Enterprise Skills and Firm Performance in Zambia:

Evidence from Structural Equation Modeling of a Skills Demand Model

THE WORLD BANK
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<th>Description</th>
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<tr>
<td>BRIC</td>
<td>Brazil, Russia, India, and China</td>
</tr>
<tr>
<td>CIMO</td>
<td><em>Calidad Integral y Modernización</em> (Integral Quality and Modernization Program), Mexico</td>
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<tr>
<td>DEC</td>
<td>Development Economics Vice Presidency</td>
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<td>ESS</td>
<td>Enterprise Skills Survey</td>
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<td>GNI</td>
<td>Gross National Income</td>
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<td>GSEM</td>
<td>Generalized Structural Equation Modeling</td>
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<td>HRDF</td>
<td>Human Resource Development Fund, Malaysia</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>IEG</td>
<td>Independent Evaluation Group</td>
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<td>IGC</td>
<td>International Growth Center</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<td>MESTVEE</td>
<td>Ministry of Education, Science, Technical Vocational Training and Early Education, Zambia</td>
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<td>MPT</td>
<td>Managerial, Professional, and Technical</td>
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<td>MSMEs</td>
<td>Micro, Small, and Medium Enterprises</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>PAC</td>
<td><em>Programa de apoyo a la capacitación</em> (Training Support Program), Mexico</td>
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<td>PSDC</td>
<td>Penang Skills Development Centre, Malaysia</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<td>SACMEQ</td>
<td>Southern Africa Consortium for Monitoring Educational Quality</td>
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<td>SADC</td>
<td>Southern Africa Development Community</td>
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<td>SEM</td>
<td>Structural Equation Modeling</td>
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<td>TDP</td>
<td>Technology Development Program, Zambia</td>
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<tr>
<td>TVET</td>
<td>Technical and Vocational Education and Training</td>
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<td>TEVET</td>
<td>Technical Education, Vocational and Entrepreneur Training</td>
</tr>
<tr>
<td>TEVETA</td>
<td>Technical Education, Vocational, and Entrepreneurship Training Authority, Zambia</td>
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<td>TNA</td>
<td>Training Needs Analysis</td>
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<td>ZDA</td>
<td>Zambia Development Authority</td>
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<td>ZESS</td>
<td>Zambia Enterprise Skills Survey</td>
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ABSTRACT

The objective of this Note is to investigate the skills that formal sector Zambian firms demand, the skill deficits they face, the strategies that firms may use to mitigate skill deficits, and their impacts on firm performance. The Note addressed these issues by estimating a multi-equation skills demand model, using Structural Equation Modeling (SEM) methods, on unique data of 350 formal sector firms developed and fielded jointly with the Enterprise Survey Unit of the Development Economics Vice Presidency (DEC). The skills demand model related several latent constructs—organizational capital that drives skills demand, skill gaps as perceived by employers, and skill strategies—to firm-level productivity and wage outcomes. The findings are consistent with the predictions of the new productivity literature, skill-biased technological change, and research on education and training.

First, ostensibly similar firms of the same size within the same sector can have very different skill needs and skill strategies that affect firm performance. The firm’s organizational capital (know-how) drives skills demand which, in the short term, is manifested in skill deficits and in firm strategies to mitigate skill gaps and respond to demand. High-skills demand firms, such as those that innovate or export, face greater deficiencies in workers’ cognitive and noncognitive skills that pose operational constraints for use of technology, innovation, quality, and production. Some firms, but not others, respond with skill strategies to fill job vacancies, hire skilled expatriates, provide in-service training, and outsource professional services. They also employ a more skilled workforce with a higher share of tertiary-educated and TEVET-credentialed workers, and workers in management, professional, and technician occupations.

Second, production function estimates revealed that skill deficits negatively affect labor productivity while responsive skill strategies improve productivity outcomes. Interestingly, organization capital only affects productivity through its effect on increasing skills demand and thus expanding the gap between desired and available skills and on eliciting skill strategies from some firms but not others to address these skills gaps. The endogenous choice to deploy skill strategies was addressed using an instrumental variable measuring the density of access to skill sources for firms located in different regions and sectors. Instrumenting for skill strategies increased our estimates of the causal impact of skill strategies on labor productivity.

Finally, improvements in labor productivity are associated with higher firm-level wages. In wage equations controlling for skills composition of the workforce, industry and location, firms with higher labor productivity paid significantly higher average wages, roughly equivalent to two-thirds of the higher labor productivity. Like the production function results, skill gaps are associated with lower average wages while skill strategies improve wage outcomes. This result is consistent with the hypothesis that high skills-demanding firms and firms investing in the skills of their current workforce pay wage premiums to attract, reward, and retain their most skilled workers. Wage levels are lower on average in manufacturing relative to service sectors, and in Lusaka-based firms, as compared to firms outside Lusaka which face greater skill shortages.
I. INTRODUCTION

This Note reports the findings of an analysis of the Zambia Enterprise Skills Survey (ZESS). The survey of 350 formal sector enterprises was jointly designed and implemented by the Education Global Practice (Eastern and Southern Africa) and the Enterprise Survey Group of the Development Economics Vice Presidency (DEC). Fielded in 2016, the ZESS was designed to elicit quantitative and qualitative information on the organization and behavior of firms; their skill needs, skill deficits, and skill practices; and firm performance. These unique data are analyzed using Structural Equation Modeling (SEM) to provide novel insights into how firm-level latent (unobserved) measures of organizational capital, skill gaps, and skill strategies are related to firm-level labor productivity and wages. The ZESS also elicited detailed information from firms about skills from universities, TEVET institutions, and private sector training providers, which provide rare insights into firms’ main sources of skills supply.

The Note begins by providing the country context for this study. It highlights salient features of the Zambian economy, labor market, and education and training systems, as well as the key factors that constrain economic growth, industrial diversification, productivity improvements, and job creation. The issue of skills is front and center in policy discussions: what kinds of skills are needed for the continued growth and modernization of the Zambian economy; are the right kinds of skills—cognitive, technical, and soft skills—being supplied by the education and training institutions; are there skill gaps in supply relative to what is demanded by enterprises; if there are skill deficits, why do most Zambian employers not rate education among their top constraints nor provide their workforce with in-service training to upgrade skills; do skill deficits constrain firm performance, and what can policy makers do to remedy this so as to improve labor productivity and create jobs.

Section II outlines the conceptual model and analytical framework used to address these skills questions using the 2016 ZESS. In this model, the demand for different skills can vary across otherwise similar firms because of heterogeneous (and unobserved) capabilities. In the short run, skill gaps may arise because of limited local supply of labor with the multi-dimensioned skill attributes demanded by employers; these skill gaps are unobserved, but proxy measures are available from employer assessments of skill deficiencies of their workforce and the constraints they pose for operations. Skill gaps can constrain operations, leading some more capable firms (but not others) to respond with skill-deficit mitigating strategies. These strategies are imperfectly observed but include in-service training programs to upgrade skills, hiring to fill job vacancies, using high-skilled expatriate staff, and outsourcing key professional services. The postulated relationships between these latent constructs and their measures and consequences for firm performance are analyzed using SEM.

This Note extends this skills demand model to investigate the potential endogeneity of skill strategy choice and its effects on productivity and wage outcomes. Estimates of impacts on firm performance are potentially biased when skill strategy choices are not random but correlated with unobserved firm-level productivity attributes. The causal relationships of interest are identified...
through the use of an instrumental variable measuring access to skill sources for firms operating in different regions and sectors. This instrumental variable approach and the addition of a second wage outcome equation is readily accommodated within our SEM framework.

Section III describes the 2016 ZESS data and the empirical analyses of the base skills demand model using SEM. 1 In the ZESS, 350 formal sector enterprises in four regions were surveyed, stratified by three firm sizes, and eight manufacturing and services sectors. This section provides summary statistics of variables used to measure the latent constructs—organizational capital, skill gaps, and skill strategies—and the production function. These descriptive statistics are reported across two dimensions: first, from a demand perspective (comparing firms with high- and low-skill needs), followed by a supply perspective comparing regions with different skills supply endowments (Lusaka and non-Lusaka firms). The results of jointly estimating the multi-equation base model by SEM are then reported. They broadly confirm the key hypotheses of the skills demand model and provide novel insights into how organizational capital, skill gaps, and skill strategies influence firm-level labor productivity outcomes. Additional instrumental variable results are reported on the causal effects of skill strategies on labor productivity and wages. Instrumenting increases the estimated productivity impact of skill strategies by 50 percent as compared to the baseline model; it increases estimates of wage effects even more.

The Note concludes in Section IV with a summary of the main findings and their implications for policies to support skills development and productivity growth in Zambian enterprises.

Country Context

Zambia, a land-locked country of 11.5 million people in East Africa, is a lower-middle income country with a per capita income of US$1,350 in 2012. Over the past two decades, economic growth has been rapidly fueled in part by the development of copper mining, inflow of foreign direct investment, and expansion of trade and growth in the construction, transportation, and services sectors. Social indicators have improved—with declines in poverty incidence and an increase in levels of educational attainment of the workforce—but job creation in the formal sector has not kept up with population growth, and unemployment rates remain high, especially among youth. Numerous factors constrain economic growth and job creation. Business environment constraints include infrastructure deficits, power shortages, access to finance, and excessive regulation; trade competitiveness is limited by poorly developed supplier networks, small domestic markets, and wage rates that are high by regional and Sub-Saharan standards (Zambia Economic Brief 2013).

The enterprise sector in Zambia is heterogeneous, comprising a large micro, small, and medium enterprise (MSME) sector that makes up more than 90 percent of enterprises in the country, and a small sector of large enterprises employing 100 or more workers. MSMEs themselves are very heterogeneous: the majority comprise low-productivity survivalists, located in rural areas and

1 The Enterprise Skills Survey (ESS) instrument, first piloted for Tanzania in 2015, was used to investigate the skills demand model using traditional regression analysis (Tan, Bashir, and Tanaka 2016).
focused on agriculture; the others are urban-based enterprises operating in trade, manufacturing, and services sectors and have higher productivity and growth potential. Firms in the bottom quartile of MSMEs have productivity levels one-sixth to one-seventh of those in the top quartile, according to the Zambia Business Survey (Clark et al. 2010). The Business Survey identifies some of the key factors driving these productivity-level differentials such as (1) access to water and energy; (2) access to finance; (3) the education and experience of the owner-operators; and (4) use of modern technologies, such as cell phones and Internet, though the relative importance of each factor varies by sector across firms of different sizes.

Skills are thought to be a constraint to growth and job creation. With increased budgetary allocations to secondary and tertiary education, a rising share of the workforce is now completing secondary education; the share of the workforce with tertiary education remains small, at less than 1 percent. Furthermore, shortcomings in education (textbooks, teachers) at the primary level compromise learning at higher levels of education, as suggested by Zambia’s low rankings in math and reading scores on Southern Africa Consortium for Monitoring Educational Quality (SACMEQ) tests of primary school students in South and East African countries. Inadequate public resources are allocated for technical education, vocational, and entrepreneurship training (TEVET), which is important for the growth and diversification of the economy (World Bank 2015). While progress has been made to establish a skills qualification framework and a TEVET authority to assess and accredit training institutions, the supply and quality of graduates from TEVET institutions appear to be inadequate relative to the needs of employers.

Curiously, few employers in Zambia rank inadequate education among their top constraints to operations, and few enterprises provide in-service training to their current employers to mitigate any skill deficiencies (World Bank Zambia Enterprise Survey 2008). The low ranking of inadequate education as a constraint by employers may simply reflect the relative severity of other business environment constraints noted earlier. While education per se may not be a problem, evidence assembled from different sources by Moono and Rankin of the International Growth Center (2013) suggests that gaps exist in the levels and quality of local skills supply relative to skill needs, driven by several factors:

- **Structural change.** Over time, the Zambian economy has moved toward more capital-intensive (and skill-intensive) sectors such as mining, construction, transportation, and manufacturing, which increase the demand for workers with higher education and technical skills. Given the limited supply of these skills, most of the 309,000 jobs created between 2006 and 2010 (Central Statistical Office 2012) have gone to community/personal services and wholesale and retail trades (which require lower-level education and skills) while jobs have actually been lost in the mining, manufacturing, and finance sectors, suggesting a mismatch between skills supply and demand.

- **Skills supply.** The supply of university and Technical and Vocational Education and Training (TVET) graduates, while increasing in recent years, may be inadequate to meet the economy’s skill needs. University enrollments have expanded by almost 50 percent in 2005–2009 (to 19,000) from the establishment of 14 private universities and the conversion
of some colleges into universities. The supply of technically trained graduates from public and private TEVET institutions—about 34,000 in 2009—is also limited, given low levels of public funding, and the Government’s goal of enrolling 50,000 TEVET students by 2015 was not met. The returns to education beyond secondary school are very high, pointing to the presence of unmet demand for higher-level skills. In mining and manufacturing, the largest premiums are to undergraduate degree holders, craft certificate holders, technicians, and post-graduate degree holders, and by this metric, the demand (premiums) for higher-level skills is greater in larger enterprises than in MSMEs.

- **Quality and relevance of skills.** Graduates of higher education and TVET institutions appear to lack modern, industry-relevant skills. Interviews with firms and representatives of industry associations confirm that, since 1974, when the Government took technician training responsibilities away from industry, there has been a consistent mismatch between skills provided by the education system and what industry demands. Industry experts confirm that most higher education graduates have theoretical knowledge but lack the hands-on skills that industry requires. The search for properly qualified graduates with the relevant skills is usually daunting, and when found, usually costly.

- **Expatriate labor.** Employers respond to limited local availability of high-level skills by using expatriate labor. In mining, the sourcing of local workers with relevant skills is daunting and expensive (hence large wage premiums), and most big mining firms must rely on expatriate workers. In construction, recruiting local labor is challenging because of the small pool of qualified workers and competition from international companies, resulting in high wages and making retraining of local labor risky because of ‘skills poaching’ by other firms. Expatriate workers are often better educated and trained, require little retraining, and are available at wage rates comparable to those offered to local workers.

