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Services Inputs and Firm Productivity in Sub-Saharan Africa: Evidence from Firm-Level Data

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This paper investigates the relationship between the productivity of African manufacturing firms and their access to services inputs. We use data from the World Bank Enterprise Survey for over 1,000 firms in ten Sub-Saharan African countries to calculate the total factor productivity of firms. The Enterprise Surveys also contain unique measures of firms' access to communications, electricity and financial services. The availability of these measures at the firm level, both as subjective and objective indicators, allows us to exploit the variation in services performance at the sub-national regional level. Furthermore, by using the regional variation in services performance, we are also able to address concerns about the possible endogeneity of the services variables. Our results show a significant and positive relationship between firm productivity and service performance in all three services sectors analysed. The paper thus provides support for the argument that improvements in services industries contribute to enhancing the performance of downstream economic activities, and thus are an essential element of a strategy for promoting growth and reducing poverty.

JEL Codes: *L8*, *F2*, *D24*

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1. Introduction

Services inputs play an important role in many economic activities. It is difficult to think of any firm in either industry or services that does not rely on telecommunications services, financial services or energy. Yet, access to reliable services of adequate quality varies substantially across countries and often presents difficulties for firms in Sub-Saharan Africa.

The tradability of services inputs across national and even regional borders is quite limited, in spite of the increasing scope for electronic delivery. While physical inputs can be imported from other parts of the country or world, firms are more reliant on the state of locally produced services inputs in telecommunications, banking and electricity distribution, the three services which we focus on this paper. As a result, difficulties in procuring adequate services inputs locally may constrain firm performance.

There are several channels through which inadequate services inputs could affect the performance of firms. If telecommunication services are unreliable, firms may find it difficult to communicate and coordinate with clients and suppliers, and lose staff time in the process. Inadequacies in banking services may prevent a firm from exploiting productivity-enhancing investment opportunities and create unnecessary friction in the financial functioning of the firm. Inadequacies in power provision may disrupt the production process, cause productive assets to lie idle and thus decrease productivity.

Many African countries have been engaged in trade liberalisation in recent years. But successful participation by African producers in export markets may be constrained by the difficulty in accessing services inputs at home. In fact, unless African firms are able to access services inputs of competitive quality and prices, they may find it difficult to compete even in the domestic market. In many African countries, firm expenses on services inputs constitute a considerably larger fraction of total costs than those in other parts of the world and often dwarf labour costs (Eifert *et al.*, 2005). Hence, any improvement in the conditions at which these services inputs can be purchased is likely to have at least as much of an influence on total costs as a change in labour costs.

This paper investigates the extent to which the productivity of African manufacturing firms is related to difficulties in procuring

services inputs, using firm-level data from ten Sub-Saharan African countries. The sources of this data are the World Bank Enterprise Surveys, conducted in over 1,000 firms in Ethiopia, Kenya, Madagascar, Mali, Mauritius, Senegal, South Africa, Tanzania, Uganda and Zambia. We use information on firm inputs and outputs to calculate total factor productivity (TFP) of firms. The Enterprise Surveys also contain unique measures of the performance of communications, electricity and financial services. The availability of these measures at the firm level, both as subjective and objective indicators, allows us to exploit the variation in services performance at the sub-national regional level. By using the regional variation of services performance, we are also able to address the possible endogeneity concerns about the services variable.

Our results show a significant positive association between the performance of manufacturing firms and indicators of the availability of services in the region. These findings are consistent with the view that services matter for the productivity of firms, and provide evidence of the relevance of services sectors beyond the boundaries of the sectors themselves. As the International Labour Organization World Employment Report 2004–5 states, 'bridging the global productivity divide is essential for fighting poverty and stimulating growth in both output and decent and productive employment'. Productivity is a necessary condition for creating incomes that allow people to escape from poverty. This paper strengthens the argument that reforming services industries can contribute to enhancing the productivity of downstream economic activities, and thus be an essential element of a strategy for promoting growth and reducing poverty.

