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Productivity, Shocks and Management Practices*

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Abstract

We examine the links between productivity and shocks, particularly exchange rate fluctuations on firm productivity, with data from Ethiopia and Uganda. These two countries offer a useful comparison: they are two small land-locked economies with different exchange-rate regimes. Uganda has a floating exchange-rate regime in contrast to the crawling peg regime effective in Ethiopia. We focus on currency shocks to the costs of imported inputs:using matched customs and firm-level data to examine the impact of currency shocks and input shortages. A particular advantage is that we use the actual currency of invoicing rather than the bilateral exchange rate to construct the measure of currency shocks. For Ethiopia, where we have detailed data on management practices, we also ask whether management affects productivity. We find that depreciations raise productivity, potentially through increased competition in Ethiopia but leave Ugandan productivity unaffected. Good management matters for firm productivity in Ethiopia but does not mitigate the effects of shocks.

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1 Introduction

What is the impact of exchange-rate fluctuations on firms in developing countries? In what follows we examine the links between productivity and shocks, particularly exchange rate fluctuations on firm productivity, comparing Ethiopia and Uganda. These are both land-locked economies with small but growing manufacturing sectors. Value-added in Ethiopian manufacturing stands at an average of 6% in the last five years and growing at 14% per year while that in Uganda has averaged 9%, but growing far more slowly at 3% per year (see the World Bank Value Added Database). But critically, the exchange rate regimes in the two countries allow for a sharp contrast: The National Bank of Ethiopia operates a managed float and has a policy of gradual depreciation of the Birr (which is not freely convertible), with occasional sharper adjustments reflecting changes in the parallel market, while in Uganda, the capital account is open and the exchange rate is floating, thus implying potentially different impacts of exchange rate fluctuations on productivity.

This also allows us to explore the micro-economic channels through which these fluctuations operate. Exchange rate fluctuations will affect firms differently depending on the currencies their imports and exports are invoiced in and their exposure to traded inputs and outputs. The competitive pressures induced thus are likely to affect firm productivity with potentially ambiguous effects. For instance, a depreciating home currency imposes greater competitive pressure through increased costs of inputs, which might encourage firms to adopt more efficient production techniques or force less productive firms to exit the market (Melitz (2003); Melitz and Ottaviano (2008)). Verhoogen (2008), suggests another route to productivity improvements where depreciation leads to quality upgrading. Alternatively, such exchange rate depreciation which raises a firm's total sales may lead to higher productivity in increasing returns to scale firms (Fung (2008)). However, depreciation, by raising the costs of imported inputs might force substitution into poorer quality but cheaper inputs might also lower labour productivity and lower the quality of outputs (Bustos (2011)). In brief, theory suggests that the potential effects of fluctuations are ambiguous but empirical evidence, particularly at the firm-level, is sparse [1].

[1] Alfaro et al. (2018) examine the effects of aggregate Real Exchange Rate (RER) on Total Factor Productivity(TFP): in Asia, real depreciations are associated with faster growth of firm-level TFP, negative effects in import-intensive emerging economies elsewhere and no effects for industrialised economies; Ekholm et al. (2012) use Norwegian firm-level data on trade exposure to examine the effects of a real appreciation and find re-structuring of firms led to increases in TFP; Choi and Pyun (2017) provide a year-by-year analysis and find that RER depreciation has positive effect on productivity. This positive effect is more pronounced for firms with higher export exposure. They also find that the significant productivity gain in response to immediate RER depreciation disappears when RER depreciation persists over time; Dai and Xu (2017) construct firm-specific effective exchange

In addition to our focus on two of the poorer developing economies, we are also able to construct firm-level effective exchange rate fluctuations using both information on imports and exports but also uniquely, data on the currency of invoicing, which allows us to construct the exact impact on importers and exporters of fluctuations in exchange rates. Most studies use data on currency shocks at the aggregate level or do better as in Dai and Xu (2017) and Murphy and Siedschlag (2012), who use data on trade flows to construct shocks based on bilateral exchange rates. However, this remains a proxy given that it does not capture the actual rate used in contracting trades. The construction of firm- specific real effective exchange rates (REERS) does help to identify heterogeneous trade exposure of firms by trading partner but given that bilateral transactions are usually invoiced in vehicle currencies, this introduces more heterogeneity than is likely to be correct. Cravino (2015) is the only other paper we are aware of that uses data on the currency of invoicing to examine the effect of exchange rate fluctuations, in this case on aggregate productivity in Chile.

We use a survey of medium and large manufacturing firms and associated establishments in Ethiopia over the period 2015-17 (Large and Medium Scale Manufacturing Industries Survey (LMMIS))[2] that is conducted annually by Ethiopia's Central Statistical Authority, together with administrative data on importers, exporters and prevailing exchange rates recorded by the Ethiopian Customs and Revenue Authority (ERCA) to study firm productivity and exposure to shocks, particularly in the price of imported inputs. A special feature of this survey is that it records the currency in which transactions are invoiced. We focus on imports in part because imported inputs in manufacturing account for over 70% of merchandise imports, while manufacturing exports make up a bare 4%. Firms are very sensitive to currency shocks: access to foreign exchange has been rationed in this period and thus fluctuations in the exchange rate affect the cost and quantity of imported inputs. We are particularly interested in the latter; the rationing of foreign exchange[3] combined with thin domestic input markets makes the supply of imported inputs critical across many sectors in Ethiopia [4]. In addition, we were

rates based on trade data to examine the consequences for labour re-allocation

[2]These data have been used to examine related issues, relying on the period 1996-2011. For instance, Abreha (2017) has an excellent account of the relationship between importing and firm productivity, finding evidence for selection and learning from importing, while Bigsten et al. (2016) examine the impact of trade liberalisation on firm performance. Gebrewolde and Rockey (2016) examine the consequences of industrial policy post 2003.

[3]Private sector access to foreign exchange (U.S. dollars) is severely constrained by a large trade deficit and ambitious government infrastructure projects funded by foreign debt, which enjoy priority in allocation of foreign currency. The National Bank of Ethiopia's annual report claims that 38% of total imports ($6 billion) was spent on capital goods and 31% ($4.9 billion) on consumer goods.

[4](Aghion et al. 2009) examines the links between exchange rate volatility and productivity growth, arguing that exchange rate volatility leads to fluctuations in a firm's profit since revenues fluctuate but its costs do not,

able to incorporate a module on management practices in the LMMIS: senior managers at the establishment were surveyed on the management and organisation of their establishment and the associated firm. This allows us to explore whether better-managed firms are able to better cope with shocks. We have similar data on Uganda for this period where in contrast to Ethiopia, which operates a floating exchange rate, thus implying a potentially different impact of exchange rate fluctuations on productivity. The data on Uganda are confined to data on sales from the corporate tax records and while we have similar data on exports and imports from the Customs and Revenue authorities (as well as the currency of invoicing), we do not have data on management practices or detailed information on the firm as in the LMMIS above. Nevertheless, a comparison here is illuminating since there are both land-locked countries with a heavy reliance on imported inputs but substantially different exchange rate regimes. We take up this comparison below but we begin by documenting the dispersion of productivity across firms and within industry in Ethiopia. In addition, we use data on management practices across firms to examine the relationship with productivity. We use this information together with that on productivity shocks to the firm and examine whether better managed firms are also better equipped to deal with shocks to productivity. We then turn to the Ugandan case and again, document the dispersion of productivity across firms and within industry and examine the impact of currency shocks, comparing this rather less granular description to the Ethiopian case.

To summarise, this paper makes a contribution to three strands of the literature on firm productivity. The first is the literature on currency of invoicing and the links to firms [5] we are able to match data on the currency that imports are invoiced in to the characteristics of the direct importers and extrapolate this to indirect importers using the same inputs. The second is the link from exchange rate fluctuations to firm-level outcomes, particularly productivity, where the literature is sparse as explained above.In part, this is the difficulty of obtaining administrative data on both customs transactions and firm-level data that can be matched to it, as is true here for both Ethiopia and Uganda. Finally, we also contribute to the substantial literature on imports and productivity, including on Ethiopia [6]. We now turn to a brief discussion of the

under assumptions of input price stickiness, leading to lower growth in productivity.

[5]There is a large literature studying the determinants of invoicing (see for Goldberg and Tille (2008) instance) but few that are able to link these to firm characteristics. The handful of papers that can do so include Amiti et al. (2018) who use data on Belgian firms and their imports to study exchange rate pass-through; Chen et al. examine detailed firm-level transactions data for UK imports, invoicing currency choices and the response of import prices to exchange rate changes; Corsetti et al (2019) who use similar data on the UK to establish that the currency in which exports and imports are invoiced is a good proxy for the currency in which firms set prices.

[6]The literature on the effects of exports and imports on productivity is extensive; the main issue is trying to

literature on productivity dispersion which is our jumping-off point to discuss the links between currency shocks and productivity in Ethiopia and Uganda.

2 Productivity Dispersion and its discontents

(Syverson 2011) examines productivity differences within 4-digit SIC industries in the US (quite narrow industries like "Greeting Cards" or "Industrial Sealants") and finds that in the average industry, the 90-10 ratio of total factor productivity plants is about 2, implying that the plants in the top decile plant in the average industry produced twice as much output as those in the bottom decile, using the same inputs. When comparable establishment-level data is used, the dispersion of productivity is found to be much higher in developing countries: (Hsieh and Klenow 2009), compare the dispersion of productivity within narrowly defined manufacturing industries in China, India and the US, and found it to be much lower in the USA. For China and India, the data are drawn from three rounds of annual surveys of manufacturing enterprises, with TFP measured based on both revenue and quantities. As a benchmark, in the US the TFP of a firm in the 90th percentile of the productivity distribution is about 8.9 times higher than that of a firm in the 10th percentile. By contrast, the ratio reaches 11.5 in China and a staggering 22.4 in India [7]. Relying on the same methodology, (Pagés 2017) computed firm- or establishment-level physical TFP in the manufacturing sector of seven Latin American countries and found even larger dispersion in these countries, ranging from 17 in Ecuador to 28 in Mexico. (Faggio et al. 2010) document dispersion of productivity within industries in the UK and find it has trended upwards over the last 20 years while (Bartelsman et al. 2013) find a large dispersion of both TFP and labour productivity within industries in France, German, Netherlands, the UK, and the US.) Why might we see productivity dispersion even within establishments and firms within narrow industrial classifications? (Syverson 2011) summarises the literature on the determinants of productivity and offers two kinds of explanations for inter-firm productivity differences. The first includes factors that operate primarily within businesses, say at firm or plant level. These are potentially under the control of management or others within the firm. The within-firm productivity drivers are essentially inputs that usually go unmeasured or mis-measured in the standard data sets. They include managerial practices, where good management lies in smooth

identify the mechanisms that drive the positive effect of trade that are usually found. Amiti and Konings (2007) find that importing intermediate inputs raises productivity for Indonesian firms, while Halpern et al. (2015) examine Hungarian manufacturing and estimate potential gains from imports using a structural model.

[7](White et al. 2017) and (Rotemberg and White 2017) note that methods of imputing values and editing outliers in the U.S. Census of Manufactures contribute sharply to reducing measured dispersion, suggesting that the lower dispersion in US data is misleading.

coordination and efficient use of labour, capital, and intermediate inputs. The quality of inputs also matter and will lead to measured productivity differences if standard input measures don't fully reflect quality differences. Other potential missing inputs include information technology and research and development.

The second set of determinants refers to the environment external to the firm. The impact of these external factors might not always be direct, but they can affect producers' willingness and ability to harness factors within the firm. They may also influence the amount of productivity dispersion that is sustainable in equilibrium. Such external factors might offer incentives to individual producers to become more efficient or act to select more efficient producers over time. These external factors might range from external competitiveness, thin credit markets, regulation and the flexibility of input markets. (Cusolito and Maloney 2018) decompose the growth of the aggregate physical measure of productivity, (TFPQ) by the contribution of within firm and between firm determinants and that due to net entry of firms using (Melitz and Polanec 2015) decomposition on six middle-income and developing countries including Ethiopia . The find that the within-firm determinants are relatively more important than the between in four of the six cases, explaining half or more of efficiency growth in these economies, especially in Ethiopia [8] and China.

A key reason to examine the importance of within-firm and without-firm determinants of productivity is to ask whether these factors are amenable to policy changes. How might government policies encourage productivity growth? It would seem that the external set of productivity drivers must be particularly amenable, since the government can do little about the factors that operate primarily within firms. The environmental factors are by their very nature the easiest to manipulate via government policy but in turn might also have an important effect on within-firm determinants. This is what we seek to understand. In what follows below, we begin by describing the Ethiopian data in detail: we document the dispersion in productivity and its variation and the impact of shocks on productivity followed by a similar discussion for Uganda. Given that we have detailed data on management practices in Ethiopia but not its equivalent in Uganda, we also take a detour to describe the important role of management practices in firm outcomes.

[8] This is based on data for the years 2000-2007.

3 Estimating Productivity and Descriptive Statistics

We use the LMMIS data on Ethiopia and the CIT data for Uganda to construct estimates of productivity. Since the data on Uganda are more sparse and only contain information on sales and expenses, we also provide comparable estimates for Ethiopia using similar variables. We use these data to estimate total factor productivity using standard methods in the literature and present our estimates below. Building on these estimates, we document the dispersion in TFP and the relationship of TFP to both within-firm drivers of productivity and external drivers as suggested by (Syverson 2011).

3.1 Empirical Specification: TFP estimates and the impact of shocks on productivity

We wish to capture the effects of external shocks on productivity and to do so, we consider a plant with a Cobb-Douglas production function a below:

$$Y_{it} = A_{it} L_{it}^{\beta^l} K_{it}^{\beta^k} M_{it}^{\beta^m} \tag{1}$$

$$y_{it} = \beta^0 + \beta^l l_{it} + \beta^k k_{it} + \beta^m m_{it} + e_{it} \tag{2}$$

where output in firm i at time t, Y_{it}, is a function of labour, L_{it}, capital, K_{it}, material inputs, M_{it} and A_{it} which captures the technology. Taking the natural logs of Equation 1, denoted in lowercase, we begin by estimating plant level total factor productivity (TFP) as the residual in the production function. The difficulties of obtaining unbiased parameters of the production function, due to issues ranging from the endogeneity of input choice, selection bias in entry and exit to the difficulty of obtaining firm-level prices have led to several alternative estimators being proposed in the literature (see (Eberhardt and Helmers 2016)).