The ZESS provides additional insights into the skills supply sources used by employers to hire workers and provide in-service training to their current employees. Firms were asked to identify up to three named providers for each type of skill source—universities and colleges, TEVET institutions, in-house training, and external training programs—including their names and location. Over two-thirds of the ESS sample identified at least one higher education institution, one-quarter named one or more TEVET institution, and one-fifth reported in-service training sources, with most of the latter relying on in-house training staff as the principal provider.²

- For firms in each of the four regions surveyed by the ESS, the principal source for all skill types combined is the region itself. Proximity appears to be an incentive for employers to use local skill providers rather than those from more distant sources. In Kitwe, 43 percent of skill sources are local; the corresponding figures are 38 percent for firms in Ndola, and

² For all four skill types combined, the median responding firm provided a total of about 2 named skill providers, the top 10 percent of responders reported a total of 4 providers, and two firms reported 11 skill providers out of a maximum of 12 providers.
50 percent for Livingstone-based firms. In contrast, firms in Lusaka rely on local providers for an astounding 77 percent of their skill sources.

- The second largest source of skills for non-Lusaka firms is invariably Lusaka. Lusaka accounts for 36 percent of skill sources for Kitwe firms and for 30 percent of skill sources for firms in Ndola and Livingstone. Other than Lusaka, firms in Kitwe and Ndola source skills from other cities in the Copperbelt Province or from the neighboring Central Province. Other than local skill sources, Lusaka-based firms also source widely from the Copperbelt Province (which include Kitwe and Ndola) and, to a more limited extent, from other provinces in Zambia.

- The regional distribution of where skill sources are located is very uneven. Aggregating skill sources by location, Lusaka emerges as the region with the largest agglomeration of named universities, colleges, and TEVET institutions in the country, accounting for 155 university sources and 119 TEVET sources. By comparison, 84 university and 11 TEVET sources are Kitwe based. The comparable figures are 17 and 41 skill sources based in Ndola, and 8 and 6 for Livingstone-based sources. Thus, while firms in the Lusaka region have access to a dense network of local skill sources, their counterparts outside Lusaka are more reliant on Lusaka-based universities, colleges, and TEVET institutions for their pre-employment skills.

- Some Zambian firms also cited foreign universities and colleges as important skill sources, possibly responding to skill gaps by hiring highly skilled expatriate labor. Of the foreign skill sources identified, the largest foreign skill source was South Africa followed by India, the United Kingdom, and the United States. With a few exceptions, most foreign sources identified were universities.

- Less than one-fifth of ZESS firms reported providing in-service training for their current workforce. Most rely on in-house staff trainers, which explains why less than 10 percent of all skill sources are for in-service training. The vast majority of identified training providers are Lusaka based so that few firms located outside Lusaka tend to report use of external training providers. These findings are consistent with the low reported incidence of in-service training programs among formal sector Zambian firms. The most recent data from the World Bank’s enterprise surveys suggest that the incidence of in-service training

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3 The most commonly cited Lusaka-based universities and TEVET institutions were the University of Zambia, Fairview College, and Evelyn Hone College.

4 Kitwe-based universities include Copperbelt University (formerly part of the University of Zambia) and the newly established Cavendish and Copperstone Universities.

5 Most cited university sources in Ndola are the Northern Technical College and Northrise University.

6 The relative rankings of cities as a source of university and TEVET skills hold up if the comparisons are based on the numbers of distinct universities and TEVET institutions identified as opposed to the total counts of sources cited. This measure—which relies on the names of institutions—is necessarily less precise than total counts because of typographical errors and multiple ways in which institutions may be named, though an attempt was made to correct misspellings and standardize institution names.

7 This may reflect Zambia’s historical and trade ties with South Africa and their common membership in the Southern African Development Community (SADC).
in Zambia lags behind that of many other Sub-Saharan African countries. In fact, the incidence of in-service training in Zambia is below the Sub-Saharan Africa regional average of 30.2 percent which, in turn, is lower than the regional averages for manufacturing firms in the developing countries of East Asia, Latin America, and Europe and Central Asia.

With this country and skills profile as background, the following sections turn next to an analysis of these policy concerns about the potential mismatch between skills supply and demand in the formal sector, the extent and nature of skill deficits, potential skill strategies to mitigate skill deficits, and their effects on firm performance. A skills demand model is presented and implemented using firm-level data from the ZESS. Insights from analyzing these data using an SEM approach are discussed.

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8 At 28.2 percent, in-service training in Zambia is lower than that of low-income Tanzania and Uganda (30 percent to 35 percent); other lower-middle-income countries such as Nigeria, Kenya, and Ghana (31 percent to 41 percent); and upper-middle-income South Africa (37 percent). The World Bank categorizes developing countries as ‘low-income’ when per capita gross national income (GNI) is less than US$1,045, and it uses the US$4,125 per capita income cut-off to distinguish between ‘lower-middle-income’ and ‘upper-middle-income’ countries.
II. ANALYTIC FRAMEWORK

The analytic framework draws upon a new empirical literature that seeks to explain the growth of productivity among firms. In his review of this literature, Syverson (2011) points out that there is broad consensus among researchers about the existence—within narrowly defined industrial sectors—of a pervasive dispersion in productivity levels across firms using the same measured inputs. This within-sector dispersion is much larger than mean productivity differences between sectors. While it is large in high-income countries, this productivity dispersion across firms in the same sector may be even larger in developing countries (Hsieh and Klenow 2009). Productivity-level differences across firms also appear to persist over time, suggesting either that firms have persistent (but unobserved) heterogeneous productive capabilities or, alternatively, that their productivity levels may differ as a consequence of their responses to uncertain demand. The challenge for research is to unpack this productivity ‘black box’ to explain what drives differences within and between sectors and how firm responses may give rise to different productivity outcomes.

Research has focused on employer responses to two broad sets of demand drivers: one from firm-specific productivity attributes and another from competitive pressures affecting numerous firms, such as trade and technological changes (Syverson 2011). Employer responses to the first set comprise individual firm-level strategies such as the introduction of new management practices, team production, inventory control, and quality-control circles (Bloom and van Reenen 2010; Brynjolfsson and Milgrom 2013; Milgrom and Roberts 1990), investing in information and communication technology (ICT) or introducing new product and process technologies (Bartel, Ichinowski, and Shaw 2007), and employer provision of in-service training programs (Dearden, Reed, and van Reenen 2005; Tan and Lopez-Acevedo 2003). These factors are under the control of the firm. Employer responses to the second set of factors focus on strategies adopted by many firms to align with broad demand shifts affecting production and the structure of whole or multiple sectors, such as trade liberalization (Pavcnik 2002) or trade-induced technological change (Bloom, Darca, and van Reenen 2015). These factors do not directly affect productivity, but the competitive pressures that accompany them may elicit responses from firms (such as those described earlier) that do. Taken together, firm responses to the two kinds of demand, together with new firm entry, are thought to be the key drivers of productivity dispersion within and between firms and, more broadly, productivity growth.

In this literature, a robust empirical finding is the complementary nature of firm investments in education and skills, on one hand, and in modern management practices and innovative behavior

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9 The earlier productivity research, which relied on aggregate sectoral data, implicitly assumed that firms were homogeneous and experienced the same productivity growth profile as the aggregate sector. The recently available firm-level data indicate that this assumption is untenable. Research using firm-level panel data points to considerable heterogeneity in productivity among firms even in narrowly defined sectors and provides insights into how productivity evolves through a dynamic process of new firm entry and growth of more productive firms and exit of less-productive incumbent firms.

10 Measuring within-industry productivity dispersion at the 90th and 10th percentile, Hsieh and Klenow (2009) find productivity differences of 5 to 1 in China and India as compared to 2 to 1 in the United States.
on the other, and the positive correlations between these two kinds of inputs and firm productivity outcomes. This correlation arises because, as pointed out by Theodore Schultz (1975), the more educated and skilled are better able to discern the systematic from the random, and thus to deal with disequilibria or uncertainty from the ‘Green Revolution’, technological change, trade, and globalization. Since Schultz’s pioneering research on the productivity of more educated farmers, a compelling body of global evidence has accumulated for firms on the comparative advantage of educated and skilled workers in implementing new technology (Bartel and Lichtenberg 1987), on the skill-based nature of technological change (Behrman, Bound, and Machin 1998; Tan 2005) and more recently, on modern management and workplace practices to use new technology, that finds organizational change to be biased toward the use of more skilled labor (Black and Lynch 2001; Bloom and van Reenen 2010; Bresnahan, Brynjolfsson, and Hitt 2002; Caroli and van Reenen 2001).

The study contributes to this literature by formulating and testing a skills demand model for formal sector enterprises in Zambia. It differs from the literature in two ways: first, it departs from the recent management research relating total factor productivity to a composite management score made up of firm rankings on 18 monitoring, target setting, and human resource practices11 (Bloom, Sadun, and van Reenen 2016). Instead, it treats organizational and human resource practices separately so that complementarities between them are not simply assumed but are testable. Organizational capital—managerial practices and other intangible knowledge from foreign ownership, innovation, and operational experience12—are hypothesized to create demand for different skill mixes that, in the short run, may give rise to skill gaps when skills supply is inadequate in meeting skill needs. How firms respond to this demand and its attendant skill gaps through their human resource strategies (hiring to fill vacancies, skills upgrading through training, using expatriate labor, or outsourcing professional services) are hypothesized to affect firm performance. Second, the skills demand model is estimated using SEM) instead of ‘classical’ regression methods. Several theoretical constructs in this skills demand model—organizational capital, skill gaps, and skill strategies—are latent (or imperfectly observed) variables and must be measured by their observable proxy variables. SEM, which includes regression analysis as a special case, is ideally suited to estimating systems of equations with both latent and observed variables and for identifying the key relationships between variables.

The Skills Demand Model

Consider the following simple model of a firm making choices about the skill composition of its workforce. It faces the following production function relating output (or sales) to technology,

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11 This ‘Management as Technology’ approach underpins the authors’ World Management Survey that has been fielded in over 11,000 firms in 34 countries including the United States; Europe; and several Brazil, Russia, India, and China (BRIC) countries and expanded more recently to include countries in Latin America and Sub-Saharan Africa. Management scores vary widely both within and across countries, are correlated with countries’ income, reflect competitive pressures from trade and innovation, and explain as much as 30 percent of Total Factor Productivity within and across countries.

12 The management scoring methodology excludes indicators for management practices involving innovation, R&D, exporting, or foreign ownership, though Bloom and van Reenen (2010) find positive correlations between firm management scores and these other indicator variables.
broadly defined, and numbers of workers with different levels of educational attainment or skill qualifications:

$$Y_j = Z_j F(K_j, L_1, \ldots L_b),$$  \hfill (1)

where $Y_j$ is output in firm $j$, $Z_j$ represents the technology of the firm, $K_j$ its stock of physical capital, and $L_{bj}$ the number of workers of different types $b$. Following the literature reviewed earlier, technology $Z_j$ can vary significantly across firms even in the same sector because of differences in the stock of intangible technical know-how that confers on firms an advantage. This intangible capital $Z_j$ which we refer to as organizational capital, is not observable, but we hypothesize that it is related to a vector $X$ of firm attributes $k$:

$$Z_j = D(X_1, \ldots X_k),$$  \hfill (2)

where $X_k$ includes measures such as modern management practices, foreign ownership and export orientation, innovative behavior, and accumulated operating experience.

Given this production function and treating $Z_j$ (and $K_j$) as quasi-fixed in the short term, cost minimization for a given level of output yields (by Shepherd’s lemma) the following skills demand for different worker types:

$$S_{bj} = Z_j G(Y_j, w_1, \ldots w_b),$$  \hfill (3)

where $S_b$ is the share (or cost share depending upon function $G$) of each worker type $b$, $Y_j$ is output, and $w_b$ represents the relative shadow price of each worker type. Given the paucity of reliable wage data on the different skill groups, we use a closely related specification in which skills demand is expressed in terms of skill shares of the total workforce.\(^\text{13}\) Following the literature,\(^\text{14}\) we hypothesize that firms with more firm-specific intangible organizational capital are more likely to demand a higher skill mix than other firms.

At any point in time, however, firms’ actual skills mix may diverge from their desired (or optimal) skills. It may take time for actual skill mix to reach desired levels because employers have limited flexibility to replace incumbent workers with new hires who have the requisite skills.\(^\text{15}\) In the Zambian context, this may take a considerable amount of time given the limited local supply of highly educated and trained workers and demand shocks from globalization and technological

\(^\text{13}\) The ZESS elicited data on mean wages of the workforce by occupation but not level of education; however, these wage data were incomplete and not deemed reliable. The challenges of finding reliable wage data have prompted most researchers to rely instead on empirical specifications using skill shares of total labor (Almeida 2010).

\(^\text{14}\) One of the robust empirical findings in the literature is the positive relationship between education and skills, on one hand, and innovation and use of modern management practices by firms (Bresnahan, Brynjolfsson, and Hitt 2002; Brynjolfsson and Migno 2013; Caroli and van Reenen 2001).

\(^\text{15}\) Abowd et al. (2007) exploit the availability of matched employer-employee panel data to study the responses of employers to gaps between desired and actual skills mix, using a partial adjustment model.
change that increase the demand for workers, especially those with higher-level educational and occupational skills.

Denoting a firm’s desired skills mix as $S_{bj}^*$, the divergence between actual and desired skill mix may be represented as follows:

$$\Delta S_{bj} = \gamma_{bj} (S_{bj}^* - S_{bj}), \quad (4)$$

where $\Delta S_{b}$ denotes the skills gap of type $b$ workers, and $\gamma_{b}$ indexes the extent of this divergence for each skill type $b$. The desired skills mix $S_{bj}^*$ is not known, so $\Delta S_{b}$—termed skills gap—is also not observable. However, we have employers’ qualitative assessments $M_{bj}$ of whether current workforce education and skills are adequate, relative to their needs and whether skill shortages pose obstacles to the firms’ operations in areas such as innovation, quality control, supply chain and marketing. Substituting equation (3) into (4), $\Delta S_{b}$ can be expressed as a function of organizational capital $Z_j$ and employer assessments $M_{bj}$ as in (5).

$$\Delta S_{bj} = \gamma_j(Z_j) G'(M_{1j}, \ldots, M_{bj}). \quad (5)$$

Other things equal, we would expect the extent of skill-gaps $\gamma_j$ to be higher in firms with more organizational capital $Z_j$ that is, $\partial \gamma_j / \partial Z_j > 0$.

