The Missing Middle Managers: Labor Costs, Firm Structure, and Development[*†]

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Abstract

We use data from a compensation consulting firm to measure the compensation paid by more than 1,000 leading modern firms to managers and business professionals at their establishments around the world. Our main finding is that the annual compensation modern firms pay to these workers is more than $50,000 per year even in the poorest countries. The implied relative cost of managers and business professionals to production workers is 14 times higher in developing countries than in the United States. We use an appropriate technology model as an accounting device to show that this variation in relative costs is a significant deterrent to the adoption or expansion of modern firms in developing countries. For example, its impact on adoption is equivalent to a 60 percent sales tax levied only on the output of such firms, or financial frictions that raise the effective cost of capital from 10 to 45 percent.

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[†] We thank Giulio Fella, Pete Klenow, and Francesco Caselli for helpful discussions, and audiences at numerous seminars and conferences for comments that improved the paper. This project was funded by the European Union (ERC, ACCESS, 101043465). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Council. Neither the European Union nor the granting authority can be held responsible for them. The views expressed are also not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1 Introduction

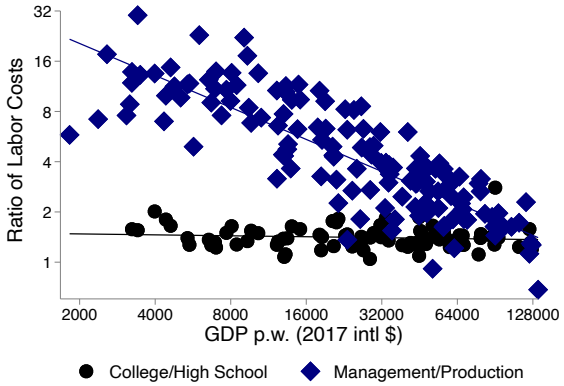
A key characteristic of modern economic growth is the systematic transformation of how production is organized (Kuznets, 1973). In developing countries it is organized along traditional lines: the majority of workers are self-employed or employed in small, unproductive single-establishment firms where workers and the owner-manager perform similar tasks.[1] By contrast, most workers in developed countries are employed in modern business enterprises: large, productive multi-establishment organizations where owners, managers, business professionals, and production workers perform distinct tasks. Explaining this transition is central for understanding the development process.

One hypothesis is that differences in firm structure are efficient responses to the fact that countries have very different factor endowments. Since developing countries have a much lower share of educated workers, traditional production might be an *appropriate technology* that allows owners to economize on the use of educated labor (Basu & Weil, 1998; Acemoglu & Zilibotti, 2001; Caselli & Coleman, 2006). The challenge for this literature is that factor scarcity matters for firms only to the extent that it is reflected in factor prices — yet, one of the most well-documented stylized facts of growth and development is that the skill premium is essentially uncorrelated with development (Banerjee & Duflo, 2005; Rossi, 2022; Malmberg, 2023).

This paper seeks to revive the appropriate technology hypothesis. Our main contribution is to provide the first detailed data on the costs that modern firms face in hiring managers and business professionals in their establishments around the world. Our methodology leverages the fact that while modern establishments are rare in developing countries, they do exist in niches such as telecommunications, financial services, or natural resource extraction. Many modern firms have far-flung operations and so find it useful to hire compensation consulting firms to advise them on labor market conditions for their more specialized and highly compensated workers. We have access to the proprietary database of one such company (the “Company") that contains information on actual compensation paid by over 1,000 modern firms to over 300,000 workers in 146 countries around the

[1] See Gollin (2008) on the prevalence of self-employment, Bento & Restuccia (2017), Poschke (2018), and Bento & Restuccia (2021) for facts about firm and establishment size, and Bassi *et al.* (2023) for task allocation.

FIGURE 1: RELATIVE FACTOR COSTS AND DEVELOPMENT



world.

The central finding in the database is that firms report remarkably high costs for managers and business professionals. Even in the poorest decile of countries in our sample, the average compensation is over $50,000, as compared to roughly $75,000 in the United States (both in 2017 international dollars). Since wages in general are dramatically lower in developing countries, these countries have much higher relative costs of management. Figure 1 illustrates the central finding by plotting the relative cost of management to production workers. Whereas we find management to be roughly 30 percent more expensive than production labor in the United States, that figure rises to a factor of 19 among the poorest decile of countries, which implies that the relative cost of managers is 14 times higher in these developing countries than in the United States. For comparison, the figure also includes a measure of the college wage premium from the literature.[2] It varies little with development.

We interpret Figure 1 as indicating that modern firms face a high relative cost of procuring the services of managers and business professionals in developing countries. To rule out other interpretations, we conduct a number of robustness checks. First, we use the detailed information on harmonized job titles in the dataset to show that our results are not explained by cross-country differences in workforce

[2]Constructed as four times the Mincerian return per year of schooling from Caselli *et al.* (2014). Rossi (2022) studies several alternative measures of the skill premium and finds that all are either constant or modestly declining with development.

composition. Second, we decompose the patterns and show that similar results apply both for domestic and multinational firms. Third, we investigate compensation patterns in alternative data sources. We show that other data sources that specialize in the labor market for managers and business professionals that work for modern firms report similar compensation levels. By contrast, workers with manager and business professional occupations in representative data sources are paid substantially less. Thus, uncovering the trends in Figure 1 requires detailed data on labor costs for modern firms.

Our second contribution is to show that the cost of management is a quantitatively important deterrent to the adoption and expansion of modern business enterprises in developing countries. We show this using an accounting framework built on an appropriate technology model. Producers in each industry take factors costs as given and choose between a traditional or modern production process. A higher relative cost of management deters adoption of modern production if modern production is more management-intensive.

We quantify this interaction between relative costs and relative factor intensity. The Company's database provides evidence on relative costs, as shown in Figure 1. We calibrate the relative factor intensity of modern and traditional technologies using evidence from the literature on firm hierarchies. We map traditional firms in the theory to small firms with one or two layers of workers in the data, meaning production workers and their supervisors. We map modern firms in the theory to firms with several layers, including middle and upper managers. The evidence of Caliendo *et al.* (2015) implies that modern firms are substantially more management-intensive.

We find that the high relative cost of management increases the relative unit cost of operating a modern firm by 65 percent in developing countries. To put this number into context, we compare it to other input cost differences and frictions highlighted in the literature.[3] Focusing on those that can be translated into shifts in relative prices, we show that the shift in the relative cost of management is large, equivalent to a financial friction that raises the effective cost of capital from 10 to 45 percent, or a 170 percent tariff on imported intermediate inputs. For a wide range

[3]Important alternative explanations in the literature include the high cost of electricity (Fried & Lagakos, 2023); financial frictions (Buera *et al.*, 2011, 2015); contracting frictions (Acemoglu *et al.*, 2007; Boehm & Oberfield, 2020), and limits on delegation (Bloom *et al.*, 2010; Akcigit *et al.*, 2021).

of industries where the advantages of modern production are not too large, this difference in relative costs provides firms a significant incentive to remain small and traditional so as to economize on management costs. At the same time, for some industries the advantages of modern production are so large that firms find it profitable to pay these high costs – these are exactly the segments of the economy from which our data come.

Finally, we examine why management is relatively expensive in developing countries. We consider three broad theories and provide evidence for each. First, modern firms may hire high-quality workers, who are likely scarce given the low education quality and emigration of skilled workers ("brain drain"). Second, labor market frictions and poor contract enforcement may imply that firms need or find it optimal to pay high wages or efficiency wages to attract workers and ensure that their incentives are aligned with those of distant ownership. Third, in related work Hjort *et al.* (2020) use the same dataset to show that multinational firms appear to anchor pay at foreign establishments to pay at their headquarters, possibly because of fairness or morale concerns.

