The Performance of New Firms: Evidence from Ethiopia's Manufacturing sector*

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Abstract

In this paper we investigate the relative importance of technological and demand constraints for firm performance using panel dataset of Ethiopian manufacturing sector (1996-2006). Previous empirical research on firm performance use revenue based productivity which confounds true efficiency with price effects. Using information on price and physical quantity of firms' products, we decompose revenue based productivity into physical productivity, price and idiosyncratic demand shocks. Comparison of various components of productivity across firms, using product and firm fixed effect estimation, reveals that entrants have lower demand and output prices than established firms. However, we do not find a robust difference in productivity between entrants and established firms. Thus, young and small firms are found to be most vulnerable to demand constraints. Analysis of firm survival using probit regression reveals that firms' access to secure market is more important determinant of survival than productivity.

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1 Introduction

A common argument in the discussion of Africa's development problems is that the African economies are too dependent on agriculture and natural resource extraction (e.g. Collier, 2008). In view of this, growth in the industrial sector is often seen as a vehicle for diversification and sustainable economic development (Page, 2010). One of the least industrially developed countries in Africa is Ethiopia, where manufacturing accounts for only 5% of total value-added and agriculture employs 85% of the workforce. Hence, Ethiopia needs substantial entry of industrial firms in order to speed up diversification. In fact, over the last decade, gross entry rates in the manufacturing sector have been rather high (on average 7.6% per year). But exit rates among new firms have been high too. According to Gebreeyesus (2008), 60% of entering firms exit the Ethiopian market within 3 years in business As a result, net entry rates in the sector have not been high enough to increase the relative size of the manufacturing sector in the last decade.

In this paper we study the economic performance of Ethiopia's new firms. We ask two specific questions. First, why do young firms have high exit rates? Previous research on African firms suggests that the likelihood of exit increases as the economic performance of the firm deteriorates. Regression results reported by e.g. Frazer (2005) Söderbom et al. (2006), Shiferaw (2007) and Gebreeyesus (2008) indicate that firms generating low levels of revenue, conditional on factor inputs, tend to have relatively low survival rates. Hence, there is some evidence that African markets drive poorly performing firms out of business. A common interpretation of this finding is that there is "creative destruction" in African markets: as resources get reallocated from poor performers to firms that use these more productively, this contributes to higher aggregate productivity (Frazer, 2005; Söderbom et al., 2006; Shiferaw, 2007; Gebreeyesus,2008).

However, unless one knows *why* there is a link between the economic performance of the firm and the likelihood of survival, whether the turnover process implies higher aggregate productivity will remain unclear. In particular, it is essential to distinguish physical productivity from high prices, or rents. No previous study in the literature on African firms makes this distinction. Could it be that the type of firms most likely to survive in Africa are not those with the highest productivity but those most able to extract rents and charge high prices? No evidence exists that would enable us to discard this as a possibility. Moreover, in view of the structure of African markets, this would appear a question worth taking seriously. In a poorly integrated market characterized by information problems, rents will be available, and firms that manage to extract these rents may record high levels of revenue even under low levels of productivity. This is just one example of a setting in which a positive relationship between a revenue-based measure of performance and firm survival does not necessarily imply that firm turnover results in aggregate efficiency gains.

In the context of industrial expansion and the contribution to such a process of new firms, patterns of firm survival are informative of one side of the story only. The other is performance conditional on survival. This leads us to our second research question: how do physical productivity, prices and demand develop in the initial years following upon entry? Similar to the literature on firm survival, there exist several studies that study the relationship between revenue-based measures of economic performance and firm age (e.g. Sleuwaegen and Goedhuys, 2002; Van Biesebroeck, 2005), but none that distinguishes between productivity and prices. Sleuwaegen and Goedhuys (2002) infer "learning" from regressions indicating a negative relationship between firm age and sales and employment growth, but unless productivity effects can be isolated from price effects the type of learning implied by such results is unclear. In principle, it is possible that previous results on learning based on revenue-based measures of performance are unrelated to physical productivity gains, which is what the underlying literature really emphasizes (e.g. Jovanovic, 1982).

In this paper we seek to fill these gaps in the literature. To this end, we use a firm-level panel dataset that covers the entire population of domestic manufacturing firms in Ethiopia that use electricity in production and that employ ten or more workers. This dataset has been used in previous work by Bigsten and Gebreeyesus (2007), Gebreeyesus (2008) and Shiferaw (2007, 2009). Importantly for our purposes, this dataset contains a detailed product-level module that enables us to construct product-specific prices and quantities at the firm-level. Equipped with these data, we can thus distinguish between prices and physical productivity and investigate how these correlate with the likelihood of exit and how they develop in the first few years following entry into the market.

Our analysis also relates to an ongoing discussion about the relative importance of different types of skills for enterprise success. Several authors have emphasized lack of technical capacity as a key reason why many firms in developing countries perform poorly (e.g. Pack, 1982; 1993; Lall, 1992). Sutton (2010), however, downplays the importance of technology as a key determinant of company success in Africa, arguing that basic manufacturing technology is relatively easy to master. Based on in-depth interviews with leading industrialists in Zambia and Ethiopia, Sutton highlights "...a crucial role played by detailed knowledge and experience both of the local market and of the international market" (Sutton, 2010, p.4) and argues that this kind of expertise "...constitutes a more important aspect of 'capability' in the present setting than does any kind of technological know-how." (Sutton, 2010, p.4). Establishing the importance of physical productivity for firm survival contributes to this discussion.