Employers may respond to identified skill gaps or more generally to increased skills demand with different strategies or mix of strategies, which we term skill strategies or $STRAT_j$. These strategies are only imperfectly observed and may include hiring to fill job vacancies, providing in-service training, using high-skill expatriates, or outsourcing key professional services when in-house expertise is lacking. We can express $STRAT_{dj}$ as follows:

$$STRAT_j = \emptyset_j(Z_j) H(N_{1j}, \ldots, N_{dj}). \quad (6)$$

where skill strategies of a firm are a function of organizational capital, $\emptyset_j(Z_j)$, and a vector $N_d$ denoting the firm’s choices or mix of different skill strategies $d$. As modern management practices and high-level skills tend to be complementary, we would expect a greater use of different skill strategies (or mix of strategies) in firms with more organizational capital, that is, $\partial \emptyset_j / \partial Z_j > 0$.

Finally, the relationships between firm performance and skill mix, skill deficits, and strategies to mitigate them may be analyzed within a production function framework such as equation (1). An intensive-form specification of a Cobb-Douglas production function (in logarithms) relates sales per worker to capital assets per worker and the labor shares of different skill groups:

$$Y_j/L_j = Z_j F(K_j/L_j, S_{1j}, \ldots, S_{bj}), \quad (7)$$

where $Y_j/L_j$ is sales per worker, $Z_j$ is organizational capital, $K_j/L_j$ are inputs of fixed physical capital assets (equipment and buildings) per worker, and $S_{bj}$ are the shares of different worker skill types $b$ as a proportion of the total workforce.
To test hypotheses about the productivity effects of skill deficits and skill strategies, we substitute equations (5) and (6) into equation (7):

$$Y_j \frac{L_j}{L_j} = Z_j \cdot \Delta S_{bj} \cdot STRAT_{dj} F' \left( \frac{K_j}{L_j} S_{1j} \ldots S_{bj} \right),$$

(8)

so that the production function now includes measures of skill gaps \(\Delta S_{bj}\) and skill strategies \(STRAT_{dj}\). They capture the productivity effects of \(Z_j\) mediated through increasing skill gaps (which negatively affect productivity) and eliciting skill strategies to mitigate skill gaps (which improve productivity), in other words,

$$\frac{\partial \left( Y_j \frac{L_j}{L_j} \right)}{\partial \Delta S_{bj}} < 0 \quad \text{and} \quad \frac{\partial \left( Y_j \frac{L_j}{L_j} \right)}{\partial STRAT_{dj}} > 0.$$

Equation (8) may also include \(Z_j\) itself, reflecting the possibility that organizational capital has its own productivity effect independent of those mediated through skills demand. The relative importance of each effect is not known a priori but dominance of the indirect productivity effects from \(\Delta S_{bj}\) and \(STRAT_{dj}\) would tend to support the skills demand model presented here.

**Empirical Implementation**

The skills demand model described earlier makes up a recursive system of equations. It can be estimated in several ways. One way is to use multiple regression methods to estimate separately the set of reduced form equations, as was done for a related study of Tanzania (Tan, Bashir, and Tanaka 2016). Another approach—the one adopted here—is to use SEM to estimate this system of equations (Bollen 1989; Joreskog 1973).\(^{16}\) The advantage of SEM over ‘classical’ regression methods is its ability to analyze complex models with both measured and latent (unobserved) variables, and to estimate the relationships between latent variables and their observed correlates, and between outcomes and their causal or explanatory factors. SEM methods, while not widely known, are often used in statistics, social and behavioral sciences, and management research.\(^{17}\)

The SEM implementation of the skills demand model involves estimation of a measurement component and a structural component, that together make up our recursive system of equations. The **measurement component** is made up of three equations relating the three latent constructs to functions of their observed measures:

\(^{16}\) SEM, sometimes called ‘covariance structure modeling’, includes factor and regression analyses as special cases. It is estimated by maximum likelihood methods, typically using LISREL or AMOS statistical software or, more recently, using the SEM and Generalized Structural Equation Modeling (GSEM) (its generalized non-linear counterpart) procedures implemented in STATA 13.

\(^{17}\) Examples of research using SEM include psychometric research on educational testing/assessment and education technology on learning outcomes (Khine 2013; Lee 2011); the determinants of the latent quality of U.S. hospital care (Gertler 1988); knowledge management practices and organizational performance of small and medium enterprises (Saini 2013, on India; Metaxas and Economou 2012, on Greece); entrepreneurship capital and the diffusion of technology and regional growth in Germany (Audretsch, Bonte, and Keilbach 2008); and the effects of education and managerial ability on the technical efficiency of Guatemalan farmers (Kalaitzadonakes and Dunn 1995).
• *Organizational capital*, the firm’s stock of intangible knowledge capital $Z_j$, is measured in equation (2) as a function $D$ of $X_k$ firm attributes such innovation, export experience, or research and development.

• *Skill gaps*, $\Delta S_{bj}$ the gap between a firm’s desired and actual skills mix, is measured in equation (5) as a function $G$ of $M_{bj}$ variables that represent employer assessments of current workforce skills and the problems skill deficiencies pose for operations.

• *Skill strategies*, $\text{STRAT}_{dj}$ representing firms’ responses to skill gaps and skills demand, is measured in equation (6) as a function $H$ of the firm’s choices among $N_d$ different skill strategies.

The **structural component** links endogenous variables in the model to the latent and other measured explanatory variables. The first set of relationships is the link from the exogenously given *organizational capital* variable to the latent variables’ *skill gaps* and *skill strategies*:

- In equation (5), *organizational capital* is linked to $\Delta S_{bj}$ by $\gamma_j$, the extent of *skill gaps*, such that *skill gaps* increase with *organizational capital*, that is $\partial \gamma_j / \partial Z_j > 0$.

- In equation (6), *organizational capital* is linked to *skill strategies* $\text{STRAT}_{dj}$ by $\Phi_j$, and if *organizational capital* and *skill strategies* are complementary, then we would expect that $\partial \Phi_j / \partial Z_j > 0$.

A second relationship is between the outcome variable—labor productivity—and the latent and other measured explanatory variables. This production relationship is specified as a log-linear, intensive form Cobb-Douglas production function in which

- Labor productivity is related to fixed capital assets per worker and skills composition of the workforce as in equation (7). The coefficients of $K_j / L_j$ and $S_{bj}$ have the conventional interpretation as the returns to employer investments in physical capital stock and different worker skills $b$; and

- Labor productivity is also affected potentially by the three latent variables, as in equation (8). *Organizational capital* $Z_j$, representing the firm’s stock of intangible knowledge capital, may either impact productivity directly, or indirectly as mediated through *skill gaps* $\Delta S_{bj}$ and *skill strategies* $\text{STRAT}_{dj}$. Unmet *skill gaps* $\Delta S_{bj}$ are hypothesized to negatively affect labor productivity while proactive *skill strategies* $\text{STRAT}_{dj}$ are hypothesized to improve it.

**Extensions to the Skills Demand Model**

It is tempting, but incorrect, to interpret the above skill strategy-productivity relationship as the causal impact of skill strategies on labor productivity. As currently structured, the skills demand model implicitly assumes that firms’ skill strategies are random. Decisions about whether to adopt
and what skills strategies to pursue are determined by the potential returns from such investments, and these decisions may be correlated with unobserved firm-specific productivity attributes (for example, workforce quality). This raises the possibility of reverse causality, in the sense that more productive firms also deploy more intensive skill strategies and biased estimates of the skill strategy-productivity relationship of interest.

Potential bias from endogenous skills strategies may be addressed using an instrumental variable (IV) approach. Similar approaches have been used to address potential biases that arise in estimating the effects of college attendance on earnings (Card 1999). Biases arise because individual decisions about college attendance are likely to be correlated with unobserved innate ability, and both affect earnings outcomes. In this literature, supply-side information on educational institutions is used to identify the direct effects of education attainment on earnings, independently of the wage effects of unobserved ability. Following Card (1999), we use information on skill sources to estimate the causal impacts of skill strategy on two measures of firm performance: labor productivity, as before, and annual wages, which is affected by labor productivity. Our instrumental variable $ASS_{rs}$ (a measure of access to skill sources for firms operating in different regions $r$ and sectors $s$) is correlated with skill strategy $STRAT_{dj}$ but uncorrelated with the common unobserved ability variable $\epsilon_j$ in the outcome equations.

The IV approach essentially involves a two-stage procedure: first, estimate a first-stage skill strategy equation to get a predicted measure of skill strategy $\hat{STRAT}_{dj}$ that is uncorrelated with $\epsilon_j$; in a second-stage outcome equation, the coefficient of $\hat{STRAT}_{dj}$ yields an unbiased estimate of the causal effect of skill strategy on productivity. This IV approach is implemented in SEM by re-estimating the multi-equation skills demand model with the following changes. First, the skill strategy equation is augmented to include the instrumental variable $ASS_{rs}$:

$$STRAT_j = \phi_j(Z_j) H(N_{dj}) + ASS_{rs} + \epsilon_j. \quad (6')$$

Two firm performance equations are included, one for labor productivity and a second for a new outcome variable, annual wages per worker:

$$\frac{Y_j}{L_j} = F'(\Delta S_{bj}, STRAT_{dj}, K_j / L_j, S_{bj}) + \epsilon_{1j}, \quad (8')$$

$$W_j = H'(\Delta S_{bj}, STRAT_{dj}, Y_j / L_j, S_{bj}) + D_{lm} + \epsilon_{2j}, \quad (9)$$

where $Y_j / L_j$ is labor productivity, $W_j$ is annual wages per worker, and $D_{lm}$ are 1,0 dummy indicator variables for Lusaka location $l$ and manufacturing sector $m$, and

$$\text{cov}(\epsilon_j, \epsilon_{1j}) \neq 0 \quad \text{and} \quad \text{cov}(\epsilon_j, \epsilon_{2j}) \neq 0,$$

---

18 This is a two-step IV estimation procedure used with Ordinary Least Squares regression methods, as implemented in STATA’s ‘ivregress’ program.
specifying that the error term of the skill strategy equation $\varepsilon_j$ co-varies with the error terms of the productivity equation $\varepsilon_{1j}$ and the wage equation $\varepsilon_{2j}$.

The specification of wage equation (9) deserves some discussion. It differs from the reduced form firm-level wage equations typically estimated in the literature in two ways. First, it does not include firm-level productivity attributes that might influence wages since they are modeled here as the latent organizational capital variable, which in turn is hypothesized to indirectly affect wages through two other latent variables—skill gaps and skill strategies. Like the productivity analyses, skill deficits reduce wages while skill strategies are hypothesized to increase wages. The second difference is the inclusion of labor productivity, the dependent variable from equation (8’), in the wage equation. While this specification would raise econometric issues in a reduced form wage model, it is readily accommodated within our SEM framework by estimating a system of equations with correlated errors across several equations. Our interest here is in exploring whether wages and labor productivity are correlated; if so, how employers share productivity gains with workers in the form of higher wages; and what these sharing arrangements reveal about how labor markets operate and the nature of skills.

Finally, the wage equation includes dummy variables for Lusaka location and manufacturing to investigate wage-level differences across regions and sectors. As noted earlier, firms in the Lusaka area are better served by a dense network of skill sources relative to firms in other regions. Sectors may also differ in their skill requirements and in access to specialized skill providers willing and able to meet their sector-specific skill needs. Are there systematic differences in wages across sectors and regions, controlling for workforce education and occupation, and what do they reveal about skills supply and demand conditions?

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Employer interviews, including with respondents to the ZESS survey, suggest that firms in sectors such as transportation, mining, and information technology (IT) face greater difficulties filling job vacancies because of a limited local supply of labor with their sector-specific educational skills and occupational training.
III. DATA AND SUMMARY STATISTICS

The data needed to study the drivers of skills demand, skill gaps, and employer strategies to meet their skills needs are from the 2016 ZESS. First piloted in Tanzania in 2015 by DEC and the Education Global Practice of the World Bank, the ZESS was designed to provide insights into the composition and demand for skills and the relationship between skills (and skill constraints) and firms’ performance in selected industries in four regions of Zambia.

The Zambia Enterprise Skills Survey

The sample for the Zambia survey was selected by stratified random sampling, following a broadly similar methodology used in the World Bank’s Enterprise Surveys. The sample frame is based on the 2010 Zambia Establishment Census, collected and maintained by the Zambia Statistical Office. Three levels of stratification were used: eight sectors, three establishment sizes, and four regions. The four regions are the capital city Lusaka (Lusaka Province), Kitwe and Ndola in the Copperbelt Province, and Livingstone in the Southern Province. The eight sectors include food processing (ISIC 15), textile and garments (ISIC 17 and 18), fabricated metal products (ISIC 28), furniture (ISIC 36), construction (ISIC 45), hotel and restaurants (ISIC 55), transportation (ISIC 60–64), and IT (ISIC 72). The three size stratifications are small (5 to 19 employees), medium (20 to 99 employees), and large firms (100 or more employees). The final sample surveyed comprised 350 establishments, with just under half of the sample in Lusaka, one-fifth each in Kitwe and Ndola, and 11 percent in Livingstone. Sixty percent of the sample are small enterprises, 30 percent are medium-size enterprises, and about 10 percent are large enterprises.

The ZESS is an abbreviated version of the World Bank’s Enterprise Survey, retaining selected key variables on firm characteristics, firm performance and productivity and adding an expanded module of questions on employment and skills. This module elicited quantitative and qualitative information from firms about (a) the education and occupational composition of their workforce; (b) their perceptions about skill gaps in education as well as in different cognitive, noncognitive, and technical skills and the constraints these pose for their operations; and (c) their strategies for meeting skill needs and mitigating skill gaps. Employers also provided information on (d) the main sources of skills supply from education and training institutions.

In common with other Enterprise Surveys, the ZESS elicited the following variables to characterize firms:

- Indicator variables for eight sectors, four regions, and three firm sizes.
- Firm attributes that research suggests are related to (often unobserved) productivity attributes, including the educational attainment of the firm’s top manager, foreign ownership, and years in operation.
- Firms’ domestic sales and sales to international markets, whether as a direct or an indirect exporter, and the year the firm began exporting.
• Engagement in innovative activities and knowledge-intensive activities, such as recent introduction of new products and services, spending on research and development (R&D), use of foreign technology licenses, new logistics systems and management practices, and internationally recognized quality systems.