Our work is most closely tied to two literatures. First, we contribute to the appropriate technology literature. Our focus on the role of managers and business professionals for large-scale modern production builds on historical work by Chandler (1977) and early appropriate technology work by Stewart (1977). We are the first to document the quantitative importance of the cost of management. Our findings are related to other recent work showing the importance of appropriate technology in other contexts, including explaining the structure of retail trade (Lagakos, 2016) or the applicability of agricultural innovation in developing countries (Moscona & Sastry, 2022). Finally, an important role for appropriate technology considerations is consistent with the recent view in the industrial upgrading literature that low adoption of new technologies in developing countries can mostly be explained as optimal responses by firms given different demand and supply conditions (Verhoogen, 2023).

Second, our work is closely related to the new literature demonstrating the importance of management (Bloom *et al.*, 2014). Our findings on relative costs help rationalize why firms choose low-quality management, including the widespread use of family members as managers, instead of hiring professional management (Bloom *et al.*, 2013). The quantitative results are related to recent work that uses

quasi-experimental evidence to show that management and firm structure respond to distance and labor supply within a country (Gumpert *et al.*, 2022; Feng & Valero, 2020). Finally, we provide some suggestive results on why managers are scarce in developing countries that connects with existing work on their education and high-skill labor markets (Bloom *et al.*, 2013; Guner *et al.*, 2018; Esfahani, 2022).

2 Data

Our empirical analysis makes use of a proprietary database collected and maintained by a global compensation consulting company (the "Company"). The central business proposition of compensation consulting firms is to provide clients with information on how the compensation of their employees compares with the prevailing rate for similar workers in the local labor market. The Company's niche among compensation consulting firms is information on developing and emerging markets.

In order to provide comparable information on labor market conditions across a wide range of countries, the Company employs professional jobs analysts who conduct interviews to learn about the tasks, responsibilities, and skills associated with each position. The analysts use this information to translate each position into the Company's internal, globally standardized job classification scheme. This scheme is extremely detailed, consisting of more than 200 job titles that allow for both horizontal and vertical differentiation of jobs (accounting versus human resources; junior accountant versus senior accountant). This work is invaluable for our purposes because it means that the data on compensation for the same job across countries is much more comparable than that produced by the standard method, which involves economists or national accountants applying crosswalks to data that include workers' self-reported occupations.

After providing the market comparison to the client, the Company adds the client's data to its database for future use. Thus, the Company's definition of market compensation is based on the compensation actually paid by previous clients in the same labor market; the market compensation data provided to future clients in the same labor market will be based in part on the current client's data. We have access to the database as of late 2015, which in turn reflects compensation reported by clients spanning the years 2000–2015. Each observation reports the firm name,

city/country, year, standardized job classification, average compensation of workers in the position in the establishment, and in many cases also the total number of such workers.[4] All observations pertain to local workers; expatriates are reserved to a separate database, which unfortunately we cannot access.

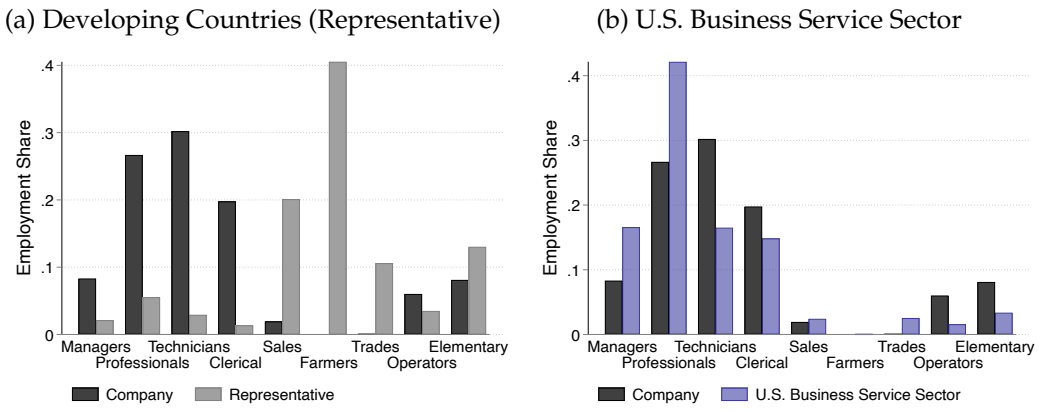
We use the firm name to merge on the firm's industry, profit/non-profit status, and headquarters location. Throughout, we restrict attention to for-profit firms and exclude charities and governmental organizations. A central feature of the database for our research question is that it covers almost exclusively modern business enterprises. Three-fourths of the compensation observations come from multinational firms. These firms are based primarily in North America (predominantly the United States), followed by Africa and Europe. Many firms in the database are large, well-known, publicly listed companies. To this point, the publicly listed U.S. firms in the database account for 32 percent of all revenue and 44 percent of all R&D investment in Compustat North America. The remaining one-fourth of observations come from large domestic firms. Both types of firms come from a wide variety of sectors, including banking, consulting, health care, mining and other natural resources, technology, telecommunications, and transport.

The establishments that appear in the Company database provide local business and headquarter services. We have verified that many firms also have separate production or sales establishments in the same country, but these establishments are not in the database, likely reflecting that the labor markets for sales and production workers are thicker, information on prevailing compensation is easier to access, and compensation for such workers is much lower. The distribution of occupations is heavily weighted towards managers and business professionals, with a small share of support workers who are captured incidentally because they work in the local headquarters establishment. If we map Company job titles to 1-digit ISCO-08 occupations, we find that the occupational profile in developing countries is very different from representative samples covering the same countries and instead similar to the profile of the U.S. business service sector (Figure 2).[5]

[4]The Company defines a labor market at the city level. However, there are only data for one city per country (generally the capital city, sometimes the business hub if that is different) and so we use country and city interchangeably.

[5]Developing countries includes all countries with GDP per worker less than $10,000 in 2017 international dollars. See Appendix A.1 for details on data sources used for comparison groups.

FIGURE 2: OCCUPATIONAL DISTRIBUTION OF COMPANY DATA



Note: Company data represent average distribution among countries with PPP GDP per worker less than $10,000.

The database reports gross and net compensation for all positions in three categories: base wage, bonus, and other income. Our preferred measure of compensation is total gross pay, which is the sum of gross wage, gross bonus, and other gross income. All amounts are reported to us in contemporaneous U.S. dollars; original data were either reported in U.S. dollars or were converted to dollars using market exchange rates. We make several adjustments to make sure that these amounts can be averaged and compared across countries and years, which is complicated by the fact that some emerging markets grow rapidly and hence experience rapid wage increases.

Our approach is to first convert all earnings back into local currency units using contemporaneous market exchange rates. We then adjust all amounts to year 2017 local currency units by adjusting for the average rate of nominal wage growth between year t and year 2017, inferred from the growth rate of nominal GDP per worker. This adjustment makes salaries comparable over time by assuming that each occupation would have experienced the aggregate average wage growth; it misses any occupation-specific wage growth. Finally, we convert year 2017 wages in local currency units to year 2017 international dollars using the PPP exchange rate.[6] We trim the bottom and top 0.5 percent of the real earnings distribution, which eliminates some outliers that look to be the result of miscoding. Our next

[6] All data for the adjustments from World Bank (2022). PPP exchange rate inferred from the ratio of GDP per capita reported in local currency units and international dollars in year 2017.

goal is to study how the real compensation of middle managers varies across countries.