Finally, our research addresses some key concerns in the general literature on firm performance. Foster et al. (2008) and Katayama, Lu and Tybout (2008) show that a revenue-based measure of total factor productivity (TFPR) will confound true efficiency with price, elasticity and scale economies and that the discrepancy between TFPR and a more appropriate measure of physical productivity may be considerable. For example, Foster et al. (2008) note that microeconomic theory predicts a negative correlation between physical productivity and prices, but then find a positive correlation between TFPR and prices in their data. Katayama, Lu and Tybout (2008) find TFPR to be very weakly correlated with alternative productivity measures based on the firm's contribution to consumer and producer surplus, again suggesting that a revenue-based measure of productivity is a poor proxy for true physical productivity.[1]

The rest of the paper is organized as follows. Section 2 defines our price and quantity variables and explains how these are measured in the data. Section 3 discusses the outcome variables of interest. Section 4 contains the empirical results. The last section concludes and discusses policy implications.

2 Definitions

2.1 Prices and Quantities

As discussed in the introduction, much of our analysis focuses on separating productivity effects from price effects. In particular, we want to distinguish between the effects of prices and productivity on firm survival rates, and document growth patterns in prices and productivity amongst young firms. To this end

[1] Assuming that firms' costs and revenues reflect Bertrand-Nash equilibrium in a differentiated product markets, and incorporating demand system they impute each firm's unobserved quantities, qualities, marginal costs and prices of each product from observed revenues and costs to construct firm's contribution to consumer and producer surplus as welfare-based measure of productivity.

we use census panel data on Ethiopian manufacturing establishments collected by Central Statistical Authority of Ethiopia (CSA). The dataset, which covers the period 1996-2006, includes all establishments in the country that employ at least 10 workers and that use electricity in production. Hence microenterprises are not represented in the dataset. In 2009, this class of firms accounted for 51% of manufacturing employment but only 11% of total manufacturing value-added. The aggregate economic performance of the manufacturing sector is thus primarily determined by the performance of medium-sized and large firms. We take this to be our population of interest.

Information available in the dataset includes capital, labor, raw material and energy inputs; investment as well as other industrial costs. The number of firms covered increases from around 600 in 1996 to approximately 1,100 in 2006. Key for our purposes is a special module in the survey instrument on prices and quantities. Every year, each firm has to provide detailed information about the type of products produced, the unit of measurement (e.g. kilos, tonnes etc.), the sales price per unit and the quantity produced, for up to 8 products. Using these data, and ignoring a composite product category labeled 'other products', our starting point is a dataset containing approximately 17,000 firm-year-product observations over our sampling period. Several of these, however, refer to products that are not precisely defined or products that will differ markedly in quality. We root out such cases using two principles. Our first principle is based on the idea is that a product category should be such that consumers would not differentiate between unlabeled products belonging to it. To illustrate how we use this rule, we would exclude "meat" a priori (on the grounds that there are likely substantial quality differences within this category), but would consider "beer" to be a suitable product category. Of course there are different types of beer, and perhaps one ought to distinguish between dark beer and lager, or between beers of differing alcoholic strength, however this is not possible given the information available. We consider brick of clay, cement block, cement floor tiles and cement to be the least heterogenous types of products in our data, and define these to be 'homogenous' products. In the empirical analysis below, some of the robustness checks will be done based on this subset of homogenous products only.

The procedure described above narrows down the set of products but some of the remaining products still feature considerable price variation in the cross-section, which suggests important quality differences are still present. To address this potential problem, we used a second rule stating that, in a cross-section of firms producing a given product, the coefficient of variation of output price should not exceed 0.5. Products for which the coefficient of variation is higher than 0.5 were thus excluded. Finally, we drop product categories with less than 100 remaining observations, unless the product is deemed to be homogeneous a priori. Taken together, these rules imply we end up with a total of 27 different products in our core sample. These are listed in table A1 in the appendix. Our set of selected products constitutes around 7800 product-year observations covering 13 sectors. Food, Beverage, Textiles, Footwear, Chemicals and Non-Metal sectors constitute 94% of the total product-year observations of selected products.

In our dataset, while most of the products, such as bricks of clay, cement blocks, nails, sugar, bread and wheat flour, are reported separately as a single product, some of our products can be considered to be a composite product aggregating over similar products. These products include: edible oil, liquor and soft drinks among others. This is the level of aggregation CSA uses and we take that as given and assume that there is high substitutability between the components of such aggregated products. The product soft drink for example contains Coca Cola, Fanta and other similar brands of soft drinks. Even though consumers can differentiate between such products, we assume that there is high substitutability between such products and treat soft drink as homogenous product. The same type of argument follows for products such as Tea, Milled Coffee, Edible oil, Liquor, Beer. This also the approach followed by Foster et al (2008). All quantity measures are standardized so as to have a common unit of measurement, e.g. weights are measured in KG, volumes in liter, areas in square meter or square feet depending on the product etc.

In table A1, we present summary statistics of nominal output prices of our selected products after controlling for outliers by ignoring the bottom and top 3 percent of our observation on product prices. Besides having wide industry coverage, our selected products have a major economic significance for their producers. Table A2 in the appendix presents summary statistics of revenue share of our selected products when these products are the firm's most important product.[2] We define major product as the product with highest revenue share in total output among set of firm's selected products. This will give us a smaller sample size of about 3500 where the average revenue share is 74%. Among firms' major products, all products except Leather garment, Crust and Wet blue hides;

[2] The average combined revenue share of our selected products including firm's non-major products is 92%.

and Wires have a median revenue share of 50% or more.