• Key variables needed to estimate a production function model as a measure of firm performance; besides total sales and employment in the last fiscal year, data were elicited on the value of intermediate inputs and fixed assets, separately for machinery and equipment and buildings.

Skills encompass the broad set of cognitive, noncognitive (social and behavioral), and technical competencies needed to perform effectively. Skills are acquired from education and training institutions, both before entering the labor market and while employed, in company-sponsored in-service programs. The ZESS elicited information on the following skill dimensions:

• Workforce education by four levels of schooling: primary, lower secondary, upper secondary, and tertiary education, as well as their distribution in the total workforce.

• The share of the workforce with formal pre-employment TEVET qualifications as a separate category.

• Skill composition by seven occupations—managers, professionals, technicians and associate professionals, clerical jobs, sales, production operators, and other unskilled workers—separately for local Zambian and expatriate employees. Managers, professionals, associates, and technicians are considered high-skill occupations and are referred to as managerial, professional, and technical (MPT) workers.

• Qualitative indicators of the adequacy of different workforce competencies (as judged by employers) compared to those needed by the firm, including a wide range of cognitive, noncognitive (soft skills), and job-specific technical skills.

• Any company-sponsored in-service training, whether in-house or external training, and conditional on training, the number of workers trained, and the main training provider.

Skill deficits reflect a mix of demand and supply factors. To operationalize the measurement of skill deficits, the ESS elicited both qualitative and quantitative information on employers’ assessments of skill deficits and their potential responses to meet skill demand needs and mitigate these skill gaps. These are described in the following paragraphs.

Skill Gap Indicators

• **Assessments of current and needed skills.** Employers assessed the severity of educational deficiencies as an obstacle to the firm’s operations and rated how well current competencies of their workforce matched the skills needed by the enterprise, in technical
and job-specific skills, in soft skills such as problem solving, communication, and language, as well as the work ethic of employees.

- **Operational problems resulting from inadequate skills.** Employers rated the extent to which skill deficits posed problems for several specific operational areas, including maintaining production levels, quality control, use of new technology, engaging in innovative activities, and sales and marketing.

**Potential Employer Responses**

- **Company-sponsored training.** Firms reported on their in-service training for current employees, whether the programs are run in-house or by external providers. In-service training programs are designed to remedy deficits in pre-employment skills, upgrade existing skills, or develop new skills as requirements change.

- **Hiring new workers.** Employers reported on whether they had any job vacancies over the past two years and if so, how many new workers were hired for each occupation. New hires represent one potential employer response to specific occupational skill shortages.

- **Use of foreign workers by occupation.** As a measure of domestic availability of specific occupational skills, employers were asked about their use of expatriate workers (and the share of foreign workers) in different occupations.

- **Outsourcing of specialized services.** Firms often outsource accounting, engineering, legal, and architectural services. Such skills may not be available in-house, and there is interest in knowing whether they are sourced domestically or abroad.

Another unique feature of the ESS is the questions on the firm’s skills supply. Employers were asked about the main education, TEVET, and training institutions used to hire new workers and to provide continuing education and training to current employees. Employers were asked to name up to three universities and three technical institutions from which they hire the most, along with their location and public/private status. They were asked to do the same for up to three training institutions—other than in-house trainer staff—that provided in-house and external training for current employees. Their responses provide rich geographic information on where employers source their skills. This information is exploited in Section IV to define a distance-weighted measure of the density of access to skill sources for firms in different regions and sectors, for use as an instrumental variable for firms’ skill strategy choices.

**Summary Statistics**

A subset of these data is used for the SEM of the skills demand model described in the previous section. Table 1 presents summary statistics for the variables used to measure the latent constructs—organizational capital, skills gap, and skill strategies—and compares these measures for several groups of firms hypothesized to differ in their skills demand, or that might face different skills supply-demand conditions by virtue of their regional location. T-tests of significance are
reported for group differences in these measures. For the first comparison, we define (for illustrative purposes) a ‘high-skills demand’ group of 216 firms that were exporters and/or that recently introduced new products or services; the ‘low-skills demand’ group of 134 firms are those that were neither innovators nor exporters.\textsuperscript{20} The second comparison is between Lusaka-based firms and firms located in the other three regions. As noted earlier, there is a strong agglomeration of universities, TEVET institutions, and in-service training providers in Lusaka so the skill supply situation is more favorable to Lusaka-based employers than to employers in other regions.

Consider the variables listed in Table 1 to measure the intangible knowledge and managerial know-how embodied in firms’ organizational capital. These include several sets of indicators (1,0) variables: (a) \textbf{firm attributes} including whether top managers are university educated, the firm has foreign ownership, belong to a multi-establishment firm, is an exporter, and young firms in operation for less than 5 years; (b) \textbf{managerial practices} including new logistics systems, having internationally recognized quality certification, and introduction of new management practices; and (c) \textbf{innovative activities} including recent introduction of new products and services doing R&D and licensing foreign technology. With the exception of young firms, all measures are hypothesized to increase the firm’s stock of intangible organizational capital and, by extension, its demand for higher-level skills. On the other hand, young firms are hypothesized to have less intangible knowledge capital given their limited years in operation learning by doing.

How do high-skills and low-skills demand firms compare in terms of measures of their latent organizational capital? Among high-skills demand firms, over 90 percent have recently introduced new products and services and 20 percent are exporters; low-skills demand firms, by definition, are neither innovators nor exporters. However, the other measures for organizational capital also differ, sometimes dramatically, in ways consistent with the skills demand hypothesis: foreign ownership, the share of firms introducing new logistics systems and managerial practices, and doing R&D is two to four times higher among high-skills demand firms than among those with low-skills demand. Other differences are more modest but not statistically significant: high-skills demand firms tend to have more university-educated managers, be part of multi-establishment firms, and have foreign technology licenses and quality certification, but they are less likely to be young firms.

\footnote{This simple characterization of firms, first used in the analysis for Tanzania (Tan, Bashir, and Tanaka 2016) turns out to be a powerful discriminator of the drivers of skills demand.}
<table>
<thead>
<tr>
<th>Organizational Capital</th>
<th>Low-Skills Demand</th>
<th>High-Skills Demand</th>
<th>t-test</th>
<th>Outside Lusaka</th>
<th>Lusaka Location</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top manager is university educated (1,0)</td>
<td>0.560</td>
<td>0.588</td>
<td>—</td>
<td>0.591</td>
<td>0.562</td>
<td>—</td>
</tr>
<tr>
<td>Some foreign ownership (1,0)</td>
<td>0.127</td>
<td>0.213</td>
<td>*</td>
<td>0.133</td>
<td>0.231</td>
<td>*</td>
</tr>
<tr>
<td>Firm is an exporter (1,0)</td>
<td>0.000</td>
<td>0.204</td>
<td>**</td>
<td>0.088</td>
<td>0.166</td>
<td>*</td>
</tr>
<tr>
<td>Multi-establishment firm (1,0)</td>
<td>0.321</td>
<td>0.380</td>
<td>—</td>
<td>0.287</td>
<td>0.432</td>
<td>**</td>
</tr>
<tr>
<td>Young firm operating less than 5 years (1,0)</td>
<td>0.134</td>
<td>0.102</td>
<td>—</td>
<td>0.099</td>
<td>0.130</td>
<td>—</td>
</tr>
<tr>
<td>New products/services last 2 years (1,0)</td>
<td>0.000</td>
<td>0.917</td>
<td>**</td>
<td>0.503</td>
<td>0.633</td>
<td>*</td>
</tr>
<tr>
<td>New logistic system last 2 years (1,0)</td>
<td>0.269</td>
<td>0.648</td>
<td>**</td>
<td>0.442</td>
<td>0.568</td>
<td>*</td>
</tr>
<tr>
<td>New management system last 2 years (1,0)</td>
<td>0.172</td>
<td>0.528</td>
<td>**</td>
<td>0.409</td>
<td>0.373</td>
<td>—</td>
</tr>
<tr>
<td>Doing research and development (R&amp;D) (1,0)</td>
<td>0.045</td>
<td>0.190</td>
<td>**</td>
<td>0.077</td>
<td>0.195</td>
<td>**</td>
</tr>
<tr>
<td>Have foreign technology licenses (1,0)</td>
<td>0.157</td>
<td>0.185</td>
<td>—</td>
<td>0.122</td>
<td>0.231</td>
<td>**</td>
</tr>
<tr>
<td>Have international quality certification (1,0)</td>
<td>0.037</td>
<td>0.042</td>
<td>—</td>
<td>0.033</td>
<td>0.047</td>
<td>—</td>
</tr>
<tr>
<td><strong>Skill Gaps</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workers have poor writing skills (1,0)</td>
<td>0.090</td>
<td>0.106</td>
<td>—</td>
<td>0.105</td>
<td>0.095</td>
<td>—</td>
</tr>
<tr>
<td>Workers have poor numeracy skills (1,0)</td>
<td>0.104</td>
<td>0.116</td>
<td>—</td>
<td>0.105</td>
<td>0.118</td>
<td>—</td>
</tr>
<tr>
<td>Workers have poor language skills (1,0)</td>
<td>0.164</td>
<td>0.144</td>
<td>—</td>
<td>0.127</td>
<td>0.178</td>
<td>—</td>
</tr>
<tr>
<td>Workers have poor computer/IT skills (1,0)</td>
<td>0.231</td>
<td>0.194</td>
<td>—</td>
<td>0.177</td>
<td>0.243</td>
<td>—</td>
</tr>
<tr>
<td>Skill deficiencies pose production problems (1,0)</td>
<td>0.179</td>
<td>0.319</td>
<td>**</td>
<td>0.232</td>
<td>0.302</td>
<td>—</td>
</tr>
<tr>
<td>Skill deficiencies pose quality problems (1,0)</td>
<td>0.224</td>
<td>0.292</td>
<td>—</td>
<td>0.238</td>
<td>0.296</td>
<td>—</td>
</tr>
<tr>
<td>Skill deficiencies pose problems using new technology (1,0)</td>
<td>0.246</td>
<td>0.356</td>
<td>*</td>
<td>0.304</td>
<td>0.325</td>
<td>—</td>
</tr>
<tr>
<td>Skill deficiencies pose problems for innovating (1,0)</td>
<td>0.187</td>
<td>0.282</td>
<td>*</td>
<td>0.249</td>
<td>0.243</td>
<td>—</td>
</tr>
<tr>
<td>Skill deficiencies pose marketing/sales problems (1,0)</td>
<td>0.231</td>
<td>0.412</td>
<td>**</td>
<td>0.331</td>
<td>0.355</td>
<td>—</td>
</tr>
<tr>
<td><strong>Skill Strategies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outsourcing professional services (1,0)</td>
<td>0.433</td>
<td>0.514</td>
<td>—</td>
<td>0.475</td>
<td>0.491</td>
<td>—</td>
</tr>
<tr>
<td>Percent workers receiving in-house training (%)</td>
<td>6.291</td>
<td>17.806</td>
<td>**</td>
<td>9.840</td>
<td>17.207</td>
<td>*</td>
</tr>
<tr>
<td>Percent workers receiving external training (%)</td>
<td>3.358</td>
<td>1.185</td>
<td>*</td>
<td>0.884</td>
<td>3.231</td>
<td>*</td>
</tr>
<tr>
<td>Number of vacancies filled</td>
<td>2.209</td>
<td>2.662</td>
<td>—</td>
<td>1.254</td>
<td>3.811</td>
<td>**</td>
</tr>
<tr>
<td>Percentage share of expatriate MPT staff (%)</td>
<td>9.773</td>
<td>13.359</td>
<td>—</td>
<td>9.950</td>
<td>14.156</td>
<td>—</td>
</tr>
<tr>
<td>Medium-size firm indicator variable (1,0)</td>
<td>0.328</td>
<td>0.324</td>
<td>—</td>
<td>0.326</td>
<td>0.325</td>
<td>—</td>
</tr>
<tr>
<td>Large-size firm indicator variable (1,0)</td>
<td>0.045</td>
<td>0.130</td>
<td>**</td>
<td>0.099</td>
<td>0.095</td>
<td>—</td>
</tr>
</tbody>
</table>

*Note: t-test of significant group difference at the * 1 percent and ** 5 percent level.*
Like the high-skills demand group, Lusaka-based firms also have higher values of the measures for organizational capital than firms located in other regions. Firms in Lusaka have more of the attributes associated with skills demand (foreign ownership, exports, and multi-establishment status), and they tend to be more innovative (introduce new products and services, do R&D, and have foreign technology licenses). Many of these measures are two to three times as large for these firms as for firms operating outside Lusaka, with differences that are statistically significant. It appears that skills demand is higher among Lusaka-based firms than firms outside Lusaka.

In Table 1, the latent construct skills gap is measured by two sets of (1,0) indicator variables, all defined so that positive values represent a skill deficit. One set of variables measures the employer’s assessment of workers’ competencies and whether they are less than needed by the firm: writing, numeracy, English language competencies, and computer/IT skills. A second set of variables measure assessments of skills-related operational problems and whether skill inadequacies pose problems in five operational areas: maintaining production, quality control, use of new technologies, innovating, and marketing and sales.

Two broad points emerge from Table 1 when comparing measures of skill gaps in high-versus low-skills demand firms and Lusaka-based firms versus firms in other regions. First, there does not appear to be any systematic pattern between groups in how employers assess skill deficits in the competencies of their workforce. This is true for comparisons of high-versus low-skills demand firms and for firms in Lusaka and outside Lusaka; t-tests for group differences are invariably insignificant. Employers in Zambia may not know what skill competencies they need, and thus find it difficult to judge if competencies are deficient, relative to their needs. Second, and much more discriminating, are employer assessments of the problems inadequate worker skills pose for various operations. Across the board, high-skills demand firms are more likely than low-skills demand firms to rank inadequate skills as being a problem for all five areas of operations. Statistically significant differences are found for problems maintaining production, marketing/sales, use of new technology and innovating; skill deficiencies also pose problems for quality control, but the difference is small and not statistically significant.