2. Related Literature

There is a growing body of evidence of the relevance of services sectors for growth and productivity. At the aggregate level, Eschenbach and Hoekman (2006) document a positive correlation between the extent of services liberalisation and economic growth in transition countries during the 1990–2004 period. Mattoo, Rathindran and Subramanian (2006) present econometric evidence from a sample of 60 countries over the 1990–1999 period that openness in the financial and telecommunications sectors influences

long-run growth performance. At the micro level, Arnold, Javorcik and Mattoo (2006) provide evidence for a positive link between services liberalisation and downstream manufacturing performance for the case of the Czech Republic.[1]

To the best of our knowledge, the role of services inputs in Sub-Saharan Africa has not yet been analysed rigorously in the literature. Most of the literature on the performance of production establishments in the region has focused on the relationship between export status and performance (Van Biesebroek, 2005; Bigsten *et al.*, 2004; Mengistae and Pattillo, 2004). Clarke (2005) investigates the relationship between policy variables and the export performance of African firms and finds that restrictive trade and customs regulations appear to discourage exporting.

Tybout (2000) reviews the performance of manufacturing firms in developing countries and identifies the following reasons for the poor performance of many developing-country establishments compared to global best practice: limited market size (which may be aggravated by insufficient transport services), lack of human capital, and difficulties in accessing manufactured inputs and infrastructure services at competitive prices and quality. The objective of this paper is to assess the significance of the last variable, access to infrastructure services.

Finally, as noted above, Eifert *et al.* (2005) analyse the share of 'indirect' costs for firms in 42 countries. Most of these indirect costs are attributable to services-related inputs into production—energy, transport, telecom, water, insurance, marketing, travel, independent professionals and accounting. They find that in countries such as China, India, Nicaragua, Bangladesh and Morocco, indirect costs account for 13–15% of total costs, around half the level of labour costs. In most African countries, indirect costs average as high as 20–30% of total costs, often dwarfing labour costs.

[1] A related literature considers the importance of services reform for goods trade. Fink, Mattoo and Neagu (2005) show that communication costs matter for export performance for certain goods, and Freund and Weinhold (2002) find a trade-enhancing effect of internet connectivity.

3. Data and Empirical Strategy

Our establishment-level data come from the World Bank Enterprise Surveys. Data from these surveys are available for a cross-section of firms from ten Sub-Saharan African countries which were surveyed following the same methodology. The countries are Ethiopia, Kenya, Madagascar, Mali, Mauritius, Senegal, South Africa, Tanzania, Uganda and Zambia, and the surveys were undertaken between 2001 and 2005.

The Enterprise Survey data contain detailed information on output and production inputs, which we transform into real values using the respective Gross Domestic Productivity deflator and then convert into US dollars using the yearly average exchange rate. We estimate TFP as the residual of the Cobb-Douglas production function in equation (1), with real output as a function of capital, labour and intermediate inputs. Particular attention was given to the capital variable. In firm-level data sets, this is usually the variable, which creates the strongest concerns regarding correct measurement, because firms have an incentive to overstate depreciation and understate the book value of their physical capital for tax reasons. To avoid this problem, the Enterprise Surveys contain a question about the current resale value of the machinery and equipment if the firm had to sell it the next day, and we use this information to estimate the value of the capital stock. We estimate the production function as,

$$y_i = \alpha_s + \beta_s \cdot l_i + \gamma_s \cdot k_i + \delta_s \cdot m_i + \mu_i. \quad (1)$$

where y_i represents real firm output, l_i is labour, k_i capital and m_i intermediate inputs. The estimated coefficients vary at the level of each manufacturing industry s, which include food and beverages, textiles and garments, chemicals and pharmaceuticals, metals and metal products, non-metallic mineral products as well as wood products and furniture.[2] The parameters of the production function (1) are identified using two approaches: the first is an ordinary least square (OLS) estimator and the second is the semi-parametric

[2] Unfortunately, we were not able to obtain reasonable production function estimates for the chemicals and pharmaceuticals industry using the Olley/Pakes approach and had to drop this sector from the regressions when we use the TFP estimates originating from that procedure.

estimator suggested by Olley and Pakes (1996). The latter uses the firm's investment behaviour to control for a possible estimation bias that may arise if a firm makes its input choices contingent on an unobserved productivity shock affecting μ_i.[3]

The second building block of our analysis is information about the performance of services sectors, which is also available from the Enterprise Surveys. The surveys contain both subjective and objective measures of local services performance. The subjective measures are firms' valuation on a scale from 1 to 5 as to how much of a constraint they consider electricity, telecommunications and access to finance for their businesses. The objective measures come from questions about the delay involved in having a new phone line installed, the number of days required to clear a domestic or foreign money wire, the number of days with power outages in the previous year and whether a firm has chosen to install its own power generator. Table 1 shows descriptive statistics of these measures by country.