3 Empirical Results

Now that we understand the nature of the database, we use it to address our main question of interest: how does the cost of managers and business professionals for modern firms vary with development? We estimate regressions of the form

$$\log(w_{c,t,f,j}) = \gamma + \eta \log(y_c) + \beta X_{c,t,f,j} + \varepsilon_{c,t,f,j}, \tag{1}$$

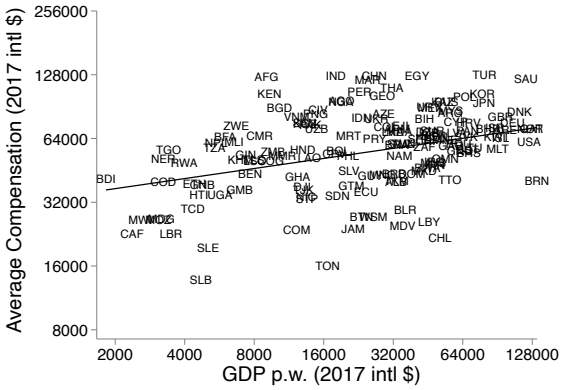
where $w_{c,t,f,j}$ is the total real gross compensation for workers in country c and year t working for firm f in standardized job j, y_c is the real GDP per worker in country c, and X is a vector of controls. The main parameter of interest is η, the elasticity of compensation with respect to GDP per worker.

This compensation elasticity captures how much the the cost of management for modern firms varies with development. Two simple benchmarks can help build intuition. The first is a standard neoclassical growth model with homogeneous labor. A representative firm in each country takes input costs as given and produces output using a Cobb-Douglas production function with country-specific total factor productivity. In this model, compensation per employee is the labor share times GDP per worker, which implies that the compensation elasticity is one. The second benchmark is a simple application of the law of one price with heterogeneous labor. If a given type of worker earns the same compensation in all countries, then the compensation elasticity is zero.

Table 1 shows the results from estimating equation (1). Recall that each observation in our database includes the number of workers and average compensation per country-year-firm-job; we weight the regression by the number of workers and report robust standard errors. Column (1) shows the simplest specification, which includes no controls at all. In this case, the estimated elasticity is 0.16. Figure 3 plots average real compensation by country against GDP per worker. The estimated trend line shows that real compensation is more than $32,000 per year even in the poorest countries.

The remaining columns include controls to adjust for time effects as well as

FIGURE 3: MIDDLE MANAGER COMPENSATION AND DEVELOPMENT



possible cross-country differences in the mix of jobs in the Company database. In column (2) and (3) we add job and year fixed effects and then job-year interactions. Including these controls cuts the estimated compensation elasticity to 0.11. In columns (4) and (5) we add the identity of the firm as a control, either as a fixed effect (column (4)) or interacted with year and job (column (5)). Doing so reduces the estimated compensation elasticity further, to 0.08–0.09. Column (5) is particularly useful for alleviating any remaining concern about the comparability of jobs across countries, as it compares compensation for the same job in the same parent firm across affiliates in different countries.

TABLE 1: ESTIMATED COMPENSATION ELASTICITY W.R.T. GDP PER WORKER

	(1)	(2)	(3)	(4)	(5)
Log GDP p.w.	0.158***	0.114***	0.113***	0.088***	0.085***
	(0.038)	(0.007)	(0.007)	(0.005)	(0.004)
Fixed Effects	None	Year + Job	Year × Job	Year + Job + Firm	Year × Job × Firm
R-squared	0.021	0.718	0.727	0.842	0.853
N	160,681	160,656	160,455	160,653	85,062

Standard errors in parentheses

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

We investigate the heterogeneity of this result along two dimensions. First, we consider whether it differs much between foreign affiliates of multinational firms and domestic establishments, inferred from whether an establishment is in

the same country as the firm's headquarters. The results are shown in Table 2. We cannot include firm fixed effects when investigating domestic establishments, so we control for job-year interactions as in column 3 of Table 1. The first column repeats those results for comparison.

TABLE 2: ESTIMATED COMPENSATION ELASTICITY BY ESTABLISHMENT TYPE

	All	By Firm Type	
		Foreign	Domestic
Log GDP p.w.	0.113***	0.111***	0.110***
	(0.007)	(0.006)	(0.014)
Fixed Effects	Year × Job	Year × Job	Year × Job
R-squared	0.727	0.732	0.727
N	160,455	126,039	34,161

Standard errors in parentheses

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

The remaining two columns show the results for foreign affiliates and domestic establishments. Note again that the majority of our sample is foreign affiliates (126,039/160,455 $\approx$ 79 percent). However, the estimated compensation elasticity for the two groups is almost identical. This implies that our findings are not particular to affiliates of multinational firms.

We also investigate how our results vary by skill level. We use the vertical dimension of the Company's internal job classification scheme to group workers into four broad skill levels. The bottom skill level includes workers who are not in manager or business professional roles. These are cleaners, guards, drivers, and so on. The remaining groups capture different skill levels of managers and business professionals. The low skill level includes workers with clerical jobs, such as secretaries. The medium skill level includes workers with business associate and business professional jobs, such as accountant. The high skill level includes those with upper management role, such as senior executive.

Table 3 shows the implied compensation elasticity for these different skill groups, each estimated with job-year interactions, which control for heterogeneity across countries in the mix of jobs within each broad group. The first column again shows that the elasticity in the aggregate is 0.11. Turning to the results by skill level, there is a very clear pattern: the elasticity is lower for workers with higher skill lev-

TABLE 3: ESTIMATED ELASTICITY OF COMPENSATION BY SKILL LEVEL

	All	By Skill Level			
		Non-Management	Low	Medium	High
Log GDP p.w.	0.113***	0.205***	0.145***	0.069***	0.012*
	(0.007)	(0.019)	(0.013)	(0.005)	(0.005)
Fixed Effects	Year × Job	Year × Job	Year × Job	Year × Job	Year × Job
R-squared	0.727	0.364	0.467	0.251	0.165
N	160,455	10,322	71,111	47,090	31,932
Example Job		Driver	Secretary	Accountant	Senior Executive

Standard errors in parentheses

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

els. While the elasticity is 0.21 for the non-management workers, it falls to 0.15 for the least-skilled managers, 0.07 for the medium-skilled managers, and 0.01 – essentially zero – for the high-skilled managers.[7]

The low compensation elasticity for managers and business professionals – equivalently, higher relative compensation for managers and business professionals in developing countries – is the central empirical finding of our paper. In Section 4 we take these relative costs as given and investigate their consequences for the adoption and expansion of modern business enterprises. But first, we validate these findings using alternative sources that focus on modern firms and compare them to findings for the broader economy.

3.1 Validating Middle Manager Compensation

We start by validating the high real cost of management for modern firms in developing countries. Again, the important challenge is to find data that focus on the small modern sector. For this, we turn to data from a complementary data source: recruitment consultancies. Whereas compensation consulting firms provide information on market pay that can be used to help with worker retention, recruiting firms help with vacancy fulfillment. Our specific data comes from Robert Walters,

[7] A related question is whether clients vary the relative mix of skill levels that they hire in response to this variation in relative costs. In Appendix A.2 we show that there is no evidence that they do so.

a self-described "global specialist professional recruitment consultancy."[8] Robert Walters provides recruiting services for many of the same types of positions and in many of the same countries as the Company.

Robert Walters uses its experience in vacancy fulfillment to produce an annual Salary Survey, which lists for select countries/regions and jobs the typical salary range in the current and previous year. The data in the Salary Survey differ from the Company's database in three main ways. First, it is much less detailed. In developing countries it generally aggregates countries into regions (such as East Africa) and focuses on a small set of the most commonly filled jobs. Second, the data reflect Robert Walters' experience placing new workers, including expatriates, rather than payments to all local workers. Finally, it reports salaries exclusive of bonuses and other benefits.