2.2 Productivity and Demand

We assume that the production by firm i of product u at time t can be represented by a production function which we write in logarithmic form as:

$$\log Y_{iut} = \log A_{iut} + \log F(K_{iut}, L_{iut}, M_{iut}, E_{iut}), \tag{1}$$

where Y_{ijt} denotes physical output, A_{ijt} is physical total factor productivity, K_{ijt} is capital stock, L_{ijt} is labor input M_{ijt} is raw material inputs, E_{ijt} is energy, and $F(\cdot)$ is a Cobb-Douglas function featuring constant returns to scale:

$$\begin{aligned} \log F(K_{iut}, L_{iut}, M_{iut}, E_{iut}) &= (1 - \alpha_{Lj} - \alpha_{Mj} - \alpha_{Ej}) \ln K_{iut} \\ &\quad + \alpha_{Lj} \ln L_{iut} + \alpha_{Mj} \ln M_{iut} + \alpha_{Ej} \ln E_{iut} \end{aligned} \tag{2}$$

where$\alpha_{Lj}, \alpha_{Mj}, \alpha_{Ej}$ are production function parameters, specific to sector j. Taking this framework as our point of departure, we construct two productivity measures: the conventional revenue based productivity (TFPR), and physical quantity based productivity (TFPQ).

The definition of TFPR is standard and straightforward:

$$TFPR_{it} = \log \left(\sum_u P_{iut} Y_{iut} \right) - \log F(K_{it}, L_{it}, M_{it}, E_{it}),$$

i.e. the log of total sales net of the contribution of the inputs to output. Note that the inputs here are defined at the firm-year level. The parameters $\alpha_{Lj}, \alpha_{Mj}, \alpha_{Ej}$ are estimated using a cost shares approach. Specifically, α_{Lj} is calculated as the sector j average of the share of the wage bill in total sales, while α_{Mj} and α_{Ej} are calculated as sector averages of the shares of total raw materials and energy expenditure, respectively, in total sales.[3] Labor L_{it} is measured as the number of workers, M_{it} and E_{it} are measured as the firm's expenditure on raw material and K_{it} is the value of the capital stock.[4] All

[3]Energy input includes expenditures on fuel, electricity; and wood and charcoal used for energy.

[4]Capital stock is measured by the average of capital stock at the beginning and end of the year at replacement value. We construct a capital stock using perpetual inventory method where different depreciation rates are assumed for different category of capital. We used 5% for dwelling houses, non-residential buildings and construction works; 8% for machinery and

financial values are expressed in constant terms using a GDP deflator. One implication of defining M_{it}, E_{it} and K_{it} in value terms is that our measure of productivity will reflect heterogeneity in input prices with firms facing higher input prices appearing as less efficient.

The definition of physical productivity (TFPQ) is as follows:

$$TFPQ_{iut} \equiv \log A_{iut} = \log Y_{iut} - \log F(K_{iut}, L_{iut}, M_{iut}, E_{iut}). \qquad (3)$$

For multi-product firms we need to deal with aggregation issues. The first issue is that factor inputs are not observed at the product level, which makes it problematic to define $TFPQ_{iut}$ for multiproduct firms. To address this problem we assume that the intensity with which inputs are used for producing product u is proportional to the value share:

$$X_{iut} = \theta_{iut} \times X_{it},$$

$X = \{K, L, M, E\}$, where

$$\theta_{iut} = \frac{P_{iut}Y_{iut}}{\sum_u P_{iut}Y_{iut}} \equiv \frac{P_{iut}Y_{iut}}{P_{it}Y_{it}}.$$

The second aggregation issue, again arising for multiproduct firms, concerns the construction of a firm-year level measure of physical productivity based on product-firm-year level productivity levels defined by (3). Adopting a weighting scheme based on the product revenue shares would not be helpful here as this would yield TFPR. Instead, we focus on the major product of firms, in terms of sales values, and calculate physical productivity for the major product only. Hence, we write

$$TFPQ_{it} = \log Y_{i(u=m)t} - \log F(K_{iut}, L_{iut}, M_{iut}, E_{iut}) - \log \theta_{i(u=m)t}, \qquad (4)$$

where $u = m$ indicates the major product for firm i at time t. Note that, for single-product firms, the aggregation issues do not arise; $\log \theta_{i(u=m)t} = 0$.

An important driving factor of output prices is the underlying consumer demand for the products. We obtain a measure of the state of demand by estimating the following demand equation using firms' major product.

equipment; and 10% for vehicles and furniture and other fixtures.

$$\log Y_{i(u=m)t} = \beta_1 \ln P_{i(u=m)t} + \sigma_{lt} + \lambda_u + \varepsilon_{iut} \quad (5)$$

where β_1 is the price elasticity, σ_{lt} is a town-year fixed effect (controls for variation in demand across locations and over time), λ_u is product fixed effect and ε_{iut} is residual demand, capturing shifts in the demand curve due to idiosyncratic demand shocks. To estimate ε_{iut} consistently, we need to take into account the endogeneity of the price variable.[5] Following Foster, Haltiwanger and Syverson (2008), we instrument the price variable using physical productivity as defined in (4). We focus on the set of homogenous products with comparable product quality to estimate our demand equation.

3 Outcomes of Interest

3.1 Firm Survival

We start with a simple probit specification where we model the likelihood of firm exit as dependent on revenue-based productivity, firm age, size and a vector of control variables X_t: conditional on economic performance.

$$\Pr(exit_{i,t+1} = 1) = \Phi\left(\theta_0 + \theta_1 \ln(Age_{it}) + \theta_2 \ln(Size_{it}) + \theta_3 \ln TFPR_{it} + X'_{it}\theta_4\right), \quad (6)$$

where $exit_t = 1$ if firm i exits the market between t and $t+1$ and $\Phi(\cdot)$ is the cumulative density function for the standard normal distribution. The vector of control variables X_{it} includes variables such as: type of ownership; whether the firm has any export; and year, sector and sometimes product fixed effects. We use this specification primarily to relate to the existing literature. Previous studies (e.g. Frazer, 2005; Söderbom et al., 2006; Shiferaw, 2007; Gebreeyesus,2008) have documented a positive relationship between revenue based productivity and firm survival, but as discussed in the introduction it is not clear whether this association in the data is due to higher physical productivity or higher

[5] Estimation of our demand equation using OLS will give us biased estimates of the price elasticity as the output price is positively associated with the unobserved component of demand. This is because firms optimally increase output prices as a result of favorable demand shocks. We need an instrument closely related to prices but orthogonal to demand shocks. Supply side variables, such as physical productivity and input prices, are potential candidates as they are correlated with production cost and hence output price. Physical productivity is a relevant IV as efficient firms are likely to have lower costs and pass this on to customers by charging lower output prices.

prices.