While the World Bank Enterprise Surveys have the advantage of containing information about services performance at a more disaggregated level than the country level, the fact that this information comes from the same firms whose performance we examine also creates challenges.

The challenges in this exercise are twofold. Relating a firm's performance to its own perceptions of, or even its own measurable experiences with, access to services would create concerns about endogeneity. Perceptions are likely to be influenced by success, and a more efficient firm may be more efficient because of particular characteristics that also affect the treatment it receives from services providers, like size and the resourcefulness of the manager. These issues make a one-to-one juxtaposition at the level of the firm an unattractive empirical strategy. At the other extreme, aggregating all the information to the country level would make it impossible to control for other country-specific differences in governance, institutions, business climate or geography in a cross-section. And it would leave the unique variation at the sub-national level unexploited.

[3] Other applications of the Olley/Pakes procedure which contain detailed descriptions of the methodology can be found in Pavcnik (2002) or Arnold and Hussinger (2006).

Table 1: *Descriptive Statistics of the Services Performance Measures*

Objective measures

Country	Number of days to obtain a telephone connection			Number of days to clear a foreign currency wire			Number of days to clear a domestic currency wire			Number of days of power outages in a year			Percentage of firms owning a generator		
	mean	p50	N.	mean	p50	N.	mean	p50	N.	mean	p50	N.	mean	p50	N.
Ethiopia	155	90	147	7.9	5	50	2.1	1	181			0	17%	0	418
Kenya	99	42	171			0			0	84	40	247	71%	1	278
Madagascar	64	30	69	7.5	5	183	3.5	2	256	78	30	240	22%	0	293
Mauritius	22	10	89	3.5	3	171	1.5	1	166	8	4	199	39%	0	204
South Africa	8	5	241	3.6	3	414	2.5	2	522	6	4	384	9%	0	603
Tanzania	23	14	68	6.3	4	93	4.4	3	139	67	48	211	55%	1	271
Uganda	33	7	130			0			0	71	30	268	36%	0	300
Zambia	89	30	20	4.6	4	161	2.4	2	144	38	17.5	204	39%	0	205

Subjective measures: Services as an obstacle to business on a 0 to 4 scale

Country	Telecommunications			Access to financing			Cost of financing			Electricity		
	mean	p50	N.	mean	p50	N.	mean	p50	N.	mean	p50	N.
Ethiopia	1.5	1	408	1.9	2	355	1.9	2	338	2.1	2	416
Kenya	2.1	2	272	2.0	2	270	2.9	3	266	2.3	2	270
Madagascar	1.2	1	293	2.5	3	279	2.8	3	281	2.2	2	293
Mauritius	0.6	0	204	2.0	2	202	2.3	2	202	0.9	0	204
South Africa	0.5	0	603	0.8	0	603	1.2	1	603	0.7	0	603
Tanzania	1.0	1	272	2.1	2	269	2.3	3	268	2.6	3	270
Uganda	0.7	0	289	2.1	2	282	2.5	3	267	2.1	2	290
Zambia	1.6	1	205	2.2	3	203	3.3	4	204	2.0	2	205

Our empirical strategy is thus to go the middle way by exploiting the regional variation within countries. Rather than using the individual firm's responses to the services-related questions on the right hand side, we aggregate these responses up to regional averages. This reduces considerably the influence that an individual firm's performance can have on the value of a right hand side variable. At the same time, regions within a country share all the possible unobservable influences that are determined at the country level, and introducing country fixed-effects allows us to capture these unobserved differences.

In order for our estimation strategy to be reasonable, we require a sufficiently large number of observations per region to bring down the influence that an individual firm's response can have on the right hand side variable, and sufficiently large number of regions within a country for the country fixed-effects to have any meaning. These requirements come at the cost of having to exclude Senegal and Mali from our regressions, because in these two countries, almost 90% of the firms in our sample are located in the capital region, leaving little regional variation to be exploited. In the other countries, we find a reasonable distribution of firms across regions, whose number ranges from 3 in Uganda to 8 in Ethiopia.

