0.007)	(0.009)	(0.008)
Trade openness (log)	0.261	-0.313	-0.720**	0.732**
	(0.343)	(0.338)	(0.310)	(0.310)
GDP per capita growth (log)	-0.261	0.338	-0.203	0.250
	(0.267)	(0.271)	(0.222)	(0.221)
GDP growth (log)	0.261	-0.324	0.220	-0.258
	(0.260)	(0.264)	(0.217)	(0.216)
Rule of Law	-0.706**	0.684**	-1.081***	1.077***
	(0.296)	(0.294)	(0.270)	(0.267)
Instruments				
Shock Temperature			0.338***	0.352***
			(0.045)	(0.045)
Shock Precipitation			-0.200***	-0.170***
			(0.052)	(0.056)
Observation	5599.000	5599.000	5599.000	5599.000
Model Wald chi-squared	1316.475	1423.600	2884.385	3208.076
Wald chi-squared test of exogeneity			26.670	24.960
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 16: The effects of electricity access and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins)

	Dependent variable : Share of sales directly exported and domestically sold by firms (log)							
	Ordinary least square with country and industry fixed effects							
	Sales exported		Domestic sales		Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
l.Electricity access (log)	0.582***	0.609***	-0.414***	-0.442***	0.567***	1.242***	-0.254**	-0.990***
	(0.137)	(0.137)	(0.106)	(0.106)	(0.151)	(0.370)	(0.117)	(0.282)
l.Undervaluation (log)	0.058	0.647**	-0.040	-0.665***				
	(0.056)	(0.287)	(0.042)	(0.232)				
Nationals share of capital (log)	-0.005	-0.005	0.080***	0.080***	-0.005	-0.005	0.082***	0.082***
	(0.018)	(0.018)	(0.014)	(0.014)	(0.018)	(0.018)	(0.014)	(0.014)
Foreign share of capital (log)	0.181***	0.180***	-0.071***	-0.070***	0.181***	0.180***	-0.070***	-0.069***
	(0.017)	(0.017)	(0.012)	(0.012)	(0.017)	(0.017)	(0.012)	(0.012)
Government share of capital (log)	0.075**	0.074**	0.020	0.021	0.075**	0.074**	0.022	0.022
	(0.034)	(0.034)	(0.020)	(0.020)	(0.034)	(0.034)	(0.020)	(0.020)
Medium size	0.411***	0.411***	-0.183***	-0.183***	0.411***	0.409***	-0.181***	-0.178***
	(0.027)	(0.027)	(0.020)	(0.020)	(0.027)	(0.027)	(0.020)	(0.020)
Large size	1.190***	1.189***	-0.615***	-0.614***	1.189***	1.185***	-0.610***	-0.606***
	(0.042)	(0.042)	(0.033)	(0.033)	(0.042)	(0.042)	(0.033)	(0.033)
Location (= large city)	-0.099***	-0.101***	0.021	0.024	-0.098***	-0.106***	0.022	0.031
	(0.032)	(0.032)	(0.023)	(0.023)	(0.032)	(0.032)	(0.023)	(0.023)
Households consumption (log)	1.071***	1.064***	-0.731***	-0.724***	1.004***	0.796***	-0.227	0.001
	(0.149)	(0.149)	(0.116)	(0.117)	(0.225)	(0.246)	(0.170)	(0.184)
Government consumption (log)	-0.495***	-0.465***	0.269**	0.238**	-0.474***	-0.693***	0.328***	0.567***
	(0.160)	(0.160)	(0.120)	(0.120)	(0.162)	(0.186)	(0.121)	(0.128)
Investment	0.010**	0.009*	-0.014***	-0.013***	0.008	0.006	-0.007*	-0.005
	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
Sales 3 years ago (log)	0.023***	0.023***	-0.003	-0.003	0.023***	0.023***	-0.003	-0.004
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
Trade openness (log)	-0.318	-0.273	0.132	0.084	-0.223	-0.089	0.053	-0.093
	(0.218)	(0.219)	(0.152)	(0.151)	(0.194)	(0.207)	(0.138)	(0.144)
GDP per capita growth (log)	-0.748***	-0.814***	0.389***	0.459***	-0.780***	-0.672***	0.351**	0.233
	(0.200)	(0.203)	(0.148)	(0.151)	(0.198)	(0.202)	(0.149)	(0.151)
GDP growth (log)	0.766***	0.830***	-0.395***	-0.463***	0.797***	0.691***	-0.358**	-0.243
	(0.198)	(0.201)	(0.146)	(0.149)	(0.196)	(0.200)	(0.147)	(0.149)
Rule of Law	-0.576***	-0.539***	0.053	0.014	-0.509***	-0.476***	0.071	0.034
	(0.187)	(0.188)	(0.143)	(0.145)	(0.160)	(0.161)	(0.124)	(0.125)
l.Electricity access*l.Undervaluation		-0.172**		0.183***				
		(0.080)		(0.064)				
l.Depreciation (log)					-0.027	1.965*	0.529***	-1.646**
					(0.185)	(1.029)	(0.143)	(0.820)
l.Electricity access*l.Depreciation						-0.583**		0.636***
						(0.289)		(0.228)
Observation	12454.000	12454.000	12452.000	12452.000	12454.000	12454.000	12452.000	12452.000
F-stats	122.420	116.068	57.057	55.232	122.466	115.457	57.579	55.218
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 17: The effects of electricity access and real exchange rate (undervaluation and depreciation) on the allocation of manufacturing firms between the export and domestic market (extensive margins)