We present three estimates: Fixed effects (FE) and two semiparametric estimators, the first (OP) based on (Olley and Pakes 1996), and the second (LP) by (Levinsohn and Petrin 2003). In addition, following (Amiti and Konings 2007), we modify the procedure in the OP and LP estimators to incorporate the firm's decision to enter the international market, via importing and/or exporting. Finally, we also present an alternative approach commonly used (see e.g. (Bloom et al. 2018) for instance) and define productivity in terms of labour productivity, by expressing Equation 2 above in terms of labour units thus [9]:

$$Ln\frac{Y_{it}}{L_{it}} = \beta_k ln\frac{K_{it}}{L_{it}} + \beta_m ln\frac{M_{it}}{L_{it}} + (\beta_k + \beta_l + \beta_m - 1) \times l_{it} + e_{it} \tag{3}$$

[9] Note that this formulation allows us to test the coefficient on l to examine returns to scale. If this coefficient=0, this would indicate constant returns to scale.

3.2 Data Descriptive Statistics: Ethiopia

The Central Statistical Agency (CSA) in Ethiopia conducts annual surveys of medium and large establishments and associated firms using the ISIC-Rev.3 classification and covers all firms with at least ten employees and using power-driven machinery. The surveys provide detailed information on the ownership, production, domestic and export sales, domestic and imported material inputs, employee composition, and asset structure of firms. Data on capital includes the book value of capital stock and the paid-up value of initial capital. We use data for the most recent two years, 2015-2017, together with the module on managerial practices that was administered in 2017.

Table 1 offers a summary description of the main variables we discuss for firms that use imported inputs (loosely labeled importers)[10] versus those that do not, pooled over the two years, 2016-2017. Two-thirds of firms use imported inputs, but of these only 20% are direct importers. The majority of firms using imported inputs are indirect importers, purchasing their inputs from import agents or large firms. Their dependence on imported inputs is high; the median share is 50 percent, while the 75th percentile of firms and over are entirely dependent on imports. Importers are larger, with median employment at 30 workers, about three times the median employment of non-importing firms. This is entirely because they use more production workers for the share of administrative and technical workers is identical across the size distribution. The distribution of productivity (using the Levinson-Petrin measure here) is near identical in both sets of firms. They have similar complaints and about two-thirds percent of firms in both categories report that the shortage of raw materials is the key constraint to operating at full capacity, both this year and the previous year.

The two groups of firms differ in a few important respects. First, on a scale of 0 to 1, with 0 being the least and 1 the most structured management practices, the median management z- score at 0.37 (and the average) amongst importers is twice as high as non-importers, with a median score of 0.18.[11] They are also half as likely (9% to suspend operations as a consequence of a shortage of raw materials and inputs. The Herfindahl index, ranges from 1/N to one, where N is the number of firms in the market. The index is lower for importers at 0.15 compared to that of non-importers at 0.24 but the fact that both are relatively large[12] suggests low competitiveness in manufacturing particularly amongst non-importers. Importers are also more specialised in

[10] We do not deal with the potential selection into importing inputs directly but clearly this is likely to be endogenous to productivity.

[11] (Note that the number of observatons is lower here because management scores are only available for 2017).

[12] The Herfindahl index in the 75th percentile is 0.25

their production with a lower index of diversification[13] and more likely to be exporters at 6 percent compared to non-importers at 4 percent of the sample. The public sector is similarly represented in both groups, with 3 percent of importing firms in the public sector compared to 2 percent for non-importers.

The next set of tables, Table 2a and Table 2b describe the different estimates of TFP, using the OP, LP and FE estimators and this is in turn compared to the standard measure of labour productivity, yl. Table 2a displays these estimates using quantity measures while Table 2b uses revenue measures. The coefficients are similar in both cases, both across the different sources of measures and the measures themselves. The LP and FE estimates seem close (apart from the value of inputs where the LP estimate is higher) with the OP coefficients are higher for all variables. The last column provides estimates of the production function as set out in Equation 2 , with the coefficient on labour estimated at zero, suggesting constant returns to scale. Table 2c examines how well these estimates correlate: first, while the quantity measures of TFP are highly correlated amongst themselves, their correlations with the measures of sales, while respectable, are lower. However, in both cases, the LP and FE estimates are very highly correlated, at 0.97. Furthermore, the yl (labour productivity) estimates are strongly correlated with the FE estimates in both cases again. In what follows, when describing variation across the productivity distribution, we confine our attention to the labour productivity measure (yl) and the Levinson-Petrin measure of TFP (LP) since they represent the main alternatives.

Figure 1 displays the kernel densities of yl and TFP(LP)and TFP-LP (Sales) for comparison. It is clear that the dispersion in yl is larger than that in TFP(LP). The distributions of TFP(LP) based on sales revenues lies to the left of that based on quantities, but are similar in dispersion. Table 2d describes the dispersion of productivity by industry using the TFP(LP) measure within main industry groupings. We begin with the ISIC 4 digit level, which is the most granular division in the data. In order to describe dispersion within these industries, it was necessary to aggregate some of them (denoted by the suffix, XX to the ISIC 2 digit code in the table) since the number of firms within finer categories became too small to capture with any sensible measure of dispersion. The table suggests that productivity dispersion is far smaller than that described for even for the USA, usually treated as the benchmark; the average across all industries for the 90th percentile relative to the 10th percentile is 8.5 with the highest dispersion in machinery at 12.5 and textiles at 11.5. The lowest dispersion, perhaps unsurprisingly is in flour mills at 4.

There are a number of reasons why we might observe dispersion in productivity within

[13]This is measured as the sum of each product's sales squared divided by the total sales of all products squared; if every product has an equal share in sales, this index takes the value 1

narrow industry classification as outlined earlier. In the Ethiopian case, a particular issue is the dependence on imported inputs whose shortages may well affect domestic supply of intermediates to other firms too. Figure 2 describes this dependence by productivity quintiles, for both labour productivity and TFP (LP). Firms report the reasons for relying on imported inputs, with the most important reason being the lack of domestic substitutes. The dependence increases with labour productivity, from 25 percent to 42 percent, measured in terms of there being no local supply, but increases to over 75 percent for the top quintile in productivity if we include the lack of sufficient or poor quality local supply. The pattern is similar for TFP(LP) quintiles, with two highest quintiles reporting being similarly constrained.

Table 1 suggestes that 17% of non-importers and 9% of importers suffered from operations breaks due to shortages of raw materials. Figure 3 describes the main reasons for the break amongst these firms: overwhelmingly, the firms report that shortages of materials (or foreign exchange shortages for importers) was the reason for the break in operations, overwhelming such reasons as power cuts which are included in "other reasons" category. Figure 4 displays the main constraints to working at full capacity reported by firms. The main constraint reported, consistent with the pattern above, is the shortage of raw materials and spare parts, reported by over 25 percent of firms in the bottom quintile of labour productivity, rising to just under 40 percent for the top quintile, for both measures of productivity.

Figures Figure 5a-Figure 5g display the relationship across the productivity distribution for key correlates: size (total employment), labour quality (proxied by the share of administrative and technical workers); the share of imported inputs; the management score and finally, currency shocks for both importers and exporters, with the former being measured at both the official and parallel rates. In brief, across both measures of productivity, each of these variables (apart from the shock to exporters) describes a clear and increasing effect across productivity quintiles. There is sharp and increasing relationship between productivity and size, particularly so using the TFP(LP) measure. More productive firms have higher quality of labour in terms of the share of skilled labour, use more imported inputs, have better quality management but also suffer more from exchange-rate shocks as importers. There is little variation in the effect of currency shocks to exporters across the distribution.

3.3 The role of management practices

There is now a considerable body of literature, mainly due to Bloom and confederates that emphasises the key role of good management practices in affecting firm-level productivity and its growth. The appendix to this paper offers a full description of the relationship between

management practices and labour productivity. We concentrate on this measure to keep the analysis comparable with other studies on management practice (see Bloom et al forthcoming). In summary we find that:

i) Management scores in Ethiopia (for firms with more than 20 workers) are lower with a mean of 0.5 compared the US benchmark of 0.6 as reported by Bloom et al, but with a similar dispersion (see Figure A1 and Table A1).
ii) Larger firms (with 20 or more workers) are distinctly better managed, with a distribution that lies to the right of that of small firms (see Figure A2).
iii) Older firms, incorporated firms and state firms are better managed (Appendix: Table A2, Figure A3, Figure A4 and Figure A5).
iv) Exporters and (direct) importers are better managed (Appendix Figure A6-Figure A7, Table A4 and Table A5).
v) There is little difference in management practices between family firms and non-family firms in contrast to much of the evidence from other countries (Figure A8 and Table A3).
vi) Better managed firms are also more productive (measured as labour productivity) as in Table A6 and Table A7.

4 Data and Productivity: Uganda

The data on Uganda come from the the Corporate Income Tax Data for the years 2014-2017, giving us a sample of 2577 pooled over the years or approximately 500 firms in each year. In addition, as in Ethiopia, these data are used together with the information from the Revenue and Customs Authorities and allow us to match the record of imported inputs by firms and the currency they are invoiced in. We construct TFP measures (OP, LP and FE) based on sales since these are the only variables available. In addition, we also estimate labour productivity, where size is proxied by the total costs of labour in terms of total salaries.

Table 3 provides descriptive statistics on these variables, by importers of inputs and non-importers, where importers in this sample are direct importers, contrary to Ethiopia.The distribution of the main estimates of productivity in the first four rows are symmetric, with yl perhaps with the highest dispersion but with a similar mean to the TFP(LP) estimates, also reflected in Figure 6. Importers have higher productivity across all points in the distribution. In the absence of data on quantities of inputs including total employment, the distribution of salaries and the ratio to sales to salaries offers a proxy for the size distribution of firms. Importing firms are

relatively larger using these measures; they are also larger measured by the share of materials to salaries and benefits to salaries.

Table 4a and Table 4b display the estimates of productivity using the data on sales revenues. Table 4a provides estimates using all years, 2010-2017, while Table Table 4b uses only the data from 2016-17, as a comparison with the estimates for Ethiopia. The coefficients in the productivity regressions are very similar in the 2016-17 data and the data across all years, except for the OP satimates, where the coefficient on the proxy for labour (ln(salary) is much larger in the 16-17 data. Table 4c displays the correlations across the three TFP measures using all years and those using only the 16-17 data. Each of the measures is strongly correlated with the its counterpart measure using the 16-17 data; however, correlations across measures are weaker than the estimates of TFP based on quantities for the Ethiopian sample. Clearly, revenue-based measures are noisier but the pattern of correlations remains strong. Table 4d describes the dispersion in productivity by industry: it is striking that the dispersion by industry is far smaller than in Ethiopia and certainly far smaller than for other countries where similar information is available. The largest dispersion is in non-metallic minerals where the 90th percentile sees 5.7 times the productivity in the 10th percentile.

Figure 7a - Figure 7e describe the relationship across the productivity distribution for key correlates as in Figure 5a-Figure 5g for Ethiopia: size (total salaries), labour quality (proxied by the share of benefits to salaries); the share of imported inputs; and finally, currency shocks for both importers and exporters. Again, across both measures of productivity, we see a similar relationship but it is less pronounced than in the Ethiopian case. Size and labour quality are rather flat and rise only in the highest productivity quintile while the share of imported inputs rises across the distribution. The currency shock to importers actually falls across the distribution - but the effect of currency shocks to exporters is negative and increasing across the distribution. This seems consistent with a period where the Ugandan shilling is depreciating against the dollar (rewrite after curr inv).

5 The effect of shocks on productivity

We now turn to an examination of the effects of external shocks on productivity and examine two categories of shocks. The first is a self-reported measure, summarised in Figure 3 for Ethiopia [14], where firms were reported that they had suffered from n operation break or suspension of operations due to a shortage of raw materials and spare parts. The second shock captures the

[14] We do not have similar data for Uganda.

effect of exchange rate fluctuations, weighted by the import intensity of firms. Note that we focus on this shock because the rationing of foreign exchange in Ethiopia makes the fluctuations in the exchange rate potentially result in two opposite effects: first by raising the price of inputs it increase cost of operation and second by relaxing a rationing in the quantity of imported inputs that exists before the devaluation. currency shock measures are generally generated as changes to effective exchange rate faced by an industry (Goldberg 2004) or a firm. Ekholm et al. (2012) in its investigation of the employment response of Norwegian manufacturing firms to the Norwegian Krone's real appreciation in the early 2000s constructs the currency shock as the change in aggregate (country) level effective exchange rate and interacted it with firm level trade exposure. Dai and Xu (2017) use firm level bilateral exchange rate with firm level import weights to construct the currency shock in their study.

We have transactional levle data on imports and the currency they are invoiced in, which allows us to calculate the exact magnitude of the fluctuation faced by the firm. This is weighted by the import intensity of the firm, measured as the (lagged) share of import by firm i using currency j, where j is the currency of invoicing. Thus the month-on-month shock is defined as import intensity of the firm in currency k multiplied by the change in the value of the currency (birr/currency j), which is then aggregated over the year to give an annual measure. For firms importing indirectly, this variation is then appropriately re-weighted taking an industry average measure, multiplied into each firm's import intensity. We construct a similar measure for the export shock. The derivation of the import shock is laid out below. Let i denote the manufacturing firm in Ethiopia/Uganda; j,the currency of invoice for the good and e,the exchange rate (e.g. Birr/USD or UGS/USD) between currency j and the birr/UGS. The currency shock is generated as follows:

$$\Delta IMFEER_{it} = \Sigma_j \frac{IM_{ij,t-1}}{\Sigma_j IM_{ij,t-1}} \Delta \ln \epsilon_{jt} \tag{4}$$

$IM_{ij,t-1}$ is the i^{th} firm's import invoiced in currency j in time t-1, $IM_{i,t-1}$ is total import of firm i in period t-1,$\Delta \ln \epsilon_{jt}$ is the change in birr to currency of invoice exchange rate in period t. The weights are generated in period t-1 to mitigate potential endogeneity issues. We are interested in assessing whether the productivity of a plant i is a function of external shocks and follow this to ask how external shocks such as exchange rate fluctuations affect productivity. We do this at the second stage, using the plant level measures of TFP from equation (2), and estimate the following specification, dropping the subscript t since we have management

measures only for 2017:

$$\begin{aligned} tfp_i =& \alpha_{ISIC} + \rho_1(Indirect\_Importer_i) + \rho_2(Direct\_Importer_i) + \rho_3(currency\_shock\_Importer_i) \\ &+ \rho_4(Management_i) + \rho_5(High\_Concentration_i) * (Currency\_shock_i) \\ &+ \rho_6(Operations\_Break\_shock_i) + \rho_7(Operations\_Break\_shock_i) * (Management_i) \\ &+ \rho_8(Exporter_i) + \rho_{13}(currency\_shock_Exporter_i) + \epsilon_{it} \end{aligned} \tag{5}$$

5.1 currency shocks, Management and Productivity in Ethiopia

The specification above designed to understand the impact of currency shocks includes a self-reported measure of shocks to production (a break in operations because of a shortage of materials) to examine the robustness of the relationship between management practices and the ability to deal with shocks[15]. Note that the currency shock directly affects importers (and exporters) and does not affect non-importers or non-exporters, while the self-reported measure of operations breaks affects all firms.