Our empirical specification in equation (2) is quite simple: We regress firm TFP on measures for the performance of services, aggregated to regional averages. Additional controls in our regressions are fixed effects for countries and for industries, as well as a vector of covariates X that have been typically recognised as relevant for firm performance in the literature. These are export status, firm size (by means of an indicator for firms with more than 50 employees) and domestic versus foreign ownership. For the latter, we follow the standard definition of foreign direct investment used by the International Monetary Fund and consider firms with at least 10% foreign capital share foreign-owned.[4] Finally, since location in the capital region may have advantages that go beyond

[4] Export status and foreign ownership are potentially endogenous variables. For this reason, all regressions were replicated without these two variables, and none of the results presented in this paper are sensitive to their inclusion. The estimated services coefficients and standard errors were so similar to the ones presented here that we refrained from presenting these results. They are available upon request from the authors.

differences in services provision, we also control for location in a nation's capital.

$$\mu_i = \varphi + \lambda \cdot \text{services\_performance}_{\text{reg}} + \pi \cdot X + D_{\text{country}} \cdot \kappa + D_{\text{ind}} \cdot \vartheta + \varepsilon_i \pm. \quad (2)$$

Equation (2) is estimated using robust standard errors clustered on regions, following the procedure suggested by Moulton (1990). With respect to our services performance variables, we generally prefer the objective measures to the subjective ones, because we believe that the former are less subject to the possible endogeneity of perceptions. It turns out, however, that the respective subjective and objective measures are highly correlated, as can be seen from some simple descriptive regressions presented in Table A1 in the Appendix. This gives us reason to believe that we are capturing differences in access to services across African regions in a meaningful way.

When estimating equation (2), we have a choice: we can enter the services indicators either one by one or simultaneously. If the indicators for all services matter, the one-by-one models may suffer from an omitted variables bias. On the other hand, to the extent that the performance across services is correlated, a regression containing all indicators at once may suffer from a multicollinearity problem. Given this situation, our strategy is to estimate equation (2) both ways. For ease of exposition, we will first enter the performance measures for the three services sectors separately into equation (2), and then present the results of a model containing measures for all three at the same time, including a model in which we condense the services variables into a principal component to mitigate the multicollinearity problems.

4. Results

4.1. Electric Power

We begin with the provision of electric power. Table 2 shows the relationship between manufacturing firm productivity and the performance of this sector in the same region, suggesting a significant relationship between the measures of manufacturing firm performance and the reliability of electricity provision. The variable available in the Enterprise Surveys for this sector measures the number of days with power outages over the previous year. A

Table 2: *TFP and Electricity*

TFP estimation procedure:	OLS	Olley/Pakes
Days with power outages	−0.003*	−0.006***
	[0.002]	[0.002]
Share of firms that own a generator	0.800**	0.699**
	[0.317]	[0.337]
Exporter	−0.067	−0.011
	[0.060]	[0.076]
Age of the firm	−0.000	0.001
	[0.001]	[0.002]
Size of the firm	0.188***	0.200***
	[0.033]	[0.050]
Foreign owned	0.035	0.051
	[0.062]	[0.067]
Location in capital region	0.190**	0.165
	[0.071]	[0.103]
Country dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	927	824
Adjusted R-squared	0.30	0.48

Robust standard errors clustered by regions in parentheses. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. The services-related variables are used in regional averages.

particular caveat applies to this sector: faulty energy provision from the public grid does not necessarily imply that the firm had access interruptions, because producing electricity in-house using a private generator is a means of circumventing the deficiencies of electricity provision from the public grid. Given the significant scale economies in electricity production, it is clearly not a cost-effective way of providing the firm with energy, but generators can dampen the link between the reliability of power provision and firm performance. This is why we want to control in our regressions for the use of firm-owned generators.

