

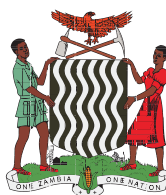
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# Who's productive in Zambia's private sector? Evidence from the Zambia Business Survey

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## About this publication

This report forms part of the findings of the Zambia Business Survey (ZBS). The ZBS comprised two separate surveys. The MSME Survey was a nationally representative survey across all nine provinces of individuals who owned and ran their own businesses and employed up to 50 individuals. The supplementary Large Business Survey (LBS) was a survey of 161 large enterprises employing 51 or more individuals.

The results of the ZBS are in the main summary report, *The profile and productivity of Zambian businesses*. Analysis of the data resulted in four technical papers, including this one. The other papers cover:

- The business landscape, which looks at the environment in which Zambian businesses operate (*The business landscape for MSMEs and large enterprises in Zambia*)
- Access to finance, which explores the demand-side data relating to access to financial services (*Demand-side analysis of access to financial services for businesses in Zambia*)
- The Business Facilities Measure, a model that groups enterprises and divides the market into more manageable segments (*Segmenting the market into powerful pictures: Application of the Business Facilities Measure - BFM*)

These reports are available via the web or from the offices of the four partner agencies that produced this work: Zambia Business Forum ([www.zbf.org.zm](http://www.zbf.org.zm), [secretariat@zbf.org.zm](mailto:secretariat@zbf.org.zm)); Private Sector Development Reform Programme ([www.psdrrp.org.zm](http://www.psdrrp.org.zm)); FinMark Trust ([www.finmark.org.za](http://www.finmark.org.za), [julietmunro@iconnect.zm](mailto:julietmunro@iconnect.zm)); and World Bank Zambia Country Office ([www.worldbank.org/Zambia](http://www.worldbank.org/Zambia), Pyramid Plaza, Plot No 746 Church Road, Lusaka. Tel: 260-1 252 811).

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# Introduction

**Past analyses of private-sector competitiveness in Zambia have been hampered by their focus on large formal sector enterprises.** While these studies have yielded important insights, it is important to recall that 80 percent of private-sector business in Zambia is conducted by enterprises with fewer than 50 employees. Most of these firms are very small informal<sup>1</sup> operations, with less than five employees. These firms constitute the bulk of private sector employment in Zambia, employing 73% of the total labor force.<sup>2</sup> Little has been known to date of the performance characteristics of these firms and the constraints under which they operate, rendering it difficult for policy makers, businesses and donors to design policies, services and/or programs to help improve their performance.

**The Zambia Business Survey (ZBS) was designed to bridge this knowledge gap; it is the first comprehensive, nationally representative survey of micro, small and medium-sized enterprises (MSMEs) across all nine provinces.**<sup>3,4</sup> The survey covers urban and rural areas all nine provinces. The sampling methodology ensured that all MSMEs—including informal firms that are hard to find—are represented.<sup>5,6</sup> The ZBS is the first survey providing detailed information on the provision of finance, infrastructure and business support services to the private sector, along with a host of other information on enterprise employment, sales, costs and factors determining business viability and potential.

**This report examines the productivity of Zambian enterprises.** It is one of four technical papers that collectively provide a comprehensive profile of business activity in Zambia, including the performance of Zambian businesses, the constraints under which they operate and the provision of business services that impact their competitiveness and growth. The report has three goals. First, it will identify the salient characteristics of private-sector small business activity in Zambia. Second, it will identify and analyze the key constraints holding back small-business performance. Third, it will identify policies and programs that will enable these small businesses to grow rapidly in the medium term.

The remainder of this report is organized as follows: The first section describes enterprise characteristics, including the sectors in which firms operate, their location, employment characteristics and revenues. The second section discusses measures of firm performance, and examines dispersions in levels of performance between MSMEs versus large firms, and also dispersions in performance within the MSME sector. Section 3 discusses the reasons for differences in performance, and presents the econometric estimates<sup>7</sup> which highlight factors that are significant

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<sup>1</sup> Firms are defined as informal if they are not registered with Zambia Revenue Authority for tax purposes.

<sup>2</sup> Zambia Labor Force Survey, CSO 2005.

<sup>3</sup> GRZ recently revised its definitions of MSMEs. Firms between 50-100 employees are now classified as medium enterprises. The results of the ZBS suggest that the lower bound of this range is too high for its target population.

<sup>4</sup> The sample was selected through rigorous area sampling using a methodology based on the ILO's 3-stage sampling method.

<sup>5</sup> See Steadman Group (2009b) for a more detailed description of the survey.

<sup>6</sup> A supplementary survey of 161 large firms (employing greater than 50) was undertaken at the same time. The survey instrument was similar, but not identical. The identification of potential respondents was not done in as comprehensive and systematic a fashion. Results from this supplementary survey will be compared and contrasted with those of the MSME survey, but the focus of attention will be the MSME survey.

<sup>7</sup> As an example: an educated entrepreneur in Lusaka along the line of rail is observed to have higher productivity than another less educated entrepreneur located in the Western province. Is this difference simply due to differences in location, or due to differences in education? Econometric analysis allows us to examine productivity as a residual, after adjusting for various endowments and constraints that influence firm level performance, and thus sort between these complementary influences and identify the ones that are most important.

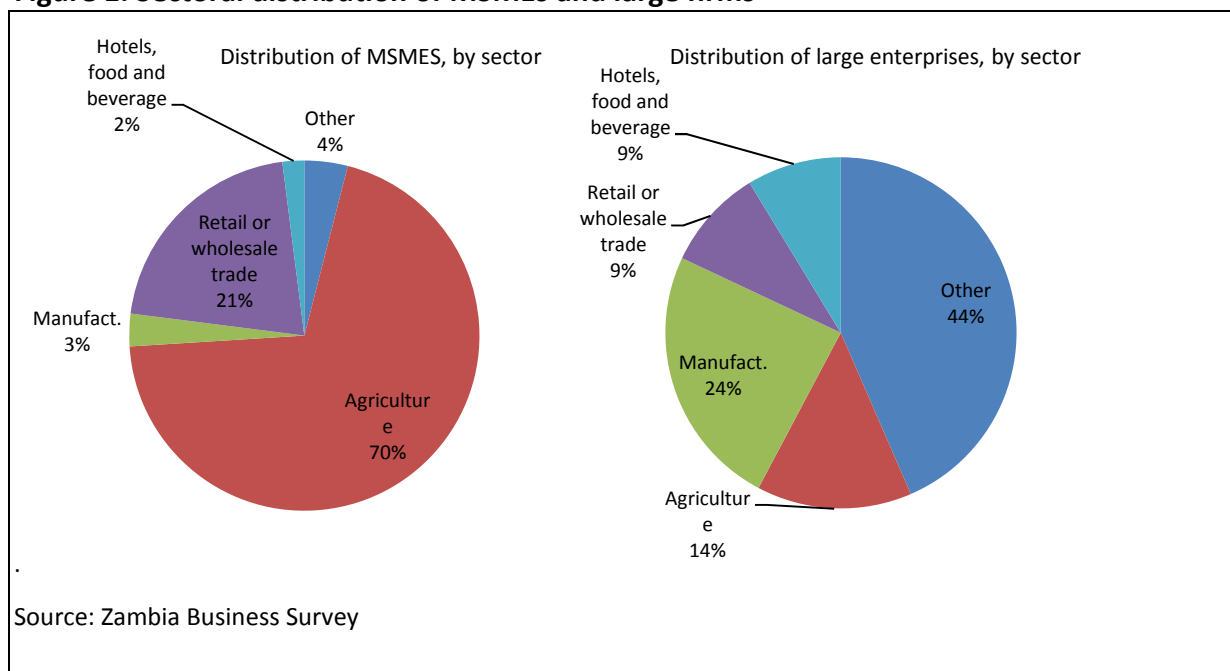
drivers of firm efficiency and competitiveness. Section 4 presents policy recommendations. An appendix describes the economic theory underlying the econometric tests.

## I. Zambian enterprise characteristics

This section describes the business landscape in Zambia, including the sectors and regions in which firms operate, the range of business sales, and the inputs (capital and labor) that are used in the production process. Each of these will have an impact on the measurement and analysis of productivity that follows in Section 3 below.