	Dependent variable : Exporters and domestic sellers							
	Probit with country and industry fixed effects							
	Exporters		Domestic sellers		Exporters		Domestic sellers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
l.Electricity access (log)	0.551***	0.572***	-0.698***	-0.720***	0.470***	1.269***	-0.587***	-1.415***
	(0.135)	(0.136)	(0.136)	(0.138)	(0.147)	(0.343)	(0.148)	(0.342)
l.Undervaluation (log)	0.007	0.652**	-0.055	-0.698***				
	(0.058)	(0.256)	(0.058)	(0.256)				
Nationals share of capital (log)	0.022	0.022	-0.017	-0.017	0.020	0.020	-0.015	-0.015
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Foreign share of capital (log)	0.156***	0.155***	-0.154***	-0.153***	0.155***	0.155***	-0.153***	-0.152***
	(0.016)	(0.016)	(0.015)	(0.015)	(0.016)	(0.016)	(0.015)	(0.015)
Government share of capital (log)	0.085***	0.085***	-0.085***	-0.085***	0.084***	0.083***	-0.084***	-0.083***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Medium size	0.545***	0.544***	-0.528***	-0.526***	0.544***	0.541***	-0.525***	-0.522***
	(0.035)	(0.035)	(0.034)	(0.034)	(0.035)	(0.035)	(0.034)	(0.034)
Large size	1.148***	1.146***	-1.149***	-1.147***	1.145***	1.140***	-1.145***	-1.139***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Location (= large city)	-0.034	-0.035	0.042	0.043	-0.034	-0.046	0.041	0.053
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Households consumption (log)	2.247***	2.347***	-2.423***	-2.515***	1.988***	1.749***	-2.052***	-1.807***
	(0.215)	(0.222)	(0.210)	(0.216)	(0.270)	(0.283)	(0.268)	(0.280)
Government consumption (log)	-0.385*	-0.309	0.407**	0.333	-0.416**	-0.698***	0.432**	0.722***
	(0.205)	(0.209)	(0.206)	(0.209)	(0.205)	(0.242)	(0.205)	(0.242)
Investment	-0.002	-0.003	-0.004	-0.003	-0.005	-0.008	0.002	0.004
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Sales 3 years ago (log)	0.023***	0.024***	-0.021***	-0.022***	0.024***	0.025***	-0.022***	-0.023***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Trade openness (log)	0.028	0.090	-0.113	-0.175	0.036	0.190	-0.195	-0.356
	(0.268)	(0.270)	(0.269)	(0.271)	(0.244)	(0.258)	(0.245)	(0.260)
GDP per capita growth (log)	-1.176***	-1.272***	1.338***	1.433***	-1.152***	-1.021***	1.332***	1.197***
	(0.227)	(0.234)	(0.229)	(0.236)	(0.223)	(0.227)	(0.225)	(0.228)
GDP growth (log)	1.190***	1.282***	-1.344***	-1.437***	1.168***	1.040***	-1.341***	-1.208***
	(0.225)	(0.231)	(0.226)	(0.233)	(0.221)	(0.224)	(0.222)	(0.225)
Rule of Law	-0.576***	-0.551***	0.591***	0.566***	-0.632***	-0.605***	0.626***	0.598***
	(0.177)	(0.178)	(0.177)	(0.177)	(0.170)	(0.171)	(0.168)	(0.169)
l.Electricity access*l.Undervaluation		-0.198***		0.197***				
		(0.075)		(0.075)				
l.Depreciation (log)					-0.311	2.014**	0.421**	-1.989**
					(0.191)	(0.891)	(0.190)	(0.884)
l.Electricity access*l.Depreciation						-0.694***		0.718***
						(0.257)		(0.255)
Observation	12585.000	12585.000	12585.000	12585.000	12585.000	12585.000	12585.000	12585.000
Model Wald chi-squared	2736.237	2699.900	2867.293	2832.430	2725.288	2701.525	2852.622	2826.562
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 18: The effects of power outages (number of power outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (intensive margins)