The estimated coefficient on our outage measure is negative and significant at the one-percent level using the semi-parametrically estimated firm productivities (and at the ten-percent level using ordinary least squares). In other words, firms in regions with

more frequent power outages are less productive than others. We also find the coefficient on the share of firms that own a generator to be significant and positive. This is consistent with the interpretation that firms that are able to generate their own electricity are benefiting from the fact that the continuity of their production is not dependent on the continuity of local energy provision. In fact, our data display a strong and positive relationship between the decision to acquire a generator and the degree to which firms perceive electricity supply problematic. As shown in the Appendix, a firm's perception of the difficulties in accessing reliable energy is a highly significant predictor of the firm's odds of owning a generator. This is true both at the level of firms and for regional averages.

4.2. Telecommunications

Besides electricity, telecommunications services are a further essential services input for manufacturing firms. Information on the functioning of the telecommunications sector is available in the form of two objective measures: the number of days required to obtain a new phone connection and the number of days with telephone outages in the last year. We interpret both of these variables as broad indicators of sector performance: In countries with competitive and efficient telecommunications markets, getting a new phone line connected tends to be a matter of at most a few days and there are few outages, whereas in countries with inefficient public monopolies, there tend to be long waiting lists for phone lines (the median wait time in Ethiopia was 90 days, for example), and a lack of investment by monopoly incumbents can cause regular outages. The two telecommunications performance variables measure similar, albeit not identical, aspects of telecommunications performance. Introducing both at the same time could cause multicollinearity problems, but on the other hand we would not want to discard the information contained in either of them. For this reason, in Table 3 we use the first principal component of the two as our preferred indicator of performance in the telecommunications sector.[5] These results, based on clustered robust standard errors, show a significant relationship between telecommunications performance and firm productivity in downstream manufacturing

[5] These regressions were also run including each of the two measures separately, and the estimated coefficients were equally significant. These results are available from the authors upon request.

Table 3: *TFP and Telecommunications*

TFP estimation procedure:	OLS	Olley/Pakes
Telecom Performance PC	−0.063	−0.124*
	[0.060]	[0.064]
Exporter	−0.048	0.016
	[0.060]	[0.075]
Age of the firm	0.000	0.001
	[0.001]	[0.002]
Size of the firm	0.186***	0.172***
	[0.033]	[0.055]
Foreign owned	0.040	0.052
	[0.061]	[0.067]
Location in Capital Region	0.174**	0.148
	[0.066]	[0.099]
Country dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	927	824
Adjusted R-squared	0.30	0.48

Robust standard errors clustered by regions in parentheses. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. The services-related variables are used in regional averages. Telecom Performance PC: First principal component of the following two variables: delays in obtaining a phone connection and number of days of telephone outages in the last year, both averaged at the regional level.

sectors when TFPs are estimated using the semi-parametric estimator.[6] Improved access to telecommunications inputs (expressed by a low value on our measure) is associated with higher performance of manufacturing firms.

4.3. Financial Services

With respect to the financial sector, we use information on the role of banks to facilitate payment transactions with domestic and international business partners. We proxy the efficiency with which

[6] Note that if we do not apply the Moulton (1990) procedure for clustering standard errors but use Hubert-White-corrected robust standard errors instead, the estimated coefficients for both TFP measures are significant at the 1% level.

payment transactions are conducted by using information from the Enterprise Surveys on the number of days required to clear either a domestic or an international payment transaction. For example, clearing a foreign currency wire takes around 3 days in Mauritius and almost 8 days in Ethiopia. Clearing a domestic currency wire takes an average of 4 days in Tanzania. While this is an admittedly specific element of banking transactions, it is likely to proxy the overall transaction efficiency of locally available banking services. Since we are again facing two similar but not identical measures of transaction efficiency of banks, we use once again the first principal component of the two measures as our preferred measure of banking performance.[7]

The results in Table 4 show a significant positive relationship between firm productivity and the efficiency of the banking system in facilitating payment transactions, as measured by the speed of payment processing. The relationship holds regardless of whether we focus on the processing of domestic currency payments or international transactions, and regardless of which of the two productivity estimates we use. Even when the two measures are introduced together, both remain significant at the 5% level. In other words, firms in those regions where banks operate more efficiently are on average more productive than the firms located in regions with low banking efficiency.[8]

4.4. Entering All Three Services Sectors into the Regressions

In addition to entering performance measures for each service sector separately, it is also interesting to see how far our results hold when we simultaneously enter measures of all three services sectors into the estimation of equation (2). The question here is whether we can detect a significant association between firm productivity and the performance of a given services sector, conditional on the performance of other services. Table 5 presents these results.