A very different situation arises in the Lusaka versus non-Lusaka comparisons. Here, what emerges is the striking absence of any statistical difference in the way the two groups assess the operational problems posed by skill deficiencies. This is despite the fact that Lusaka-based firms, like the high-skills demand firms, have higher measures of organizational capital and thus greater skills needs. To the extent that these assessments measure the gaps between skills demand and supply, they imply that Lusaka-based firms face more favorable skills supply conditions than firms in other regions. Another implication is that poor access to skill supply sources can pose operational problems for firms facing greater skills demand associated with a higher stock of organizational capital.

The final latent construct—skill strategies—is measured by four potential firm responses to increased skills demand and identified skill deficits. Potential responses include (a) outsourcing professional services, measured as a (1,0) indicator variable if the firm outsources any legal,
engineering, accounting, or architectural services; (b) **employer provision of training**, measured by the percentage of workers trained in-house and from external providers; (c) **hiring new staff**, measured by the number of vacancies filled in the past two years; and (d) **filling high-skill positions with expatriates** when local supply is limited, as measured by the percentage of total MPT positions filled by expatriates. In addition, indicator variables for medium- and large-size firms are included to accommodate any scale economies that might arise in the use of different skill strategies.

Variable means of the skill strategy measures are presented in Table 1 for the different groups of firms. Comparing high- versus low-skills demand firms, the table indicates that high-skills demand firms provide in-house training to a higher proportion of its workforce but less external training as compared to low-skills demand firms. These group differences are statistically significant. They also hire more expatriates to fill high-skilled MPT positions and fill slightly more job vacancies than their low-skills demand counterparts, but these differences are not significant. A higher proportion of high-skills demand firms are large, which might reflect the fact that exporters tend to be larger firms, or the interpretation that there are scale economies in deploying skill strategies. Comparing skill strategies by region, Lusaka-based firms provide significantly more workforce training from both in-house and external training sources and fill three times as many job vacancies as firms operating in other regions, possibly reflecting the more favorable skills supply conditions in Lusaka. They also appear to hire more high-skill expatriates, but the differences are modest. There are no size distribution differences between firms in different regions.

To summarize, high-skills demand firms and Lusaka-based firms possess more of the attributes associated with organizational capital or the stock of technical know-how and, consequently, have greater skills demand. High-skills demand firms are more likely to experience skill gaps as manifested in the problems skill deficiencies pose for operations. Lusaka-based firms, however, are not likely to experience skill gaps than firms in other regions despite high-skills demand, reflecting more favorable skills supply conditions in Lusaka with its dense network of universities, TEVET institutions, and training providers. In terms of skill strategies, high-skills demand firms provide more in-house training but less external training to its workforce. Firms in Lusaka provide more training from both in-house and external sources and fill more job vacancies than firms in other regions, again reflecting its more favorable skill supply conditions.

**Empirical Results**

The system of equations that makes up the skills demand model is estimated simultaneously by SEM using maximum likelihood methods. The results are reported in Table 2, first for the measurement component equations and then for the structural production function equation.

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21 We use the SEM maximum likelihood with missing values method that fits the system of equations for all observations, assuming joint normality of variables and randomly distributed missing values.
Table 2 reports the standardized coefficients of key variables used to measure the latent constructs organizational capital, skill gaps, and skill strategies. With several exceptions,22 the relationships between the latent variables and their observable measures are generally estimated quite precisely, and are statistically significant at the 1 percent level. Many of the relationships between observable measures and their latent constructs are consistent with our prior observations:

- As hypothesized, organizational capital is positively correlated with top managers being university educated, with indicator variables for firms’ foreign-ownership, exporter, and multi-establishment status; recent introduction of new products and services; management practices and logistics systems; and with innovative behavior such as doing R&D and using foreign technology licenses. However, organizational capital is lower in young firms. In terms of coefficients, the most important measures of a firm’s organizational capital are

22 The two exceptions are (a) having an internationally recognized quality certification, and (b) the indicator for medium-size firms. Quality certification was not significantly related to organizational capital as hypothesized. While the medium-size indicator was not significant, large firm size was, supporting the hypothesis that there may be economies of scale in implementing many skill strategies.
recent introduction of logistics systems, new management practices, and introduction of new products and services.

- Skill gaps are positively correlated with employers’ assessments that the cognitive and noncognitive skills of the workforce are inadequate relative to the firms’ skill needs and that these inadequacies posed problems for operations. Of these two sets of variables, the operational problems posed by inadequate skills—especially using technology and innovating—had the largest estimated coefficients in measuring skill gaps. This may reflect the fact that employers find it easier to judge how skill deficits affect their operations than to assess whether specific skill competencies meet the firm’s needs.

- All four measures—outsourcing professional services, providing in-house and external training programs for employees, filling job vacancies, and using high-skill expatriate managers, professionals, and technicians—are positively correlated with the latent skill strategies construct, as is the large firm-size indicator. The coefficient estimated for the latter, but not the medium-size indicator, suggests that there are important scale economies for large firms in implementing strategies to meet the firms’ skill needs.

Table 3 presents the structural equation estimates of the effects of both observed and latent variables on firm performance. Three structural relationships are estimated: first, two structural equations relating organizational capital to the latent variables skill gaps and skill strategies, and second, the Cobb-Douglas production function relating the logarithm of labor productivity to observed measures of workforce skill composition and the latent organizational capital, skill gaps, and skill strategies variables. Table 4 also reports key correlations (or covariances) between organizational capital and observed production function variables and between the latent variables skill gaps and skill strategies.
### Table 3: SEM Estimates of Structural Production Function Equations

<table>
<thead>
<tr>
<th>Structural Equations</th>
<th>Standardized Coefficients</th>
<th>Standard Errors</th>
<th>z-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log (labor productivity) ← Log (capital per worker)</td>
<td>0.4556</td>
<td>0.0404</td>
<td>11.27</td>
</tr>
<tr>
<td>% Upper secondary</td>
<td>0.0087</td>
<td>0.0480</td>
<td>0.18</td>
</tr>
<tr>
<td>% Tertiary educated</td>
<td>0.0510</td>
<td>0.0528</td>
<td>0.97</td>
</tr>
<tr>
<td>% Managers, professionals, and technicians</td>
<td>0.1498</td>
<td>0.0492</td>
<td>3.04</td>
</tr>
<tr>
<td>% TEVET credentialed</td>
<td>0.1380</td>
<td>0.0491</td>
<td>2.81</td>
</tr>
<tr>
<td>Skill Strategy</td>
<td>0.1903</td>
<td>0.0881</td>
<td>2.16</td>
</tr>
<tr>
<td>Skill Gap</td>
<td>−0.1341</td>
<td>0.0544</td>
<td>−2.46</td>
</tr>
<tr>
<td>Organizational Capital</td>
<td>0.0291</td>
<td>0.0893</td>
<td>0.33</td>
</tr>
<tr>
<td>Constant</td>
<td>5.8901</td>
<td>0.4213</td>
<td>13.98</td>
</tr>
</tbody>
</table>

| Skill Gap ← Organizational Capital | 0.2084 | 0.0727 | 2.87 |
| Skill Strategy ← Organizational Capital | 0.5276 | 0.0946 | 5.58 |

| cov (log K per labor, Org Capital) | −0.0104 | 0.0662 | −0.16 |
| cov (Upper secondary, Org Capital) | −0.1733 | 0.0604 | −2.87 |
| cov (Tertiary, Org Capital) | 0.3526 | 0.0565 | 6.24 |
| cov (MPT workers, Org Capital) | 0.2439 | 0.0595 | 4.10 |
| cov (TEVET workers, Org Capital) | 0.2897 | 0.0591 | 4.91 |
| cov (Skill Gap, Skill Strategy) | −0.1169 | 0.0962 | −1.22 |

**Note:**
Sample size: 345 observations.
LR test of model versus saturated: \( \chi^2(475) = 1,238.8 \), Probability > \( \chi^2 \) = 0.0000.

The production function results are fairly conventional. They indicate that the amount of fixed capital per worker and the skill composition of the workforce are both significant determinants of labor productivity. First, fixed capital has an estimated coefficient of 0.456 which, in the Cobb-Douglas specification used here, suggests that a 1 percent increase in capital usage will increase output by 0.456 percent. Second, the productivity effects of skill composition are best reflected in the high-skill occupational mix and TEVET credentials of the workforce and not by their formal education composition. A 1 percent increase in the share of managers, professionals, and technicians increases productivity by 14 percent; the corresponding increase in productivity for TEVET credentialed workers is about 13 percent. The lack of statistical significance for upper secondary and tertiary-educated skill shares does not imply that formal higher education is unimportant; both are requirements for entry into professional, associate professional, and technician training programs that are positively correlated with productivity.

Less conventional are the novel productivity results of the latent variables—organizational capital, skill gaps, and skill strategies. As hypothesized, skill gaps reduce labor productivity (coefficient of −0.134) while skill strategies raise labor productivity (coefficient of 0.1903), both estimates are statistically significant at the 1 percent level. It appears that employers’ assessments of skill gaps accurately reflect the adverse productivity consequences of skill deficiencies and operational problems posed by their workers’ skill gaps. Their strategies to upgrade worker skills...
through in-service training, fill job vacancies, outsource professional services, and use high-skill expatriates have a direct impact on improving labor productivity.

Organizational capital on its own has no measurable direct effect on labor productivity (coefficient of 0.029). However, organizational capital indirectly affects labor productivity through the other two structural equations for skill gaps (coefficient of 0.208) and skill strategies (0.527), both of which are statistically significant at the 1 percent level, as reported in Table 4. The significance of these results is worth reiterating: organizational capital both widens the deficiencies in current skills and the problems they pose for operations and generates demand for different skill strategies to mitigate these skill gaps. The magnitude of these indirect effects may be computed as the products of the coefficients from organizational capital to each latent variable and from that latent variable to productivity. Thus, the indirect effects of organizational capital though skill gaps are $(0.208 \times -0.134)$ or $-0.028$, and those through skills strategies are $(0.527 \times 0.190)$ or $0.100$. Ignoring the statistically insignificant direct effect, the total indirect effect of organizational capital on labor productivity is positive $0.072 (-0.028 + 0.100)$ reflecting the combined effects skill gaps and skill strategies.

The covariance structure between organizational capital and measured variables is also illuminating about the nature of the production function. First, organizational capital is uncorrelated with physical capital per worker. This implies that firms with more intangible knowledge capital—whether embodied in new management practices, foreign ownership, innovative behavior, or export orientation—use production technologies that are no more (or less) capital intensive than other firms. Second, and unlike physical capital, organizational capital is strongly complementary with the use of human capital. It is positively (and significantly) correlated with the shares of high-skill labor—the tertiary educated, with TEVET qualifications, and employed in MPT occupations—but negatively correlated with the share of less-skilled workers and those with upper secondary education or less. These patterns of correlations are consistent with the hypothesis that modern management practices and innovation are skill biased in their use of labor.

Finally, the covariance between the latent skill gaps and skill strategy variables is estimated to be negative (coefficient of $-0.117$) but not statistically significant. Recall the earlier observation that causality between the two latent variables may run both ways: from skill gaps to skill strategies (firms respond positively to skill deficits with skill strategies) and from skill strategies to skill gaps (observed skill gaps are lower because of skill strategies implemented). Thus, the effects from two-way causality tend to offset each other, and only the net effects are observed. Because the covariance between the two variables is negative, we may deduce that the effects from strategies to skill gaps dominate, in other words, the measured skill gaps are lower primarily because they are mitigated by different skill strategies.

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23 The omitted reference group—the shares of workers with primary and secondary education—would presumably also be negatively correlated with organizational capital.
Distribution of Latent Variables and Labor Productivity

With the SEM estimates of the skills demand model in hand, the predicted values of *organizational capital*, *skill gaps*, and *skill strategies* can be used to compare the means and distributions of these latent variables across different groups of firms and investigate their relationships to labor productivity. As before, we compare high-skills and low-skills demand firms and firms located in Lusaka and outside Lusaka (Kitwe, Ndola and Livingstone). In each comparison, we now distinguish firms by size: small firms with less than 20 employees versus medium (20 to 99 employees) and large firms (100 or more employees) combined. Note that the factor scores for the three latent constructs are normalized to have means equal 0 for the sample as a whole, so the comparisons show how means of the latent variables and labor productivity differ across groups of firms varying in skills demand and regional location, and firm size. Mean factor scores less than 0 imply lower values of that latent variable, while mean factor scores above 0 imply higher values of that variable.