We also compare these estimates to the specification that uses labor productivity as our measure of productivity as in Equation 3 augmented by our measures of shocks and additional variables as above. Furthermore, following Amiti et al. (2018), we also include measures of concentration (Herfindahl) to proxy for competitiveness, also interacted with the currency shock. Specifically, we interact the currency shock with a dummy indicator for high concentrated industries (with a Herfindahl index in the 75th percentile, equal to 0.25).We describe the impact of these variables and explain the use of the addition of the 'Letter of Credit' variable below.

Table 5a and Table 5b present the results for Ethiopia, using the measure of currency shocks based on official and the parallel market rates respectively.The first two rows of both tables capture the effects of using imported inputs; this effect is strongly significant and positive for firms that directly import inputs. The effect of the currency shock for firms that use imported inputs or 'Importers' is positive and significant. Note that the shock is zero for non-importers. The coefficients on the exchange-rate shock are positive and similar in size across all four measures of productivity within each table, ranging from 0.05-0.08 using the official rate measure versus 0.01 using the parallel market measure. The magnitude of the coefficients is smaller with the use of the parallel market rates, suggesting that the use of the parallel market goes a considerable way to ease the effect of the rationing of foreign exchange.

[15]The specification for the Ugandan case is a simpler version of the equation below, and includes only the currency shocks to both importers and exporters. However, we will re-estimate the specification for the Ethiopian case using the simpler specification together with revenue-based TFP in order to compare the two countries.

The coefficient on the interaction of the shock with a dummy for "high concentration" or an HHI in the 75th percentile, is sharply negative and significant in both tables, suggesting that the exchange-rate shock is muted in highly concentrated industries. The results we see here are consistent with the competitiveness hypothesis, which suggests that exchange rate depreciations boost productivity in the more competitive (or less concentrated) industries. Being an exporter is also associated with higher productivity but only significantly so using the TFP(LP) and TFP(FE) estimates in both tables, while the effect of the currency shock on exporters is negligible.

A key interest lies in the effect of good management: do better managed firms manage shocks better too? The direct effect of management is positive and significant in both Table 5a and Table 5b for the LP and FE estimates: clearly, good management is associated with higher productivity. However, it does little to mitigate the effects of an operations break on productivity, whose potential negative effect on productivity is significant only in the case of the FE estimates.

In summary, the impact of official currency shocks is important and significant and heterogeneous across firms, with weaker effects on importers in highly concentrated industries. It is also clear that the use of the parallel market mutes the effect of currency shocks. The direct effect of good management on productivity is large but there is little evidence that it affects firms exposed to shocks differently[16].

5.2 currency shocks and Productivity in Ethiopia and Uganda

Table 5c - Table 5e offer estimates of the effect of exchange-rate shocks on productivity calculated using sales revenues rather than quantities. Table Table 5c reproduces the previous estimates in Table 5a using this alternative calculation. The effects of the currency shock are similar to Table 5a across all measures but only significant for the yl and FE estimates. As before, the effects of higher concentration weaken the positive effects on productivity (noisily estimated but of similar magnitude for the FE estimates) of depreciations. The main difference is that the effects of using imported inputs (Importer) are now positive and strongly significant for the LP and FE estimates[17]. Finally, the direct effect of management remains large and significant but again, only in the case of the yl and FE estimates.

We now turn to a simplified specification presented below for estimating the effects of currency

[16] We also examined whether it mitigated the effect of currency shocks but this was negligible in every specification and has been omitted from the tables in the interests of clarity.

[17] Oddly, the effect of being an exporter seem to be negative in the case of the OP estimates using the TFP based on sales. It is also the case that the OP estimates seem to be noisier than every other estimate.

shocks on productivity that allows us to directly compare the results for Uganda[18], where we have no data on management or breaks in operations.

$$\begin{aligned} tfp_i =& \alpha_{ISIC} + \rho_1(Indirect_Importer_i) + \rho_2(Direct_Importer_i) + \rho_3(currency\_shock\_Importer_i) \\ &+ \rho_4(High\_Concentration_i) * (Currency\_shock_i) + \rho_5(Exporter_i) \\ &+ \rho_6(currency\_shock_Exporter_i) + \epsilon_{it} \end{aligned} \tag{6}$$

The results of the comparison between Table 5d and Table 5e for Ethiopia using the simplified specification suggests that the effects of the exchange-rate shock are now noisily estimated except for the yl and TFP(FE) estimates that remain unchanged in the case of shocks measured using the official and parallel rates. They retain similar magnitudes and significance, with the effects of the parallel rate shock being smaller as before and only significant in the case of the FE estimates. The effects of using imported inputs are strong and positive for both direct and indirect importers as are the effects of being an exporter, except in the case of TFP(OP) where the effect of exporting seems oddly perverse and negative as before in Table 5e

We are now in a position to compare the effects of currency shocks (both import and export) in Uganda. The effects of both shocks are negligible, including in the TFP(FE) and yl regressions but the effects of being an importer are significant only in the yl estimates. For exporters, there is a strong positive association with productivity across all the estimates of productivity. Given the robustness of the TFP(FE) and yl estimates in Table 5d-Table 5e for Ethiopia, we cautiously conclude that currency shocks have little effect in Uganda but do matter in Ethiopia, particularly using the official rates to measure the currency shocks. The use of the parallel market helps to shelter firms from productivity shocks in Ethiopia.

6 Conclusion

We use data from a detailed survey of firms in Ethiopia (2015-2017) and the Corporate Income Tax Data from Uganda (2010-2017), together with administrative data from the Customs and Revenue Authorities in both countries, to examine the impact of firm-specific currency shocks on firm productivity. In addition, in the Ethiopian case, we also administered a survey to capture management practices which allows us to ask whether better management mitigates the effect of shocks on firms.

[18] We do not distinguish between direct and indirect importers in Uganda since the number of firms that do not import directly is very small.

We find that better management has strong direct effects on productivity: better-managed firms are significantly more productive. But better management does little to mitigate the effects of shocks. We find strong effect of exchange-rate shocks on productivity: depreciations raise productivity. However this is offset in major part if firms are in a less competitive sector. The shock is prominent if measured using the official rate - but is far smaller if the parallel market rate is used to measure the intensity of the shock in Ethiopia, under its current exchange rate regime. In contrast, in the case of Uganda, where the exchange rate is determined as a floating rate in the market, we cautiously conclude that currency shocks have no effect on productivity- where the caution is due to the potentially noisy effects of using sales revenues to estimate productivity.

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Table 1 Summary statistics

	p25	mean	p50	p75	count
firms that use only Domestic inputs					
TFP(Levinsohn-Petrin)	5.99	6.53	6.55	7.06	1175
TFP(Olley-Pakes)	3.48	3.90	3.95	4.39	1175
TFP(Fixed Effects)	-0.88	-0.18	-0.19	0.59	1175
Labour Productivity	11.12	12.25	12.22	13.47	1175
Share of Imported Inputs	0.00	0.00	0.00	0.00	1175
Total Employment	13.00	60.66	19.00	38.25	1175
Admin-Tech Share	0.12	0.27	0.22	0.39	1174
Management score (z-score)	-0.55	0.10	0.18	0.78	631
Concentration (HHI)	0.08	0.27	0.24	0.40	1175
Product Diversification (HHI)	0.08	0.39	0.26	0.66	1175
Current Main Constraint:Materials	0.00	0.59	1.00	1.00	1014
Last Year's Main Constraint:Materials	0.00	0.59	1.00	1.00	873
Op break-Materials/Forex shortage	0.00	0.17	0.00	0.00	1175
Government Owned	0.00	0.02	0.00	0.00	1175
Exporter	0.00	0.04	0.00	0.00	1175
firms that use Imported Inputs					
TFP(Levinsohn-Petrin)	6.25	6.78	6.80	7.31	2373
TFP(Olley-Pakes)	3.56	3.93	3.98	4.35	2373
TFP(Fixed Effects)	-0.48	0.24	0.28	0.98	2373
Labour Productivity	11.80	12.85	12.90	13.95	2373
Share of Imported Inputs	0.05	0.47	0.40	0.95	2373
Total Employment	15.00	134.04	30.50	96.25	2373
Admin-Tech Share	0.13	0.29	0.25	0.40	2213
Management score (z-score)	-0.40	0.26	0.37	0.95	996
Concentration (HHI)	0.07	0.23	0.15	0.37	2373
Product Diversification (HHI)	0.06	0.36	0.17	0.56	2373
Current Main Constraint:Materials	0.00	0.66	1.00	1.00	1958
Last Year's Main Constraint:Materials	0.00	0.65	1.00	1.00	1713
Op break-Materials/Forex shortage	0.00	0.09	0.00	0.00	2373
Government Owned	0.00	0.03	0.00	0.00	2373
Exporter	0.00	0.06	0.00	0.00	2373
All fims					
TFP(Levinsohn-Petrin)	6.16	6.69	6.72	7.24	3548
TFP(Olley-Pakes)	3.54	3.92	3.97	4.36	3548
TFP(Fixed Effects)	-0.65	0.10	0.11	0.86	3548
Labour Productivity	11.54	12.65	12.69	13.81	3548
Share of Imported Inputs	0.00	0.31	0.05	0.68	3548
Total Employment	14.00	109.74	24.75	72.00	3548
Admin-Tech Share	0.13	0.28	0.24	0.40	3387
Management score (z-score)	-0.48	0.20	0.28	0.89	1627
Concentration (HHI)	0.07	0.24	0.17	0.40	3548
Product Diversification (HHI)	0.07	0.37	0.20	0.58	3548
Current Main Constraint:Materials	0.00	0.64	1.00	1.00	2972
Last Year's Main Constraint:Materials	0.00	0.63	1.00	1.00	2586
Op break-Materials/Forex shortage	0.00	0.12	0.00	0.00	3548
Government Owned	0.00	0.03	0.00	0.00	3548
Exporter	0.00	0.06	0.00	0.00	3548
Observations	3548				

Table 2a Productivity Estimates(16-17)-Ethiopia

	(1) TFP-OP	(2) TFP-LP	(3) TFP-FE	(4) yl
Ln(Production Workers)	0.09***	0.07***	0.08*	
	(0.03)	(0.02)	(0.05)	
Ln(Admin Tech Workers)	0.24***	0.19***	0.18***	
	(0.03)	(0.02)	(0.06)	
Ln(Value of Inputs)	0.51***	0.45***	0.30***	
	(0.03)	(0.06)	(0.05)	
Ln(Book Value of Capital)	0.18***	0.11***	0.14***	
	(0.06)	(0.04)	(0.04)	
Importer	0.11	0.05	0.12*	
	(0.08)	(0.06)	(0.07)	
Exporter	0.05	-0.07	0.01	
	(0.04)	(0.16)	(0.20)	
ln(Capital/Labour)				0.12***
				(0.01)
ln(Materials/Labour)				0.58***
				(0.03)
ln(Labour)				0.02
				(0.02)
Admin-Tech Share				0.61***
				(0.10)
Constant			8.34***	4.08***
			(0.84)	(0.24)
Observations	2289	3548	3548	4135

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2b Productivity Estimates-sales (16-17) Ethiopia

	(1) TFP-OP	(2) TFP-LP	(3) TFP-FE
lwage	0.19***	0.18***	0.15***
	(0.02)	(0.01)	(0.03)
Ln(Value of Inputs)	0.53***	0.41***	0.31***
	(0.03)	(0.05)	(0.05)
Ln(Book Value of Capital)	0.23***	0.13***	0.11***
	(0.04)	(0.02)	(0.03)
Importer	-0.04	0.09*	0.12*
	(0.13)	(0.05)	(0.06)
Exporter	-0.17	0.00	-0.13
	(0.23)	(0.17)	(0.21)
Constant			7.11***
			(0.92)
Observations	2670	4289	4289

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2c Correlations across different productivity measures

	(1)						
	TFP(LP)	TFP(OP)	TFP(FE)	TFP_sales(LP)	TFP_sales(OP)	TFP_sales(FE)	yl
TFP(LP)	1						
TFP(OP)	0.880***	1					
TFP(FE)	0.964***	0.753***	1				
TFP_s(LP)	0.417***	0.503***	0.346***	1			
TFP_s(OP)	0.408***	0.504***	0.333***	0.998***	1		
TFP_s(FE)	0.592***	0.307***	0.696***	0.666***	0.652***	1	
yl	0.764***	0.548***	0.850***	0.215***	0.205***	0.622***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2d Productivity Dispersion by Industry: Ethiopia

	(1)				
	mcount	p90	p10	d90_10	ratio_90_10
Other food and beverage	365	8.23	5.96	2.27	9.73
Flour mills	422	7.67	6.31	1.36	3.91
Baked goods	211	7.38	5.52	1.87	6.48
Textiles	123	7.88	5.43	2.45	11.59
Wearing apparel	65	7.60	5.46	2.14	8.47
Leather and Footwear	116	7.64	5.65	1.99	7.30
Wood/sawmills	89	7.48	5.83	1.64	5.16
Printing/publishing	140	7.49	5.71	1.78	5.91
Chemicals	143	7.95	6.01	1.93	6.92
Plastics and Rubber	281	7.66	5.57	2.09	8.10
Concrete and Cement	406	7.68	5.43	2.25	9.46
Stone	1053	7.57	5.54	2.03	7.59
Machinery	80	8.26	5.74	2.53	12.54