	Dependant variable : Share of sales directly exported and domestically sold by firms (log)					
	Linear fixed-effects model		Instrumental variables for panel-data models			
	Sales exported	Domestic sales	Sales exported		Domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1	Model 2	First Stage	Model 3	First Stage	Model 4
Number of power outages (log)	-0.019***	0.004		-0.368***		0.084**
	(0.007)	(0.005)		(0.060)		(0.041)
l.Undervaluation (log)	0.062	-0.032	0.859***	0.519***	0.856***	-0.137**
	(0.056)	(0.042)	(0.084)	(0.096)	(0.084)	(0.066)
Nationals share of capital (log)	-0.004	0.080***	-0.009	-0.007	-0.011	0.081***
	(0.018)	(0.014)	(0.023)	(0.020)	(0.023)	(0.014)
Foreign share of capital (log)	0.181***	-0.071***	0.019	0.188***	0.016	-0.072***
	(0.017)	(0.012)	(0.021)	(0.019)	(0.021)	(0.012)
Government share of capital (log)	0.077**	0.018	-0.038	0.066*	-0.039	0.021
	(0.034)	(0.020)	(0.034)	(0.035)	(0.034)	(0.020)
Medium size	0.415***	-0.186***	0.047	0.424***	0.048	-0.189***
	(0.027)	(0.020)	(0.039)	(0.030)	(0.039)	(0.020)
Large size	1.198***	-0.620***	0.005	1.191***	0.007	-0.619***
	(0.042)	(0.033)	(0.049)	(0.046)	(0.049)	(0.033)
Location (= large city)	-0.109***	0.031	0.154***	-0.049	0.155***	0.017
	(0.032)	(0.023)	(0.044)	(0.036)	(0.044)	(0.024)
Households consumption (log)	1.138***	-0.797***	-3.402***	0.427**	-3.403***	-0.633***
	(0.149)	(0.117)	(0.275)	(0.211)	(0.275)	(0.146)
Government consumption (log)	-0.358**	0.162	0.231	-0.562***	0.240	0.208*
	(0.152)	(0.114)	(0.243)	(0.173)	(0.243)	(0.117)
Investment	0.010**	-0.013***	0.127***	0.053***	0.127***	-0.023***
	(0.005)	(0.004)	(0.008)	(0.009)	(0.008)	(0.006)
Sales 3 years ago (log)	0.021***	-0.001	0.032***	0.034***	0.032***	-0.004
	(0.004)	(0.003)	(0.006)	(0.005)	(0.006)	(0.004)
Trade openness (log)	-0.333*	0.160	0.203	-0.431*	0.211	0.182
	(0.199)	(0.138)	(0.336)	(0.225)	(0.336)	(0.140)
GDP per capita growth (log)	-0.255	0.033	-0.913***	-0.474***	-0.918***	0.084
	(0.162)	(0.119)	(0.217)	(0.173)	(0.217)	(0.119)
GDP growth (log)	0.271*	-0.037	0.925***	0.514***	0.929***	-0.093
	(0.159)	(0.117)	(0.212)	(0.171)	(0.212)	(0.117)
Rule of Law	-0.487***	-0.022	-1.366***	-1.268***	-1.356***	0.158
	(0.178)	(0.135)	(0.268)	(0.239)	(0.268)	(0.173)
Instruments						
Shock Temperature			0.403***		0.407***	
			(0.076)		(0.076)	
Shock Precipitation			-0.693***		-0.689***	
			(0.070)		(0.070)	
Observation	12493.000	12491.000	12493.000	12493.000	12491.000	12491.000
F-stats	121.664	55.570		103.289		54.626
Kleibergen-Paap rk Wald F statistic				72.428		72.268
Kleibergen-Paap rk LM statistic				140.754		140.395
Chi-sq(2) P-value				0.000		0.000
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 19: The effects of power outages (number of power outages) and real exchange rate undervaluation on the allocation of manufacturing firms between the export and domestic market (extensive margins)