Table 4 presents the predicted means of the three latent variables and the logarithm of labor productivity. First, compare low-skills and high-skills demand firms separately by size in the first panel A. Small low-skills demand firms have less *organizational capital* ($-0.067$) than comparable small high-skills demand firms ($0.013$), as do their medium-size and large counterparts ($-0.036$ versus $0.061$). This pattern holds as well for comparisons of their skill strategies: small low-skills demand firms use fewer skill strategies ($-0.087$ versus $-0.029$) as compared to small high-skills firms; among medium and large firms, the comparable figures are ($0.021$ versus $0.097$) for skill strategies. When it comes to skill gaps, high-skill demand firms have larger skill deficits than low-skills demand firms, controlling for firm size. Small high-skill demand firms have larger skill gaps than those with low skills demand ($0.016$ versus $-0.015$); among medium and large firms, the comparable figures are ($0.009$ versus $-0.031$). Also noteworthy is the comparison of skill-gaps separately by skills demand: within each skills-demand category, larger firms have fewer skill gaps than small firms: $-0.031$ versus $-0.015$ for low-skills demand firms and $0.009$ versus $0.016$ for high-skills demand firms, suggesting that larger firms are better able to mitigate skill deficiencies than their smaller counterparts. These mean differences in *organizational capital*, *skill gaps*, and *skill strategies* by skills demand and firm size are associated positively with differences in labor productivity outcomes, consistent with the SEM estimates of the skills demand model.
Table 4: Predicted Means of Latent Variables and Labor Productivity: by Firm Size for Different Firm Samples

<table>
<thead>
<tr>
<th>Firm Samples</th>
<th>Small</th>
<th>Medium/Large</th>
<th>Small</th>
<th>Medium/Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Skills Demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Skills</td>
<td></td>
<td></td>
<td>High Skills</td>
<td></td>
</tr>
<tr>
<td>(84 firms)</td>
<td></td>
<td></td>
<td>(118 firms)</td>
<td></td>
</tr>
<tr>
<td>Low Skills</td>
<td>-0.0674</td>
<td>-0.0361</td>
<td>0.0132</td>
<td>0.0607</td>
</tr>
<tr>
<td>(50 firms)</td>
<td>June 27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skill strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.0872</td>
<td>-0.0214</td>
<td>-0.0288</td>
<td>0.0097</td>
<td></td>
</tr>
<tr>
<td>Skill gap</td>
<td>-0.0149</td>
<td>-0.0310</td>
<td>0.0161</td>
<td></td>
</tr>
<tr>
<td>Log (Sales/Worker)</td>
<td>11.283</td>
<td>11.893</td>
<td>11.423</td>
<td>12.041</td>
</tr>
<tr>
<td>B. Regional Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside Lusaka</td>
<td></td>
<td></td>
<td>Lusaka</td>
<td></td>
</tr>
<tr>
<td>(104 firms)</td>
<td>June 27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Skills</td>
<td>-0.0375</td>
<td>0.0198</td>
<td>-0.0020</td>
<td>0.0369</td>
</tr>
<tr>
<td>(77 firms)</td>
<td>June 27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skill strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.0680</td>
<td>0.0445</td>
<td>-0.0374</td>
<td>0.1004</td>
<td></td>
</tr>
<tr>
<td>Skill gap</td>
<td>-0.0094</td>
<td>0.0000</td>
<td>0.0165</td>
<td>-0.0084</td>
</tr>
<tr>
<td>Log (sales/worker)</td>
<td>11.386</td>
<td>11.923</td>
<td>11.342</td>
<td>12.066</td>
</tr>
</tbody>
</table>

Note: Predicted means of latent variables organizational capital, skill gap, and skill strategy are constrained to equal zero. Log (sales/worker) is the logarithm of labor productivity. Samples are defined by (a) whether firms introduced new product/services in the last two years or exported or neither innovated nor exported; (b) whether firms were located outside Lusaka (Kitwe, Ndola, or Livingstone) or in Lusaka; and (c) the firm’s industrial sector, whether in manufacturing or in non-manufacturing (construction, transportation, hotels and restaurants, and IT sectors).

What about firms located in Lusaka, the capital city, versus firms located in the other regions Kitwe, Ndola, and Livingstone? Panel B shows a similar pattern of differences in the mean values of organizational capital and skill strategies by firm size and location as described earlier for high-skills and low-skills demand firms. Interestingly, while larger firms located in Lusaka have fewer skill deficiencies than their smaller counterparts (−0.008 versus 0.165)—similar to what was observed in Panel A—larger firms outside Lusaka have greater skill deficiencies than smaller firms (0.000 versus −0.009). Unlike Lusaka, larger firms in Kitwe, Ndola, and Livingstone appear to be disadvantaged in meeting their skill needs from local skills supply, a finding consistent with the analyses in Table 1.

Group means, while instructive, are not very illuminating about differences in the distribution of factor scores which can vary dramatically in their mode and skewness across different groups of firms. Figures 1 to 3 graphically display the kernel density distributions of labor productivity and these latent variables from the SEM estimates for the same groups identified in Table 4. As mentioned earlier, factor scores have been normalized to have mean 0 for the total sample. Each figure displays—in four panels—the distributions of factor scores for the three latent variables and for the logarithm of labor productivity. In each panel, graphs of the distributions of factor scores are overlaid for the two groups of firms being compared, controlling for firm size: in Figure 1, for high-skill and low-skill demand firms, and in Figure 2, for firms located in Lusaka and outside Lusaka.
First, consider Figure 1. The first panel (top left) compares the distributions of organizational capital for low-skill and high-skill demand firms, separately by firm size. The blue and red lines represent low-skill and high-skill demand firms, respectively, with the area under each line measuring the share of firms at each level of the factor score for organizational capital. It is clear—that the two groups of firms have very different distributions of organizational capital: most low-skill demand firms have negative factor scores for organizational capital, while most high-skill demand firms have positive factor scores. The second panel (bottom left) shows the distributions of skill strategies by size. Like organizational capital, most low-skill demand firms have negative values of skill strategies while the distribution of skill strategies for high-skill demand firms is skewed toward positive values, with a long positive tail especially for medium and large firms. The third panel (top right) shows distributions of skill gaps with the majority of firms—both high- and low-skill demand—having negative factor scores. However, compared to low-skill firms, a smaller share of high-skill demand firms has negative factor scores and a much larger share has positive factor scores. The fourth panel (bottom right) shows the labor productivity distributions for these two groups of firms, with a slight productivity advantage for high-skill demand firms.
Figure 2 compares the distributions of factor scores and labor productivity for firms located in and outside Lusaka, separately by firm size. It shows that firms located in Lusaka differ from those located outside Lusaka in several distinct ways. First, the distribution of organizational capital for Lusaka-based firms is higher than that for firms located outside Lusaka in each firm size category. Second, the distribution of skill strategies has a longer right tail for firms in Lusaka, especially among medium and large firms, suggesting that larger firms in Lusaka are either more proactive in their skill strategies (because of demand from higher organizational capital) or that more supply-related opportunities are available (such as a larger skill pool and access to more training providers or professional services firms) for firms to implement their skill strategies. Third, small firms outside Lusaka generally have lower skill gaps than their counterparts in Lusaka; in contrast, larger firms outside Lusaka have more skill deficits than their large Lusaka counterparts, with a greater share of medium and large firms having positive factor scores for skill deficits. This implies that the skill needs of many larger firms located outside Lusaka are not being met.

The final figure explores the covariance between firms’ skill gaps and skill strategies and their consequences for the distribution of labor productivity. Given a level of skill gaps, are more vigorous skill strategies to mitigate deficits—filling job vacancies, hiring high-skill expatriate staff, worker training, and outsourcing professional skills—associated with higher labor productivity? To address this question, we categorize firms by whether they have low- or high-skill gaps and low- or high-skill strategies. Since factor scores of latent variables are normalized to have means 0, we define skill gaps and skill strategies as being ‘low’ if their factor scores are less than 0 and ‘high’ if factor scores are equal to or greater than 0. This cross-classification leads to four possible outcomes: firms with low skill gaps and low skill strategies (137 firms), low skill
gaps and high skill strategies (72 firms), high skill gaps and low skill strategies (75 firms), and high skill gaps and high skill strategies (66 firms).

Figure 3: Distribution of Labor Productivity by Firm Size

Figure 3 compares the distributions of labor productivity for these four groups of firms, separately by firm size. The x-axis measures the logarithm of labor productivity, while the y-axis measures the kernel density distribution of labor productivity. The left panel focuses on the sample of firms with low skill gaps, the right panel on the sample with high skill gaps. Controlling for firm size, it is clear—for firms with both low and high skill gaps—that high skill strategies are associated with improvements in labor productivity. For each group of firms with low or high skill gaps, a high skill strategy shifts the mode and skew of the labor productivity distributions to the right of the distributions for the comparison group with low skill strategies, that is, to higher levels of labor productivity.

To summarize, comparisons of the means and distributions of the latent variables and labor productivity can provide novel insights into how organizational capital, skill gaps, and skill strategies vary across different groups of firms. While they are instructive, comparisons of group averages of factor scores, as in Table 4 potentially conceal important differences between groups in the distributions of these latent variables, as was made clear in Figures 1 and 2. Just as important is the observation that distributions of these latent variables and labor productivity can and do overlap. While medium and large firms have, on average, higher means factor scores than small firms, not all large firms have more organizational capital or higher labor productivity than their smaller counterparts; some are less well managed, less innovative, and not very productive as
compared to many small firms. Figure 3 makes the point that high skill strategies to mitigate skill gaps or to respond to skills demand improve labor productivity and firm performance.

**Additional Results on Firm Performance**

We now take up the issue of whether these skill strategy-productivity estimates represent simple associations or the causal effects of skill strategies on firm performance. The choices that firms make about skills may not be random. Decisions about whether to adopt and what skills strategies to pursue are determined by the potential returns from such investments, and these decisions may be correlated with unobserved firm-specific productivity attributes not already accommodated by our latent organizational capital variable (for example, workforce quality). This raises the possibility of reverse causality, in the sense that more productive firms also deploy more intensive skill strategies, and may result in biased estimates of the skill strategy-productivity relationship of interest. We follow Card (1999) and adopt an instrumental variable approach to address this issue.

We instrument for skill strategy using a measure of access to skill sources for firms operating in different regions and sectors. ZESS asked firms to identify up to three named institutions from three main skill sources—universities, TEVET institutions, and in-service training providers—as well as the skill source’s regional location from which distance to the firm’s location can be estimated. Not all firms responded but two-thirds of the responding firms provided information on at least one skill provider, for a total of 463 named skill sources. Their responses are used to define potential ‘catchment’ areas of named skill sources for firms varying by location—Kitwe, Ndola, Lusaka, and Livingstone—and four broad sectors in which firms operate: manufacturing, restaurants and hotels, transportation and construction, and IT. All firms in each region-sector pair are assumed to be in the same skills catchment area, and they thus face the same access to different sources of skills supply irrespective of how they responded to skill sources in the ZESS survey.

Following Doyle and Skinner (2016), we define $ASS_{rs}$ as the distance-weighted density of access to different skill sources:

$$ASS_{rs} = \sum_{k=1}^{K} \frac{\log (d_{rk})^{-1}}{},$$

where $d_{rk}$ is the estimated driving distance from the firm’s region $r$ to the location of each unique named skill source $k$. Driving distances (in kilometers) between Zambian locations are computed using travelmath.com, with more accessible (closer) sources given greater weight by expressing distances as the inverse of their log transformation. $ASS_{rs}$ is the sum of the inverse of log distances over all skill sources $K$. As constructed, this measure is higher for firms that face greater density of access to skills. If proximity and access to a dense network of skill sources facilitates deployment of skill strategies, then $ASS_{rs}$ should be positively correlated with $STRAT_j$ but independent of firm-specific errors, being based on region and sector only.

We implemented this IV approach by adding $ASS_{rs}$ to the skill strategy equation and reestimating the expanded system of equations using SEM (see the analytic model in section II). This expanded model includes an equation for a second outcome, annual wages per worker, that may also be
determined in part by labor productivity. Like labor productivity, the endogenous choices firms make about skill strategies may result in biased estimates of wage determinants. There is interest more generally in the relationship between labor productivity and wages, whether employers share productivity gains with workers in the form of higher wages, and what these sharing arrangements reveal about the nature of skills. The wage equation also allows for wage-level differences across sectors and regions, which may provide insights into skills supply and demand conditions.

**Estimates for Labor Productivity Outcomes**

The IV results are reported in Table 5 for the labor productivity equation. Only the results for the firm performance equations are reported. The results (not reported here) from the other components of the system of equations are largely unchanged, with one exception: in the skill strategy equation, the coefficient (0.15) of the instrumental variable ASS_{rs} was positive and statistically significant, as required for ASS_{rs} to be a good IV for skill strategies. For insights into the potential bias resulting from endogenous skill strategy choices, IV estimates of the productivity equation are compared to those from the base model that treats skill strategies as being randomly determined.

The results in Table 5 indicate that estimates of the productivity effects of skill strategies are biased downward. In the original SEM results (henceforth the “baseline model”), the estimated coefficient of STRAT_{dj} in the production function was 0.196; in the IV model, the same coefficient increases to 0.285 or by about 50 percent. To the extent that our IV approach eliminates biases arising from endogenous skill strategy choices, the latter coefficient may be interpreted as being causal. This result reinforces our previous baseline model findings that proactive skill strategies have a large and positive effect on improving labor productivity. The other production function coefficients are largely unchanged as compared to those reported previously for the baseline model and need no further elaboration.

### Table 5: Baseline and IV Estimates of the Production Function

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Base Model</th>
<th>IV Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log (labor productivity)</td>
<td>Coefficient</td>
<td>Z-stat</td>
</tr>
<tr>
<td>Skill gaps</td>
<td>−0.138</td>
<td>**</td>
</tr>
<tr>
<td>Skill strategies</td>
<td>0.196</td>
<td>**</td>
</tr>
<tr>
<td>Log (physical capital per worker)</td>
<td>0.447</td>
<td>**</td>
</tr>
<tr>
<td>% Upper secondary educated</td>
<td>0.006</td>
<td>—</td>
</tr>
<tr>
<td>% Tertiary educated</td>
<td>0.066</td>
<td>—</td>
</tr>
<tr>
<td>% Managers, professionals, technicians</td>
<td>0.155</td>
<td>**</td>
</tr>
<tr>
<td>% TEVET credentialed</td>
<td>0.131</td>
<td>**</td>
</tr>
<tr>
<td>Constant</td>
<td>5.853</td>
<td>**</td>
</tr>
</tbody>
</table>

*Note:* (1) Base model refers to the original specification of the skills demand model; the IV model is the specification with the skill sources instrumental variable included with cross-equation covariance of error terms for the skill strategies and firm performance equations; (2) * and ** denote statistical significance at the 1 percent and 5 percent levels.
Estimates for Annual Wage Outcomes

The IV results for the annual wage equation are reported in Table 6 together with those from the corresponding baseline model. Here, the dependent variable is the logarithm of the firm’s annual wage bill—wages, salaries, bonuses, and social security payments—divided by total employment. Wages are related to the latent variables skill deficits and skill strategies, the log of labor productivity, controls for the educational and occupation composition of the workforce, and indicator variables for firms operating in the Lusaka region and in manufacturing.24

Like the productivity results in Table 5, the wage effects of skill strategies are biased downward by the endogeneity of skill strategy choices. However, the bias in estimated wage effects is much greater. Compared to the baseline wage model, the estimated coefficient of skill strategies in the IV model increases from 0.176 to 0.463, or more than double. Interestingly, skill gaps are associated with payment of lower, but not statistically significant, wages while such skill deficits significantly affect labor productivity outcomes.