Figure 1 Kernel densities of TFP estimates

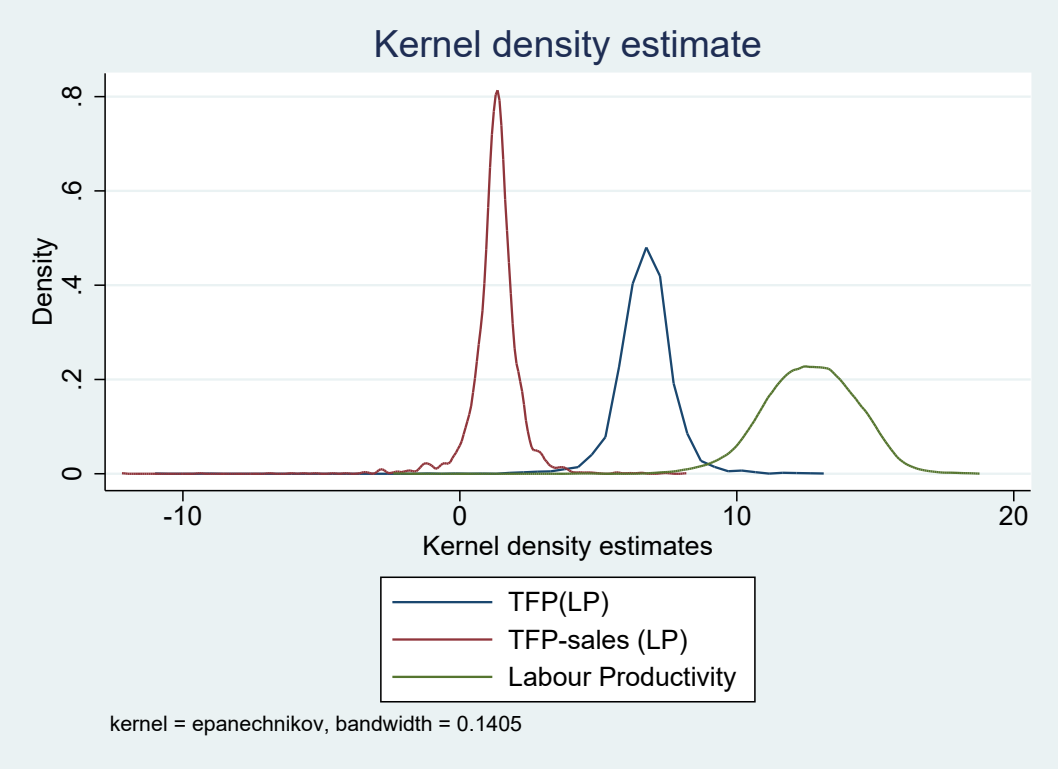
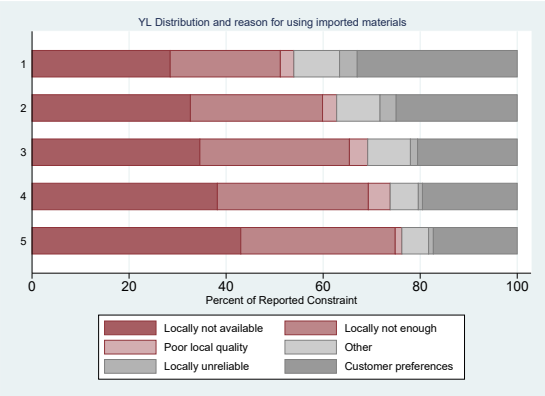
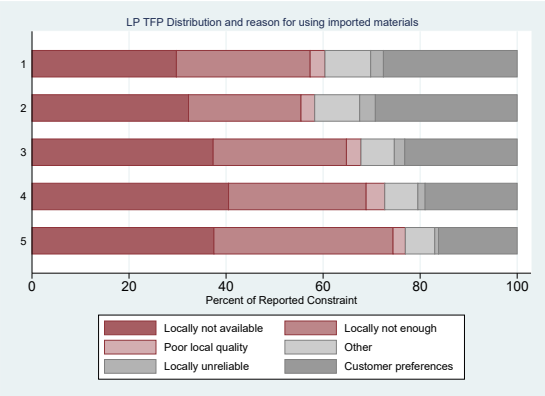


Figure 2 Productivity distribution by reported constraint: imported materials

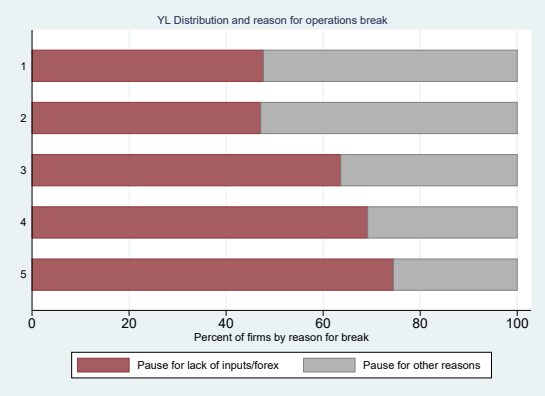


(a) Productivity: yl

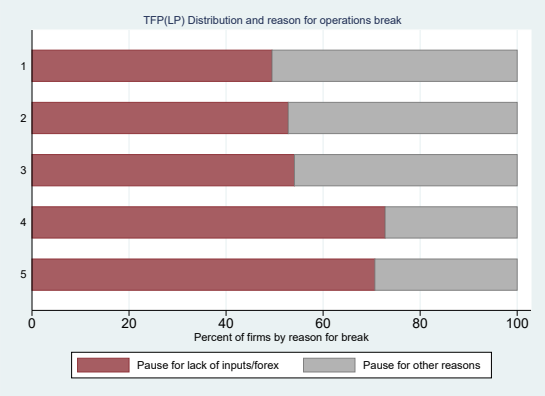


(b) Productivity: LP

Figure 3 Productivity distribution by reported reason for breaks in operation

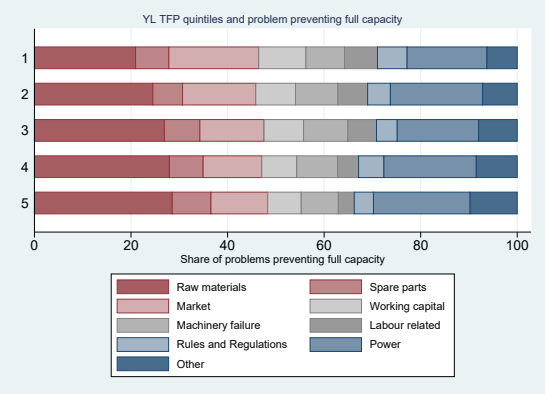


(a) Productivity: yl

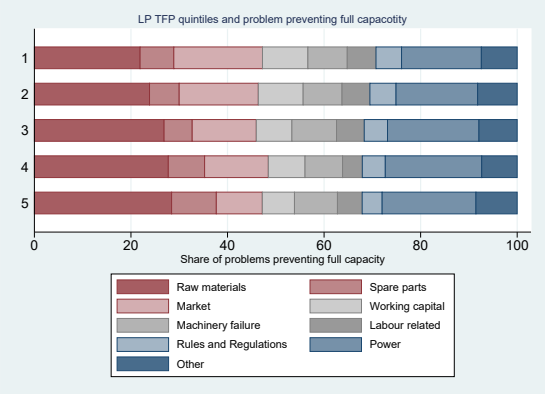


(b) Productivity: LP

Figure 4 Productivity distribution by reported reason for operating under capacity

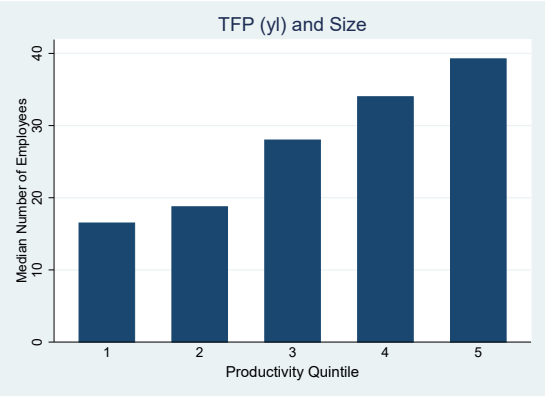


(a) Productivity: yl

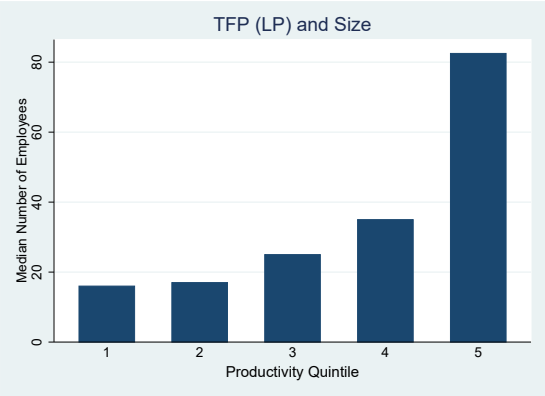


(b) Productivity: LP

Figure 5a Productivity distribution by firm size

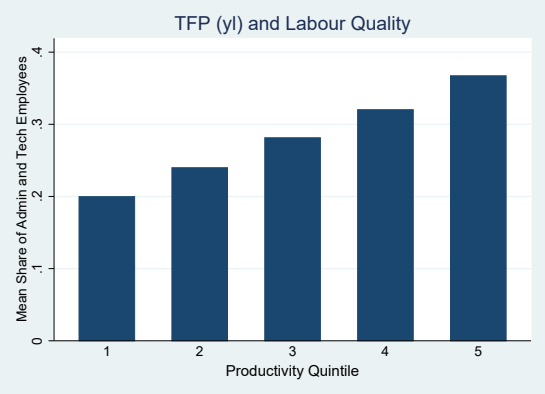


(a) Productivity: yl

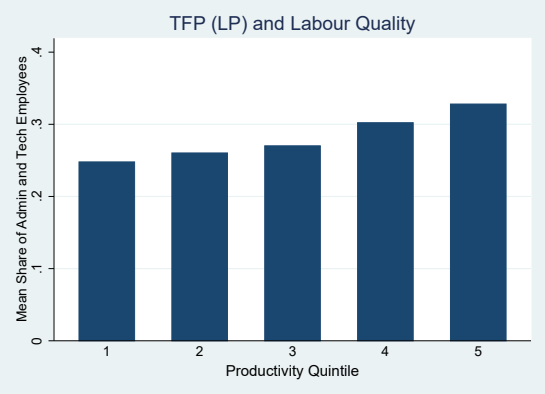


(b) Productivity: LP

Figure 5b Productivity distribution by share of administration workers

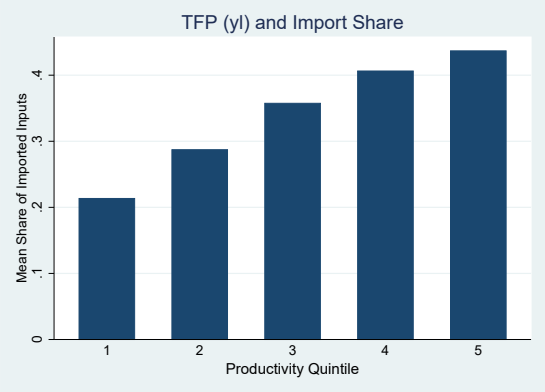


(a) Productivity: yl

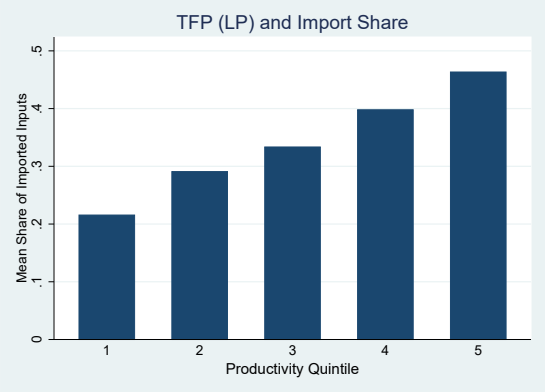


(b) Productivity: LP

Figure 5c Productivity distribution by share of imported inputs

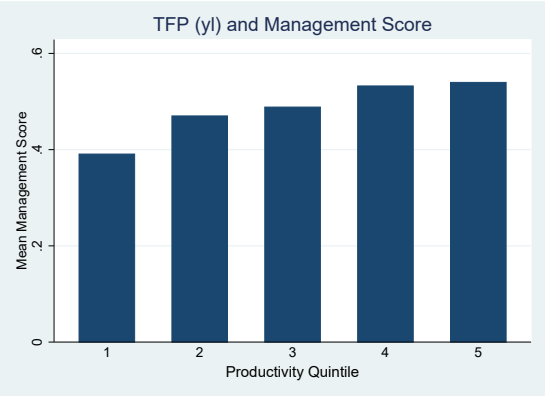


(a) Productivity: yl

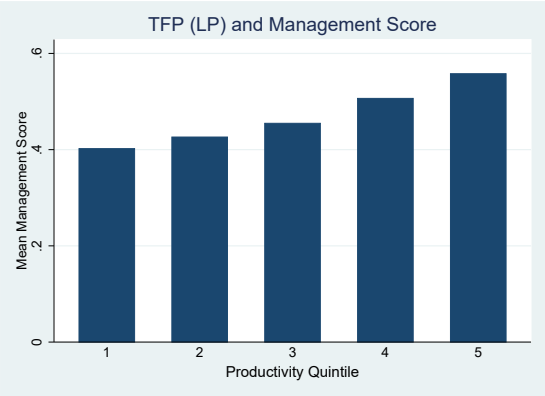


(b) Productivity: LP

Figure 5d Productivity distribution by management score

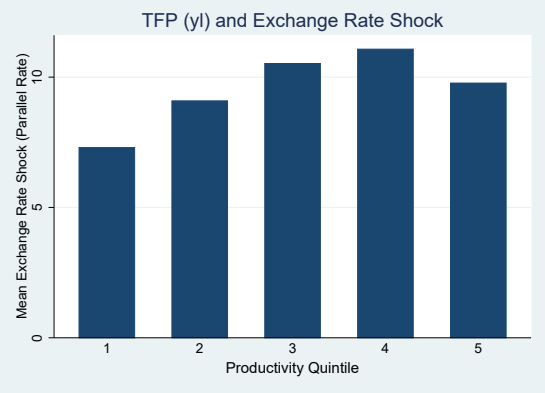


(a) Productivity: yl

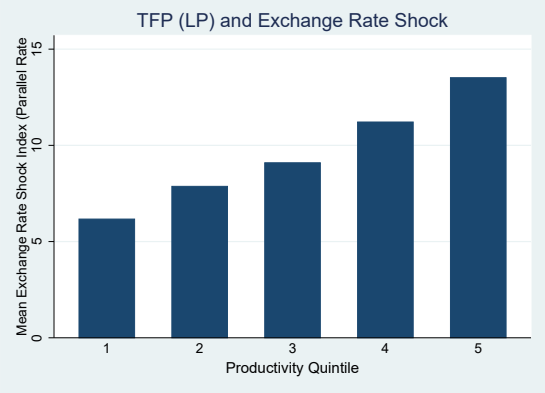


(b) Productivity: LP

Figure 5e Productivity distribution and exposure to parallel market currency shock