**The sectoral distribution of firms shows that agricultural firms dominate the MSME sector; large firms are in more diverse sectors.** Figure 1 below presents the sample distribution of firms by sector. We see that 70% of MSMEs are located in agriculture; most of the remainder-21%-are located in the retail sector. Only 2% of firms are located in service industries such as hotel, restaurant and transport. Manufacturing comprises only 3% of the sample, and these are mainly small agro-processing activities. Firms in the large enterprise survey are far less concentrated in agriculture and wholesale and retail trade (see panel 2 in Figure 1). Moreover, many of these firms are in the manufacturing sector (about 24 percent of firms). Furthermore, we find more diversity of sectors and industries represented among large firms—about 44 percent are in other sectors such as mining and excavation, vehicle repair, transportation and storage, education, finance, real estate, electricity, gas and water.

**Figure 1: Sectoral distribution of MSMEs and large firms**



**Zambian businesses along the line of rail have access to better services.** Historically, Zambia’s growth has occurred along the railway line connecting the Copperbelt with Lusaka and Livingstone. Four provinces that lie along this line of rail-Copperbelt, Central, Lusaka and Southern-are more densely populated, urbanized and have a more developed infrastructure compared to other provinces. Differences in population densities, urbanization, access to public electricity and key sources of water supply are presented in Table 1 below. Corresponding differences exist in the population of MSMEs. 35% of MSMEs along the line of rail have access to water supply, compared to 19% in other provinces. 13% of MSMEs along the line of rail report having electricity from the public grid, while only 5% of MSMEs in other provinces have such access. However, other corresponding differences, such as access to better roads, to business support services and to larger markets, are

not measurable, but may contribute towards differences in observed productivity. Differences in productivity within MSMEs that may arise due to advantages of being located along the line of rail are examined in Section 3 below<sup>8</sup>.

**Table 1: Differences in service provision in provinces along the line of rail versus others**

				Populati on Density (per sq. km)	%age population					
					Urban	Rural	Electricit y	Water Supply		
	Province	Population	Area (sq.km)	2000				Borehole	Public tap	Own tap
Line of Rail	Copperbelt	1,581,221	31,328	50.5	77.9	22.1	43.9	3.7	10.1	44.3
	Lusaka	1,391,329	21,896	63.5	81.8	18.2	51.4	11.7	41.2	27.6
	Central	1,012,257	94,394	10.7	24	76	11.9	30.7	8.9	9.6
	Southern	1,212,124	85,283	14.4	21.2	78.8	13.5	37.3	9.2	12.9
Other	Eastern	1,306,173	69,106	17.8	8.8	91.2	4.8	43.8	2.9	2.9
	Luapula	775,353	50,567	15.3	13	87	4.6	7.7	1.2	0.6
	Northern	1,258,696	147,826	8.5	14.1	85.9	6.5	9.7	6.7	3.8
	N-Western	583,350	125,826	4.6	12.3	87.7	4.9	12.1	9.6	3
	Western	765,088	126,385	6.1	12.1	87.9	3.5	23.1	4.6	3

Source: Zambia Living Standards Monitoring Survey, 2006

**Most workers in MSMEs are unpaid family members or workers paid in kind:** A challenge for any productivity analysis that includes household enterprises is measurement of employment. Estimates of employment are likely to be noisy for this sector, given the use of part-time workers, seasonal workers and family labor. However, if the biases from measurement errors are similar across firms within particular groups, it is still possible to obtain reasonable measures of productivity.

The survey asked detailed questions on employment. Individual managers of each firm were asked whether they were the sole owners. If not, they were asked details on the number of workers who were paid, unpaid or paid in kind. Our data show that a near-majority of employees in the MSME sector are unpaid family members (44%), and almost a quarter of the remainder are paid in kind (23%). Only one-third of workers are paid in cash.

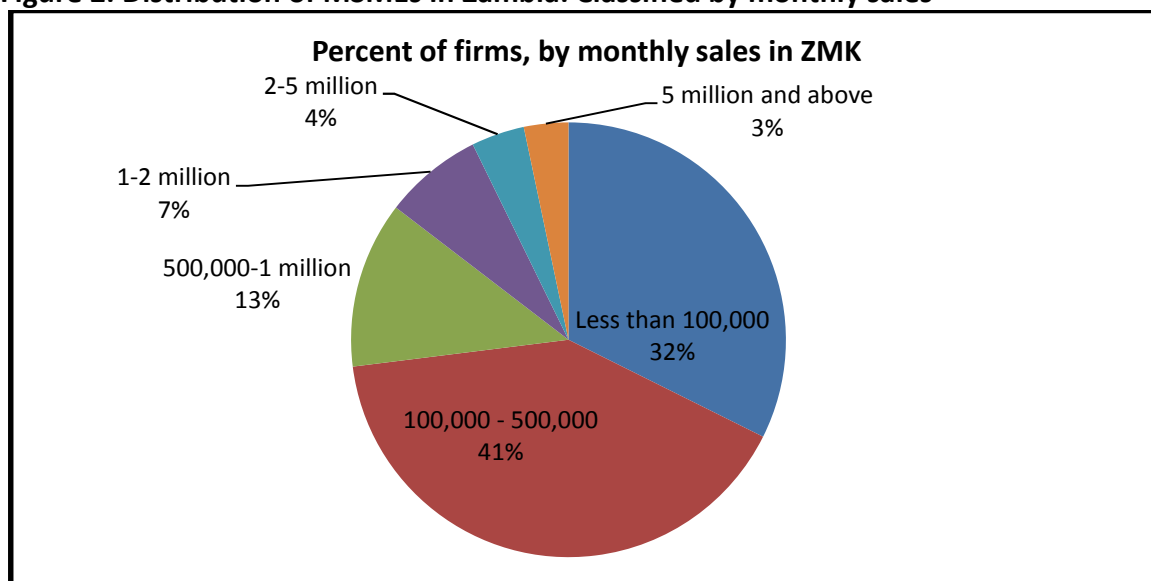
**There are very few firms that pay market wages and have only paid-in-cash employees.** Firms that use unpaid family labor are likely to use their workers less efficiently than firms that have to pay market wages for their workers in cash. Workers that are paid-in-kind are likely to be less productive than workers paid in cash. It is important to control for these differences when measuring the productivity of enterprises. Data show that 35% of MSMEs are sole-ownerships, having no unpaid, paid-in-kind or cash employees. 32% of the remainder are family firms, with the owner working along with unpaid family members. About one fifth (21%) have a mix of unpaid family members, workers paid in kind and cash, while only 12% of MSMEs are “entrepreneur” firms, where all workers are paid in cash only. Differences in methods of organization are likely to be correlated with enterprise efficiency, and are examined below.

<sup>8</sup> It is important to note that almost the entire population of large firms is located along the line of rail. Surveys of these firms (such as those in the World Bank Enterprise Surveys and Zambia Business Survey of Large firms) are drawn from a population list that covers only the four provinces along the Line of Rail. Even the CSO’s indices of Industrial Production are computed from a population of formal sector firms in the four provinces along the line of rail.

**Most MSMEs are very small in terms of sales.** Past studies of the MSME sector do not include any productivity analysis, due to lack of reliability in their measures of enterprise revenues. This present survey is unique in that it collects detailed information on enterprise sales and costs, that allow us to examine different measures of productivity.

Firms were asked about their total monthly sales. The distribution of firm size by sales is presented in Figure 2 below. Of the firms that answered the question on sales, about 73 percent reported sales of less than 500,000 ZMK per month.<sup>9</sup> Using exchange rates from the time of the survey, this is about \$140 per month (about \$1,680 per year).<sup>10</sup> Only about 3 percent of the firms had sales of over 5 million ZMK per month.

**Figure 2: Distribution of MSMEs in Zambia: Classified by monthly sales**



Source: Zambia Business Survey

**However, for firms in agriculture, the total output may be greater than total sales, since a part of output may be consumed, bartered or given away.** Firms in agriculture were asked details on the percentage of output that was sold versus consumed or bartered. Most firms reported some household consumption-the median was 30%. In estimating productivity differentials, we adjust for this difference between sales and output. Details are presented in the section below.