We focus on their data for Africa exclusive of South Africa, which contains most of the poorest countries in the Company's sample. The geographic detail in the Salary Survey increases over time; we collect data from the 2017 survey, which was the first to decompose Africa into four geographic regions: North Africa, East Africa, West Africa, and Central-South Africa (Robert Walters, 2017). The Salary Survey includes a salary range for 65 roles spread across these four regions. Broadly, the survey supports high salaries. For example, the midpoint of the salary range for a General Manager in Central Africa is $90,000; for a Head of Supply Chain in East Africa, $67,500; for an HR Manager in West Africa, $80,000.

For a more thorough comparison, we match the Robert Walters survey responses to the Company's database. We map regions to countries by using commentary from the last four years of Salary Surveys to infer the set of countries in each region where Robert Walters is active. We merge occupations using several examples showing actual mappings from common job titles to the Company's standardized job scheme in developing countries. We replace the salary range with the midpoint and adjust to 2017 international dollars using the same algorithm that we applied to the Company's database. We compare Robert Walters' salary figures to the gross salary in the Company database (rather than total gross compensation). This procedure allows us to compare gross salary for 12,000 observations in 19 countries in Africa in the Company database to equivalent reports from Robert

[8] https://www.robertwaltersgroup.com/careers/robert-walters/where-we-work.html, July 18, 2023.

Walters.

We find that on average the Company compensation is actually 23 percent *lower* than that in Robert Walters. The gap is plausibly accounted for by the fact that Robert Walters includes expatriates in its database. If we aggregate the gap in pay between sources to the country level, it is weakly negatively correlated with development. We interpret these findings as showing that two sources covering the same labor market from different angles agree on the high cost of management and business professionals for modern firms in developing countries. This cost is the key margin we quantify in Section 4.

3.2 Comparison to Nationally Representative Data Sets

Our main focus is on the cost of management for modern firms. A strength of the Company's database and also the information provided by Robert Walters is that it is specific to these firms. In this section, we compare these compensation results to those that can be estimated in standard, representative data sets. Our goal here is twofold. First, we want to show the quantitative importance of having access to data specific to modern firms. Second, we want to establish some findings on the compensation at traditional firms that will be useful when quantifying the technology adoption choice in the next section.

The key limitation of standard data sets is that they ask workers detailed questions about their occupation but few questions about the organization or structure of their employer. As a result, in general the best we can do is to classify workers based on their self-reported occupation. The drawback of this approach is that it pools together a diverse set of workers who have different qualifications and perform different tasks at different types of firms: the managers of small retail establishments have little in common with regional presidents of multinational firms. Further, the share of managers who are middle and upper managers varies systematically with development (Tamkoç, 2023). In practice, most self-identified managers in developing countries work in traditional firms.

We construct compensation from nationally representative data sets for three countries. We focus on the poorest countries (Bangladesh and Bolivia) and the richest country (United States) for which we have nationally representative data sets that also include data on earnings. In each of the three chosen countries we

compute weighted mean log earnings for managers and non-managers in the nationally representative data sets and the Company database. In all cases we divide through by non-agricultural GDP per worker, which we construct using data from World Bank (2022). We use non-agricultural GDP because most agricultural workers are self-employed and do not report earnings in our microdata. Further, it is well-known that agricultural workers have lower earnings, particularly in developing countries, so this restriction makes our earnings and productivity figures more comparable (Gollin *et al.*, 2014).

TABLE 4: LABOR EARNINGS BY OCCUPATION AND SOURCE

	Managers		Non-Managers	
	Company	Representative	Company	Representative
Country				
Bangladesh	8.94	1.65	0.85	0.44
Bolivia	4.39	0.94	0.96	0.49
United States	0.52	0.34	0.61	0.33

Company refers to findings for modern firms in the Company's database described in section 2. Representative refers to findings for all firms from representative data sources described in appendix A. All figures are earnings relative to non-agricultural GDP per worker.

Table 4 shows the relative earnings for each country. There are three main findings. First, the Company database and the nationally representative data sets agree closely on compensation in the United States. This reflects a combination of the fact that modern firms are common and the fact that modern-traditional pay gaps for managers are not too large in the United States. Second, compensation is much higher in the Company database than the nationally representative data sets for the developing countries. We return to the general difference in pay levels in Section 5.3. Third, this gap is much larger for managers than for production workers. This gap reflects exactly that most firms in developing countries are traditional and pay gaps between supervisors or owner-managers in traditional firms versus middle and upper managers in modern firms are large.[9]

[9] Esfahani (2022) also studies the gap in earnings between managers and non-managers using representative data from 76 countries. He finds that the relative earnings of managers declines with development, but by a much more modest amount than the Company database. His estimates imply that the manager earnings premium would be twice as large in our poorest countries as in our richest.

4 Quantifying the Importance of Management Costs

This section quantifies the effect of the cost of management and business professionals on the adoption of modern firms around the world. Our approach is to use a model of appropriate technology adoption as an accounting device. In these models, producers in a variety of industries choose between traditional and modern production technologies. The degree of adoption is determined by the relative productivity of the modern technology and the relative cost of hiring the necessary labor and other inputs needed to operate a modern firm. We use the model to quantify the effect of variation in the relative cost of management for adoption of modern firms. We also use the framework to put the effect into context by comparing it to other cost shifters that the literature has explored.

We start with a simplifying framework that makes strong functional form assumptions about the production function for modern and traditional production. This setup yields transparent results that build intuition. In Section 4.4 we study how these results generalize to a setting with more flexible production functions.

4.1 Cobb-Douglas Framework

Each country is home to a range of industries I. Output in each industry can be produced using two possible constant returns to scale technologies, which we label M ("modern") and T ("traditional"). Firms in each industry choose the technology that allows them to produce in the cost-minimizing way.

Their production choice depends on two factors. First, each industry has idiosyncratic productivity for engaging in modern and traditional production denoted by $z_{i,M}$ and $z_{i,T}$. The ratio of these productivities captures how well-suited the industry is for modern production. The benefits of modern production are large for industries such as cement and steel where it is possible to use "capital-intensive, energy-consuming, continuous or large-batch production technology to produce for mass markets" (Chandler, 1977, p. 347). Firms in such industries are organized into large, integrated, multi-establishment firms essentially everywhere today. By contrast, modern production is less advantageous for products that are labor-intensive and do not allow for continuous or batch production, such as plumbing services.

Second, modern and traditional production also differ in their factor structure.

We start by assuming that modern and traditional production each use a Cobb-Douglas production function that is common across industries. We further impose that the labor share is the same for modern and traditional production, motivated by the observation that the labor share of GDP is uncorrelated with development despite the fact that developed countries have much more modern production (Gollin, 2002). This leads to unit cost functions:

$$c_M = [w_p^{1-\alpha_M} w_m^{\alpha_M}]^{s_L} \times (P_M)^{1-s_L} \times e^{\tau}$$
$$c_T = [w_p^{1-\alpha_T} w_m^{\alpha_T}]^{s_L} \times (P_T)^{1-s_L}$$

where w_p is the cost of production and supervisory labor, w_m is the cost of management and business professional labor, P_M and P_T are the cost of non-labor inputs in the two industries, τ is a wedge capturing other barriers to adopting modern production, and s_L is the labor share. We assume throughout $\alpha_M > \alpha_T$, which implies that modern production is more management-intensive than traditional production.