	Dependant variable : Exporters dummy and domestic sellers			
	Probit models		Probit IV models	
	Exporters dummy	Domestic sellers	Exporters dummy	Domestic sellers
	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Number of power outages (log)	-0.028***	0.023***	-0.323***	0.307***
	(0.008)	(0.008)	(0.047)	(0.056)
l.Undervaluation (log)	0.043	-0.088	0.434***	-0.457***
	(0.057)	(0.057)	(0.079)	(0.086)
Nationals share of capital (log)	0.022	-0.017	0.015	-0.012
	(0.017)	(0.017)	(0.016)	(0.016)
Foreign share of capital (log)	0.156***	-0.153***	0.136***	-0.136***
	(0.016)	(0.015)	(0.016)	(0.017)
Government share of capital (log)	0.086***	-0.087***	0.058**	-0.060**
	(0.026)	(0.026)	(0.025)	(0.026)
Medium size	0.550***	-0.532***	0.470***	-0.462***
	(0.035)	(0.034)	(0.043)	(0.045)
Large size	1.155***	-1.156***	0.966***	-0.983***
	(0.041)	(0.041)	(0.077)	(0.083)
Location (= large city)	-0.050	0.063*	0.007	0.007
	(0.035)	(0.035)	(0.034)	(0.035)
Households consumption (log)	2.335***	-2.559***	1.361***	-1.620***
	(0.213)	(0.209)	(0.295)	(0.328)
Government consumption (log)	-0.218	0.191	-0.307*	0.273
	(0.192)	(0.191)	(0.175)	(0.177)
Investment	0.002	-0.008	0.041***	-0.045***
	(0.007)	(0.007)	(0.009)	(0.010)
Sales 3 years ago (log)	0.022***	-0.019***	0.030***	-0.027***
	(0.005)	(0.005)	(0.004)	(0.004)
Trade openness (log)	-0.117	0.058	-0.145	0.093
	(0.234)	(0.231)	(0.219)	(0.215)
GDP per capita growth (log)	-0.706***	0.738***	-0.791***	0.822***
	(0.177)	(0.176)	(0.155)	(0.154)
GDP growth (log)	0.717***	-0.740***	0.815***	-0.837***
	(0.173)	(0.172)	(0.151)	(0.151)
Rule of Law	-0.612***	0.604***	-1.126***	1.108***
	(0.170)	(0.169)	(0.169)	(0.175)
Instruments				
Shock Temperature			0.540***	0.557***
			(0.068)	(0.072)
Shock Precipitation			-0.581***	-0.564***
			(0.082)	(0.091)
Observation	12624.000	12624.000	12624.000	12624.000
Model Wald chi-squared	2728.474	2862.621	4136.188	4106.534
Wald chi-squared test of exogeneity			24.146	16.770
Country fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes

Notes: robust standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A Appendix

Table A.1: Number of firms and share of each non-manufacturing industry in the total sample

Industries	ISIC Code	Number of firms	Percent
Other Industries	4	243	2.45
Mining and quarrying	10	2	0.02
Collection, purification and distribution of water	40	3	0.03
Construction	45	1,221	12.29
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	50	6,255	62.95
Hotels and restaurants	55	1,179	11.87
Transport, storage and communications	60	766	7.71
Real estate, renting and business activities	70	265	2.67
Health	85	1	0.01
Other community, social and personal service activities	90	1	0.01
Total		9,936	100.00

Table A.2: Number of firms and share of each manufacturing industry in the total sample