**Enterprises are established with very little startup capital:** A major source of difference in firm productivity could be related to capital use. The ZBS did not ask entrepreneurs about their current capital stock. However, firms were asked a question on the amount of capital they required to start operations. We use this as a proxy measure for capital stock.<sup>11</sup> Figure 3 presents the average startup capital per worker in agriculture versus other sectors. The median capital per worker is extremely low-less than \$100.00 in all cases.

For firms that have unpaid family members working on the farm or in retailing, or for firms that have some mix of unpaid and paid workers, we see that the average capital invested is less than \$30.00

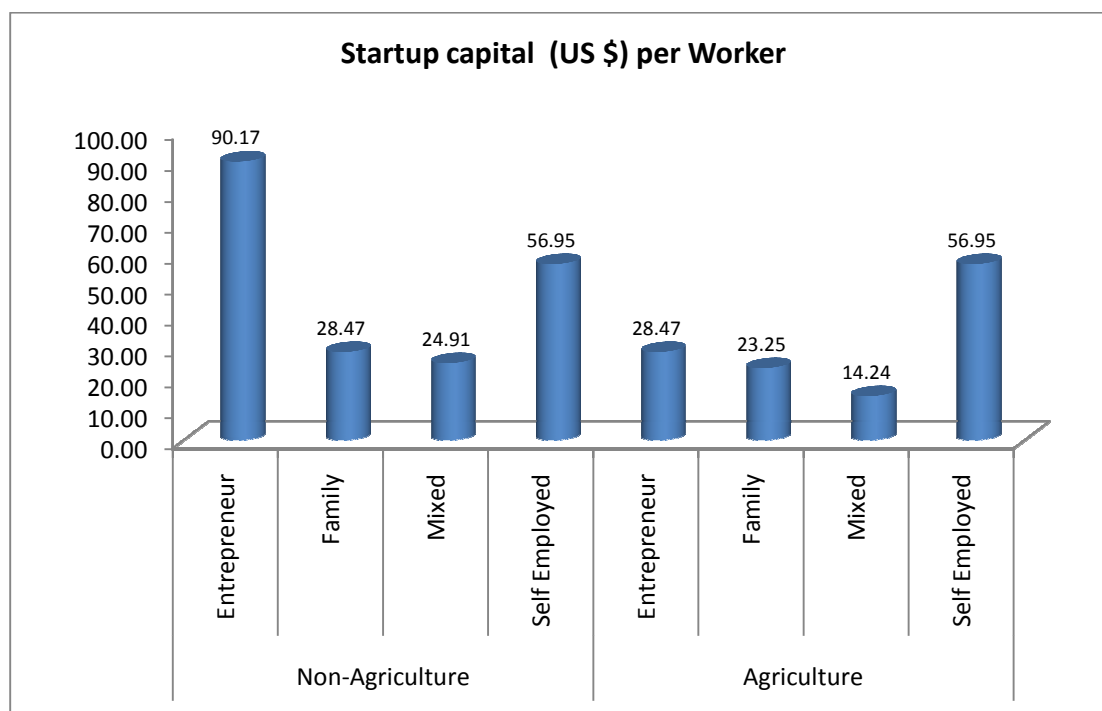
<sup>9</sup> About 20 percent of firms did not answer this question. For those who answered in estimated annual sales, this was averaged over 12 months; For those who answered in dollar amounts the amount was converted to ZMK using an exchange rate of 1 US Dollar = 3512.9 ZMK (2008 est.)

<sup>10</sup> In early May 2009, the exchange rate was approximately ZMK4,500 per \$1. This amount then equals approximately \$110 per month or \$1,320 per year.

<sup>11</sup> The ICA survey on microenterprises asked firms about the resale value of their capital stock. The resulting distribution of firms is very similar to those found in the present survey.

per worker. It is highest for entrepreneurial firms in retailing and service sectors, at \$90.00 per worker. The average for self-employed individuals across all sectors is \$56.00.

**Figure 3: Startup capital per worker**



Source: Zambia Business Survey

## 2. The record on enterprise productivity in Zambia

The ZBS does not have information explicitly on the international competitiveness of private enterprises. This note will address the question of international competitiveness indirectly by examining the determinants of and constraints on the productivity of the firms. Productivity will be measured in two ways. The first measure is labor productivity, or output divided by the number of workers<sup>12</sup>. The second measure is total factor productivity, and is derived by adjusting labor productivity for the various endowments and constraints influencing firm-level performance. Policies that lead to increased productivity on average will be considered policies that increase international competitiveness.

**MSMEs are far less productive than large formal firms.**<sup>13</sup> MSMEs produce far less output for each worker they employ than large, formal firms in the same sectors.<sup>14</sup> Workers in the average microenterprise in the agricultural and service sectors produce only about one-sixth of workers in the average large firm in the same sectors. The difference for workers in manufacturing and retail firms is even greater— those in microenterprises produce about one-ninth of the amount that workers in large enterprises do in the manufacturing sector and less than one-twelfth as much in the

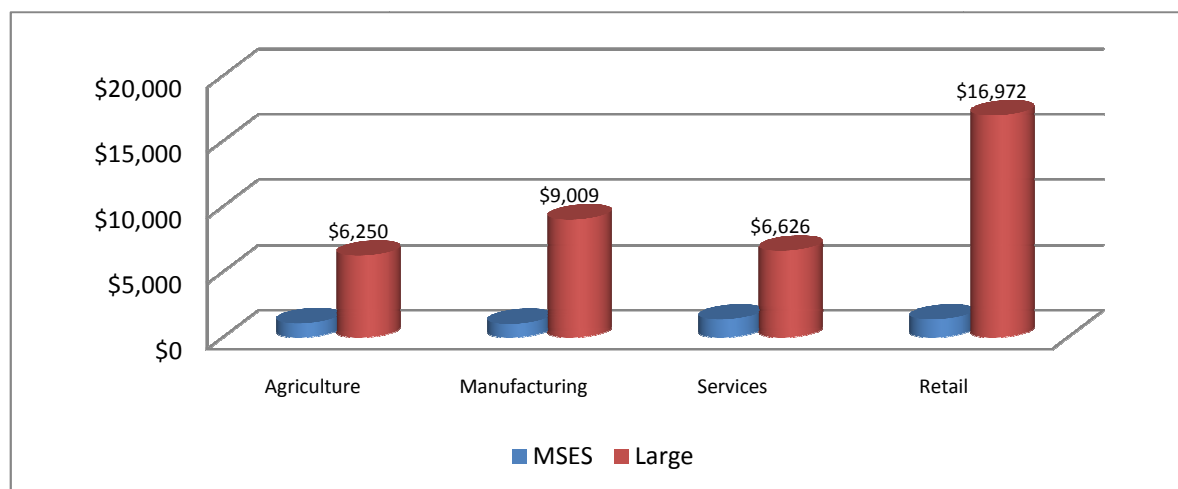
<sup>12</sup> Note that output is measured in value terms (i.e., in monetary terms) rather than in physical units. This is standard when comparing enterprises in sectors where quality varies.

<sup>13</sup> Performance is measured by output per worker. Labor is a common input found in most production processes. The efficiency with which firms use labor to produce goods is the single largest factor determining living standards. Increases in productivity can boost living standards because companies can increase wages by rising output.

<sup>14</sup> Note that output is measured in value terms (i.e., in monetary terms) rather than in physical units. This is standard when comparing enterprises in sectors where quality varies.

retail trade sector. Unless the productivity of the workers in microenterprises can be increased, it will be difficult to increase the wages of their workers and the income of their owners. Subsequent analysis in this section focuses on the productivity of MSMEs, of which little is known to date.

**Figure 4: Differences in labor productivity between MSMEs and large firms**



Source: Zambia Business Survey

The description of firms reported in the preceding section suggests two important decompositions of firms in the sample. First, the agricultural firms using different inputs, capital and methods of organization have different production functions than firms in other sectors: they are likely to have quite different characteristics from non-agricultural firms. Second, three forms of “industrial organization” are identified that can lead to significantly different worker productivity. “Entrepreneurial” firms are those which have paid in cash employees in addition to the owner but no unpaid or family workers. “Sole owner” firms are those in which the owner is the only worker. “Family” firms are those in which family members or others are unpaid workers. The following sections disaggregate the data to uncover these differences.