Modern production will be chosen by producers in all industries satisfying the condition

$$\frac{z_{i,M}}{z_{i,T}} \geq e^{\tau} \left(\frac{w_m}{w_p}\right)^{(\alpha_M - \alpha_T)s_L} \left(\frac{P_M}{P_T}\right)^{1-s_L}, \tag{2}$$

that is, in industries where the productivity advantage of the modern technology exceeds its cost disadvantage. There exists a cutoff relative productivity level such that (2) holds with equality. A decline in the cost of management or in adoption barriers lowers this cutoff productivity level, leads to a switch to modern production in industries with intermediate levels of comparative advantage, and expands the size of the modern sector.

4.2 Quantification

We isolate the effect of the relative cost of management for the adoption of modern firms in equation (2). The equation shows that the strength of this effect depends on three ingredients: the difference in relative labor costs between developing and developed countries; the difference in management intensity between modern and traditional production; and the labor share.

The first ingredient is relative labor costs. We take the cost of management and

business professionals from the Company database. Specifically, we focus on compensation for managers and business professionals and residualize for job-year interactions to control for differences in workforce composition. We estimate the cost of production and supervisory labor for a wide range of countries by taking 44 percent of each country's non-agricultural GDP per worker. As we showed in Table 4, this estimate closely approximates the cost of non-managerial labor in representative data sets. The resulting estimates for the relative cost of management to production labor are plotted in Figure 1 in the introduction. Relative costs vary by a factor of more than 14 between the poorest decile of countries and the United States.

One possible alternative would be to take the cost of non-management for modern firms from the Company database as well. We choose not to do so for two reasons. First, labor costs for these incidental workers may not provide useful information on the cost of production and supervisory labor, which are not included in the database. Second, as Table 4 shows, these workers are paid more, particularly in developing countries. This fact implies that our approach is conservative; using the Company data for the cost of production labor would only widen the cross-country variation in the relative labor costs of operating a modern firm.

The second ingredient is the difference in management intensity between modern and traditional production. The Company database is not useful for estimating this difference because it does not have information on traditional firms or production and supervisory labor at modern firms. Instead, we turn to the recent literature that empirically characterizes the nature and importance of firm production hierarchies.[10] Caliendo *et al.* (2015) use matched employer-employee data from France with unique codes that describe each worker's position in the hierarchy of the firm, ranging from production and clerical workers at the bottom to supervisors, senior staff and top managers, and finally owners who draw a salary at the top. They show that firms follow a natural hierarchy: the simplest firms have only one or two layers, almost always consisting of production workers and their supervisors, while more complex firms have three or four layers.[11]

[10]See Garicano (2000) and Garicano & Rossi-Hansberg (2006) for the development of the theory of why firms form hierarchies.

[11]In addition to characterizing the firm hierarchy, Caliendo *et al.* (2015) and subsequent work show that the depth of production hierarchies matters for a number of outcomes, and that growing and shrinking firms re-organize themselves in a manner that is consistent with theory (Tåg, 2013;

We equate traditional production in our accounting theory to firms with one or two layers in their production hierarchy in the French data, and modern production to firms with three or four layers.[12] This is consistent with the view that the typical small firm in a developing country has only production workers and a manager whose main role is to supervise labor and also engage in production (Bassi *et al.*, 2023). There are no senior staff or top managers – people who oversee other managers, set the firm strategy, formalize business policies, or allocate resources. This mapping is also consistent with our view that all firms in the Company data are modern – they all have local headquarters establishments staffed by middle and upper managers, implying that their firms have at least three layers in their hierarchy.

Our key input from this literature is the compensation shares of management in traditional and modern production, α_T and α_M. We define these as the compensation share of workers on the third and fourth layers of the firm hierarchy. Since traditional firms have no workers on this level, we set $\alpha_T = 0$. For modern firms, this class of workers receives 28% of compensation, giving us $\alpha_M = 0.28$.[13]

The third ingredient for our calculation is the labor share. As a starting point, we use the $s_L = 2/3$ for both sectors, which is consistent with Gollin (2002).

Equation (2) shows that labor costs enter the technology adoption decision through the term $(w_m/w_p)^{(\alpha_M - \alpha_T)s_L}$. Combining the three ingredients, we can now back out the implied labor cost shifter associated with cross-country variation in the relative cost of management. Focusing on the comparison between the poorest decile of countries in the Company's database and the United States, we find:

$$\text{Log Cost Shifter} = \underbrace{\Delta \log \frac{w_m}{w_p}}_{\log(14.5)=2.67} \times \underbrace{(\alpha_M - \alpha_T)}_{0.28-0} \times \underbrace{s_L}_{2/3} = 0.50. \tag{3}$$

The relative unit cost of operating a modern firm is increased by 50 log points – about 65 percent – by the high relative cost of management in developing coun-

Caliendo *et al.*, 2020; Bonilla & Polanec, 2021; Friedrich, 2022; Pieri & Vatiero, 2022).

[12] This division implies that just over half of French firms are modern, but their larger size means that they account for 95 percent of value added.

[13] The compensation share is computed using the data underlying Figure 5 in Caliendo *et al.* (2015), which the authors kindly shared with us. Tåg (2013) reports similar figures for Sweden.

tries. A simple interpretation of this figure is that the high relative cost of managers and business professionals in developing countries has the same effect on technology adoption decisions as a 65 percent sales tax that only applies to firms using modern production.

Our view is that for a wide range of industries where modern production confers a productivity advantage that is not too large, this cost shifter can help rationalize why production is organized through modern, multi-establishment firms in the United States but through traditional, small enterprises in developing countries. At the same time, we acknowledge that this cost shifter is not prohibitive. For some industries where the productivity advantage of modern production is large enough, firms find it advantageous to pay these high costs. Indeed, the existence of some such industries and firms is at the heart of the company's business model, and of our empirical methodology.

4.3 Comparison to Other Cost Shifters

An alternative way to think about the quantitative importance of labor costs is to put them into the context of other cost shifters. We focus on two that have been proposed in the literature and that can be quantified in a similar fashion as relative labor costs: financial frictions that raise the effective cost of capital and tariffs that raise the cost of imported intermediate inputs. Other factors that may be important deterrents to setting up modern firms in developing countries are harder to quantify through this framework. For example, corruption is plausibly important, but it is harder to quantify the relative cost of corruption in developing versus developed countries or the relative intensity of modern versus traditional production in non-corrupt institutions.

To quantify the effect of other inputs, we return to our accounting framework and allow the price of non-labor inputs to the modern and traditional sector P_M and P_T to be composed of bundles of factors $f \in F$. We continue to maintain the assumption that the modern and traditional production functions are Cobb-Douglas with different output elasticities for the factors given by $\alpha_{M,f}$ and $\alpha_{T,f}$.

This implies that the price of non-labor inputs can be written as

$$P_T^{1-s_L} = \prod_f p_f^{\alpha_{T,f}}$$
$$P_M^{1-s_L} = \prod_f p_f^{\alpha_{M,f}}.$$

Given this setup, the effect of input costs for an arbitrary input f is a natural extension of the effect of labor costs that we derived above:

$$\text{Log Input } f \text{ Cost Shifter} = \Delta \log p_f \times (\alpha_{M,f} - \alpha_{T,f}). \tag{4}$$

This equation extends our earlier intuition to any factor that is more expensive in developing countries and used more intensively in modern production. It is also useful for quantifying the relative importance of different cost shifters. For example, financial frictions operate at least in part through raising the effective cost of capital. Consider the extreme scenario where modern production uses capital with a factor share of $1/3$ (consistent with national accounts data from developed countries) and traditional production does not use capital at all. It would need to be the case that financial frictions raise capital costs by a factor of 4.5 – say, from 10 to 45 percent – for financial frictions to have the same quantitative impact on technology adoption decisions as the relative cost of management.[14]

Similarly, tariffs raise the cost of imported intermediate inputs and it is natural to think that modern production uses intermediate inputs more intensively. If we again consider the extreme scenario where modern production has an intermediate input share of 50 percent and traditional production has an intermediate input share of 0 percent, and we assume that all intermediate inputs are imported, it would need to be the case that tariffs raise input costs by a factor of 2.7, which is equivalent to a 170 percent tariff. We conclude that management and business professional labor costs are an important determinant relative to other factors considered in the literature.