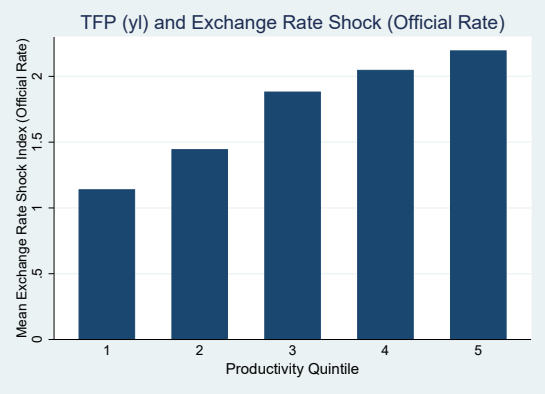


(a) Productivity: yl

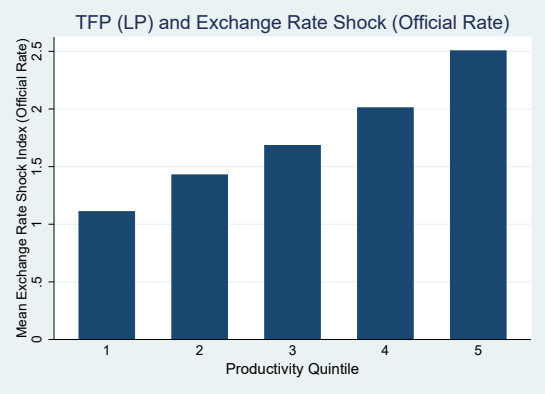


(b) Productivity: LP

Figure 5f Productivity distribution and exposure to official market exchnage rate shock

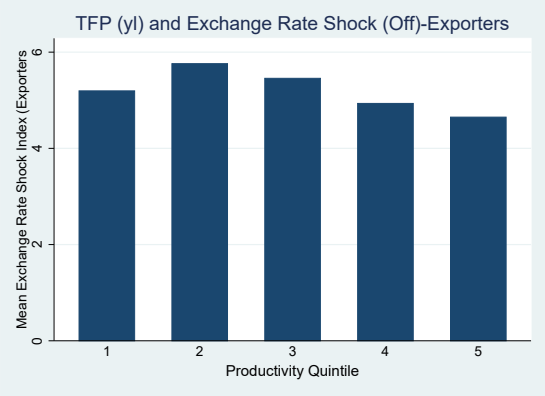


(a) Productivity: yl

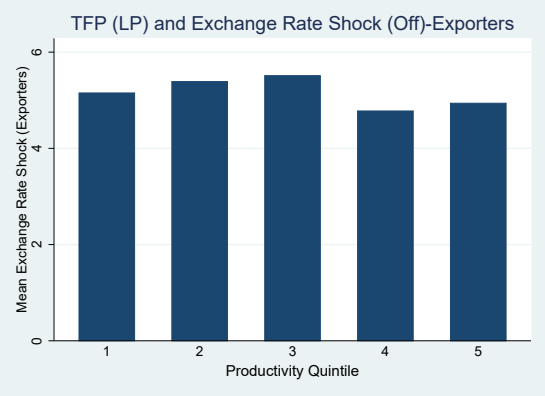


(b) Productivity: LP

Figure 5g Productivity distributionand exposure to official market exchnage rate shock: exporters



(a) Productivity: yl



(b) Productivity: LP

Table 3 Summary statistics: Uganda

	p25	mean	p50	p75	count
Domestic inputs					
TFP(Levinsohn-Petrin)	2.45	2.74	2.72	3.03	4331
TFP(Olley-Pakes)	0.29	0.56	0.54	0.80	4331
TFP(Fixed Effects)	-0.50	-0.05	0.02	0.51	3953
yl	2.16	3.05	2.97	3.87	4138
salaries and wages	6212220.00	2.07e+08	21950000.00	80550000.00	4331
Sales/Salary	8.64	53.29	19.56	47.78	4138
Raw Materials/Salary	5.07	43.58	13.03	35.30	4007
Benefits/Salary	0.00	0.12	0.00	0.09	4331
Exporter	0.00	0.22	0.00	0.00	4331
Imported Inputs					
TFP(Levinsohn-Petrin)	2.68	2.90	2.91	3.13	1833
TFP(Olley-Pakes)	0.34	0.55	0.53	0.75	1833
TFP(Fixed Effects)	-0.23	0.19	0.29	0.73	1700
yl	2.73	3.55	3.50	4.34	1807
salaries and wages	20066000.00	2.81e+08	63418500.00	1.99e+08	1833
Sales/Salary	15.36	79.86	33.01	76.75	1807
Raw Materials/Salary	9.26	61.12	21.38	53.38	1807
Benefits/Salary	0.00	0.43	0.03	0.14	1833
Exporter	0.00	0.43	0.00	1.00	1833
Total					
TFP(Levinsohn-Petrin)	2.51	2.79	2.78	3.07	6164
TFP(Olley-Pakes)	0.31	0.56	0.54	0.79	6164
TFP(Fixed Effects)	-0.43	0.02	0.09	0.58	5653
yl	2.31	3.20	3.15	4.00	5945
salaries and wages	8140000.00	2.29e+08	30596500.00	1.19e+08	6164
Sales/Salary	10.07	61.36	23.24	54.61	5945
Raw Materials/Salary	6.04	49.03	15.21	40.79	5814
Benefits/Salary	0.00	0.21	0.00	0.10	6164
Exporter	0.00	0.29	0.00	1.00	6164
Observations	6164				

Table 4a Productivity Estimates 2010-2017: Uganda

	(1)	(2)	(3)	(4)
	OP	LP	FE	yl
Ln(Salary)	0.16***	0.17***	0.33***	0.01**
	(0.04)	(0.01)	(0.02)	(0.00)
Ln(Raw Materials)	0.70***	0.64***	0.32***	
	(0.04)	(0.02)	(0.02)	
Ln(Total Capital)	0.17***	0.10***	0.15***	
	(0.05)	(0.02)	(0.02)	
Importer	0.13*	0.05***	0.07*	
	(0.08)	(0.02)	(0.03)	
Exporter	0.08	0.08***	0.01	
	(0.05)	(0.02)	(0.03)	
kl				0.08***
				(0.01)
ml				0.80***
				(0.01)
Benefits/Salary				0.00
				(0.00)
Constant			4.08***	0.70***
			(0.51)	(0.07)
Observations	422	6164	5635	5141

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4b Productivity Estimates 16-17: Uganda

	(1)	(2)	(3)	(4)
	TFP-OP	TFP-LP	TFP-FE	yl_1617
Ln(Salary)	0.24***	0.18***	0.35***	0.01**
	(0.05)	(0.01)	(0.03)	(0.00)
Ln(Raw Materials)	0.64***	0.65***	0.34***	
	(0.05)	(0.03)	(0.03)	
Ln(Total Capital)	0.09	0.09***	0.14***	
	(0.07)	(0.02)	(0.03)	
Importer	0.14	0.05**	0.06	
	(0.12)	(0.03)	(0.05)	
Exporter	0.08	0.09**	0.07	
	(0.10)	(0.04)	(0.05)	
kl				0.08***
				(0.01)
ml				0.80***
				(0.01)
Benefits/Salary				0.00
				(0.00)
Constant			3.37***	0.70***
			(0.59)	(0.07)
Observations	239	4318	3938	5141

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4c Correlations across different productivity measures

	(1)						
	TFP(LP)	TFP(OP)	TFP(FE)	TFP(LP)16-17	TFP(OP)16-17	TFP(FE)16-17	yl
TFP(LP)	1						
TFP(OP)	0.837***	1					
TFP(FE)	0.627***	0.510***	1				
TFP(LP)16-17	0.999***	0.841***	0.628***	1			
TFP(OP)16-17	0.975***	0.898***	0.585***	0.978***	1		
TFP(FE)16-17	0.612***	0.528***	0.997***	0.615***	0.584***	1	
yl	0.510***	0.263***	0.188***	0.497***	0.557***	0.171***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4d Productivity Dispersion by Industry: Uganda

	(1)				
	mcount	p90	p10	d90_10	ratio_90_10
Food Processing	590	3.33	2.15	1.18	3.24
Flour Mills	378	3.34	2.29	1.06	2.87
Baked goods	996	3.39	2.20	1.19	3.28
Beverages	762	3.28	1.84	1.44	4.22
Apparel and Footwear	551	3.19	1.96	1.22	3.40
Wood	243	3.15	1.86	1.29	3.63
Paper	366	3.07	1.91	1.17	3.21
Printing	2048	3.00	2.02	0.98	2.66
Chemicals	671	3.13	2.16	0.97	2.64
Rubber	370	3.12	2.27	0.85	2.35
Non-metallic minerals	271	3.56	1.83	1.73	5.66
Basic metals	323	3.40	2.11	1.29	3.62
Fabricated Metal	377	3.08	2.11	0.97	2.63
Machinery	213	3.22	1.99	1.23	3.44
Furniture	246	3.04	2.10	0.94	2.56
Parts and Repairs	10167	3.32	2.15	1.17	3.23

Figure 6 Kernel densities of TFP estimates: Uganda

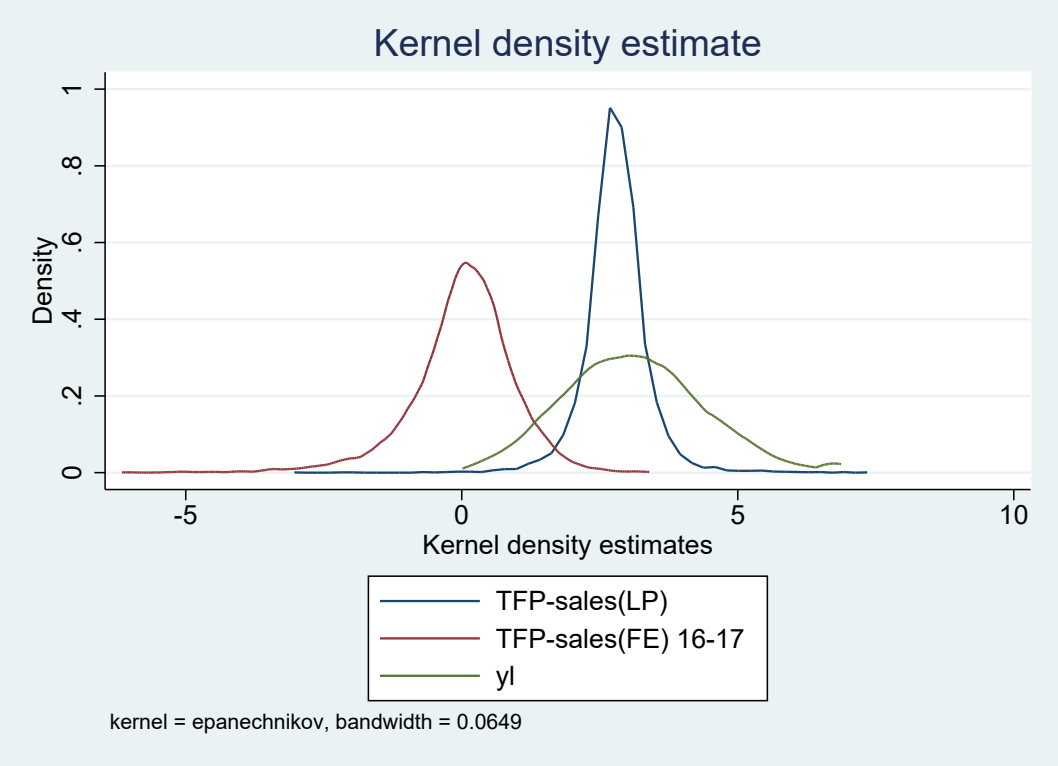
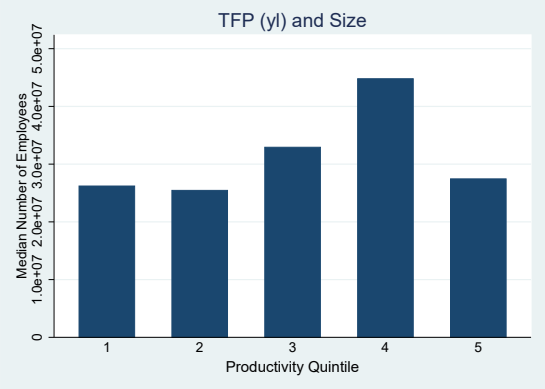
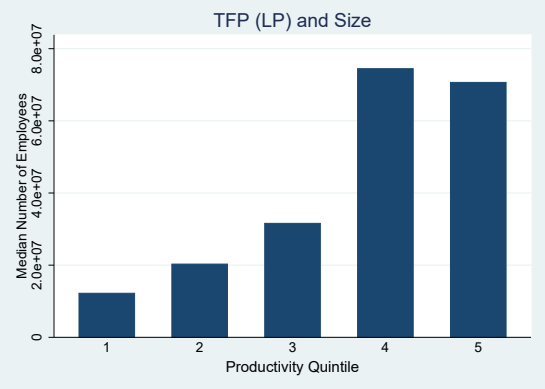