Figures 5 and 6 illustrate smoothed kernel density functions summarizing the distribution of the logarithm of average labor productivity by firm.<sup>15</sup> The horizontal axis is the logarithm of sales per worker. The vertical axis is the likelihood that a firm with that level of productivity will be observed in the sample. The firms are divided into the three groups mentioned above: entrepreneurial firms, sole-owner firms and family firms. (Family firms are classified to include all firms that have both unpaid and paid workers.)

**MSME productivity is likely to differ between agricultural firms and other sectors.** Comparison of the density functions for “entrepreneurial firms” in Figures 5 and 6 illustrates two distinctive features for average productivity of agricultural firms relative to non-agricultural firms.

- There is a “two-peaked” distribution of average productivities: the modal productivity (just under 8.0) is nearly identical between agricultural and non-agricultural firms, but there is also a high probability of observing an entrepreneurial firm with lower average productivity (just above 6.0). Non-agricultural firms have a single-peaked and more “normal” distribution of average productivity.

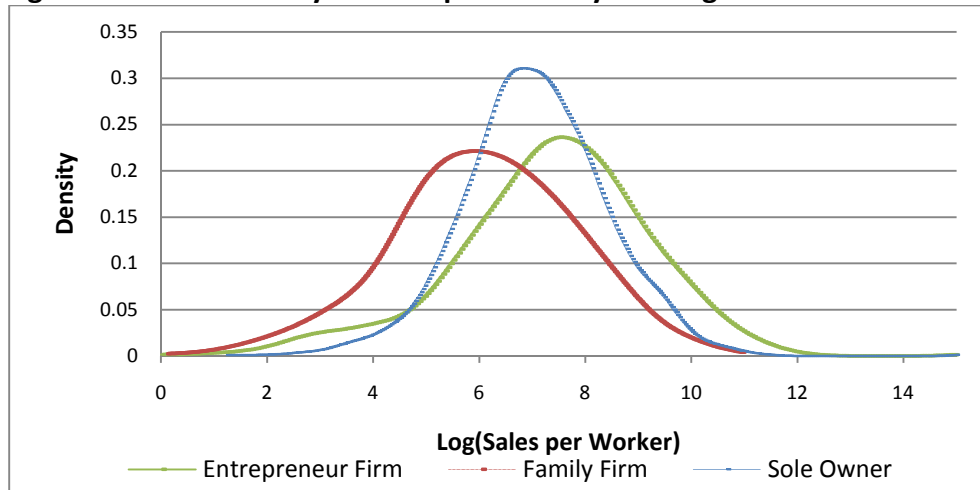
<sup>15</sup> Parameters for creating the kernel density?



- Productivity in agricultural firms is more concentrated around the modal level. The non-agricultural sector has more diffuse distributions of average worker productivity by firm.

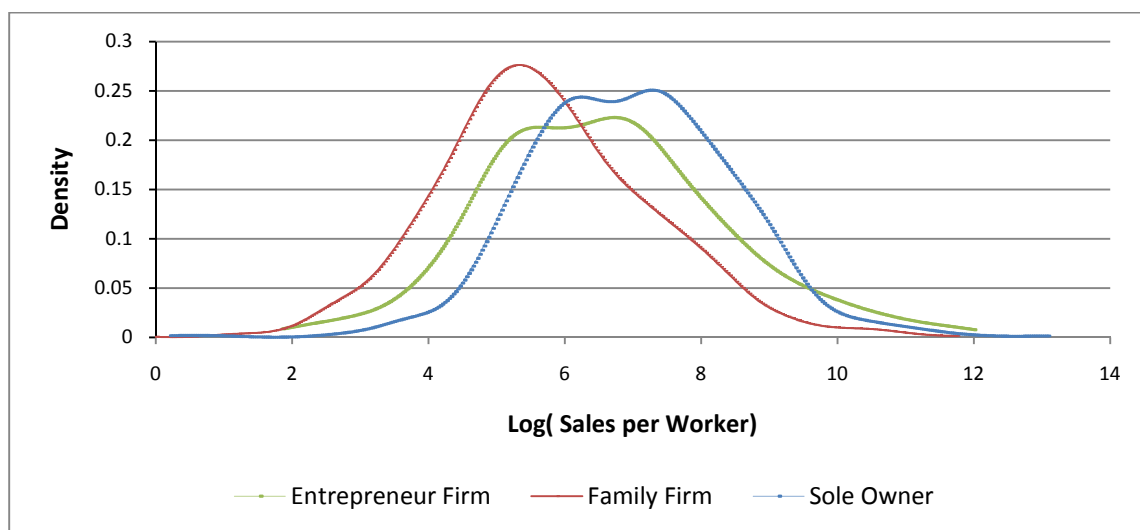
**MSME productivity will depend on the form of industrial organization.** Examination of Figure 5 uncovers that workers in the entrepreneurial firms in non-agriculture- mainly retailing operations- have the highest productivity on average; this is to be expected, since these firms are paying a market wage to their employees. The sole-owner firms have the next-most productive workers, but with a greater variation in average productivity than characterizes the entrepreneurial firms. The family firms have on average the least-productive workers of the three groups: as they use unpaid labor, it is not surprising that they will use labor less productively than the others.

**Figure 5 : Kernel density of labor productivity: Non-agriculture**



A similar pattern is observed in agriculture (Figure 6). Family firms have much lower productivity than firms in the other two groups. Sole owners and entrepreneurial firms have similar productivity patterns-with large variations in productivity for all groups. It is worthwhile noting that very few entrepreneurial firms exist in the MSME population in agriculture-those that do are very small operations. Large commercial farms are not included in this group.

**Figure 6: Kernel density of labor productivity in agriculture**



### 3. What have been the causes for differing productivity in Zambian MSMEs?

The productivity theory presented in Appendix I suggests four different systematic hypotheses to explain the variations in average productivity observed across firms within Zambia. Each hypothesis is potentially true, and regression analysis will be used to test it.

- The first explanation is that of the observed endowments of the firms. Firms with larger capital stock will have greater worker productivity, *ceteris paribus*. In agriculture, worker productivity will depend on land size as well as capital stock.
- The second explanation is based upon the sector of operation of the firm, the location, and the industrial organization. Agricultural and non-agricultural firms will have different average productivity of workers. Workers in rural and urban firms will have different productivity on average. Firms in provinces along the line of rail are likely to have higher average productivity compared to those in other Provinces. Worker productivity in retail and manufacturing firms will differ from that of services firms, and from each other. Workers in entrepreneurial firms will have different productivity characteristics, and the ratio of unpaid workers to total workers will affect average worker productivity.
- The third explanation is based upon the human capital of the owner of the firm. Secondary-school finishers will lead to greater average worker productivity than non-finishers; vocational-school and university finishers will lead firms characterized by greater average productivity than those led by secondary-school finishers. (This pattern is possibly different between agricultural and non-agricultural firms.)
- The fourth explanation builds upon access (or non-access) to productive inputs. A firm with access to water, electricity, banking or cellphone services may not choose to use those services. However, if it does choose to use the services its workers should enjoy increased productivity. Thus, we anticipate that access to these inputs will be productivity-enhancing on average for the firm.

These factors will not explain all the variation in average worker productivity across firms. There will also be a firm-specific productivity that is known to the firm owner but unobserved in the survey. We will provide an estimate of that (total factor) productivity and describe the correlations of that productivity measure with various measures of business sophistication – cellphone use, financial record-keeping, and use of bank accounts.

Table 2 summarizes the results of estimation of a cross-firm labor productivity equation based upon the hypotheses outlined above.<sup>16</sup> The first explanation is supported for both non-agricultural and agricultural firms: as the value of capital stock increases, so also does the productivity of labor. The point estimate of 0.26 for non-agricultural firms (or 0.18 for agricultural firms) is sensible, and indicates that a 10-percent increase in capital endowment will lead to a 2.6 percent (1.8 percent) increase in productivity. For agricultural firms, increase in land size by 10 percent (land is measured in acres) will lead to a 1.6 percent increase in productivity.