[14]The labor cost shifter is $0.5 \approx \log(4.5) \times (0.33 - 0)$.

4.4 General Framework

Our results suggest that a high relative cost of management can be a powerful deterrent to technology adoption. However, the results were based on the restrictive assumptions: Cobb-Douglas production functions and common labor shares. In this section we develop a more general framework that relaxes these assumptions.

As in Section 4.1, each country is home to a range of industries I that produce using a constant returns to scale technology. Producers in each industry choose between a traditional and a modern technology to minimize unit costs:

$$c_i(\Theta) = \min\left\{\frac{c_T(\Theta)}{z_{i,T}}, \frac{c_M(\Theta)}{z_{i,M}}\right\} \qquad i \in I.$$

We allow c_T and c_M to be flexible functions of a generic F-dimensional vector of costs $\Theta \in \mathbb{R}^F$; we think of F loosely as being the number of factors, although we can interpret factors broadly. As before, the modern technology is used for the set of industries satisfying

$$\frac{z_{i,M}}{z_{i,T}} > \frac{c_M(\Theta)}{c_T(\Theta)},$$

which is the more general version of equation (2).

Our goal is to provide a general characterization of the importance of the cost of factor f to cross-country differences in adoption of the modern technology. To do so, we order countries according to $y \in [\underline{y}, \bar{y}]$, where y could be PPP GDP per worker or a broader index of economic development. We assume that each element of the cost vector is a smooth, differentiable function of y, $\Theta(y)$. Then we totally differentiate relative unit costs with respect to development to obtain:

$$\begin{aligned}\frac{d\log\frac{c_M}{c_T}}{dy} &= \sum_{f=1}^{F} \frac{\partial \log\frac{c_M}{c_T}}{\partial \log(\Theta_f)} \frac{d\log(\Theta_f)}{dy} \\ &= \sum_{f=1}^{F} \left[s_{M,f}(\Theta) - s_{T,f}(\Theta)\right] \frac{d\log(\Theta_f)}{dy}. \end{aligned} \tag{5}$$

The first line shows that the local change in relative unit costs with respect to development is simply the summed contribution of all the factors in Θ, where the contribution of each factor is expressed as the change in relative costs with respect to a local change in the factor price times the rate at which the factor price changes

with development. The second line applies Shephard's Lemma to show that the change in relative costs with respect to a local change in the factor price is equal to the local difference in factor shares between the modern and traditional technologies for factor f.

To obtain global changes, we integrate this expression to obtain

$$\log \frac{c_M}{c_T}(\bar{y}) - \log \frac{c_M}{c_T}(\underline{y}) = \sum_{f=1}^{F} \int_{\underline{y}}^{\bar{y}} \left(s_{M,f}(\Theta) - s_{T,f}(\Theta)\right) \frac{d \log(\Theta_f)}{dy} dy. \qquad (6)$$

The effect of each factor is now the integral over the relevant span of development. For each income level, the integrand is the difference at that income level between the factor share of f in modern and traditional production respectively, times the rate of factor price change with development.

It is straightforward to show that this expression nests our previous results. In the special case of Cobb-Douglas production functions, $s_{M,f}(\Theta) = s_{M,f}$ is a constant that is independent of factor prices. Then equation (6) simplifies to the product of the difference in constant factor shares times the gap in log factor prices, which is the essence of equation (3). More generally, this expression shows that in considering alternatives to Cobb-Douglas production functions, it is both useful and sufficient to study how factor shares vary with factor prices and development. We use these results in our sensitivity analysis.

4.5 Sensitivity Analysis

We focus our sensitivity analysis on relaxing two key assumptions. The first is that modern production is a Cobb-Douglas aggregator of management and production labor. As shown above, we can focus on how the factor shares of the two types of labor vary with development. It is not possible to examine this using evidence from the firm hierarchy literature because this literature focuses on European countries and so does not provide comparable figures from countries with very different income levels and relative factor prices.

However, the Bureau of Economic Analysis does collect data on the business activities of majority-owned foreign affiliates of U.S. multinational enterprises. Until the year 2007, they collected and tabulated data on total labor compensation as well as total compensation of managerial, professional, and technical labor by

country of affiliate. We use the data from 2004, the last benchmark year to break compensation figures out in this way (Bureau of Economic Analysis, 2004, Table III.H 1).

On average, 49 percent of compensation is to managerial, professional, and technical workers. This figure includes a slightly broader set of workers and is somewhat higher than the corresponding figure for French firms in Caliendo *et al.* (2015). However, more importantly, this share varies little with development, despite the large differences in relative prices of management and production labor that we have documented so far. For example, managers receive 51 percent of compensation across Europe and 47 percent across Africa. For the 53 countries that have both compensation statistics and real GDP data, the correlation between log GDP per worker and the management share of compensation is positive but low, at 0.16. The predicted values from a regression of management compensation shares on log GDP per worker implies the richest countries have a share just 6 percentage points higher than in the poorest countries. Thus, the constant factor assumption embedded in Cobb-Douglas production functions seems a useful approximation to the data.

The second assumption we relax is that modern and traditional firms are equally labor-intensive. As we noted in Section 4.1, we view this as a natural starting point given the fact that the aggregate labor share of GDP is uncorrelated with development. However, as Gollin (2002) notes, this share is challenging to estimate in developing countries given the large share of self-employed workers. Our goal is to explore the plausible alternative that traditional production is more labor-intensive than modern production.

We find that this actually strengthens our main results. We formally derive the full cost shifter in Appendix B, but the main intuition is straightforward. If modern and traditional production have different labor shares, then there is an additional term in the labor cost shifter equation that captures the difference in labor shares between modern and traditional production multiplied by the relative cost of labor against non-labor factors in developed versus developing countries. Labor is relatively expensive in developed countries. Thus, if traditional production is more labor-intensive, then this further helps explain why developed countries are more likely than developing countries to adopt modern production.

5 Understanding Management Compensation

So far we have established that modern firms face a high relative cost for management and business professionals in developing countries. We calculate that this is an important deterrent to the adoption and expansion of modern business enterprises in developing countries. We now discuss several candidate explanations for why the cost of management and business professionals for modern firms in developing countries is high.

5.1 Quality Differences

Modern firms may face higher costs for management than traditional firms because they hire higher-quality managers. This explanation would make sense given the overall scarcity of highly skilled workers in developing countries. For example, a much lower share of the workforce has completed tertiary education in developing countries, which is often a necessary entry requirement for management and business professional roles at modern firms (Barro & Lee, 2013). Adding to this, the overall quality of education is much lower in developing countries, which leads to less human capital among college graduates in developing countries (Hanushek & Woessmann, 2012; Schoellman, 2012; Cubas *et al.*, 2016; Martellini *et al.*, 2024). Thus, the premium may reflect in part that modern firms are bidding up the price of a scarce resource. This interpretation is consistent with the growing evidence that management training interventions improve the quality of management and firm profitability (Bloom *et al.*, 2013; Giorcelli, 2019; Bianchi & Giorcelli, 2022).