One of our two main goals in this paper is to shed light on the relative importance of physical productivity and output prices for firm survival.

The importance of demand and productivity on firm survival is investigated by generalizing the exit model introduced above as follows:

$$\begin{aligned}\Pr(exit_{i,t+1} &= 1) = \Phi(\theta_0 + \theta_1 \ln Age_{it} + \theta_2 \ln Size_{it} + \theta_{31} \ln TFPQ_{it} \\ &+\theta_{32} Demand_{it} + X'_{it}\theta_4),\end{aligned} \tag{7}$$

where $Demand_{it} \equiv \hat{\varepsilon}_{iut}$ is the estimated residual from (5). Note that $TFPQ$ is defined as output conditional on inputs used in the production process, while *Demand* is defined as output conditional on the price charged to customers. We also consider specifications in which we replace *Demand* by the output price directly. Given that these alternative specifications condition on TFPQ, the coefficient on the price variable is interpretable as measuring a demand effect.

3.2 Growth

How do physical productivity, prices and demand develop in the initial years following upon entry? To answer this question we run regressions of the following form:

$$\begin{aligned}\ln \Psi_{it} &= \gamma_{11} Enter_{it} + \gamma_{12} \ln Age_{it} + \gamma_2 \ln Size_{it} + \gamma_{31} \ln TFPQ_{it} \\ &\acute{\gamma}_{32} Demand_{it} + X'_{it}\gamma_4 + e_{ijt},\end{aligned}$$

where Ψ_{it} is physical productivity, price and demand for firm i at year t. $Enter_{it}$ is a dummy variable equal to one if firm i is a new entrant in period t and zero otherwise. We control for firm size, firm age, and a vector of control variables. error term. Controlling for firm size is important for two reasons. First, the demand residual obtained from (5) is dependent on scale; for example, large firms will produce a high level of output conditional on price. Second, it is of interest to see whether firms of differing size have different levels of productivity and demand.

4 Empirical Analysis

Having a dataset that covers the entire population of formal manufacturing firms employing at least 10 workers is key to construct our entry, exit and firm age variables. A firm is considered to be an entrant if it is observed in our dataset for the first time in the sample period 1996-2006. If we observe a firm in 1996 for the first time in our dataset, we use an information on year of establishment to decide whether the firm entered in year 1996 or earlier. We then create a dummy variable $Entry_t = 1$ if a firm enters between $t-1$ and t. Similarly, we construct an $Exit_{t+1}$ dummy equal to one if a firm exits the market between years t and $t+1$. We observe a small number of cases of muliple-entry in our dataset, i.e. firms re-entering the market after exit (less than 5% of the observations fall into this category). It hard to define firm age for such cases, and we therefore exclude multiple-entry when making comparison of firm performance of firms in different stage of their life cycle. However, we keep these observations when studying firm survival. It is also possible firms exit and enter because they cross the size threshold for the Ethiopian census i.e. 10 workers. We view such cases as exits and entrants for our population of interest which is the formal sector.

Table 1 presents descriptive statistics of the key variables used in this analysis. On average, 23% of the observations constitute new entrants while the average exit rate is 21%. Young firms constitute a significant share of our sample. The median firm age is only six years of business experience and 49 % of the firms are aged five years or less. It is also worth noting that majority of the firms (82%) are domestic privately owned firms. As few as 6 % of the firms have any export.

Table 2 shows pair-wise correlations between measures of log output price and the productivity measures netting out product and year fixed effects. We find that physical productivity is negatively correlated with price while revenue. This is consistent with the theoretical prediction that more efficient firms can produce at lower cost, enabling them to lower their prices. It is this feature of physical productivity measure that makes it a candidate instrumental variable for output prices in our estimation of demand equation. In contrast, revenue-based productivity is positively related to price.

Estimation of demand equation is key for decomposing demand side variables into price and demand shocks. Table 3 presents results for our demand equation. Town-year fixed effects are included to control for average income of firm's local market over time. Product fixed effects capture scale differences in prices across products. Column (1) shows OLS results. The OLS estimate of the price elasticity is equal to -0.739. We suspect this is severely biased towards zero, as firms likely raise prices in respond to positive demand shocks. Consistent with this hypothesis, estimating the demand equation using physical productivity as an instrument for price provides us with a larger negative price elasticity (around -4), suggesting that firms face an elastic demand curve (Column 2).[6] .

Demand residuals capture unusually high output demand for a given price. This is potentially capturing quality differences for a given product across firms, which may lead to a biased price elasticity of demand and consequently to a biased measure of demand. We investigate whether this appears to be a problem by adding to the specification an interaction term between the price variable and a dummy for the set of homogenous products in the data (i.e. Cement Block, Cement floor tiles and Cement). The results, shown in column (3), indicate that the coefficient on this interaction variable is relatively small and wholly statistically insignificant. This suggests the estimated price elasticity is not contaminated by product heterogeneity within product categories. The residuals of our demand equations in column 2 and 3 are used as the basis for calculating idiosyncratic demand shocks for subsequent analysis below.

Next we investigate the persistence in prices, productivity and demand. Current physical productivity, average product price and demand shocks are regressed on their one period lag and a set of control variables including ownership status, exports and product dummies.[7]. A coefficient closer to one on the lagged dependent variable indicates stronger persistence. Results are shown in Table 4. We find that the demand side variables - log price and demand - are more persistent than physical productivity. Differences in firm performance on these key variables and their implication for firm survival are investigated below.