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<sup>16</sup> The estimation of productivity for each sector in Table 3 is undertaken jointly with labor demand using the seemingly unrelated regression (SUR) technique. Coefficients significantly different from zero at the 95 percent level of confidence are indicated with \*\*, and those significantly different from zero at the 90 percent level of confidence are indicated with \*. Entrepstat is an instrumental variable created from the probit estimation of the probability that a firm will be an entrepreneurial firm rather than one of the other categories.

**Table 2: Determinants of the logarithm of labor productivity in Zambian MSMEs**

Variable	Agriculture	Non-agriculture
	SUR	SUR
<b>Intercept</b>	5.31*** (0.25)	5.42*** (0.17)
<b>Log(Capital)</b>	0.18*** (0.03)	0.26*** (0.03)
<b>Log(Land)</b>	0.16*** (0.05)	
<b>Rural</b>	0.26* (0.14)	-0.37*** (0.08)
<b>Line of Rail</b>	0.62*** (0.09)	0.30*** (0.08)
<b>Retail</b>		0.37*** (0.13)
<b>Manufacturing</b>		0.19 (0.16)
<b>Secondary</b>	-0.03 (0.17)	0.26*** (0.09)
<b>Vocational</b>	0.45 (0.55)	0.08 (0.24)
<b>University</b>	1.19 (1.54)	0.10 (0.59)
<b>Electricity</b>	0.52*** (0.21)	0.24*** (0.10)
<b>Water</b>	0.23*** (0.09)	-0.12 (0.10)
<b>No Bank Access</b>	-0.10 (0.18)	-0.44** (0.23)
<b>No Loan Access</b>	-0.24*** (0.09)	-0.30 (0.30***)
<b>Entrephat</b>	2.23 (2.07)	0.94 (0.72)
<b>Kindunpaid Ratio</b>	-0.87*** (0.08)	-0.90*** (0.08)
System weighted. Rsq	0.26	0.25

Note: Coefficients significantly different from zero at the 99 percent level of confidence are indicated with \*\*\*, 95 percent level of confidence are indicated with \*\*, and those significantly different from zero at the 90 percent level of confidence are indicated with \*. The excluded category for education is primary and below. Excluded category for sectors is Services (hotels, restaurants etc). No bank access is a dummy variable equal to 1 if the district has no banks, No loan access is a dummy variable, equal to 1 if the district has no bank or Non-Bank financial intermediaries providing loan access. Entrephat is an instrumental variable created from the probit estimation of the probability that a firm will be an entrepreneurial firm rather than one of the other categories.

The sectors of operation and the industrial organization prove to contribute significantly to observed productivity. For non-agricultural firms, a rural location is associated with a 37 percent drop in productivity. Firms along the line of rail have a 30% higher productivity relative to firms in other provinces. Participation in the retail sector is 37 percent more productive than in services (the excluded sector). The choice of being an entrepreneurial firm is associated with 94 percent higher productivity, although this is measured imprecisely.<sup>17</sup> Productivity is reduced significantly by firm decisions to organize around unpaid or paid-in-kind labor.

Agricultural firms show different productivity patterns relative to other sectors. Farmers along the Line of Rail have 62 percent higher productivity compared to those in other provinces, and output per worker is 26 percent higher for farmers in rural areas. Entrepreneurial firms are more productive than their counterparts (including the sole-owner firms), although not significantly so. Here also, the percent of workers that is unpaid is significantly and negatively correlated with the firm-level productivity of labor, indicating that policies that move some unpaid labor to off-farm activities would increase productivity in agriculture.

The third explanation of productivity is based on the human capital of the firm's owner. In Zambia, the educational attainment of the owner contributes positively to productivity in both agricultural and non-agricultural firms, but the effect is statistically significant only in non-agricultural firms. Completing secondary school raises productivity in non-agricultural firms by 26 percent relative to those led by owners with less education, but the increase in productivity from vocational or university education is less (and statistically insignificant). In agriculture, more education is associated with greater productivity but the effects are not statistically significant. Similar studies in other countries have shown high returns to vocational training and university education. While average productivity of firms with more educated managers is shown to be greater than others, these regression results imply that much of the observed productivity difference is due to complementary factors such as access to infrastructure and business services and so on.

Access to infrastructure and inputs, the fourth explanation, proves to make a significant contribution to productivity in both non-agricultural and agricultural firms. Four measures of access are tested: access to the electric grid, access to piped water, access to banking services (checking and saving accounts), and access to lending services.<sup>18</sup> In the non-agricultural firms, access to electricity is associated with 24 percent higher productivity. Access to banking services is associated with 44 percent higher productivity. These are significantly different from zero. In agricultural firms, electricity and water access raise productivity by 52 percent and 23 percent, respectively; lending access leads to a 44 percent increase in productivity. There is thus a sizeable positive effect from extending the physical availability of each of these inputs or services; the magnitude of the effect differs depending upon whether the firm is agricultural or non-agricultural.<sup>19</sup>

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<sup>17</sup> The choice to operate an entrepreneurial firm could logically be dependent upon the unobserved productivity of the firm. To correct for this source of bias, an instrument for the entrepreneurial-firm choice was constructed from a first-stage probit estimation of that choice vs. the other two categories. The predicted probability from that probit was the instrument *Entrephat*.

<sup>18</sup> These are measures of physical access – are these inputs or services available? The explanatory variables are 0 if no access and 1 if access – whether or not the firm chooses to use those inputs or services.

<sup>19</sup> It is important to note that these physical-access variables are defined geographically – if the region has no banks, for example, there is no physical access to banking services. There could also be other differences across regions that contribute to the effect attributed to physical access to electricity, water, banking services or lending.

While these four hypotheses have significant power in explaining productivity, there is much cross-firm variation left unexplained. As the  $R^2$  statistics of Table 2 indicate, these explanations cover 26 and 25 percent, respectively, of the variation in non-agricultural and agricultural firms. The remaining variation can be interpreted as the component of productivity observed by the owner but unobserved by the econometrician. This firm-level productivity (or total factor productivity of the firm) is positively associated with measures of business facilitation.

Correlations between these measures and total factor productivity are presented in Table 3 below. We see that use of banks and cellphones is not significantly correlated with productivity for farmers. Keeping financial records however, is positively associated with productivity, with farmers keeping financial records being almost 10 percent more efficient than others. For firms outside agriculture, all these business facilitation measures are significant and positive. Using a cellphone for business purposes (to contact suppliers and clients) is associated with 18 percent higher productivity, keeping financial records is associated with 15 percent higher productivity, and use of bank accounts is associated with 10 percent higher productivity. These are all very significant. Unfortunately, while these positive correlations may be signs of increased productivity from more sophisticated business practices, it is also possible that the firm chooses more sophisticated business practices because it is more productive. We cannot choose between these explanations with the data at hand.

It is important to note here that other measures of business facilitation-including being members of business associations and using internet services- were not significantly correlated with business productivity.

**Table 3: TFP Correlations**

	Agriculture (Prob >  r )	Non-Agriculture (Prob >  r )
Business Phone	0.02 (0.61)	0.18*** (<0.001)
Financial Records	0.09*** (0.0002)	0.15*** (<0.001)
Use of Banks	-0.0001 (0.95)	0.10*** (<0.001)

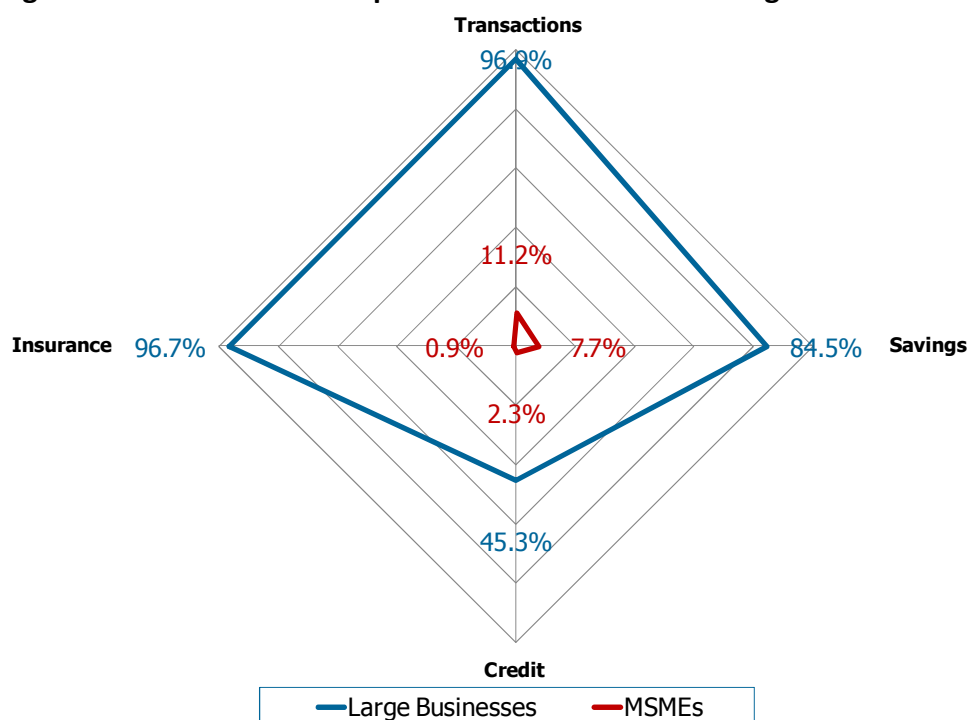
## 4. How can these firms transition to higher-productivity outcomes?