5.2 Global Labor Market

A second reason to suspect that high-quality managers are scarce in developing countries is that migration plays an important role in these labor markets. Brain drain of skilled workers from developing countries is a well-documented phenomenon (Docquier & Rapoport, 2012). Educated, high-ability workers are particularly likely to emigrate from developing countries (Kerr *et al.*, 2016; Martellini *et al.*, 2024). While these flows are not always large relative to total population, they can exacerbate the shortage of skilled managers coming from the lack of high-

quality education. Related to migration, we also observe that expatriate workers continue to fill a significant share of management roles in developing and emerging markets (Hsieh *et al.*, 1999; Cho, 2018). It is hard to rationalize their continued utilization (given the cost) without appealing to a shortage of the relevant skills in these economies.

Migration offers a particularly appealing explanation for why the real cost of high-skilled managers does not vary at all across countries (Table 3); if such workers find it sufficiently easy to migrate, then we would expect a law of one price to hold, at least approximately. On the other hand, it would require a striking coincidence to generate the same result through offsetting supply and demand shifts for countries across a wide range of development.

5.3 Segmented Labor Markets

While the scarcity of high-quality management likely explains part of our wage findings, it is unlikely to explain all of them. Perhaps the clearest indicator that further exploration is needed is the high wages modern firms pay to their non-managers – the cleaners, guards, and drivers that work at the local headquarters. There are existing theories that explain why complementarities might lead modern firms to hire the best cleaners, guards, or drivers (Porzio, 2017). Nonetheless, it is hard to imagine that modern firms hire such workers whose marginal product is 2–3 times that of the typical non-manager in the economy. This finding leads us to consider theories where modern firms pay otherwise identical workers higher wages. We label these theories of segmented labor markets because segmentation is needed to rationalize why workers do not move in response to wage differentials.

There are a number of potential theories for why labor markets might be segmented. First, a growing literature shows the importance of labor market frictions in developing countries. For example, workers appear to churn among jobs more frequently and are less likely to reallocate across sectors or regions in the face of large gaps in wages or productivity (Donovan *et al.*, 2023; Lagakos, 2020). These same frictions may hinder workers from moving to high-wage, modern firms. Abebe *et al.* (2021) show that it is harder to attract productive workers because those workers have a higher opportunity cost of applying for jobs, which is con-

sistent with the presence of recruitment consultancies in developing countries.

Second, modern firms may find it optimal to pay (higher) efficiency wages in developing countries. Contracting is generally more difficult in such economies given the poorly functioning legal systems and courts (Acemoglu *et al.*, 2005; Boehm & Oberfield, 2020). Further, modern business enterprises rely on advantages conveyed by superior technologies or stocks of intangible capital. Workers and particularly managers and business professionals at the local headquarters may have access to sensitive business information. Providing insufficient incentives could thus be very costly.

Existing work shows that firms do respond by limiting how much decision making they decentralize in poor countries or relying more on family members in management roles (Bloom *et al.*, 2012; Akcigit *et al.*, 2021; Bloom & Van Reenen, 2007; Bloom *et al.*, 2013). Efficiency wages would provide a natural mechanism in cases where sensitive information and decision-making cannot be centralized. Finally, specialized workers who cannot emigrate face a thin labor market. Given this, employers might find it optimal to increase pay to replace the motivation usually supplied by outside career options.

Third, in related work, Hjort *et al.* (2020) use the same database we use in this paper to show that wages in a firm's headquarters have a direct, causal effect on wages for the same jobs in the firm's foreign affiliates.[15] They show evidence that this is because many employers use firm-wide wage-setting procedures, which helps rationalize in particular the high wages for workers in low-skill occupations in foreign establishments (see also Goldschmidt & Schmeider, 2017; Derenoncourt *et al.*, 2021). Alfaro-Urena *et al.* (2021) also show that multinational firms pay a premium in Costa Rica; the premium is larger there for less skilled workers. We also find a particularly low elasticity of compensation within firms (Table 1 , Column 5). However, we note that our results do not appear to be driven particularly by multinational firms (Table 2).

[15]The sample analyzed in Hjort *et al.* (2020) includes public sector employers, but only multinational employers.

6 Conclusion

This paper consists of two main exercises. First, we use the proprietary database of a compensation consulting company to document that the relative cost of management and business professionals is 18 times higher in the poorest countries than in the United States. Second, we use an accounting approach derived from appropriate technology models to show that this deters the adoption and spread of modern production in developing countries because modern production is more management-intensive.

Our hope is to revive the appropriate technology hypothesis. The main idea in that literature is that traditional production in developing countries might be an optimal response to the very different factor endowments available there. Empirically, the obstacle has been to identify what factors are sufficiently expensive in developing countries and important for modern production so as to generate a sizable quantitative impact on adoption decisions. Our work shows that managers and business professionals are one important input that does satisfy both of these criteria, whereas more general factors such as skilled or educated labor do not. Our results raise the question of whether other detailed measures of wages paid by occupation or type of firm might reveal similar informative trends.

Looking ahead, we hope that our work can inspire more research into the nature of skilled labor markets in developing countries. Many open questions remain. Why are educational wage premia disconnected from management prices? To what extent do high management prices reflect scarcity of skills or labor market frictions? If the high prices reflect scarcity, what prevents people from reaping very high returns by acquiring the right skills? If the high prices reflect labor market frictions, what is the nature of these frictions? These questions require a coherent model, and while we have many building blocks – educational quality, brain drain, segmented labor markets, efficiency wages – their synthesis into a full model remains work for the future.

References

ABEBE, GIRUM, CARIA, A. STEFANO, & ORTIZ-OSPINA, ESTEBAN. 2021. The Selection of Talent: Experimental and Structural Evidence from Ethiopia. *American Economic Review*, **111**(6), 1757–1806.

ACEMOGLU, DARON, & ZILIBOTTI, FABRIZIO. 2001. Productivity Differences. *Quarterly Journal of Economics*, **116**(2), 563–606.

ACEMOGLU, DARON, JOHNSON, SIMON, & ROBINSON, JAMES A. 2005. Institutions as a Fundamental Cause of Long-Run Growth. *Chap. 6, pages 385–472 of:* AGHION, PHILIPPE, & DURLAUF, STEVEN N. (eds), *Handbook of Economic Growth*, vol. 1A. Elsevier.

ACEMOGLU, DARON, ANTRÀS, POL, & HELPMAN, ELHANAN. 2007. Contracts and Technology Adoption. *American Economic Review*, **97**(3), 916–943.

AKCIGIT, UFUK, ALP, HARUN, & PETERS, MICHAEL. 2021. Lack of Selection and Limits to Delegation: Firm Dynamics in Developing Countries. *American Economic Review*, **111**(1), 231–275.

ALFARO-URENA, ALONSO, MANELICI, ISABELA, & VASQUEZ, JOSE P. 2021. *The Effects of Multinationals on Workers: Evidence from Costa Rican Microdata*. Mimeo Universidad de Costa Rica.

BANERJEE, ABHIJIT V., & DUFLO, ESTHER. 2005. Growth Theory through the Lens of Development Economics. *Chap. 7, pages 473–554 of:* AGHION, PHILIPPE, & DURLAUF, STEVEN N. (eds), *Handbook of Economic Growth*, vol. 1A. Amsterdam: Elsevier.

BARRO, ROBERT J., & LEE, JONG WHA. 2013. A New Data Set of Educational Attainment in the World, 1950–2010. *Journal of Development Economics*, **104**, 184–198.