Industries	ISIC Code	Number of firms	Percent
Manufacture of food products and beverages	15	2,957	24.52
Manufacture of tobacco products	16	40	0.33
Manufacture of textiles	17	625	5.18
Manufacture of wearing apparel; dressing and dyeing of fur	18	1,656	13.73
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	19	195	1.62
Manufacture of wood and of products of wood and cork, except furniture	20	524	4.34
Manufacture of paper and paper products	21	151	1.25
Publishing, printing and reproduction of recorded media	22	538	4.46
Manufacture of coke, refined petroleum products and nuclear fuel	23	31	0.26
Manufacture of chemicals and chemical products	24	630	5.22
Manufacture of rubber and plastics products	25	513	4.25
Manufacture of basic metals	26	1,015	8.41
Manufacture of other non-metallic mineral products	27	231	1.92
Manufacture of fabricated metal products, except machinery and equipment	28	1,074	8.90
Manufacture of machinery and equipment n.e.c.	29	539	4.47
Manufacture of office, accounting and computing machinery	30	8	0.07
Manufacture of electrical machinery and apparatus n.e.c.	31	239	1.98
Manufacture of radio, television and communication equipment and apparatus	32	40	0.33
Manufacture of medical, precision and optical instruments, watches and clocks	33	66	0.55
Manufacture of motor vehicles, trailers and semi-trailers	34	97	0.80
Manufacture of other transport equipment	35	45	0.37
Manufacture of furniture; manufacturing n.e.c	36	817	6.77
Recycling	37	31	0.26
Total		12,062	100.00

Table A.3: Descriptive statistics of the main variables

Variables	Observation	Mean.	Std. Dev.	Min	Max
Enterprises variables					
The share of firms' sales directly exported	12,058	12.07	27.26	0	100
The share of firms' sales domestically sold	12,058	83.02	31.46	0	100
Exporters dummy	12,062	.26	.44	0	1
Domestic sellers dummy	12,062	.73	.44	0	1
Annual number of outages	11,734	83.81	322.82	0	24000
Annual hour of outages	6,322	82.01	190.56	0	5760.2
Sales loss due to power outages (%)	5,556	7.34	13.70	-9	100
Share owned by Nationals	12,062	88.28	29.63	0	100
Share owned by Foreigners	12,061	8.24	25.52	0	100
Share owned by Government/State	12,061	1.03	8.00	0	100
Medium(20-99)	12,062	.35	.48	0	1
Large(100-more)	12,062	.23	.42	0	1
Firm locality	12,062	.38	.48	0	1
Sales 3 years ago	12,062	2.11e+07	1.35e+09	0	1.47e+11
Macroeconomic variables					
Real exchange rate undervaluation measure	12,062	-.09	.41	-1.77	1.19
Real exchange rate depreciation	12,062	.95	.23	.44	1.70
Access to electricity (% population)	12,023	39.23	20.29	4.7	99.09
Households consumption in GDP (%)	12,062	.71	.13	.26	.95
Government consumption in GDP (%)	12,062	.14	.06	.03	.34
GDP per capita growth	12,062	3.44	2.83	-4.17	15.00
GDP growth	12,062	6.17	3.037797	-1.62	18.33
Investment	11,096	22.22	6.691793	9.11	42.79
De facto Kof trade globalization indicator (% GDP)	12,062	44.65	14.70	16.58	85.37
Rule of law	12,062	-.65	.52	-1.63	.94

Table A.4: Number of manufacturing firms and share of each country in the total sample

Countries	Number of firms	Percent
Angola	681	2.76
Benin	269	1.09
Botswana	573	2.32
Burkina Faso	362	1.46
Burundi	366	1.48
Cameroon	698	2.82
Chad	284	1.15
Ethiopia	1,265	5.12
Gabon	138	0.56
Ghana	1,106	4.47
Guinea	364	1.47
Guinea-Bissau	156	0.63
Kenya	2,22	8.98
Lesotho	242	0.98
Liberia	257	1.04
Madagascar	779	3.15
Malawi	470	1.90
Mali	824	3.33
Mauritania	317	1.28
Mauritius	283	1.14
Mozambique	838	3.39
Namibia	863	3.49
Niger	272	1.10
Nigeria	4,198	16.98
Rwanda	734	2.97
Senegal	929	3.76
Sierra Leone	279	1.13
South Africa	729	2.95
Sudan	273	1.10
Togo	230	0.93
Uganda	1,199	4.85
Zambia	1,566	6.34
Zimbabwe	953	3.86

Table A.5: Summary of the Dependent variables (percentage of total sales) by country