Figure 7a Productivity distribution by size of firms: Uganda

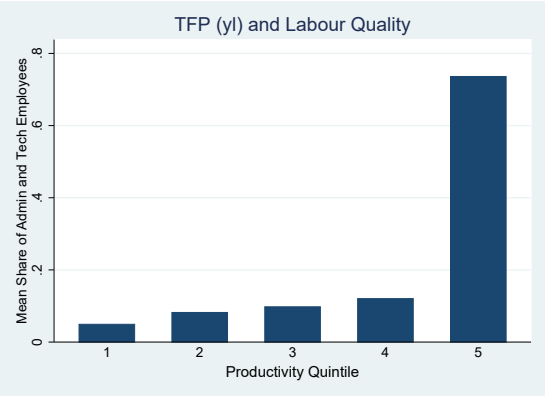


(a) Productivity: yl

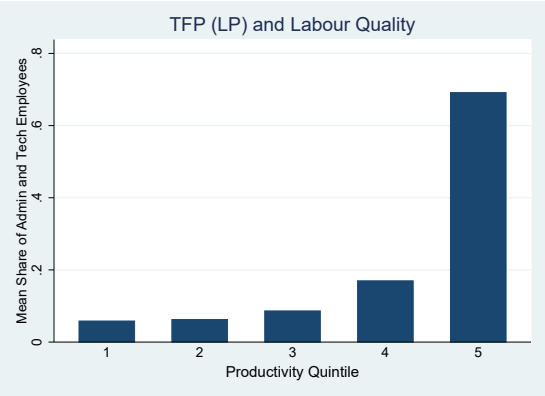


(b) Productivity: LP

Figure 7b Productivity distribution by share of administration workers: Uganda

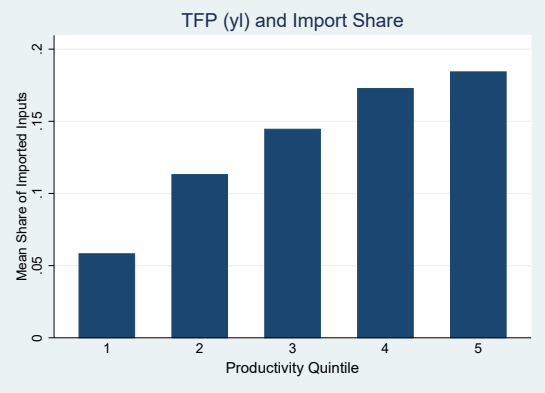


(a) Productivity: yl

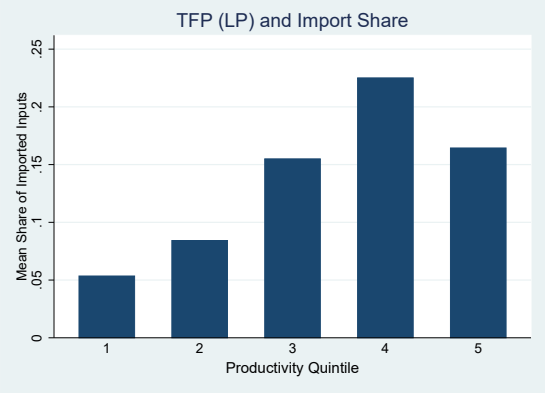


(b) Productivity: LP

Figure 7c Productivity distribution by importing status of firms: Uganda

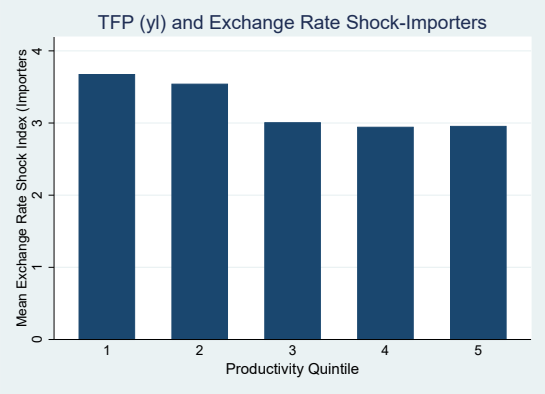


(a) Productivity: yl

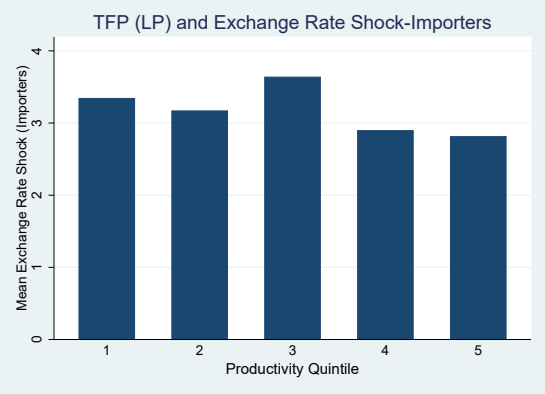


(b) Productivity: LP

Figure 7d Productivity distribution by and import shock exposure: Uganda

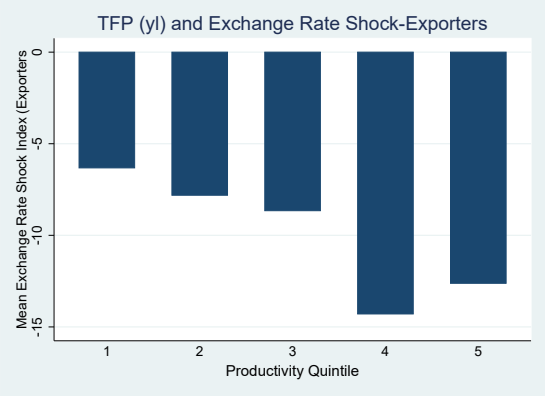


(a) Productivity: yl

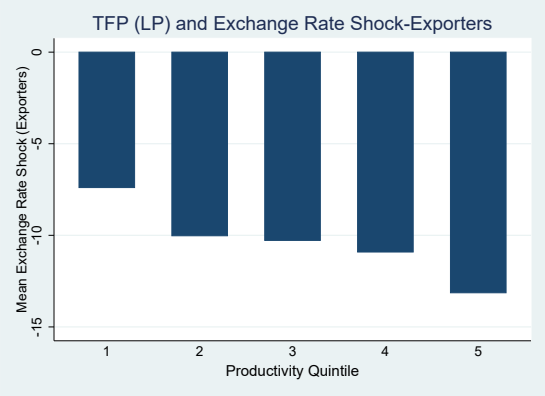


(b) Productivity: LP

Figure 7e Productivity distribution and export shock exposure: Uganda



(a) Productivity: yl



(b) Productivity: LP

Table 5a Currency Shocks (official rate), Operations Shocks and Management on TFP-Ethiopia

	(1)	(2)	(3)	(4)
	YL	TFP-LP	TFP-OP	TFP-FE
Indirect Importer	0.01	0.05	-0.00	0.12
	(0.07)	(0.07)	(0.07)	(0.07)
Direct Importer	0.18*	0.35***	0.05	0.57***
	(0.10)	(0.10)	(0.09)	(0.10)
ER Shock (official)	0.06***	0.07***	0.05***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)
Management score (z-score)	0.05*	0.13***	-0.02	0.20***
	(0.03)	(0.03)	(0.03)	(0.03)
High Con*ER Shock (Off)	-0.05**	-0.06**	-0.06**	-0.06*
	(0.03)	(0.03)	(0.03)	(0.03)
Op break-Materials/Forex shortage	0.01	-0.09	0.03	-0.19**
	(0.10)	(0.09)	(0.10)	(0.10)
Break*Management score	0.10	0.08	0.09	0.07
	(0.08)	(0.08)	(0.08)	(0.09)
Exporter	0.19	0.35***	0.05	0.46***
	(0.13)	(0.13)	(0.13)	(0.15)
ER Shock Export(official)	-0.00	0.01	-0.00	0.02
	(0.02)	(0.03)	(0.02)	(0.03)
ln(Labour)	-0.02			
	(0.04)			
ln(Materials/Labour)	0.53***			
	(0.04)			
ln(Capital/Labour)	0.13***			
	(0.02)			
Admin-Tech Share	0.63***			
	(0.15)			
Constant	4.39***	6.46***	3.87***	-0.24***
	(0.35)	(0.04)	(0.05)	(0.05)
Observations	1467	1468	1468	1468

Standard errors in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5b Currency Shocks (parallel market), Operation Breaks and Management on TFP - Ethiopia

	(1)	(2)	(3)	(4)
	YL	TFP-LP	TFP-OP	TFP-FE
Indirect Importer	0.01	0.05	-0.00	0.12
	(0.07)	(0.07)	(0.07)	(0.08)
Direct Importer	0.17*	0.35***	0.05	0.56***
	(0.10)	(0.10)	(0.10)	(0.10)
ER Rate Shock (parallel)	0.01***	0.01***	0.01**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Management score (z-score)	0.05*	0.13***	-0.02	0.20***
	(0.03)	(0.03)	(0.03)	(0.03)
High Con*ER Shock (Par)	-0.01*	-0.01*	-0.01*	-0.01*
	(0.00)	(0.00)	(0.00)	(0.00)
Op break-Materials/Forex shortage	0.01	-0.09	0.03	-0.19**
	(0.10)	(0.09)	(0.10)	(0.10)
Break*Management score	0.10	0.08	0.09	0.07
	(0.08)	(0.08)	(0.08)	(0.09)
Exporter	0.19	0.35***	0.05	0.46***
	(0.13)	(0.13)	(0.13)	(0.15)
ER Shock Export(parallel)	-0.00	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
ln(Labour)	-0.02			
	(0.04)			
ln(Materials/Labour)	0.53***			
	(0.04)			
ln(Capital/Labour)	0.13***			
	(0.02)			
Admin-Tech Share	0.64***			
	(0.15)			
Constant	4.39***	6.47***	3.88***	-0.24***
	(0.35)	(0.04)	(0.05)	(0.05)
Observations	1467	1468	1468	1468

Standard errors in parentheses

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Table 5c Currency Shocks (official), Operation Breaks and Management on TFP-Sales -Ethiopia

	(1)	(2)	(3)	(4)
	YL	TFP_sales-LP	TFP_sales-OP	TFP_sales-FE
Indirect Importer	0.16**	0.23***	0.16**	0.29***
	(0.07)	(0.07)	(0.07)	(0.08)
Direct Importer	0.28***	0.22**	0.16*	0.75***
	(0.10)	(0.09)	(0.09)	(0.10)
ER Shock (official)	0.04**	0.02	0.02	0.06***
	(0.02)	(0.02)	(0.02)	(0.02)
Management score (z-score)	0.07**	0.00	0.00	0.25***
	(0.03)	(0.03)	(0.03)	(0.03)
High Con*ER Shock (Off)	-0.05*	-0.04*	-0.04*	-0.05
	(0.02)	(0.03)	(0.03)	(0.03)
Op break-Materials/Forex shortage	-0.07	-0.02	-0.02	-0.28**
	(0.13)	(0.13)	(0.13)	(0.13)
Break*Management score	0.11	0.10	0.10	0.09
	(0.09)	(0.09)	(0.09)	(0.09)
Exporter	-0.03	0.04	-0.17	0.31*
	(0.14)	(0.14)	(0.14)	(0.17)
ER Shock Export(official)	0.03	0.03	0.03	0.05
	(0.02)	(0.02)	(0.02)	(0.03)
l_sales	-0.12***			
	(0.02)			
ml_sales	0.55***			
	(0.04)			
kl_sales	0.13***			
	(0.02)			
Admin-Tech Share	-0.01			
	(0.16)			
Constant	2.48***	1.13***	1.13***	-0.26***
	(0.33)	(0.06)	(0.06)	(0.06)
Observations	1461	1462	1462	1462

Standard errors in parentheses

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Table 5d Currency Shocks (official) and TFP-Sales-Ethiopia

	(1)	(2)	(3)	(4)
	YL	TFP_sales-LP	TFP_sales-OP	TFP_sales-FE
Indirect Importer	0.14***	0.21***	0.13***	0.31***
	(0.04)	(0.04)	(0.04)	(0.05)
Direct Importer	0.18***	0.19***	0.13*	0.66***
	(0.07)	(0.07)	(0.07)	(0.08)
ER Shock (official)	0.02**	0.01	0.01	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)
High Con*ER Shock (Off)	-0.03*	-0.02	-0.02	0.00
	(0.02)	(0.01)	(0.01)	(0.02)
Exporter	-0.12	0.02	-0.19**	0.31***
	(0.09)	(0.09)	(0.09)	(0.11)
ER Shock Export(official)	0.02	0.02	0.02	0.08***
	(0.01)	(0.01)	(0.01)	(0.02)
l_sales	-0.07***			
	(0.01)			
ml_sales	0.53***			
	(0.03)			
kl_sales	0.14***			
	(0.01)			
Admin-Tech Share	0.04			
	(0.09)			
Constant	1.80***	1.15***	1.15***	-0.19***
	(0.19)	(0.04)	(0.04)	(0.04)
Observations	3146	3289	3289	3289

Standard errors in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5e Currency Shocks (parallel) and TFP-Sales-Ethiopia

	(1)	(2)	(3)	(4)
	YL	TFP_sales-LP	TFP_sales-OP	TFP_sales-FE
Indirect Importer	0.14***	0.20***	0.12***	0.35***
	(0.04)	(0.04)	(0.04)	(0.05)
Direct Importer	0.17**	0.18**	0.12*	0.66***
	(0.07)	(0.07)	(0.07)	(0.09)
ER Rate Shock (parallel)	0.00	0.00	0.00	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
High Con*ER Shock (Par)	-0.00	-0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Exporter	-0.12	0.02	-0.18**	0.34***
	(0.09)	(0.09)	(0.09)	(0.11)
ER Shock Export(parallel)	0.00	0.00	0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
l_sales	-0.07***			
	(0.01)			
ml_sales	0.53***			
	(0.03)			
kl_sales	0.14***			
	(0.01)			
Admin-Tech Share	0.04			
	(0.09)			
Constant	1.78***	1.15***	1.15***	-0.17***
	(0.19)	(0.04)	(0.04)	(0.04)
Observations	3146	3289	3289	3289