Our results for the telecommunications and banking sectors carry through in all specifications of Table 5. We find a significant positive

[7] As in the case of telecommunications, we checked these results for robustness to include each of the two measures separately, and the estimated coefficients were equally significant. These results are available from the authors upon request.

[8] It should be recalled that the regressions include country and industry fixed effects, so that we are not picking up systematic differences in banking efficiency across these two dimensions.

Table 4: *TFP and Transaction Efficiency of the Banking Sector*

TFP estimation procedure	OLS	Olley/Pakes
Banking Performance PC	−0.183**	−0.254**
	[0.082]	[0.103]
Exporter	−0.014	0.081
	[0.076]	[0.089]
Age of the firm	0.001	0.003
	[0.002]	[0.002]
Location in Capital Region	0.111	0.115
	[0.080]	[0.099]
Size of the firm	−0.004	−0.017
	[0.058]	[0.081]
Foreign owned	0.193**	0.162
	[0.078]	[0.116]
Country dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	865	779
Adjusted R-squared	0.29	0.43

Robust standard errors clustered by regions in parentheses. ** indicates statistical significance at the 5% level. The services-related variables are used in regional averages.

correlation between the performance measures for these sectors and manufacturing productivity in all cases. For the electricity sector, only the power outages variable appears to be significant and not the generator variable. In consequence, columns III and IV present the same specification without this variable, with no noticeable consequences for the other three services indicators. In columns V and VI, we condensed the information contained in the three significant services indicators into a first principal component indicator, called services PC.

It is not straightforward to interpret the order of magnitude of our estimated coefficients. However, some interesting counterfactuals are possible on the basis of column IV of Table 5. For example, one can ask what would happen if a country like Tanzania, situated at the lower middle of the distribution of electricity performance (using the power outage variable holding the

Table 5: *TFP and Services Sector Performance*

TFP estimation procedure:	I OLS	II Olley/ Pakes	III OLS	IV Olley/ Pakes	V OLS	VI Olley/ Pakes
Days required to get a phone line	−0.004*** [0.001]	−0.005*** [0.001]	−0.004*** [0.001]	−0.005*** [0.001]		
Days to clear a domestic currency wire	−0.073*** [0.012]	−0.123*** [0.022]	−0.081*** [0.012]	−0.120*** [0.021]		
Days with power outages	−0.003* [0.001]	−0.006** [0.003]	−0.003* [0.001]	−0.006** [0.002]		
Share of firms that own a generator	0.172 [0.162]	−0.041 [0.155]				
Services PC					−0.240*** [0.084]	−0.382*** [0.107]

(*continued on next page*)

Table 5: (*continued*)

TFP estimation procedure:	I OLS	II Olley/ Pakes	III OLS	IV Olley/ Pakes	V OLS	VI Olley/ Pakes
Exporter	−0.052	0.034	−0.049	0.033	−0.045	0.033
	[0.067]	[0.069]	[0.067]	[0.069]	[0.068]	[0.071]
Foreign owned	0.225**	0.211	0.223**	0.211	0.201**	0.184
	[0.089]	[0.132]	[0.089]	[0.132]	[0.084]	[0.125]
Age of the firm	−0.000	0.002	−0.000	0.002	0.000	0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]
Location in capital region	0.300***	0.342***	0.314***	0.338***	0.243***	0.274***
	[0.032]	[0.054]	[0.031]	[0.052]	[0.048]	[0.067]
Size of the firm	0.015	0.014	0.016	0.014	0.020	0.018
	[0.062]	[0.077]	[0.061]	[0.077]	[0.062]	[0.078]
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	678	596	678	596	678	596
Adjusted R-squared	0.38	0.53	0.38	0.53	0.37	0.52

Robust standard errors clustered by regions in parentheses. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. The services–related variables are used in regional averages. Services PC is the first principal component of Days required to get a phone line, Days to clear a domestic currency wire, Days with power outages.

share of generators constant), were to move to the level of performance of South Africa, the best performer in our sample. The productivity improvement associated with such a shift would amount to 44%, based on the results in column IV of Table 5. The same exercise with respect to telecommunications performance (measured as the time required to have a phone line installed), would bring an 8% increase in the productivity of firms in Tanzania. Finally, improving banking services to the levels of South Africa is estimated to improve productivity by 22%.