The results of the previous section suggest two groups of policy initiatives to increase productivity (and competitiveness) for MSME businesses in Zambia. **First, physical access to basic business inputs and services can be extended.** Second, increased business sophistication can be encouraged with the hope of increasing productivity in consequence.

**Extend access: Our results show that firms in districts with banking and lending services access are more productive than others. In addition, there is a positive correlation between the firms use of banking and lending services and productivity.** The “Financial Access” chapter provides a detailed examination of the gains from extending access to banking services and lending and makes an important contribution to our understanding of the differences between large firms and MSMEs in Zambia. Figure 7 illustrates the results of an analysis of firms in the Zambia Business Survey. Large businesses have near-universal access to banking services for transactions and insurance. Nearly 85 percent use banking services for saving, and over 45 percent receive credits from the banking sector. The micro, small and medium enterprises that dominate the survey, by contrast, have much less

access. Only 11 percent use banks for transactions purposes, and only 0.9 percent have insurance services. Less than 8 percent use saving instruments, while only 2.3 percent receive financial credits.

**Figure 7: Access to financial products in MSMEs versus large firms**



As is evident, the MSMEs are much less likely to use banking services. As the authors point out, this could have three roots. First, the small enterprises may not have physical access to banking services – the financial institutions may not exist in their district of Zambia. Second, the MSMEs may be unable to afford the financial products offered by the financial institutions. Third, the MSMEs may have no need for financing, or more generally choose not to use the available financing. The authors divide the sample into these mutually exclusive groups for simple banking services:

- Those with access:
  - Currently banked: 11.2 percent
  - Prefers cash transactions: 2.0 percent
  - Has access but currently doesn't use it: 9.0 percent.
- Those without access:<sup>20</sup>
  - Not monetized: 2.4 percent
  - Cannot afford: 39.2 percent
  - No physical access: 37.7 percent

A similar decomposition based on use of financial credit instruments indicates an even more striking conclusion: only two percent of the MSMEs has access to credit, while 98 percent have no access. The reasons are the same: either the businesses have no physical access, or the credit instruments are too expensive. There is an additional, complementary, reason: these small businesses do not, for the most part, keep the financial records necessary to document a credit application. Remembering, by contrast, that 45 percent of large businesses used financial credits, the lack of access to credits disadvantages the small business relative to the large.

<sup>20</sup> The percentages for “those without access” are defined from the “Best Case Scenario” table on p. 44. The “not monetized” and “Physical access” percentages are taken directly from the table. The “cannot afford” percentage is derived as the balance of those without access.

Currently, the high cost and limited range of financial services limits the number of MSMEs that can afford these services. Enhancing access will require changes in service delivery – such as a significant enhancement to banking infrastructure and/or the adoption of alternative distribution strategies – and also a substantial reduction in fees.

The introduction of GPRS-based correspondent banking models where local retailers are used as bank agents to facilitate cash deposits and withdrawals is of interest. Models like this, which have been introduced successfully in Kenya (M-Pesa) and the Philippines (G-Cash), could significantly improve access to banking services in Zambia. One solution of particular significance is the Mobile Transactions (formerly Zoon) service, which was piloted within the cotton industry in Eastern Province and is now being rolled out across the country. Along these lines, stimulating competition in telecommunications will help to drive down costs and expand the network, creating a “knock on” effect for the financial services industry.

However, simply improving physical access to financial services or cellphones will not eliminate the constraints that MSMEs in Zambia face related to access to finance. MSME performance also has to be improved. The productivity analysis in this report suggests several important areas of the investment climate that need to be improved to increase the productivity of MSMEs in the country.

**Increase access to infrastructure:** Our productivity analysis shows that agricultural and non-agricultural firms are far more productive when they have access to infrastructure—electricity, cellphones, and water. Coverage among MSMEs for these services is currently very low. Even in provinces along the line of rail, only about 6 percent of rural MSMEs and 25 percent of urban MSMEs are connected to the power grid. Similarly, only 31 percent of rural MSMEs and 32 percent of urban MSMEs have access in these provinces. Access for both services is lower for firms in other provinces. Transportation infrastructure is also a serious constraint—especially in rural areas. MSME owners were more likely to say that transportation was a serious problem than any area of the investment climate other than access to finance. Almost half of the 41 percent of MSME owners that take their products to customers or markets reported that they spend between one hour and one day transporting them.

**Improve access to basic education:** MSMEs with better educated owners are more productive than other MSMEs in both the agricultural and non-agricultural sectors. Many of the MSME owners, however, only have basic levels of education – especially in rural areas. About half of MSME owners in rural areas have no education or only a primary education and about 45 percent have only a secondary education. Very few have any vocational training in rural areas and virtually none have a university education in either urban or rural areas.

In addition to the direct effect of improving education, there are also strong complementarities between education and other forms of investment. The return to improving physical infrastructure—whether for irrigation or access to cellphone banking—will be lower unless concomitant investments in education are made.

**Enhance business facilitation:** In *Segmenting the market into powerful pictures: Application of the Business Facilities Measure - BFM*, the authors grouped Zambian businesses in terms of “business facilitation”, combining various characteristics including access and use of physical infrastructure, technologies, financial records etc to categorize firms in groups based on their “facilities”. Results from this report corroborate findings from that paper, indicating that interventions that increase business facilitation including availability of cellphones and internet, business networks, training in financial record keeping and so on will lead to increased efficiency and competitiveness of Zambian MSMEs.

## Appendix: Measuring productivity

In measuring productivity in Zambia, it is useful first of all to define efficiency. In Zambia, firms face many obstacles to efficient production. If we define the production function of a firm as the maximal output feasible for any combination of inputs, we use the term “efficient” to define those firms able to bring that maximal output to market for that combination of inputs. In practice, there are many obstacles to efficiency. First, there will be firms without physical access to certain productive inputs: water, finance and electricity are potential examples. Second, there will be firms with access to inputs, but at a price inflated above world prices due to distortions in the market for the inputs.<sup>21</sup> Third, there will be costs associated with production that lower the amount brought to market. Examples will include the following: transport and storage can be so unreliable that only a fraction of output reaches the market; access to working capital may be restricted leading to an inability to use to capacity the factors of production of the firm; power generation may be sporadic, leading to downtime in production. These will all lead to inefficient productive outcomes relative to the technologically feasible output.

Consider that efficient production for producer  $i$  will be represented by the function  $A_i F(K_i, L_i, E_i, Z_i)$ . The inputs to the production process are non-exhaustive, but include for illustration capital ( $K_i$ ), labor ( $L_i$ ), fertilizer ( $E_i$ ) and cellphone use ( $Z_i$ ). Consider a producer  $i$  without physical access to cellphone use, with inflated fertilizer costs ( $v_i$ ) due to a monopoly in that market, and with unreliable storage and transportation services that lead to a loss of  $\tau_i$  percent of the product before it reaches the market. Capital is the fixed input, while the number of labor and fertilizer is chosen in each period. Each producer takes as given the wage paid for labor ( $w$ ), the price of the final good ( $p$ ), the price of fertilizer and the fixed cost of cellphone use ( $c$ ).