4.1 Firm survival

We start our analysis of firm survival by adopting specifications similar to those used in previous studies. Table 5 thus shows exit probits for which the explanatory variables are firm age, size, revenue-based productivity, and controls. The

[6] In the first stage regressions, we find a negative and significant relationship between output price and our instrument: physical productivity with the coefficient of -0.26 and significant at 1 percent for column 2 for instance.

[7] For firms stating multiple prices for same product in a given year, we take average reported price of the product for each year.

results indicate that young and small firms are more likely to exit the market than larger and more established firms. The quadratic relationship between firm age and survival indicates that firms have better prospect of survival as they grow older but the contribution of age for survival decreases over time. This result is robust after controlling for ownership ($Public_t$ and $Anyforeign_t$) and whether the firm has any export during the survey year ($Export\ Dummy_t$) In line with previous empirical findings, more productive firms, as measured by value added per employee in column 2, are more likely to survive. However, when using value of output of firm's major product as a measure of productivity, after controlling for input usage, output becomes insignificant in column 3.

We now investigate how the likelihood of firm survival relates to physical productivity and demand. Results based on our extended specification of the exit probit (7) are shown in Table 6. We find that firms with higher output demand are more likely to survive.[8] In contrast, there is no significant physical productivity effect on survival. The marginal impact of demand shocks on probability of survival ranges between 1.02 - 1.7 percentage points. This result is robust to the inclusion of alternative firm size measures except in column 2 where contemporary labor and capital inputs are added at the same time leading demand measures to be insignificant. This is because they are highly correlated with physical productivity which takes contemporary capital and labor into account. Significance is largely improved when we use startup capital and labor inputs in column 3 and when we focus on firms having only one major product over time in column 4.[9] It is also worth noting that, even conditional on performance variables, we find robust evidence that firm age and size matters for firm survival. Hence, small young firms unlikely to survive even if they perform well, though prospect of survival improves with firm age.

4.2 Growth

Comparison of various components of productivity across firms in different stage of their life cycle is informative about the nature of competition and business environment in which young firms operate. In particular; we are interested in the growth patterns of new firms in the market. In table 7, we compare productivity, price and demand shocks of entrants to that of established firms controlling for firm size and age, ownership, any exporting as well as year, product and sector

[8] We find very similar pattern when using alternative demand residual using demand residual of col 3 of table 4. These results are not presented to save space.

[9] 94% of the firms in our dataset have only one major product over time

dummies. Entrants have lower revenue based productivity which is due to the lower price they charge for their output and lower demand shocks they face. However, we do not find any significant difference in physical productivity of entrants and established firms in column 4. Whereas firms with larger initial number of workers are more productive and face favorable demand shocks, firms with larger start up capital have lower revenue and/or physical productivity though they have larger demand shock. The quadratic firm age effect, in column 2 and 3, implies that demand and output price of newly established firms catch up with time but no such evidence is found for productivity.

Comparing the performance of new firms using age dummies for the first five years of firms in the market provides better picture on persistence of demand and productivity disadvantages of new firms. In table 8, we add 5 age dummies for the first five years of firms' operation with firm age larger than five years used as base category. New firms (with $Age0_t = 1$) have lower revenue productivity due to lower output price and demand they face rather than due to being less efficient than established firms. Price and demand disadvantages of new firms persists until firms' second year, but this is not the case for their physical productivity. Lower price and demand shocks are observed as late as firms' fourth year in column 2 and 3. This is in line with the results in table 4, that price and demand shocks are more persistent than productivity. These findings suggest that small and young firms are vulnerable to demand side constraints. And in the absence of evidence of catching up effect with regards to physical productivity, previous results of learning effect may be picking up demand side effects than firms updating their technology. The evidence that absence of/limited market access is the first major growth constraints reported by firms in our dataset seems to support our findings.

Taken together, we find clear evidence that small and young firms face a significant demand constraints, i.e, lower prices and idiosyncratic demand, early on when they enter the market. There is no robust evidence that entering firms are less efficient than incumbents. When it comes to firm survival, it is demand constraints that matter most rather than physical productivity Thus the idea that African markets drive out inefficient firms is not strongly supported. The fact that there is some evidence for catching up effect on demand side over time is good news, though how long it takes to close the gaps may matter for firm survival. We find no robust evidence for the presence of catching up effect with regards to technological learning.

5 Conclusions

In this study we investigate the relative importance of supply and demand side constraints to firm performance. Previous firm level studies on productivity and firm performance are limited by the use of revenue based productivity measure which confounds true efficiency with price effect. The current study takes advantage of the availability of both price and physical quantity of firms' products to decompose revenue based productivity into efficiency and price effects using 11 year panel dataset of Ethiopian manufacturing sector.

The idea that African markets drive poorly performing firms out of business is not strongly supported in our firm exit analysis. Age and size matter for firm survival, even conditional on performance variables and the latter do not seem to have strong explanatory power. Hence, small young firms unlikely to survive even if they perform well. When comparing physical productivity and demand of entrants with more established firms, young firms are no less productive than mature firms on average but they do face lower demand during the first 1-5 years. This may be part of the explanation as to why young firms have high exit rates.

This is supported by our exit probit regressions using physical productivity and demand side variables of firm performance. We find that firms with favorable demand shocks are less likely to exit with no evidence that physical productivity improves prospect of survival. There is some evidence for increased prospect of survival and for catching up effect in closing demand gap with firm age. how long this process takes may matter as firms might be forced to exit the market before they are able to catch up and compete with more established firms. Securing access to markets by creating backward and forward linkages during most vulnerable stage of firm entry may be the way to go in terms of policy implication. Sensitivity analysis of the results to product selection with regards to homogeneity, addressing potential sample selection bias and aggregation of physical productivity for multi-product firms are the natural next steps. One can also extend the analysis to firm growth and other performance measures.