Table 6: Baseline and IV Estimates of the Wage Equation

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Base Model</th>
<th>IV Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Z-stat</td>
</tr>
<tr>
<td>Skill gaps</td>
<td>−0.074</td>
<td>—</td>
</tr>
<tr>
<td>Skill strategies</td>
<td>0.176</td>
<td>*</td>
</tr>
<tr>
<td>Log (output per worker)</td>
<td>0.640</td>
<td>**</td>
</tr>
<tr>
<td>% Upper-secondary educated</td>
<td>−0.028</td>
<td>—</td>
</tr>
<tr>
<td>% Tertiary educated</td>
<td>0.030</td>
<td>—</td>
</tr>
<tr>
<td>% Managers, professionals, and technicians</td>
<td>0.082</td>
<td>*</td>
</tr>
<tr>
<td>% TEVET credentialed</td>
<td>−0.050</td>
<td>—</td>
</tr>
<tr>
<td>Manufacturing sector indicator</td>
<td>−0.076</td>
<td>*</td>
</tr>
<tr>
<td>Lusaka location indicator</td>
<td>−0.164</td>
<td>**</td>
</tr>
<tr>
<td>Constant</td>
<td>4.118</td>
<td>**</td>
</tr>
</tbody>
</table>

Note: (1) Base model refers to the original specification of the skills demand model; the IV model is the specification with the skill sources instrumental variable included with cross-equation covariance of error terms for the skill strategies and firm performance equations. (2) * and ** denote statistical significance at the 1 percent and 5 percent levels.

Table 6 also shows that firm-level annual wages are positively related with firm-level labor productivity, a relationship that is statistically significant at the 1 percent level. This relationship has also been found at the level of the firm in Organisation for Economic Co-operation and Development (OECD) countries, and it lends support to the new productivity literature’s explanations on why large between-firm productivity and wage differentials can exist within ostensibly similar sectors (Syverson 2011). Both base model and IV model specifications estimate this relationship to be between 0.64 and 0.69, suggesting that employers share two-thirds of productivity gains with their workers in the form of higher wages. Similar research using firm-level data from the OECD countries estimate these sharing ratios to be closer to half (see Dunne

24 This wage equation specification differs from the reduced form firm-level wage equations typically estimated in the literature. First, it does not include firm-level productivity attributes which are modeled here through the latent variables organizational capital, skill deficits, and skill strategies. The second difference is the inclusion of another dependent variable labor productivity in the wage equation. This is readily accommodated within the SEM framework of estimating systems of equations with correlated errors across some equations.
et al. 2004; and Konings and Vanormelingen 2015). These differences with our estimates may simply reflect differences in how labor markets operate in developing and advanced countries or, alternatively, differences in the data, modeling, and estimation methods used.

These sharing arrangements are significant for what they tell us about how labor markets operate, and for what they imply about the nature of skills. In theory, no such firm-level productivity-wage relationship should exist in perfect labor markets with general (and transferable) skills. In the general human capital model (Becker 1964), workers bear all the costs and receive all returns to investing in general skills, and free labor mobility would compete away any residual firm-level wage premiums. However, the evidence presented here—for Zambia as well as for other OECD countries—suggests otherwise. Not only do between-firm productivity differences persist, they are correlated with between-firm wage inequality, implying the presence of productivity sharing arrangements through wages. Such sharing arrangements are consistent either with the presence of firm-specific skills in perfect labor markets, as originally postulated by Becker (1964) or, as suggested more recently by Acemoglu and Pischke (1999), with imperfect (oligopolistic) labor markets and general skills. The consensus, from panel research on the links between labor mobility and wages, appears to support the latter interpretation based on general skills.

Finally, the results suggest that there are systematic wage-level differences across regions and sectors, controlling for workforce education and occupation. Dummy indicator variables were included to compare wages of Lusaka-based firms and firms located outside Lusaka, and firms in the manufacturing sector versus those in services, transportation, and IT. On average, Lusaka-based firms pay wages that are 17 percent lower than firms elsewhere; manufacturing sector firms pay wages that are about 10 percent lower than firms in the IT and service sectors. Plausibly, it may be argued that these wage differentials reflect skills supply and demand conditions facing the different groups of firms. As noted earlier and documented in the graphical comparisons, firms operating in the Lusaka area are better served by a dense network of local universities, TEVET institutions, and training providers as compared to firms in other regions that are more constrained in their access to skills. Sectors may also differ in their skill requirements and in access to specialized skill providers willing and able to meet their sector-specific skills and in-service training needs.

25 In the presence of firm-specific skills, neither employer nor worker would have any incentives to pay for firm-specific training since unilateral dismissals of workers by employers or quits by workers would impose a sunk cost on the party financing training. The solution to this bilateral holdup issue, according to Becker (1964), is for the firm and workers to share the cost and the returns of firm-specific training.

26 General or sector-specific skills useful to other employers may be treated as if they were partly firm specific when oligopolistic markets constrain free labor mobility.

27 Employer interviews, including with respondents to the ZESS survey, suggest that firms in sectors such as transportation, mining, and IT face greater difficulties filling job vacancies because of a limited local supply of labor with their sector-specific educational skills and occupational training.
IV. SUMMARY AND POLICY IMPLICATIONS

This Note has formulated and tested a skills demand model on data from a survey of formal sector Zambian enterprises using an SEM approach. It modeled the relationships between organizational capital, skill gaps, and skill strategies on the one hand and on the other hand, how these three latent variables affect firm performance. These relationships provided numerous insights into the factors that shape firms’ demand for skills, the skill gaps that arise when existing skills supply is inadequate to meet skills needs, and skill strategies that firms use to mitigate skill gaps and respond to changing skills demand. While not all firms choose to deploy skill strategies, those that do significantly improve labor productivity and pay higher wages.

Policy concerns about the quality and limited supply of high-level skills, and the constraints they pose for development and productivity growth, appear well founded. Employer assessments, supported by the analyses, suggest that many workforce skills are inadequate compared to what firms need and these skill deficiencies negatively affect production and sales, use of new technology, and innovation. Firms that export and innovate demand more skilled workers with tertiary education, TEVET credentials, and higher occupational skills. The skills supply to meet these needs are often limited, especially when firms are located in regions outside Lusaka where skill sources are concentrated. The data indicates that firms with skill gaps face a productivity disadvantage relative to other firms. Some firms, but not others, respond to skill gaps and demand by deploying skill strategies to fill job vacancies, provide in-service training to develop or upgrade skills of their workers, hire high-skill expatriates when local supply is limited, and outsource professional services. The evidence indicates that all these strategies are causally related to improvements in productivity and wages.

The Government has a critical role to play in facilitating firms’ responses to these skill challenges. Especially important are the challenges on how to (a) increase the supply, quality, and market-relevance of pre-employment higher-level educational and TEVET skills, across regions and from both local and foreign sources, and (b) promote and finance expanded in-service acquisition of new skills and the upgrading of existing ones of the current workforce that is so important for innovation and productivity growth.

Increasing the Supply of Higher-Education and TEVET Skills

The first challenge is to expand the supply of market-relevant skills from public and private sector universities, colleges, and TEVET providers and addressing the uneven geographic distribution of skills supply. The overwhelming majority of higher education and TEVET skill sources are centralized in Lusaka, and formal sector firms located elsewhere in Zambia are highly reliant on Lusaka-based skill providers. The heavy reliance on Lusaka for the supply of tertiary-educated and TEVET-credentialed labor, and for the in-service skills upgrading of the employed workforce, raises costs for and disadvantages firms in outlying regions. As the instrumental variable analyses
indicated, firms’ decisions to deploy skill strategies depend upon their proximity and access to
different skill sources, and their choices have important consequences for firm performance.

The Government of Zambia has already greatly expanded the financing and creation of new higher-
education institutions during the Sixth National Development Plan (see Public Expenditure
Review of Education, World Bank 2015). In 2015, the budget allocation to higher education
amounted to 12.6 percent of the total education budget, which is high relative to other developing
countries at the same level of income. It is clear that the solution cannot further expand the number
of public universities and training institutions throughout the country, which in any case, is not
realistic given the constraints on the public purse and Government revenue shortfalls from the
current economic slowdown, nor is this necessarily desirable.

**Involve the Private Sector**

The state can facilitate the private sector, both university and training institutions, as well as
industry, to play a greater role in the development of market-relevant higher-level skills,
particularly through improving coordination of information, financing, and public-private
partnerships. The state has encouraged the establishment of 14 new private universities, though
few details are available on their financing, and both current and projected enrollments and areas
of study. The private sector is also being involved in management boards of public universities
and TEVET institutions that now have financial and managerial autonomy as part of the higher
education reform process. Government financing of tertiary education and training, however, has
been concentrated on selected public sector universities and large TEVET institutions. The state
should consider making access to Government institutional support available, on a competitive
basis, to both public and private sector tertiary and training institutions with the ability to work
collaboratively with industry to deliver market-relevant higher education and training.

The state should consider co-financing delivery of skills in short supply with qualified private
sector partners, especially when local public sector skill sources and alternatives are not available.
Public-private partnerships have been used successfully in many developing countries to finance
and deliver skills training at the local or regional levels. An excellent example of industry-
government collaboration is the Penang Skills Development Center in Malaysia (see box 1).
Created initially by the state government and private sector, Penang Skills Development Center
(PSDC) has evolved into a private education institution offering demand-driven certificated public
training and is now a model for similar public-private skill centers in other Malaysian states. It
demonstrates the potential of private education and training institutions being used for public
training purposes in cases where they may not be viable in themselves as private commercial
undertakings, and it does so without creating new training facilities in the public sector.
Expand the Budget Allocation to TEVET

The allocation of the education budget to TEVET is currently relatively small and the country could benefit from an expansion of the technical and vocational education and training sector (World Bank 2015). The Sixth National Development Plan’s target of enrolling 50,000 TEVET graduates by 2015 is unlikely to be achieved with the existing TEVET budget allocation. Reforms to the TEVET sector, starting with the 2001 Zambia Technical Education, Vocational and Entrepreneur Training Program, has created a competent and autonomous national training authority (TEVETA) responsible for regulation and quality assurance of both public and private TEVET institutions, and development and implementation of a national qualifications framework for TEVET. Under the Technology Development Program (TDP), TEVETA was also tasked with managing a TEVET Fund to promote delivery of demand-driven training through four windows for pre-employment, in-service and informal sector training, and rehabilitation of TEVET institutions. During the TDP, the in-service training and informal sector training initiatives were only piloted briefly but never fully funded when the TDP funding from the World Bank and bilateral development partners ended in 2009 and was not replaced either by government funding or by a proposed payroll levy to finance training on a sustainable basis (IEG 2011).

There are economic and equity justifications for expanding the budget allocation to the TEVET sector (Moono and Rankin 2013; World Bank 2015). TEVET graduates perform well in the labor market compared to those without training, both in terms of professional and technical career progression and in the high rates of return to training received. TEVET also offers the growing

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**Box 1. Penang Skills Development Center**

First established by the Penang state government and private industry as a joint training center, the PSDC has evolved into a purely private education institution providing certificate and diploma-level training. The Malaysian Government invests in the center and uses it to carry out public training programs. The PSDC, with more than 100 member companies, now runs both standardized and customized programs. It charges at cost and is basically self-financing. Companies recoup their training expenditure from the Human Resource Development Fund (HRDF), a training fund financed by a 1 percent levy on their payrolls.

The initiative for the PSDC came from the Penang state government, which provided the land and buildings. The founder members included large multinational companies with training traditions of their own. Members donate equipment, laboratories, training modules, and trainers. They have access to shared training facilities without having to duplicate with their own in-house capability. Participating SMEs enjoy technology transfer from and can benchmark their standards against those of the multinationals. Multinationals, in turn, receive better support services from their SME suppliers. Vendors donate equipment to familiarize the company workforce with their products and promote sales.

None of this is to say that the PSDC is easily replicated. Eleven other Malaysian states (out of 13) have launched similar skill development centers, with varying degrees of success, usually a function of state government commitment, regional growth dynamics, and private sector ingenuity. For example, the state of Johor invited equipment suppliers to stock and update equipment used in the skills center so training equipment was always current and comparable to those used in companies. The success of this sort of enterprise depends on a number of circumstances, most importantly, the people initiating and managing the process. Centers like the PSDC cannot be imposed; they need to grow in already fertile ground.

*Source: Pillay (2005)*
ranks of secondary school graduates an alternative route to post-secondary education, given the limited access to higher education opportunities. As a middle-income country, Zambia will also need to diversity its skill sets to meet the growing demand for professional and technical skills identified by the analysis as being in short supply, not only at the pre-employment level but also for in-service training to upgrade workforce skills and develop the productive capacity of MSMEs.

**Facilitate Access to Foreign Sources of Skills**

As the ZESS demonstrates, many Zambian employers employ high-skilled expatriate managers, professionals, and technicians because of skill gaps and limited local supply. In the face of local skill shortages, another strategy is to outsource essential high-skill legal, accounting, engineering, and architectural services to professional services firms, many of which also rely on foreign professionals. Both strategies enhance labor productivity. A major challenge with movement of labor across national borders is the lack of recognition of foreign-obtained academic and professional qualifications and experience. To secure employment abroad, the skills individuals bring must first be recognized by the host country; similarly, to practice a profession in another country, foreign qualified professionals either need to requalify in the host country—a significant entry barrier—or their foreign qualifications must be recognized by the host country.

The Government should work with regional partners to facilitate Zambian employers’ access to high-skilled foreign labor and critical services provided by professional services firms. As a member of the SADC, Zambia has ratified the 1997 SADC Protocol on Education and Training that provides for cooperation among member states in the integration of education and training policies, and the sharing of resources and experience. Employers’ skill needs cannot be met from local sources. A plan to implement the provisions of this protocol is currently under way, including the drafting and planned implementation (by 2017) of a harmonized SADC regional qualifications framework to facilitate mutual recognition of qualifications, credit transfers, and quality assurance among SADC member states. In the SADC, professional services’ firms report restrictive regulations on competition, qualifications, and foreign ownership as the major constraints to operating in the SADC countries. Progress will require greater coordination between the Ministry of Education, Science, Technical Vocational Training, and Early Education (MESTVEE) and other Zambian government agencies responsible for immigration, trade, and industry.