Consider as a benchmark the most productive producer’s efficient choice at competitive fertilizer costs ( $v_0$ ), reliable storage and transport infrastructure ( $\tau_i = 0$ ) and physical access to cellphone use ( $Z_i > 0$ ). That choice is illustrated in Figure 1 at point B, with output  $F_0$  and labor use  $L_0$ . Most firms fall short of this benchmark. If firms have no physical access to productive infrastructure (e.g., cellphone use), they can achieve at best the lower production function; there, the most productive producer will have output  $F_1$  and labor use  $L_1$ . There can also be a range of unobserved total factor productivity  $A_i$  among firms. If the most productive firm has  $A_i = 1$  and  $A_i$  is distributed in the range  $A_i \in (0, 1]$ , then the pictured outcome D falls below the efficient frontier with output  $A_i F_1$  and labor use  $L_2$ . Finally, storage losses and monopolistic pricing on fertilizer leads to an outcome E still further below the efficient frontier with output  $(1 - \tau_i) A_i F_1$  and labor use  $L_3$ . If labor productivity is measured by the ratio  $Q_i/L_i$ , then the sequence of choices pictured from point B to point E are at successively lower productivities of labor. This would seem an obvious point, given the output-reducing succession of distortions, but is less obvious when we recognize that optimal labor use is falling as well in the moves from point B to point E. As pictured in Figure 1, the distortions are on net labor-productivity-reducing.<sup>22</sup>

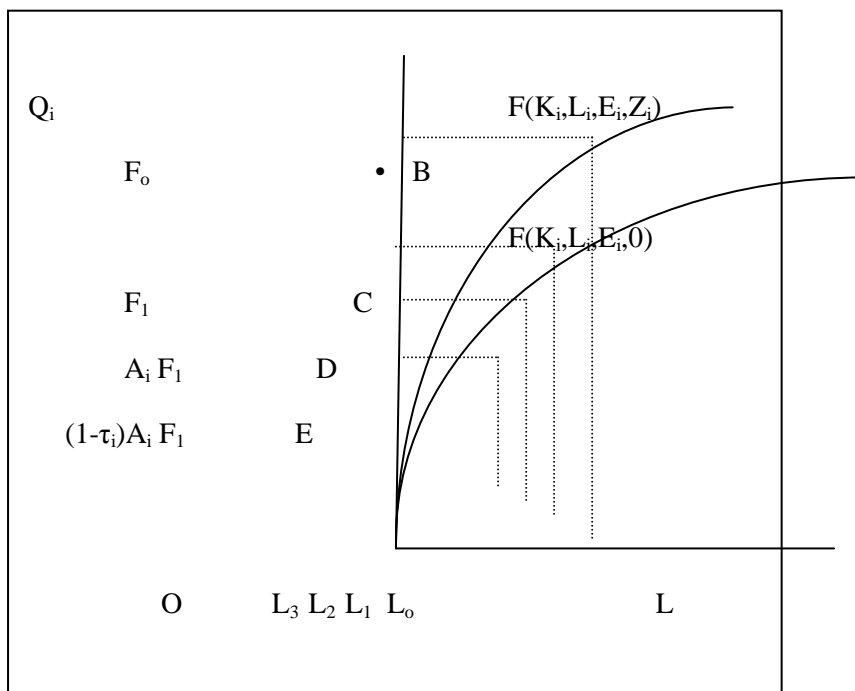
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<sup>21</sup> We could think of access to electricity in both these categories. First, there may be physical inaccessibility to the electric grid of the country. Second, there may be access through use of a generator, but at a price that is in excess of the price for electricity through the grid. There may also be regional differences in cost of electricity through the grid due to transmission inefficiencies.

<sup>22</sup> This can be seen through construction of the ray from the origin to points B, C, D, and E. The slopes of these rays are the measures of productivity.



**Figure 1: Inefficiency and productivity**



The entrepreneur will take into account the cost-driven inefficiency in choosing a scale of production.

$$\text{Max } \pi = p(1-\tau_i)Q_i - wL_i - v_iE_i - c \mathbf{1}(Z_i)_{L,E,Z}$$

This leads to three choice criteria for the producer:

$$p(1-\tau_i)A_i F_L - w = 0$$

$$p(1-\tau_i)A_i F_E - v_i = 0$$

$$p(1-\tau_i)(A_i (F(K_i, L_i, E_i, 1) - F(K_i, L_i, E_i, 0))) \geq c$$

Inverting the first two monotonic relationships yields L and E choice functions for the producer:

$$L_i = G(p(1-\tau_i), A_i, K_i, w, v_i) \quad \text{with } G_1 > 0, G_2 > 0, G_3 < 0, G_4 > 0$$

$$E_i = H(p(1-\tau_i), A_i, K_i, v_i, w) \quad \text{with } H_1 > 0, H_2 > 0, H_3 < 0, H_4 > 0$$

The final criterion defines the producer's choice to use cellphones, should he have access to them. Using a probit specification, it can be used to define the probability of cellphone use (contingent on having access) as a function of  $p(1-\tau_i), A_i, K_i, w, v_i$  and  $c$ .

Labor productivity is defined  $(1-\tau_i)Q_i/L_i$  and is pictured at point E in Figure 1. There are three effects of  $\tau_i$  on the productivity of producer  $i$ . There is a direct effect: output brought to market is reduced by an increase in  $\tau_i$ . There is an induced output effect: because of this loss, the producer will hire fewer of all inputs and thus reduce pre-loss output. There is also the induced effect on labor use: less labor is hired, raising productivity *ceteris paribus*.<sup>23</sup>

<sup>23</sup> For a Cobb-Douglas production function with capital share  $\alpha$ , these expressions simplify to  $\partial \ln L / \partial \tau_i < 0$  and  $\partial \ln(Q/L) / \partial \tau_i = 0$ : labor use falls, but productivity is unaffected. The direct and indirect effects cancel out completely.

While this is an oversimplified model, it makes two important points for analysis of productivity. First, labor productivity should be expected to fall with an increase in costs. Second, if the entrepreneur's choice of input quantities to use in production is endogenous, then these will fall as well with this increase in cost. The ability to adjust labor use will attenuate the direct negative effects of obstacles on productivity. This latter point will be most relevant to large firms with the ability to adjust labor use at the margin. For small entrepreneurs, self-employed or with at most a few employees, this ability to adjust labor at the margin is non-existent or small.<sup>24</sup> Thus, the impacts of obstacles on labor productivity should be more pronounced and more negative in micro- and small-scale enterprises than in larger enterprises.

The previous analysis focused upon firms in continuous operation facing an increase in the cost to doing business. We should also keep in mind that increased costs to doing business will discourage the entry of new entrepreneurs into the marketplace. If we take the previous example, suppose that there is a uniform distribution of firms  $i$  with varying total factor productivity  $A_i$  on the range  $[0, 1]$ . Define the discounted present value of firm  $i$  as the revenues of the firm in excess of payments to labor and losses due to obstacles:

$$DPV_i(\tau_i, A_i, r) = \sum_{t=0}^{\infty} ((1-\tau_i)A_i F(\cdot) - wG(\cdot)) / (1+r)^t$$

$DPV_i$  is monotonically increasing in  $A_i$ . It will be non-increasing in  $\tau_i$  and decreasing in  $r$ , the rate at which the entrepreneur can borrow  $P_k K_i$  from the bank. It will be profitable to spend  $P_k K$  to capitalize a firm so long as

$$DPV_i(\tau_i, A_i, r) \geq P_k K_i$$

This can be restated in terms of a benchmark firm  $A_i^0$  that is indifferent to entry:

$$DPV_i(\tau_i, A_i^0, r) = P_k K_i$$

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<sup>24</sup> Labor productivity could be measured in two ways in this simple model, depending upon our interpretation of the  $\tau_i$ . In true "iceberg" examples, as for example when a farmer produces 10 tons of grain but only  $(1-\tau_i)*10$  tons reaches the market, the observed quantity for output in the ratio will probably be  $Q_i$  rather than  $(1-\tau_i)Q_i$ . The impact on labor use will be the same as in the text, but the effect of increased obstacles on labor productivity will be only the second term in the equation. In that case, productivity will actually be increasing due to induced reduction in labor use. If, by contrast, electricity outages lead to involuntary production shutdowns, the observed quantity for output will be  $(1-\tau_i)Q_i$  as used in the text.