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Table 1: Descriptive statistics of variables used

Variables	Description	Mean	Median	stdev
Dependent Variables				
$TFPR\_slct_t$	Revenue based productivity using firm's major product	2,5	2,42	0,82
$TFPQ\_slct_t$	Physical productivity using firm's major product	0,59	0,93	1,6
Log price	Log output price per unit	2,02	1,49	1,58
$Entry_t$	$Entry_t$=1 if firm enters between t-1 and t	23%		
$Exit_t$	$Exit_t$=1 if firm exits between t and t+1	21%		
Explanatory Variables				
$(lnVA/L)_t$	Log value added per person	9,3	9,23	1,28
$(lnp_t *Q)_t$	Log value of output of firm's major product	13,46	13,19	2,21
rev_sh	Revenue share of firm's major product	0,74	0,85	0,28
lnK_t	Log of firm's capital stock	13,37	13,23	2,58
lnL_t	Log of firm's labor input	3,72	3,26	1,42
lnE_t	Log of firm's energy input	10,34	10,18	2,5
lnM_t	Log of firm's raw material input	13,3	12,96	2,2
lnKi	Log of startup capital stock	13,19	13,21	2,76
lnLi	Log of startup labor	3,69	3,14	1,47
Firm age_t	Firm age in years	12,35	6	15,85
age0	Dummy=1 for Firm age_t =0	18%		
age1	Dummy=1 for Firm age_t =1	9%		
age2	Dummy=1 for Firm age_t =2	7%		
age3	Dummy=1 for Firm age_t =3	6%		
age4	Dummy=1 for Firm age_t =4	5%		
age5	Dummy=1 for Firm age_t =5	5%		
age6	Dummy=1 for Firm age_t >5	51%		
$Export_t$	Export=1 if a firm has any export in year t	6%		
$Public_t$	A dummy = 1 if publicly owned firm	16%		
Any $foriegn_t$	A dummy = 1 if any foreign contribution to firm's current paid up capital	2%		

Table 2. Prices, output and productivity: Correlations conditional on product and year fixed effects

	Log output price	**Physical productivity**	**Revenue productivity**	**Log physical output**
Log output price	1.0000			
Physical productivity (TFPQ_slct)	-0.4868*	1.0000		
Revenue productivity (TFPR_slct)	0.0711*	0.8367*	1.0000	
Log physical output	-0.1765*	0.4661*	0.4215*	1.0000

Note: The numbers reported in the table are pair wise correlations of predicted residuals based on OLS regressions in which the price, output and productivity variables are regressed on year and product dummies. * = significant at 1%

Table 3: Estimates of the demand equation

	(1) OLS	(2) 2SLS	(3) 2SLS
Log $price_t$	-0.739***	-3.980***	-4.031***
	(0.1487)	(0.216)	(0.226)
Log $price_t$*$Homog_t$			0.304
			(0.662)
Product dummies	Yes	Yes	Yes
Town-year dummies	Yes	Yes	Yes
Observations	3175	3175	3175
R-squared	0.5990	0.3456	0.3437
Number of town-year	571	571	571

Note: Dependent variable is log physical output. The instrument in col. (2) is TFPQ_slct. The instruments in col. (3) are TFPQ_slct and TFPQ_slct*Homog. Standard errors, clustered at the firm level, in parentheses in col. (1) and conventional standard errors in parentheses in col. (2) & (3). *Homog* is a dummy variable equal to one when the products included are: Brick of Clay, Cement Block, Cement Floor tiles, Cement. These products are hypothesized to be most homogenous. *** p<0.01, ** p<0.05, * p<0.1. Unreported constant included.

Table 4: Persistence in productivity, prices and demand

VARIABLES	(1) Physical productivity	(2) log price	(3) Demand shock
$TFPQ\_slct_{t-1}$	0.344***		
	(0.0308)		
Log average $price_{t-1}$		0.414***	
		(0.0461)	
Demand $Shock_{t-1}$			0.623***
			(0.03728)
$Public_t$	0.149***	-0.140***	0.585***
	(0.0356)	(0.0377)	(0.1309)
Any $foreign_t$	-0.0673	0.0145	0.150
	(0.0649)	(0.0637)	(0. 1825)
Export $Dummy_t$	0.0433	-0.0833	0.282
	(0 .0617)	(0.0542)	(0.175)
Constant	1.273***	0.743***	-0.246
	(0.0767)	(0.1391)	(0.179)
Year	Yes	Yes	Yes
Product	Yes	Yes	Yes
Sector	Yes	Yes	Yes
Observations	2027	2027	2027
R-squared	0.196	0.298	0.466
Number of products	27	27	27

Note: Current productivity, price and demand residuals are regressed on their respective lags in a product fixed effect estimation. The demand shock is the residual for the regression shown in Table 4, col. (2). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Age, size, revenue productivity, and the likelihood of exit: Probit estimates

VARIABLES	(1)	(2)	(3)
Firm age_t	-0.0283***	-0.0303***	-0.0268***
	(0.00661)	(0.00656)	(0.00678)
Firm age $square_t$	0.000409***	0.000474***	0.000387***
	(0.000140)	(0.000136)	(0.000146)
lnK_t	-0.0699***	-0.0497***	-0.0641***
	(0.0188)	(0.0192)	(0.0202)
lnL_t	-0.299***	-0.309***	-0.171**
	(0.0551)	(0.0566)	(0.0705)
lnE_t			-0.0366
			(0.0327)
lnM_t			-0.182***
			(0.0658)
Log revenue share $(lnsh2)_t$			-0.0191
			(0.0942)
$Public_t$	0.132	0.162	0.104
	(0.159)	(0.162)	(0.163)
Any $foreign_t$	0.0958	0.128	0.0654
	(0.257)	(0.264)	(0.273)
Export $Dummy_t$	0.0516	0.0162	0.130
	(0.308)	(0.311)	(0.324)
Log $(Value added/L)_t$		-0.104***	
		(0.0297)	
Log value of major product			0.101
			(0.0719)
Year	Yes	Yes	Yes
Sector	Yes	Yes	Yes
Product			Yes
Observations	2626	2519	2509

Note: Dependent variable is $Exit_t$=1 if a firm exits between t and t+1. The output variable in col. (3) is that underlying the calculation of TFPR_slct in equation 6. Standard errors clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1. Unreported constant included.