**Develop Regional Centers of Excellence**

Another potentially fruitful area is for Zambia to participate in an SADC regional strategy to develop new sources of supply for critical skills needed for industry and innovation (see Tan 2017). Skill gaps and skill mismatches exist in many sectors across the SADC member states, and it is

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28 There is evidence that use of expatriate labor and outsourcing of professional services is associated with higher firm-level productivity. In addition to the earlier SEM analyses of the Zambia ESS data, similar production function results were found for Tanzania (Tan, Bashir, and Tanaka 2016) and for a sample of 1,100 firms in 19 COMESA countries (Tan 2017).
neither feasible nor desirable for individual countries to invest scarce resources in all skill areas. Rather, a case can be made for a regional approach to collaboratively identify skill gaps and national capabilities and to invest in a network of regional centers of excellence to exploit economies of scale and specialization in different countries. Ideally, regional centers of excellence would specialize in the critical skill areas needed in the region and work with the private sector to develop curricula, pedagogical methods, and new skills relevant to industry and the workplace.

The new knowledge developed in these centers of excellence have the character of regional public goods, and improved governance of migration should ensure that they are widely disseminated within the region. This may take several forms. First, given the shortage of highly qualified faculty, the centers of excellence will need to staff up, drawing upon the higher education and industry resources of the whole region, either on a full-time or visitor basis. Second, admissions should be open to students and industry from all member states to ensure that the new skills and knowledge are made widely available to all. Given the likely high demand for such seats, admissions should be competitive and, where resources allow, facilitated by scholarships for deserving students. Third, new curricula and pedagogical approaches piloted in the regional centers of excellence may be replicated in subsequent rounds of new regional centers, or disseminated more widely into the higher education and training systems of member states. The improved governance of migration and recognition of qualifications are essential to facilitating the free flow of faculty, students, and industry across national boundaries and to realizing the benefits of a regional approach on education and training.

Promote and Incentivize In-Service Training

A second broad challenge is to promote in-service training and incentivize employers to sponsor in-service training programs for their current employees. The incidence of in-service training is very low among formal sector enterprises in Zambia—only 23 percent of employers in ZESS reported providing their workers with training. How does the incidence of in-service training in Zambia compare to other countries in Sub-Saharan Africa or to other developing countries globally? To address this question, we present in Table 7 the most recent data available from the World Bank’s Enterprise Surveys, focusing on just manufacturing sector firms to facilitate comparability of training across countries. As Table 7 makes clear, the incidence of training in the manufacturing sector of Zambia (28 percent) is low not only by Sub-Saharan Africa standards but also low relative to other developing country comparators.
Table 7. Incidence of In-Service Training in Manufacturing Sector Firms:

<table>
<thead>
<tr>
<th>Sub-Saharan Africa Countries by Income</th>
<th>% firms</th>
<th>Regional Average of Countries</th>
<th>% firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania (2013)</td>
<td>30.7</td>
<td>Sub-Saharan Africa</td>
<td>30.2</td>
</tr>
<tr>
<td>Uganda (2013)</td>
<td>34.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lower-middle income</strong></td>
<td></td>
<td>East Asia and Pacific</td>
<td>32.9</td>
</tr>
<tr>
<td>Zambia (2013)</td>
<td>28.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria (2014)</td>
<td>30.7</td>
<td>Latin America and Caribbean</td>
<td>44.1</td>
</tr>
<tr>
<td>Kenya (2013)</td>
<td>40.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghana (2013)</td>
<td>40.1</td>
<td>South Asia Region</td>
<td>28.2</td>
</tr>
<tr>
<td><strong>Upper-middle income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>36.8</td>
<td>Europe and Central Asia</td>
<td>34.3</td>
</tr>
</tbody>
</table>

*Source: Computed from World Bank Enterprise Surveys.*

While many new graduates enter the firm with theoretical knowledge acquired in universities and TEVET institutions, many lack the applied and practical skills needed to operate effectively in a work environment. Research worldwide suggests that formal on-the-job training is critically important for upgrading skills of the current workforce and for adopting and using new technologies and that in-service training is associated with productivity growth (Tan and Lopez-Acevedo 2003; Tan 2005). The analyses reported earlier—on in-service training as a skill strategy to address skill gaps and the links between training and labor productivity—indicate that these relationships apply equally to Zambia.

Refocus Part of TEVET Fund to In-Service Training

The TEVET Fund administered by TEVETA needs to be reallocated to give more weight to in-service training promotion and delivery, especially to SMEs. As noted earlier, the TEVET Fund managed by TEVETA has four funding windows: (1) pre-employment training, (2) in-service training, (3) training for the informal sector, and (4) infrastructure investments. TEVETA has historically focused most of the TEVET funds to windows (1) and (4), that is, to financing the development of pre-employment training programs and infrastructure investments to rehabilitate and improve public-sector TEVET institutions; significantly fewer resources have gone to fund in-service and informal sector training (World Bank 2015).

A major share of the proposed expanded TEVETA budget allocation should be used to promote development and delivery of in-service training programs and entrepreneurial training for the MSMEs sector and in outlying regions that are currently underserved by skill providers. Given the limited institutional experience with windows (2) and (3), the initial focus of TEVETA should be on piloting and evaluating the cost-effectiveness of alternative training and delivery modalities for enterprise beneficiaries in different sectors and localities. This will require extensive consultation and collaboration with industry partners including industry associations and chambers of commerce; government bodies such as the Zambia Development Agency (ZDA) with overlapping
responsibilities for the development of MSMEs; and public and private sector providers (universities, TEVET institutions, and consulting firms) with the capacity and interest in delivering such training. These initiatives can then go to scale, on a cost-sharing basis, once the efficacy of the different training delivery modalities is identified, and the value of in-service training and associated extensions services demonstrated for the targeted firm beneficiaries.

Develop Cost-Effective Training for SME Clusters

What kinds of in-service training modalities are most likely to be effective for Zambian enterprises? When in-service training takes place, it is provided most commonly by in-house staff trainers; when outside providers are used, firms draw from a mix of consultants, trade associations, colleges, and TEVET institutions, and business partners, most of whom are regionally concentrated in Lusaka. What accounts for the low incidence of in-service training and the very limited use of external training providers? Is it primarily a supply constraint or a demand-side issue? Supply is obviously a factor, given the regional concentration of skill sources in Lusaka, but demand-side factors may also play a role.

To address these questions, employers in ZESS were asked why they provided little or no in-service training to their workers. Their responses, reported in Table 8, suggest that the cost and limited usefulness of training programs were more important factors than their availability. The availability of training programs and trainers turned out to be the least important obstacle to in-service training. Overwhelmingly, 38 percent of employers (42 percent of small firms) identified the high cost and poor cost-effectiveness of training programs as the primary reason for not sponsoring or providing in-service training to their employees. Besides those reasons, about 35 percent of all firms also thought training would not be useful, suggesting either that employers are not convinced about the productivity benefits of training. About 12 percent of firms claimed that they did not train their workers out of concern that other companies would ‘poach’ their skilled employees, and another 11 percent of employers noted the difficulty and workflow disruptions of releasing workers to take training courses, especially if training involved travel to Lusaka-based external providers.

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29 The Micro and Small Enterprise Department of the ZDA is responsible for, among other things, promoting and delivering business development services and capacity building for MSMEs.
30 Based on the names of external training providers used, as reported by employers in the ZESS.
Table 8: Firms’ Reasons for Not Providing Formal In-Service Training

<table>
<thead>
<tr>
<th>Reason for No Formal Training</th>
<th>Small (5–19)</th>
<th>Medium (20–99)</th>
<th>Large (100+)</th>
<th>All Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too expensive/not cost-effective</td>
<td>85 (41.9)</td>
<td>32 (34.0)</td>
<td>9 (28.1)</td>
<td>126 (38.3)</td>
</tr>
<tr>
<td>Training programs/trainers not available</td>
<td>4 (2.0)</td>
<td>5 (5.3)</td>
<td>3 (9.4)</td>
<td>12 (3.7)</td>
</tr>
<tr>
<td>Training would not be useful</td>
<td>72 (35.5)</td>
<td>29 (30.9)</td>
<td>13 (40.6)</td>
<td>114 (34.7)</td>
</tr>
<tr>
<td>Trained workers would leave</td>
<td>22 (10.8)</td>
<td>13 (13.8)</td>
<td>4 (12.5)</td>
<td>39 (11.9)</td>
</tr>
<tr>
<td>Cannot afford to release workers from work</td>
<td>19 (9.4)</td>
<td>14 (14.9)</td>
<td>3 (9.4)</td>
<td>36 (10.9)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>203 (100.0)</strong></td>
<td><strong>94 (100.0)</strong></td>
<td><strong>32 (100.0)</strong></td>
<td><strong>329 (100.0)</strong></td>
</tr>
</tbody>
</table>

Source: ZESS 2016.

Note: No response or ‘not available’ responses make us less than 1 percent and are not reported above.

While in-service training programs are available, the high cost, low cost-effectiveness, and dubious value of such programs currently offered by training providers are the major constraints for employers not offering or sponsoring in-service training for their current workforce. The high cost of offerings tailored to the specific skill needs of individual firms may not be justified for the majority of firms. Furthermore, while some training needs may be firm specific, most are likely to either be general to all firms (such as training in inventory management and quality control), sectoral in nature (for example, training for the design of textiles or leather products), or related to the use of specific technologies (such as training in ICT or equipment maintenance and repair). It is in such kinds of training that skill deficiencies are assessed to be most problematic for their operations, and that would be most in demand by employers.

International experience with in-service training policies suggests that demand-driven training can be delivered cost-effectively to clusters of MSMEs operating in the same sector and geographic regions. These approaches have several common features. The common skill needs of specific clusters of enterprises in a sector or locality would first be identified through employer interviews and with the help of local industry associations and chambers of commerce. Training programs targeting these skill needs would then be developed using local providers or, as needed, expertise from Lusaka or abroad. Such programs would be group based to reduce unit costs and delivered in a format that is least disruptive to the production needs of MSMEs. Another benefit is the long-term savings in development costs, since training materials and pedagogical methods developed for each pilot can then be replicated for similar sectors or clusters of MSMEs in other localities.
Box 2. Mexico’s Proactive Training Programs for SMEs

The Integral Quality and Modernization Program (Calidad Integral y Modernización, CIMO), established in 1988 by the Mexican Secretariat of Labor, has proven effective in serving the training needs of SMEs. Set up initially to provide subsidized training, CIMO quickly evolved to include industrial extension services when it became apparent that lack of training was only one of many factors contributing to low productivity among SMEs. By 2000, CIMO was providing an integrated package of training and industrial extension services to over 80,000 SMEs each year and training to 200,000 employees, involving more than 300 business associations, up from 72 in 1988. While the program ceased to exist after a change in Government, it offers some important lessons for training policy.

The CIMO program was designed to have broad regional coverage with minimal bureaucratic infrastructure. CIMO offices, each staffed by three to four promoters, were set up in each state and housed in business associations, which contributed office and support infrastructure. Promoters organized workshops on training and technical assistance services, identified potential local and regional training suppliers and consulting agents, both public and private, and actively sought out SMEs to deliver assistance on a cost-sharing, time-limited basis. An initial diagnostic evaluation of firms was conducted as the basis for organizing training programs and other consulting and technical assistance. The Government did not deliver this training; instead, its role was to identify qualified local training providers to deliver the training usually on a group or association basis so as to reduce unit training costs. This strategy was deliberate since one of the program’s objectives was to promote the development of regional training markets able to serve the needs of local enterprises.

Several rigorous impact evaluations have found CIMO to be a cost-effective way of assisting SMEs. While CIMO firms tended to have lower pre-program performance than a comparison group with similar attributes, their post-program outcome indicators tended to show relative improvements in indicators like labor productivity, capacity utilization, product and service quality, and wages and employment.


Mexico’s CIMO, now renamed Programa de apoyo a la capacitacion (Training Support Program, PAC), is one example. It provides insights into how the SME training program achieved broad regional coverage with minimal investments in capital infrastructure. It also demonstrates how the program evolved from a traditional training program into one offering MSMEs an integrated package of training and industrial extension services. Impact evaluations have found the CIMO program to be a cost-effective training strategy, with tangible post-training improvements in several measures of firm performance (see box 2). Similar initiatives have been used successfully in Republic of Korea to organize training consortiums for group-based training of SMEs, with the costs of training financed in part by a payroll levy-rebate scheme (see Almeida and Cho chapter in Almeida, Behrman, and David 2012).

Financing In-Service Training with Payroll Levies

Zambia should revisit the introduction of a payroll levy system to provide sustainable financing for in-service training. Originally proposed as one component of the Zambia TDP project, the proposed payroll levy system to finance the TEVET Fund was never adopted when the credit ended in 2008, and Government funding to replenish the Fund did not materialize. The private sector was also reluctant to support the proposed training levy, with little evidence on the demonstrated benefits from the in-service training initiatives and concerns over how their levy contributions would be used for other initiatives not related to in-service training.

Policy makers might look to other regions of the world that offer successful models of payroll levy systems that have been responsive to employers’ needs for continuous upgrading of worker skills.
and that give employers greater control over how levy resources are used. A successful example of such a system is Malaysia’s HRDF (see box 3.). These levy systems have the additional benefit of creating a more vibrant post-employment training market with public and private training institutions competing for an expanded pool of training resources.

**Box 3. Malaysia’s Human Resource Development Fund**

The HRDF was established in 1993 to promote enterprise-based training among firms, first in manufacturing and then, more recently, in-service sectors as well. The Act created a Human Resource Development Council (HRDC), with representatives from the private sector and responsible government agencies and a Secretariat to administer the different HRDF schemes. Eligible employers with 50 or more employees are required to contribute 1 percent of payroll to the HRDF, from which they are then eligible to claim allowable training expenditures up to the limit of their total levy payments for any given year. The HRDF requires firms to spend a minimum amount on training or lose their levy contribution, thus creating incentives for firms to train. HRDF offers a variety of schemes that give employers flexibility in training in-house or using a variety of accredited and quality-assured external public and private sector training providers.

This large secured pool of funding from payroll levies had the effect of creating a vibrant training market, with public and private sector providers competing for training resources. The HRDF also generated other benefits: it addressed information constraints through public information campaigns, subsidized delivery of training needs analysis (TNAs) to SMEs, certification and quality assurance of training providers and wide dissemination of their training offerings, and electronic billing to keep employers informed of the status of their levy use. Recognizing the cash-flow funding constraints of SMEs, the HRDC enlisted certified providers to act as its agents (collecting from users the fees for which firms are responsible and claiming the reimbursable balance from HRDF), thus reducing up-front cash outlays from SMEs.

*Source: Tan and Gill (2000).*
REFERENCES