Country	Direct Exports	Indirect Exports	Domestic Sales	Exporters Dummy	Domestic Sellers Dummy
Angola2006	.023	.23	99.74	.00	1.00
Angola2010	0	.71	99.29	0	1
Burundi2013	21.88	5.73	72.38	.40	.58
Burundi2019	20.32	7.96	71.72	.39	.60
Botswana2009	26.89	6.32	66.79	.54	.44
Botswana2017	8.07	1.30	90.63	.18	.82
BurkinaFaso2007	24.55	4.55	70.91	.32	.64
BurkinaFaso2009	20.36	3.75	75.89	.39	.61
BurkinaFaso2013	10.35	9.35	80.30	.22	.74
Benin2013	30	0	70	.67	.33
Benin2018	21.19	6.42	72.38	.51	.49
Cameroon2006	.49	1.03	98.48	.02	.97
Cameroon2009	2.48	10.62	86.90	.1	.90
Cameroon2013	.	.	.	.	.
Cameroon2014	6.75	10.27	82.98	.18	.78
Chad2016	11.73	11.05	77.23	.13	.76
Ethiopia2006	25.70	1.30	73	.36	.64
Ethiopia2009	34.79	6.55	58.66	.58	.43
Ethiopia2011	10.50	2.30	87.20	.23	.77
Ethiopia2013	36.38	14.71	48.92	.63	.33
Ethiopia2016	8.13	6.58	85.30	.35	.65
Ethiopia2019	53.08	9.13	37.80	.84	.16
Gabon2011	1.72	4.74	93.53	.02	.97
Ghana2008	17.22	.88	81.89	.26	.74
Ghana2013	5.79	1.60	92.60	.13	.87
Ghana2018	2.73	2.58	94.70	.09	.91
Ghana2019	19.46	2.84	77.71	.30	.70
Guinea2006	10.24	4.489	85.28	.33	.66
Guinea-Bissau2006	9.90	3.59	86.51	.26	.74
Guinea-Bissau2010	10.19	4.60	85.21	.32	.67
Kenya2007	11.59	2.10	86.31	.37	.63
Kenya2013	12.18	11.96	75.86	.35	.57
Kenya2010	1.99	1.26	96.75	.08	.92
Lesotho2013	10	0	90	.67	.33
Lesotho2019	42	9.52	48.48	.66	.33
Liberia2013	21.14	3.82	75.05	.47	.53
Madagascar2009	30.51	5.46	64.03	.55	.44
Madagascar2013	29.21	6.62	64.17	.59	.41
Madagascar2016	14.17	2.22	83.61	.25	.75
Madagascar2017	3.41	1.88	94.71	.10	.88
Malawi2009	28.47	8.60	62.93	.33	.60
Malawi2013	9.33	8.92	81.75	.25	.67
Malawi2019	38.68	9.2	52.12	.63 .37	
Mali2009	3.85	2	94.15	.15	.85
Mali2014	4.09	1.86	94.05	.17	.83
Mali2015	17.89	9.40	72.72	.48	.5
Mauritania2007	2.19	2.84	94.96	.07	.93
Mauritania2015	16.07	6.28	77.66	.45	.55
Mauritius2007	4.05	2.28	93.67	.09	.91
Mauritius2010	0	0	100	0 1	
Mozambique2013	22.52	6.24	71.25	.33	.66
Mozambique2019	19.67	10.18	70.15	.35	.64
Namibia2014	16.31	2.71	80.98	.17	.81
Namibia2018	5.89	4.08	90.03	.15	.84
Nigeria2006	4.96	2.72	92.32	.12	.88
Nigeria2007	.63	.29	99.08	.02	.98
Nigeria2009	3.62	2.40	93.98	.20	.80
Nigeria2010	8.19	4.01	87.80	.17	.82
Nigeria2013	2.65	.10	97.24	.08	.92
Nigeria2014	6.91	9.09	84.27	.21	.77
Nigeria2016	8.86	6.09	85.05	.17	.79
Nigeria2017	.48	2.26	97.26	.06	.94
Rwanda2012	2.34	.92	96.75	.11	.89
Senegal2012	1.33	3.48	95.18	.12	.88
Senegal2019	2.16	5.33	92.51	.10	.90
Sierra Leone2007	4.49	.43	95.09	.15	.85
Sierra Leone2009	6.95	4.76	88.29	.29	.71
Sierra Leone2019	8.39	7.06	84.56	.33	.61
South Africa2009	30.93	3.79	65.28	.55	.45
South Africa2013	21.66	7.04	71.30	.53	.47
South Africa2017	1.04	1.39	97.57	.05	.95
South Africa2019	13.06	9.37	77.57	.31	.69
Togo2008	5.10	1.98	92.92	.1	.90
Togo2013	13.14	0	86.86	.14	.86
Uganda2008	18.56	8.88	72.56	.46	.53
Uganda2013	17.74	13.92	68.35	.43	.51
Zambia2009	22.25	8.46	69.33	.36	.60
Zambia2010	1.57	.12	98.31	.13	.87
Zambia2015	16.32	8.70	74.98	.25	.72
Zimbabwe2013	16.49	1.65	81.86	.34	.66
Zimbabwe2015	16.26	7.72	76.03	.27	.71
Zimbabwe2019	21.74	.56	77.69	.38	.62