Standard errors in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5f Currency shocks and Productivity-Uganda

	(1)	(2)	(3)	(4)
	yl	TFP(OP)	TFP(LP)	TFP(FE)
Importer	0.053**	0.040	0.032	0.038
	(0.02)	(0.03)	(0.03)	(0.05)
ER Shock (Importer)	0.000	0.001	0.002	0.002
	(0.00)	(0.00)	(0.00)	(0.00)
High Con*ER Shock(Imp)	0.004	0.003	0.003	0.004
	(0.00)	(0.00)	(0.00)	(0.00)
Exporter	0.079**	0.121***	0.290***	0.325***
	(0.03)	(0.04)	(0.04)	(0.07)
ER Shock (Exporter)	0.000	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
kl	0.122***			
	(0.01)			
ml	0.750***			
	(0.02)			
Ln(Salary)	0.012			
	(0.01)			
Benefits/Salary	0.000			
	(0.00)			
Constant	0.577***	0.413***	2.791***	0.118*
	(0.19)	(0.04)	(0.04)	(0.07)
Observations	1339	1434	1434	1336

Standard errors in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Appendices

A Management score and its correlates

Table A1 Management and Firm Size: Ethiopia and the US

	Mean	Std. Dev.	p(10)	p(25)	p(50)	p(75)	p(90)
Ethiopia: Ethiopian Management Survey	0.404	0.209	0.102	0.250	0.422	0.569	0.719
Ethiopia: EMS for estab. $>$ 20 workers	0.501	0.173	0.269	0.401	0.532	0.635	0.716
US: AMS MOPS	0.615	0.172	0.379	0.521	0.648	0.742	0.806
Ethiopia: Establishment size	72.0	164.9	10	12	18	50	160
Ethiopia: Truncated establishment size $>$ 20	144.0	224.9	24	31	56	138	349
US: Establishment size	177.2	398.5	16.8	36.0	86.0	186.0	382.0

Notes: This table reports management scores and firm size distribution for Ethiopia and the US. The management score is an unweighted average across 16 questions, following Bloom et al. (forthcoming). Data for management and firm size for the US from Bloom et al. (forthcoming). Data from Ethiopia from the 2016 CSA LMMS and Ethiopian Management Survey.

Figure A1 Distribution of management practice score for firms with more than 20 employees: Ethiopia

Figure A2 Distribution of management practice score by firm size: Ethiopia

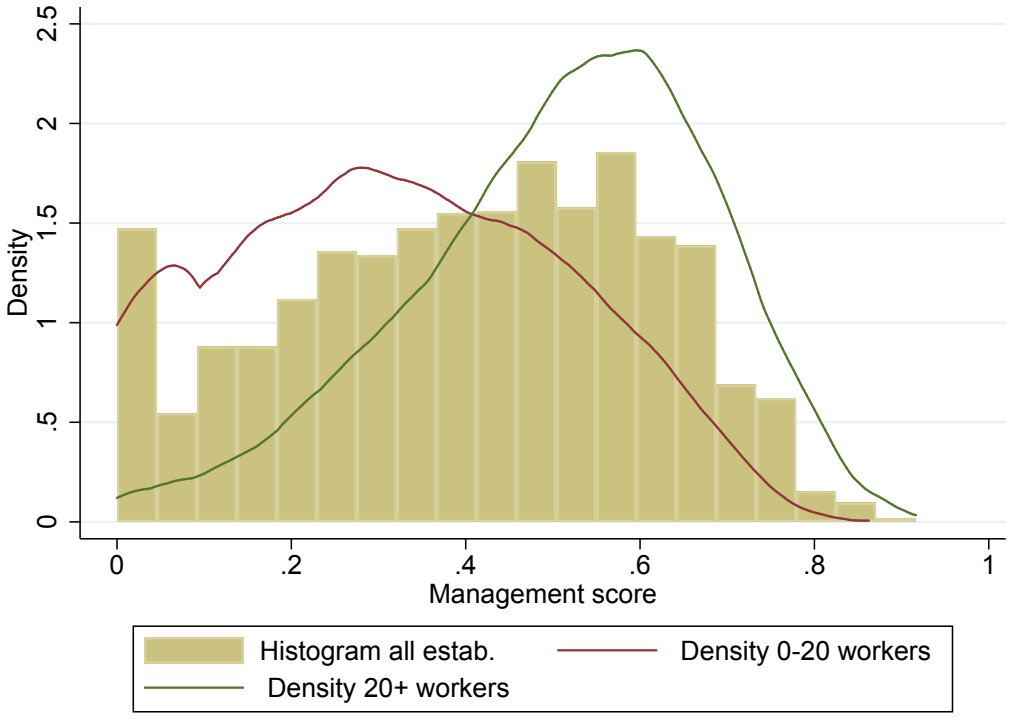


Figure A3 Distribution of management practice score by firm age: Ethiopia

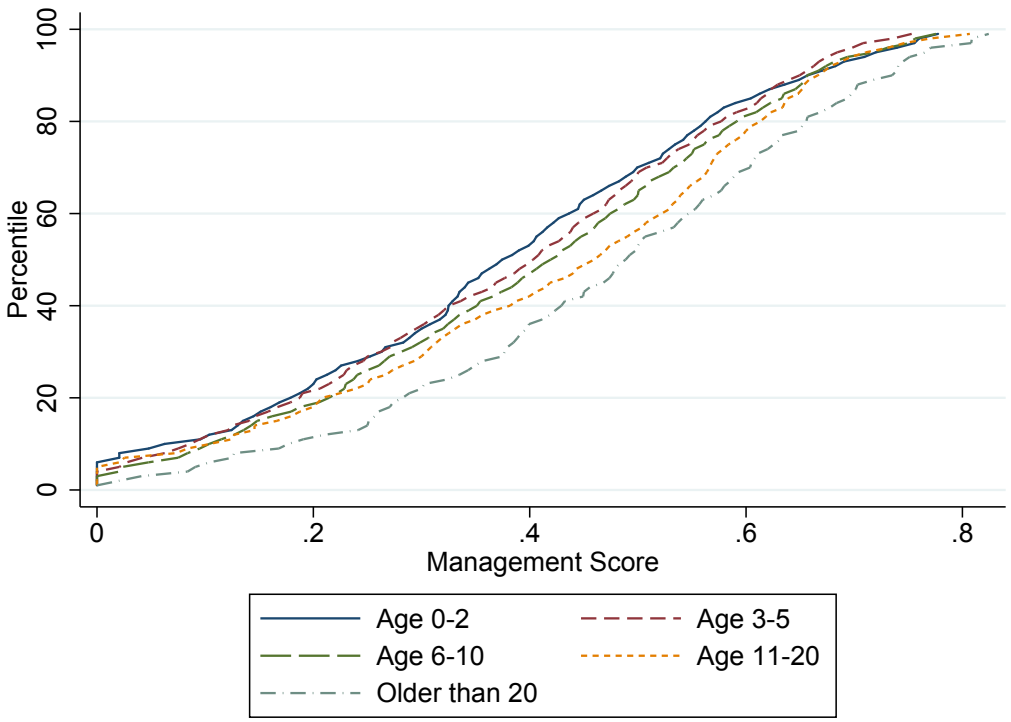


Figure A4 Distribution of management practice score by legal form: Ethiopia

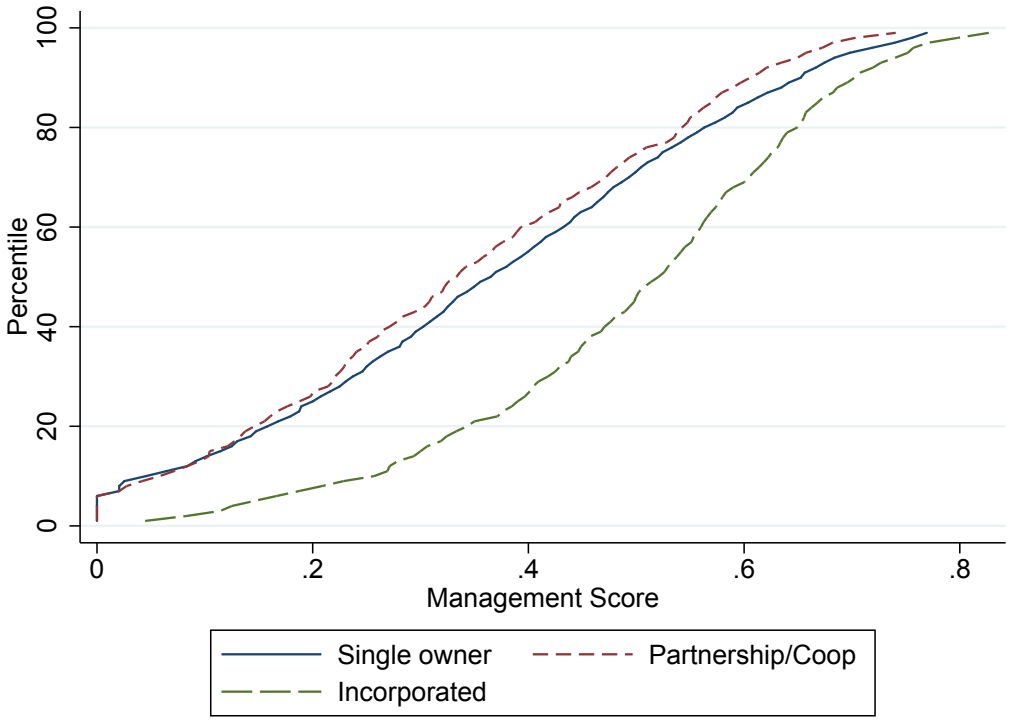


Figure A5 Distribution of management practice score by ownership: Ethiopia

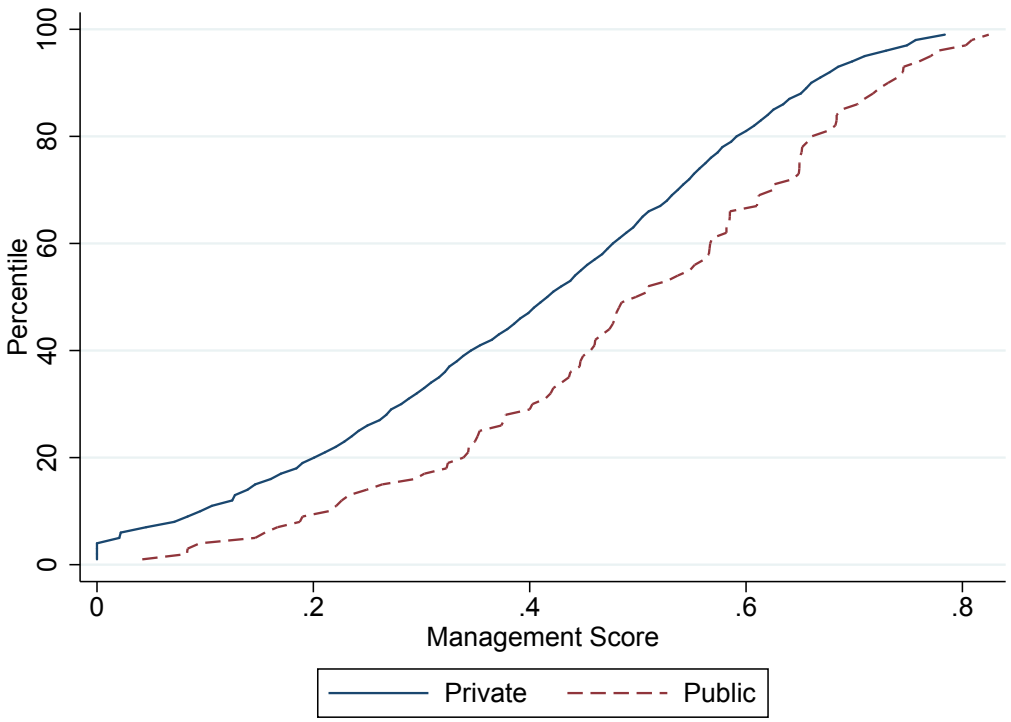


Figure A6 Distribution of management practice score by exporting status: Ethiopia

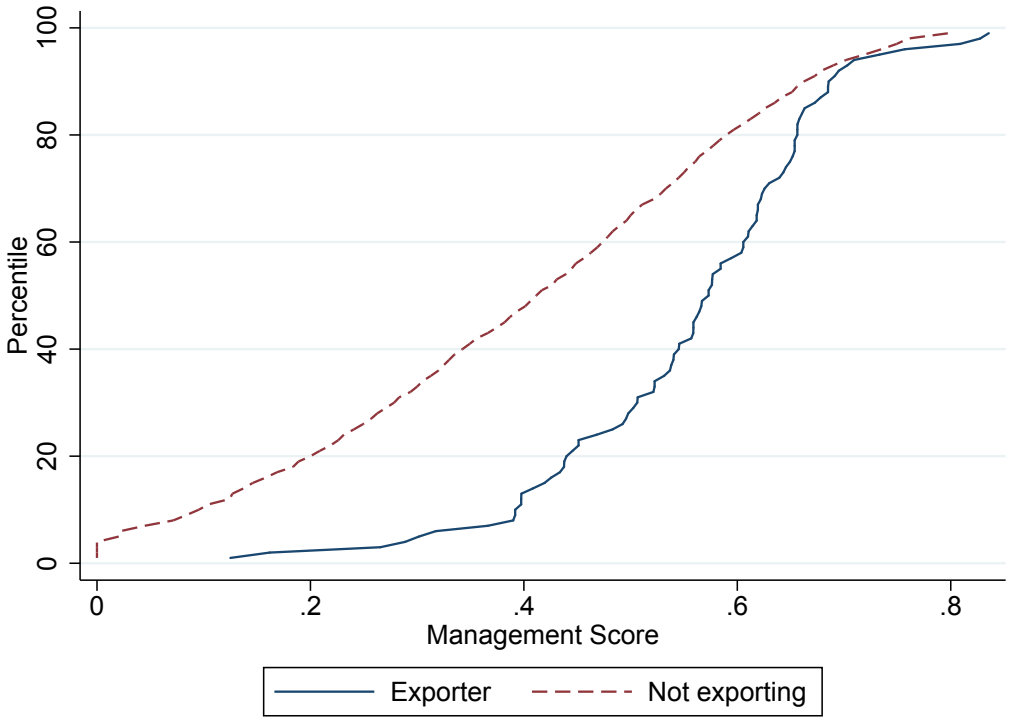


Figure A7 Distribution of management practice score by importing status: Ethiopia