**Figure 2: Inefficiency and entry**

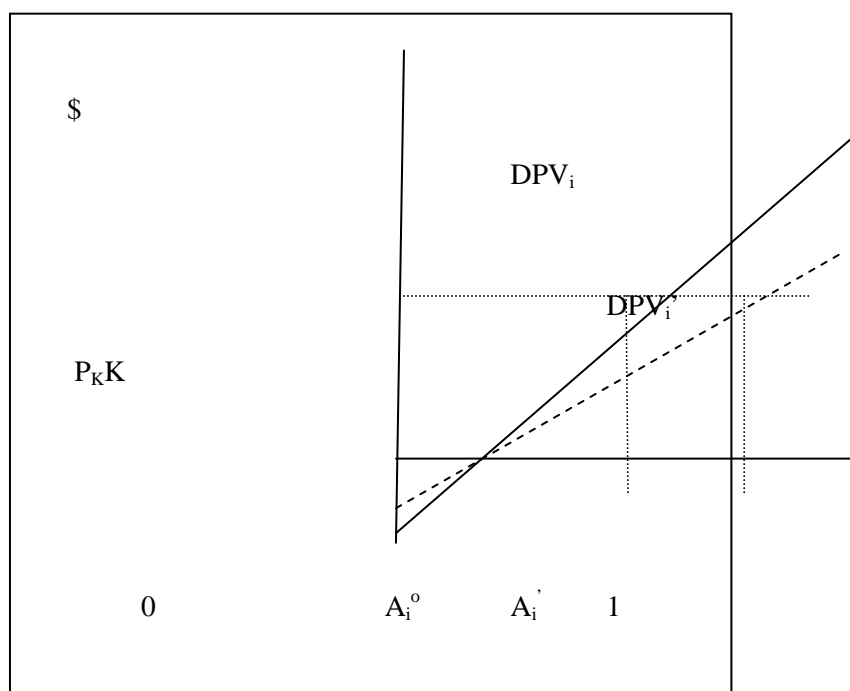


Figure 2 illustrates this benchmark firm located at point  $A_i^o$  on the  $A$  continuum between 0 and 1. Firms with total factor productivity greater than  $A_i^o$  will choose to enter and to produce, while firms with total factor productivity less than  $A_i^o$  will choose not to operate. An increase in the costs to doing business is illustrated in the shift from  $DPV_i$  to  $DPV_i'$  in Figure 2. After this shift, a smaller range of firms will be in operation. The firms with total factor productivity in the range  $[A_i^o, A_i']$  are discouraged from operations by the increase in costs of doing business.<sup>25</sup>

Our goal is to identify ways in which Zambian firms can increase productivity. The example of Figure 1 indicates three ways in which productivity can rise. First, the obstacles to doing business can be reduced: in our examples, transport and storage can be made more secure, electricity provision can be made more regular, access to working capital can be made less costly. This will push production from point C toward point B and raise productivity. Second, the firm's access to inputs complementary to labor can be increased. Improved technology, increased capital, more productive land – all of these will cause a shift upwards in the production function and greater productivity for given use of labor. Third, firms can reduce their use of labor, *ceteris paribus*, to increase measured productivity. This may also increase profits if the firms were *ex ante* behaving suboptimally.

<sup>25</sup> One major obstacle to business activity cited in the Zambian case is the lack of or high cost of access to financing. In this case, the indicator of business obstacle  $\tau_i$  could be translated into a shadow interest rate  $r_i$  for financing. The analysis of Figure 2 will be substantively unchanged by this translation.

## Appendix: Growth accounting for cellphones (or other business facilitation measures)

Suppose that there are two regions in Zambia: one with access to cell towers (denoted T) and one without access (NT). For simplicity, consider the two to have equal populations of firms. Cellphones are productive assets of the typical firm; while the firm can be productive without one, use of a cellphone increases the productivity of other factors.

Firms  $i$  are endowed with an individual and unobserved productivity  $A_i$ . These  $A_i$  are drawn from a uniform distribution over the range  $(0, 1]$ . The uniform distribution over  $A_i$  is identical in both regions.

$$\begin{aligned} Q_{Ti} &= A_i F(K, L, 1) \\ Q_{NTi} &= A_i F(K, L, 0) \\ Q_{Ti} - Q_{NTi} &\geq 0 \text{ for all } i \end{aligned}$$

In region T, firms can choose to receive either  $Q_{Ti}$  or  $Q_{NTi}$ . That decision will be made based upon the marginal productivity of cellphone use and the annual fixed cost of purchasing cellphone access. If  $c$  is the annual fixed cost of using a cellphone and  $p$  is the price of the final good sold by firm  $i$ , it will choose to do so if  $p(A_i (F(K, L, 1) - F(K, L, 0))) \geq c$ . There will be some lower  $A_i$  for which firms choose not to pay for cellphones, and at higher  $A_i$  firms will choose to pay for and use the cellphone. The crossover value of  $A_0$  separates the adopting group from the non-adopting group.

$$A_0 = (c/p) / (F(K, L, 1) - F(K, L, 0)).$$

Average output will be higher for cellphone users, but for two separate reasons:

$$Q = \frac{1}{2} \left[ \int_{A_0}^1 Q_{Ti} di + \int_0^{A_0} Q_{NTi} di + \int_{NT} Q_{NTi} di \right]$$

$$\begin{aligned} Q_T &= (1 - (1 - A_0)/2) F(K, L, 1) \\ Q_{NT} &= (A_0/2) F(K, L, 0) \quad \text{in region T} \\ Q_{NT} &= \frac{1}{2} F(K, L, 0) \quad \text{in region NT} \end{aligned}$$

In region T:

$$Q_T - Q_{NT} = (1 - (1 - A_0)/2) (F(K, L, 1) - F(K, L, 0)) + \frac{1}{2} F(K, L, 0)$$

There are induced productivity gains from cellphones, as is evident from the first term. There is also, however, a selection effect: the  $A_i$  for cellphone users are higher than those for non-users independently of the induced productivity effect.

For the entire economy:

$$Q_T - Q_{NT} = (1 - (1 - A_0)/2) (F(K, L, 1) - F(K, L, 0)) + (A_0/(1 + A_0)) F(K, L, 0)$$

The observed average difference in output among cellphone users and non-users includes the marginal productivity of cellphones weighted by the average unobserved productivity of cellphone

users. It also includes the productivity difference due to the endogenous choice of cellphone use in the second term.

So long as the access to cellphones is the sole distinguishing feature of region T, these differences can be used to identify both productivity effects.

- (1) Comparing  $Q_{NT}$  for region T with  $Q_{NT}$  for region NT will provide an estimate of  $A_0$ . For example, their ratio is equal to  $A_0$  under the distributional assumptions used here.
- (2) Once  $A_0$  is known, the difference between  $Q_T$  and  $Q_{NT}$  can be used to determine the productivity effect of cellphone use.

Considering the comparative static of cellphone use on productivity is thus inappropriate, given that cellphone use is endogenously determined. There are, however, two appropriate comparative-static effects that can be investigated if data are available.

- (1) If cellphone cost  $c$  varies by firm (possibly by region), then the firm-level productivity and the demand for cellphone use can be jointly identified. There will be different  $A_0$  by region, and this variation will allow estimation of both the price elasticity of demand for cellphones and the effect of cellphone use on productivity.
- (2) If the region T in which cellphones can be used is expanded or contracted, the change in demand for coverage can be used to derive the endogenous demand for cellphones and to decompose that effect from the effect of cellphones on productivity. In that region, for each firm  $i$ , there will be before-after observations of  $F(K,L,1)$  and  $F(K,L,0)$ . These observations can be used to identify the productivity effect.

The econometric difficulties here are caused by the unobserved productivity of individual firms. If all firms had identical technological characteristics, then the endogeneity effect would not bias the productivity difference (but then, it would also be the case that either everyone or no one would use cellphones). Improved data collection, including the collection of time series and panel data, will enable future studies to estimate the net impact of cellular telephones and other business facilitation measures on business productivity, after controlling for firm specific fixed effects.