Table 6. Exit using Probit Model

	(1)	(2)	(3)	(4)
$TFPQ\_slct_t$	0.0660	0.00480	0.0282	0.0209
	(0.0530)	(0.0567)	(0.0569)	(0.0601)
Demand $shock_t$ $(T4:2)_t$	-0.0429**	-0.0329	-0.0684***	-0.0437**
	(0.0205)	(0.0205)	(0.0206)	(0.0222)
lnK_t		-0.0725***		-0.0598***
		(0.0220)		(0.0229)
lnL_t	-0.343***	-0.265***		-0.252***
	(0.0568)	(0.0615)		(0.0659)
lnKi (initial)			-0.0606**	
			(0.0249)	
lnLi (initial)			-0.0994*	
			(0.0579)	
Firm age_t	-0.0269***	-0.0284***	-0.0288***	-0.0348***
	(0.00681)	(0.00678)	(0.00689)	(0.00827)
Firm age $square_t$	0.000408***	0.000411***	0.000374**	0.000576***
	(0.000149)	(0.000148)	(0.000150)	(0.000203)
$Public_t$	0.121	0.115	-0.0909	-0.0723
	(0.165)	(0.165)	(0.173)	(0.370)
Any $foreign_t$	0.112	0.121	0.152	0.0853
	(0.268)	(0.267)	(0.266)	(0.180)
Export $Dummy_t$	-0.00933	0.0627	-0.127	0.231
	(0.334)	(0.337)	(0.320)	(0.299)
Year	Yes	Yes	Yes	Yes
Product	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Observations	2509	2509	2402	2223

Notes: Dependent variable is $Exit_t$=1 if a firm exits between t and t+1. Col. (4) uses sample of firms with only one major product over time. Standard errors clustered at firm level in parentheses. Unreported constant included. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Prices, demand and productivity: Comparing new entrants to established firms

VARIABLES	(1)	(2)	(3)	(4)
	TFPR	Log P	Demand	TFPQ
$Entry_t$	-0.0592*	-0.0348*	-0.333***	-0.0335
	(0.0324)	(0.0191)	(0.107)	(0.0392)
$TFPQ\_slct_t$		-0.274***		
		(0.0299)		
lnKi (initial)	-0.0641***	-0.0102*	0.121***	-0.0742***
	(0.0130)	(0.00560)	(0.0299)	(0.0139)
lnLi (initial)	0.0577**	0.0112	0.843***	0.0639**
	(0.0280)	(0.0170)	(0.0904)	(0.0301)
Firm age_t	0.00334	0.00387**	0.0199*	-0.000728
	(0.00350)	(0.00188)	(0.0116)	(0.00400)
Firm age $square_t$	-4.29e-05	-8.04e-05***	-0.000397*	5.16e-05
	(4.76e-05)	(3.04e-05)	(0.000215)	(5.85e-05)
$Public_t$	0.0901	0.0266	0.0143	0.0873
	(0.0653)	(0.0365)	(0.223)	(0.0724)
Any $foreign_t$	-0.113	-0.0335	-0.165	-0.110
	(0.105)	(0.0748)	(0.363)	(0.0835)
Export $Dummy_t$	0.124	0.0911	0.395	0.0446
	(0.0767)	(0.0683)	(0.301)	(0.0895)
Year	Yes	Yes	Yes	Yes
Product	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Observations	2864	2864	2864	2864
R-squared	0.510	0.953	0.338	0.839

Notes: The dependent variable is TFPR_slct in col. 1 and TFPQ_slct col. (4). Demand is residual of demand equation in column 3 of table 4. Unreported constant included. Clustered standard errors at firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8. The evolution of prices, demand and productivity for new firms

VARIABLES	(1)	(2)	(3)	(4)
	TFPRE	Log P	Demand	TFPQE
$Age0_t$	-0.0933**	-0.0644***	-0.517***	-0.0398
	(0.0387)	(0.0229)	(0.118)	(0.0452)
$Age1_t$	-0.0711	-0.0459*	-0.305**	-0.0347
	(0.0491)	(0.0257)	(0.136)	(0.0529)
$Age2_t$	0.00790	0.0190	-0.0454	-0.0153
	(0.0535)	(0.0291)	(0.150)	(0.0637)
$Age3_t$	0.0220	0.0305	0.107	-0.0117
	(0.0552)	(0.0288)	(0.149)	(0.0596)
$Age4_t$	-0.0136	-0.0650**	-0.291*	0.0708
	(0.0425)	(0.0324)	(0.157)	(0.0445)
$Age5_t$	-0.0271	-0.0327	-0.154	0.00770
	(0.0456)	(0.0265)	(0.151)	(0.0490)
$TFPQ\_slct_t$		-0.274***		
		(0.0300)		
lnKi (initial)	-0.0659***	-0.00830*	0.130***	-0.0794***
	(0.0125)	(0.00497)	(0.0289)	(0.0137)
lnLi (initial)	0.0625**	0.00447	0.808***	0.0800***
	(0.0248)	(0.0158)	(0.0846)	(0.0273)
$Public_t$	0.0948	0.0307	0.0266	0.0883
	(0.0643)	(0.0377)	(0.225)	(0.0717)
Any $foreign_t$	-0.113	-0.0436	-0.220	-0.0952
	(0.105)	(0.0740)	(0.357)	(0.0823)
Export $Dummy_t$	0.124	0.0996	0.431	0.0339
	(0.0755)	(0.0682)	(0.300)	(0.0882)
Year	Yes	Yes	Yes	Yes
Product	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Observations	2864	2864	2864	2864
R-squared	0.510	0.953	0.337	0.839

Notes: Clustered standard errors at firm level in parentheses. Demand is the residual of the demand equation shown in Table 4, column 3. *** p<0.01, ** p<0.05, * p<0.1. Unreported constant included.