Table A.6: Summary of Power Outages and Exchange Rate Variables by Country

Country	Length of Outages	Number of Outages	Undervaluation
Angola2006	328.53	82.70	-.06
Angola2010	141.00	75.43	-.16
Burundi2013	26.90	18.31	-.26
Burundi2019	16.73	7.32	-.83
Botswana2009	42.32	34.76	.11
Botswana2017	24.40	13.40	.07
BurkinaFaso2007	20.73	12.55	.22
BurkinaFaso2009	16.73	18.14	.15
BurkinaFaso2013	34	7.83	-.24
Benin2013	.	0	-.05
Benin2018	40.39	3.42	.13
Cameroon2006	130.57	112.24	-.42
Cameroon2009	37.89	84	-.11
Cameroon2013	.	.	.
Cameroon2014	60.81	233.36	.20
Chad2016	17.14	36.22	-.12
Ethiopia2006	23.34	26.78	.83
Ethiopia2009	31.68	6.45	.31
Ethiopia2011	100.80	82.64	-.32
Ethiopia2013	18.24	6.17	.53
Ethiopia2016	55.16	39.60	-.12
Ethiopia2019	15.24	4.78	-.58
Gabon2011	60.91	76.34	-.18
Ghana2008	145.64	9.12	-.36
Ghana2013	39.82	12.11	-.13
Ghana2018	81.52	197.45	-.13
Ghana2019	48.00	30.73	-.12
Guinea2006	38.53	23.29	-.44
Guinea-Bissau2006	21.6	21.54	.35
Guinea-Bissau2010	34.71	26.95	-.14
Kenya2007	58.56	65.18	.18
Kenya2013	70.32	90.35	.31
Kenya2010	65.06	6.52	-.12
Lesotho2013	48	600	-.60
Lesotho2019	19.04	4.58	-.13
Liberia2013	66.30	742.79	-.36
Madagascar2009	34.29	6.73	-.29
Madagascar2013	25.85	10.48	.1
Madagascar2016	63.78	9.67	-.02
Madagascar2017	118.04	177.39	.15
Malawi2009	25.29	195.20	.91
Malawi2013	40	5	-.82
Malawi2019	58.17	6.60	.00
Mali2009	42	10.15	-.15
Mali2014	50.14	85.92	.02
Mali2015	168.37	3.81	.05
Mauritania2007	35.96	53.47	.25
Mauritania2015	166.43	6.79	-.08
Mauritius2007	53.04	59.43	-.10
Mauritius2010	204	68	.08
Mozambique2013	30.55	14.40	-.22
Mozambique2019	173.33	4.81	.48
Namibia2014	28.67	151.22	.02
Namibia2018	73.71	17.92	.40
Nigeria2006	49.64	78.43	-.76
Nigeria2007	110.31	322.04	.00
Nigeria2009	19.59	295.68	-.05
Nigeria2010	51.62	75.79	-.10
Nigeria2013	48	118.78	.13
Nigeria2014	168.87	453.22	-.02
Nigeria2016	54.47	36.57	-.12
Nigeria2017	66.78	186.58	-.09
Rwanda2012	76.29	4.26	-.15
Senegal2012	36	3.27	.11
Senegal2019	22.30	3.58	.05
Sierra Leone2007	73.35	140.70	-.17
Sierra Leone2009	70	58.29	-.32
Sierra Leone2019	10.34	24	.30
South Africa2009	19.43	6.09	-.09
South Africa2013	23.57	9.29	-.16
South Africa2017	160.87	94.29	.28
South Africa2019	13.86	6.86	.14
Togo2008	140.86	57.68	2.30
Togo2013	52	89.14	-.22
Uganda2008	39.05	32.96	.14
Uganda2013	35.22	20.97	.36
Zambia2009	105.34	16.49	-.04
Zambia2010	28.17	27.18	-.11
Zambia2015	93.82	4.84	-.01
Zimbabwe2013	69.88	113.74	.15
Zimbabwe2015	242.43	4.93	.00
Zimbabwe2019	108.59	283.69	-.18