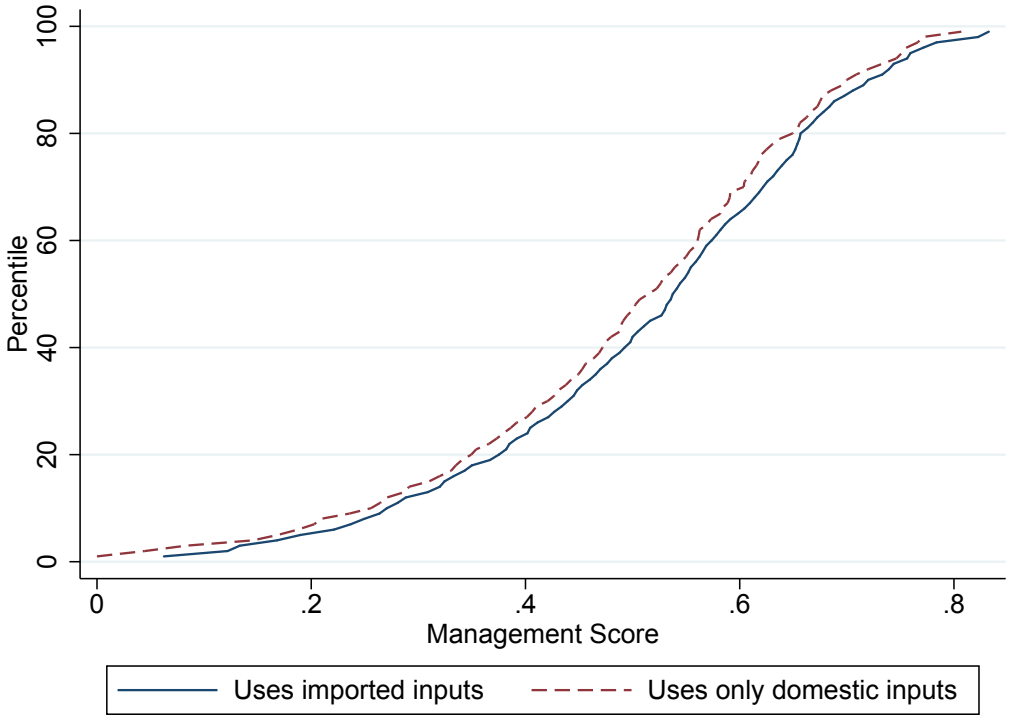


Figure A8 There are no significant differences in management between family and nonfamily owned firms: Ethiopia

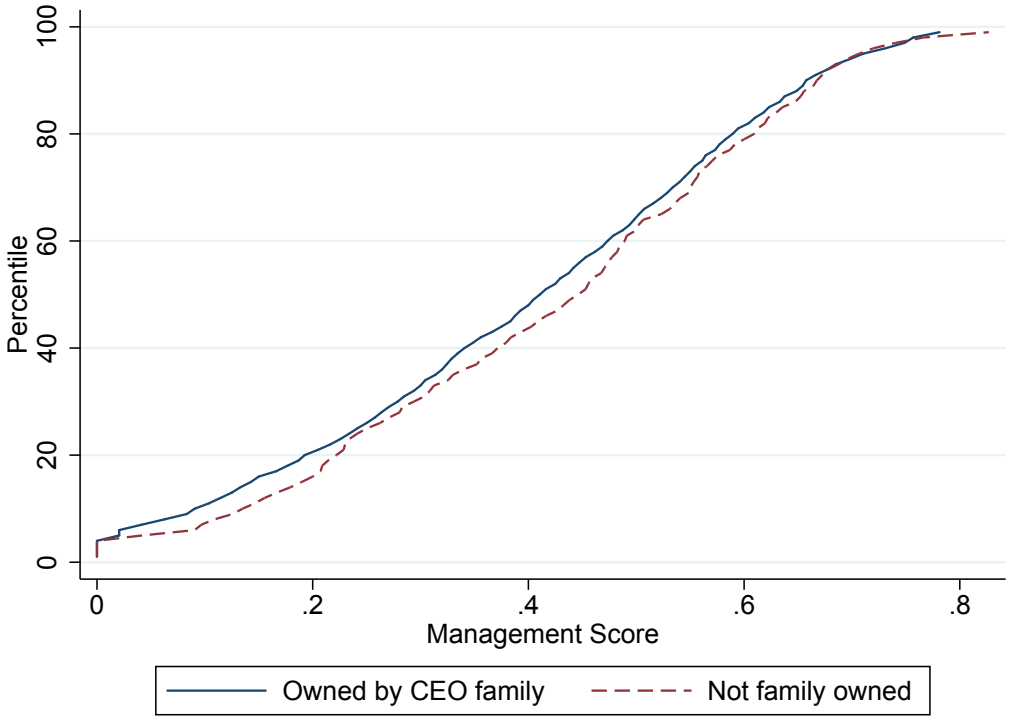


Table A2 Management, productivity, legal form and ownership

Dependent Variable:	Management score				log(Output/Employment)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management					0.267**	0.258**	0.263**	0.230**
					(0.111)	(0.110)	(0.110)	(0.112)
Management × state firm								1.013**
								(0.505)
State firm	0.0845***	0.0287*		0.0374**	-0.146		-0.136	-0.636**
	(0.0184)	(0.0166)		(0.0168)	(0.109)		(0.108)	(0.274)
Legal form: partnership			-0.0164	-0.00900		-0.0259	-0.0280	
			(0.0114)	(0.0109)		(0.0549)	(0.0551)	
Legal form: incorporated			0.0724***	0.0377***		0.0472	0.0371	
			(0.0105)	(0.0103)		(0.0622)	(0.0620)	
Log(Capital/Empl.)					0.128***	0.127***	0.127***	0.129***
					(0.0179)	(0.0181)	(0.0181)	(0.0180)
Log(Materials/Empl.)					0.545***	0.544***	0.544***	0.544***
					(0.0363)	(0.0363)	(0.0363)	(0.0362)
Log(Empl.)		0.0650***		0.0599***	0.00640	-0.00410	0.00200	0.00215
		(0.00384)		(0.00405)	(0.0256)	(0.0279)	(0.0276)	(0.0256)
Share of admin workers					0.640***	0.617***	0.633***	0.636***
					(0.116)	(0.116)	(0.116)	(0.116)
Observations	2,023	2,023	2,023	2,023	1,995	1,995	1,995	1,995

Standard errors in parentheses

Notes: This table reports association between management scores, productivity, ownership and legal status. Omitted categories are private sector firms and individual proprietors. About 5% of firms are public, 23% are partnerships, and 33% are incorporated. Sample are all 2016 LMMS firms with at least 10 non-missing responses to management questions and non-missing output, capital, labour and materials data. Industry fixed effects at the 4-digit ISIC level are included in every specification. Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3 Management, productivity, and family ownership

Dependent Variable:	Management score		log(Output/Employment)	
	(1)	(2)	(3)	(4)
Management			0.253**	0.113
			(0.112)	(0.231)
Management × family owned				0.163
				(0.246)
Family owned	-0.0199*	-0.00165	0.111**	0.0439
	(0.0108)	(0.0101)	(0.0498)	(0.106)
Log(Capital/Empl.)			0.126***	0.126***
			(0.0179)	(0.0179)
Log(Materials/Empl.)			0.545***	0.545***
			(0.0369)	(0.0371)
Log(Empl.)		0.0642***	0.00686	0.00800
		(0.00404)	(0.0260)	(0.0260)
Share of admin workers			0.639***	0.639***
			(0.118)	(0.119)
Observations	1,917	1,917	1,889	1,889

Standard errors in parentheses

Notes: This table reports association between management scores, productivity, family ownership. About 80% of establishments belong to firms owned by the CEO or their family. Sample are all non-state 2016 LMMS firms with at least 10 non-missing responses to management questions and non-missing output, capital, labour and materials data. Industry fixed effects at the 4-digit ISIC level are included in every specification. Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4 Management, productivity, exporting

Dependent Variable:	Management score		log(Output/Employment)	
	(1)	(2)	(3)	(4)
Management			0.239**	0.238**
			(0.112)	(0.113)
Management × exporter				0.0351
				(0.749)
Exporter	0.0761***	-0.00644	0.161	0.143
	(0.0200)	(0.0211)	(0.119)	(0.393)
Log(Capital/Empl.)			0.125***	0.125***
			(0.0181)	(0.0181)
Log(Materials/Empl.)			0.548***	0.548***
			(0.0373)	(0.0373)
Log(Empl.)		0.0647***	-0.00408	-0.00407
		(0.00417)	(0.0259)	(0.0259)
Share of admin workers			0.623***	0.623***
			(0.116)	(0.116)
Observations	1,909	1,909	1,881	1,881

Standard errors in parentheses

Notes: This table reports association between management scores, productivity, family ownership. About 4% of establishments are exporters. Sample are all 2016 LMMS firms with at least 10 non-missing responses to management questions and non-missing output, capital, labour and materials data. Industry fixed effects at the 4-digit ISIC level are included in every specification. Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5 Management, productivity, Importing

Dependent Variable:	Management score			log(Output/Employment)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Management				0.269**	0.282**	0.0934	0.291**
				(0.112)	(0.112)	(0.169)	(0.118)
Management × importer						0.336	
						(0.204)	
Management × Direct importer							-0.226
							(0.285)
Importer	-0.00603	-0.0259***			0.0814*	-0.0509	
	(0.00952)	(0.00893)			(0.0449)	(0.0825)	
Direct Importer			0.0142	0.215***			0.307**
			(0.0128)	(0.0762)			(0.156)
Indirect Importer			-0.0373***	0.0440			
			(0.00948)	(0.0463)			
Log(Capital/Empl.)				0.126***	0.129***	0.129***	0.125***
				(0.0178)	(0.0179)	(0.0178)	(0.0179)
Log(Materials/Empl.)				0.539***	0.542***	0.542***	0.540***
				(0.0363)	(0.0362)	(0.0361)	(0.0364)
Log(Empl.)		0.0677***	0.0623***	-0.0203	-0.00496	-0.00852	-0.0182
		(0.00379)	(0.00399)	(0.0279)	(0.0263)	(0.0267)	(0.0279)
Share of admin workers				0.617***	0.623***	0.625***	0.615***
				(0.116)	(0.116)	(0.116)	(0.116)
Observations	2,023	2,023	2,023	1,995	1,995	1,995	1,995

Standard errors in parentheses

Notes: This table reports association between management scores, productivity, family ownership. About 19% of establishments directly import material, and another 38% import only indirectly via intermediaries. Sample are all 2016 LMMS firms with at least 10 non-missing responses to management questions and non-missing output, capital, labour and materials data. Industry fixed effects at the 4-digit ISIC level are included in every specification. Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6 Management and productivity in Ethiopian manufacturing

	Dependent Variable: log(output/employment)					
	(1)	(2)	(3)	(4)	(5)	(6)
Management Score	3.117***	0.346***	0.340***	0.263**	0.212	0.256
	(0.178)	(0.107)	(0.112)	(0.111)	(0.131)	(0.198)
Log(Capital/Empl.)		0.171***	0.149***	0.129***	0.135***	0.121***
		(0.0176)	(0.0179)	(0.0179)	(0.0279)	(0.0244)
Log(Materials/Empl.)		0.577***	0.555***	0.545***	0.540***	0.538***
		(0.0292)	(0.0354)	(0.0363)	(0.0563)	(0.0417)
Log(Empl.)		-0.0374	-0.0253	0.000804	-0.165***	0.0241
		(0.0228)	(0.0255)	(0.0259)	(0.0605)	(0.0418)
Share of admin workers				0.624***	0.433***	0.751***
				(0.116)	(0.145)	(0.187)
Observations	2,057	2,057	2,023	1,995	1,047	925
Sample	All	All	All	All	Below 20 workers	Above 20 workers
Fixed Effects	None	None	Industry	Industry	Industry	Industry

Standard errors in parentheses

Notes: This table reports association between management scores and productivity. The management score is calculated like in Bloom et al. (forthcoming) Sample are all 2016 LMMS firms with at least 10 non-missing responses to management questions and non-missing output, capital, labour and materials data. Industry fixed effects are at the 4-digit ISIC level. Columns (5) and (6) split the sample by estabblishment size in terms of workers. Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7 Management and productivity in Ethiopian manufacturing: Extended

	Dependent Variable: log(output/employment)			
	(1)	(2)	(3)	(4)
Management Score: MOPS coding	0.263**			
	(0.111)			
Management Score: extended		0.291***		
		(0.113)		
Management Score: raw			0.0823***	
			(0.0299)	
Management z-Score				0.0706***
				(0.0242)
Log(Capital/Empl.)	0.129***	0.129***	0.129***	0.128***
	(0.0179)	(0.0179)	(0.0178)	(0.0178)
Log(Materials/Empl.)	0.545***	0.544***	0.544***	0.544***
	(0.0363)	(0.0363)	(0.0363)	(0.0363)
Log(Empl.)	0.000804	-0.000393	-0.00243	-0.00420
	(0.0259)	(0.0257)	(0.0257)	(0.0258)
Share of admin workers	0.624***	0.621***	0.618***	0.613***
	(0.116)	(0.116)	(0.116)	(0.116)
Observations	1,995	1,995	1,995	1,995
Sample	All	All	All	All
Fixed Effects	Industry	Industry	Industry	Industry

Standard errors in parentheses

Notes: This table reports association between management scores and productivity. The management scores in different columns are: (1) MOPS survey instrument, unit interval scale (Bloom at all, forthcoming); (2) modified MOPS instrument, unit interval scale; (3) MOPS instrument, original scale; (4) MOPS instrument, z-scores. Sample are all 2016 LMMS firms with at least 10 non-missing responses to management questions and non-missing output, capital, labour and materials data. Industry fixed effects are at the 4-digit ISIC level. Columns (5) and (6) split the sample by estabblishment size in terms of workers. Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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