Appendix

Table A1. Unit price summary for P within P3 and P97

p41c4_	**Unit**	Mean(p)	p50(p)	min(p)	max(p)	sd(p)	sd(lp)	cv(p)	N(p)
Tea	KG	11.51375	10.8	5.94	19.23	3.605473	.3188294	.3131449	126
Edible oil	KG/LT	9.621965	9.07	5.69	16.2	2.37102	.2431566	.2464174	382
Oil cakes	KG	.4516434	.4	.06	1.5	.2593364	.6203459	.574206	283
Flour (wheat)	KG	2.577765	2.65	1.0884	3.795	.5373561	.2380541	.2084581	743
Bread (for metric unit only)	KG	4.328014	4	2.5	10	1.384864	.2798264	.2541508	727
Sugar	KG	4.562897	4.21595	2.5656	10.8411	1.704542	.2982124	.3735657	40
Liquor	LT	16.32336	16.8	10.5	20	1.696183	.1085016	.1039114	413
Beer	LT	5.957133	6.301515	3.08	12.9193	1.750648	.2992096	.2938742	158
Lemonade (soft drinks)	LT	4.221937	4.166667	3.125	5.22	.5415168	.1308305	.1282626	227
Cotton fabrics	SQM	6.74187	5.985	2.55	17.27	3.283965	.4517855	.4871001	292
Cotton yarn	KG	21.16431	19	12.44	51.8	7.691528	.3082716	.3634198	132
Nylon fabrics	SQM	8.455517	8.51	4.87	12.39	1.750792	.2187746	.2070592	58
Leather garment	SQF	10.70731	9.23	1.44	41	8.157958	.6218656	.7619057	81
Crust hides and wetblue hides	SQF	6.412759	5.8	.89	15	3.354631	.5404076	.5231183	80
Leather shoes and boots	PAIRS	61.65437	58.42	25	126.18	20.66206	.3365625	.3351272	486
Timber	CUB.M	1783.654	1778	495	3800	697.2754	.42268	.3909253	167
Gravel	CUB.M	95.90831	90	39.1	195	33.52443	.3483421	.3495467	290
Plastic footwear	PAIRS	8.242137	6.9	3.04	36	5.450559	.4667361	.6613041	498
Bricks of clay	PCS	.6915603	.6	.4	1.32	.2463302	.3308411	.3561948	109
Cement blocks	PCS	2.257217	2.1	1.25	4.37	.5879784	.2434398	.2604881	1316
Cement floor tiles	SQM	40.50493	37.44	7	166	21.72471	.5029547	.5363473	175
Cement	KG	.7016772	.65335	.435	1.4901	.2638925	.3170769	.3760882	46
Nails	KG	6.206165	5.77	3.93	11.98411	1.582849	.2413431	.2550446	65
Wires	KG	8.223145	7.985	2.46	12.94	2.215233	.2940674	.26939	60
Vaseline	KG	18.16026	17	7.829999	35.33	6.017519	.3174564	.3313564	81
Paraffin	KG/LT	27.66651	20.15	8.98	83.91	18.83157	.5407912	.6806629	287
Coffee (Milled)	KG	22.8061	24	8.17	33.6	7.230071	.3778923	.3170236	41

Table A2. Revenue share of a product selected as major product among selected products

Product	mean	p50	sd	min	max	N
Tea	.7642337	.776008	.2181177	.1502504	1	45
Edible oil	.8450001	.9100978	.1677542	.3112822	1	298
Oil cakes	.5967218	.5877863	.0988283	.5102041	.7538735	5
Flour (wheat)	.9342096	1	.1643112	.0021914	1	583
Bread	.7515118	.9501183	.309753	.0081185	1	488
Sugar	.9304569	.9817675	.1243751	.5177934	1	31
Liquor	.5935034	.5999656	.2086854	.0076474	1	90
Beer	.8150789	.8723925	.1425953	.4872943	1	57
Lemonade (soft drinks)	.555601	.533848	.1061218	.2656777	1	59
Cotton fabrics	.5875103	.5187968	.2522806	.2029806	1	68
Cotton yarn	.5260595	.4967197	.2371481	.1522658	1	48
Nylon fabrics	.5298888	.5424613	.1068792	.3576697	.7146561	11
Leather garment	.2498415	.1038942	.2889866	.0004916	.9624314	26
Crust hides and	.2982448	.1665148	.2943526	.0012479	1	50
Leather shoes an	.7890972	.846727	.225266	.0249161	1	249
Timber	.9001228	1	.2424061	.0442101	1	123
Gravel	.6388954	.6026786	.2975923	.0901382	1	121
Plastic footwear	.5765909	.5234326	.3169391	.0032079	1	169
Bricks of clay	.9377542	1	.1442788	.3888889	1	59
Cement blocks	.6204691	.5831944	.2445371	.0067595	1	599
Cement floor tile	.5338686	.4990259	.2828305	.0427433	1	84
Cement	.9101429	1	.1437082	.5300261	1	39
Nails	.7790731	1	.3124588	.029105	1	67
Wires	.4207218	.2172211	.5090111	.0449441	1	3
Vaseline	.620885	.6158112	.2332482	.027773	1	30
Paraffin	.6190832	.5559087	.2478832	.2702311	1	82
Coffee (Milled)	.9689603	1	.0968267	.601117	1	31
Total	.7387405	.8448988	.2811175	.0004916	1	3515