Finally, consider the issue of endogeneity. Even with our regional aggregation strategy, our services performance indicators could still be subject to endogeneity concerns if firm location is endogenous, in the sense that firms that perform better, for reasons unrelated to services, systematically seek to locate in regions with better access to services. Our data give us only limited possibilities to address this issue, particularly because they are lacking a panel dimension. We do, however, take a look at whether there is any evidence that firms in regions with better services access are indeed different from the firms in regions with less favourable services access. In Table A2 in the Appendix, we divide regions around the median value of a principal component of services performance and test for differences with respect to firm characteristics that would seem to matter for their performance: age, size, export and R&D behaviour, the number of products, capital intensity, education of the manager and firms' perception of their technology vis-à-vis their closest competitor across these two groups of regions. Along none of these dimensions do we find evidence that firms display statistically significant differences across regions with different services performance. While this clearly falls short of being a formal test of endogenous regressors, it gives us some comfort to find that firms across regions with different services performance are not all that different, and that their location pattern is unlikely to be driven by services availability.

5. Conclusion

Difficulty in accessing essential producer services is likely to be one of the reasons behind the sluggish performance of firms in Sub-Saharan Africa. Producer services are a vital input for the manufacturing sector, and their availability, quality and cost are likely to be relevant to the productivity of firm operations. This paper uses a representative sample of manufacturing firms from ten

Sub-Saharan African countries, comprising more than 1,000 firms, to investigate the relationship between firm productivity and access to telecommunications, electricity and financial services. In order to minimise endogeneity problems with the measures of services performance, we exploit variation in services provision across sub-national regions. Our results show a significant and positive relationship between firm productivity and service performance in all three services sectors analysed and are consistent with the argument that inadequate access to essential producer services hurts African firms by undermining their productivity.

To a certain degree, the deficiencies in services provision in African countries may be related to the severity of physical conditions, but the importance of political constraints should not be underestimated. Political interest groups that obtain rents from the policy status quo may prevent the policy reforms needed for the development of the services sector. In telecommunications and electricity, for example, vested interests in monopoly providers have opposed the emergence of fully competitive markets in several of the countries studied in this paper. Getting services policy right must be an essential element of any growth enhancement and poverty reduction programme. Inadequate access to services cannot be accepted as one more aspect of the low levels of consumption in Africa, because access to services will help foster the private sector growth necessary to break the poverty trap.

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8. **Appendix**

8.1. Correlations Between Objective and Subjective Measures of Services Performance

Table A1: *Subjective and Objective Measures*

	I	II	III	IV
	Telecom as an obstacle (subjective)	Generator	Regional percentage of firms owning a generator	Cost of finance as an obstacle (subjective)
Delay in phone connection	0.001** [0.000]			
Electricity as an obstacle (subjective)		0.030** [0.008]		
Days with power outages-Regional mean-			0.003** [0.001]	
Number of days to clear a foreign currency wire				0.011* [0.006]
Estimation	Ordered probit	Probit (marginal effects)	OLS	Ordered probit
R2/Pseudo R2	0.1177	0.1916	0.86	0.1255
Observations	782	2117	1765	824

Robust standard errors clustered by regions in parentheses.
*, ** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table A2: *Comparing Regions with Above-Median and Below-Median Services Performance*

	Regional services below-median (better services)	Regional services above-median (worse services)	Difference (1)−(2)	*P*-value
Average age of the firms	18.578	17.957	0.621	0.4700
Average size of firms	0.522	0.553	−0.031	0.3326
Percentage of exporters	0.420	0.412	0.008	0.7944
Average number of products	61.481	47.970	13.511	0.2402
Average R&D spending (US$)	105.219	264.721	−159.502	0.3381
Average capital intensity (Capital in US$/Labour)	0.148	0.086	0.062	0.2278
Percentage of firms with higher or equal technology compared to the closest competitor	0.861	0.846	0.015	0.5649
Percentage of firms with highly educated manager	0.752	0.780	−0.028	0.3338

Regions are classified on the basis of a first principal component of performance across service sectors.