BASSI, VITTORIO, LEE, JUNG HYUK, PETER, ALESSANDRA, PORZIO, TOMMASO, SEN, RITWIKA, & TUGUME, ESAU. 2023. *Self-Employment Within the Firm*. NBER Working Paper 31740.

BASU, SUSANTO, & WEIL, DAVID N. 1998. Appropriate Technology and Growth. *Quarterly Journal of Economics*, **113**(4), 1025–1054.

BENTO, PEDRO, & RESTUCCIA, DIEGO. 2017. Misallocation, Establishment Size, and Productivity. *American Economic Journal: Macroeconomics*, **9**(3), 267–303.

BENTO, PEDRO, & RESTUCCIA, DIEGO. 2021. On Average Establishment Size across Sectors and Countries. *Journal of Monetary Economics*, **117**, 220–242.

BIANCHI, NICOLA, & GIORCELLI, MICHELA. 2022. The Dynamics and Spillovers of Management Interventions: Evidence from the TWI Program. *Journal of Political Economy*, **130**(6), 1630–1675.

BLOOM, NICHOLAS, & VAN REENEN, JOHN. 2007. Measuring and Explaining Management Practices Across Firms and Countries. *Quarterly Journal of Economics*, **122**(4), 1351–1408.

BLOOM, NICHOLAS, MAHAJAN, APRAJIT, MCKENZIE, DAVID, & ROBERTS, JOHN. 2010. Why Do Firms in Developing Countries Have Low Productivity? *American Economic Review*, **100**(2), 619–623.

BLOOM, NICHOLAS, SADUN, RAFFAELLA, & VAN REENEN, JOHN. 2012. The Organization of Firms Across Countries. *Quarterly Journal of Economics*, **127**(4), 1663–1705.

BLOOM, NICHOLAS, EIFERT, BENN, MAHAJAN, APRAJIT, MCKENZIE, DAVID, & ROBERTS, JOHN. 2013. Does Management Matter? Evidence from India. *Quarterly Journal of Economics*, **128**(1), 1–51.

BLOOM, NICHOLAS, LEMOS, RENATA, SADUN, RAFFAELLA, SCUR, DANIELA, & VAN REENEN, JOHN. 2014. The New Empirical Economics of Management. *Journal of the European Economic Association*, **12**(4), 835–876.

BOEHM, JOHANNES, & OBERFIELD, EZRA. 2020. Misallocation in the Market for Inputs: Enforcement and the Organization of Production. *The Quarterly Journal of Economics*, **135**(4), 2007–2058.

BONILLA, SANTIAGO, & POLANEC, SAŠO. 2021. Organization Hierarchies in the Slovenian Manufacturing Sector. *Eastern European Economics*, **59**(6), 571–596.

BUERA, FRANCISCO J, KABOSKI, JOSEPH, & SHIN, YONGSEOK. 2011. Finance and Development: A Tale of Two Sectors. *American Economic Review*, **101**(5), 1964–2002.

BUERA, FRANCISCO J, KABOSKI, JOSEPH P, & SHIN, YONGSEOK. 2015. Entrepreneurship and Financial Frictions: A Macrodevelopment Perspective. *Annual Review of Economics*, **7**(1), 409–436.

BUREAU OF ECONOMIC ANALYSIS. 2004. *U.S. Direct Investment Abroad (USDIA) Final Benchmark Data*. Tech. rept. Accesssed July 25, 2023.

CALIENDO, LORENZO, MONTE, FERDINANDO, & ROSSI-HANSBERG, ESTEBAN. 2015. The Anatomy of French Production Hierarchies. *Journal of Political Economy*, **123**(4), 809–852.

CALIENDO, LORENZO, MION, GIORDANO, OPROMOLLOA, LUCA D., & ROSSI-HANSBERG, ESTEBAN. 2020. Productivity and Organization in Portuguese Firms. *Journal of Political Economy*, **128**(11), 4211–4257.

CASELLI, FRANCESCO, & COLEMAN, II, WILBUR JOHN. 2006. The World Technology Frontier. *American Economic Review*, **96**(3), 499–522.

CASELLI, FRANCESCO, PONTICELLI, JACOPO, & ROSSI, FEDERICO. 2014. A New Dataset on Mincerian Returns. *In: Technology Differences Over Time and Space*. Princeton University Press.

CHANDLER, JR., ALFRED D. 1977. *The Visible Hand: The Managerial Revolution in American Business*. Harvard University Press.

CHO, JAEHAN. 2018. Knowledge Transfer to Foreign Affiliates of Multinationals through Expatriation. *Journal of International Economics*, **113**, 106–117.

CUBAS, GERMAN, RAVIKUMAR, B., & VENTURA, GUSTAVO. 2016. Talent, Labor Quality, and Economic Development. *Review of Economic Dynamics*, **21**, 160–181.

DERENONCOURT, ELLORA, NOELKE, CLEMENS, & WEIL, DAVID. 2021. *Spillover Effects from Voluntary Employer Minimum Wages*. mimeo, University of California, Berkeley.

DOCQUIER, FRÉDÉRIC, & RAPOPORT, HILLEL. 2012. Globalization, Brain Drain, and Development. *Journal of Economic Literature*, **50**(3), 681–730.

DONOVAN, KEVIN, LU, JIANYU, & SCHOELLMAN, TODD. 2023. Labor Market Dynamics and Development. *Quarterly Journal of Economics*, **138**(4), 2287–2325.

ESFAHANI, MEHRDAD. 2022. *Investment in Skills, Managerial Quality, and Economic Development*. mimeo, Arizona State University.

FENG, ANDY, & VALERO, ANNA. 2020. Skill-Biased Management: Evidence from Manufacturing Firms. *Economic Journal*, **130**(628), 1057–1080.

FRIED, STEPHIE, & LAGAKOS, DAVID. 2023. Electricity and Firm Productivity: A General-Equilibrium Approach. *American Economic Journal: Macroeconomics*, **15**(4), 67–103.

FRIEDRICH, BENJAMIN U. 2022. Trade Shocks, Firm Hierarchies, and Wage Inequality. *Review of Economics and Statistics*, **104**(4), 652–667.

GARICANO, LUIS. 2000. Hierarchies and the Organization of Knowledge in Production. *Journal of Political Economy*, **108**(5), 874–904.

GARICANO, LUIS, & ROSSI-HANSBERG, ESTEBAN. 2006. Organization and Inequality in a Knowledge Economy. *Quarterly Journal of Economics*, **121**(4), 1383–1435.

GIORCELLI, MICHELA. 2019. The Long-Term Effects of Management and Technology Transfers. *American Economic Review*, **109**(1), 121–152.

GOLDSCHMIDT, DEBORAH, & SCHMEIDER, JOHANNES F. 2017. The Rise of Domestic Outsourcing and the Evolution of the German Wage Structure. *Quarterly Journal of Economics*, **132**(3), 1165–1217.

GOLLIN, DOUGLAS. 2002. Getting Income Shares Right. *Journal of Political Economy*, **110**(2), 458–474.

GOLLIN, DOUGLAS. 2008. Nobody's business but my own: Self-employment and small enterprise in economic development. *Journal of Monetary Economics*, **55**(2), 219–233.

GOLLIN, DOUGLAS, LAGAKOS, DAVID, & WAUGH, MICHAEL E. 2014. The Agricultural Productivity Gap. *Quarterly Journal of Economics*, **129**(2), 939–993.

GUMPERT, ANNA, STEIMER, HENRIKE, & ANTONI, MANFRED. 2022. Firm Organization with Multiple Establishments. *Quarterly Journal of Economics*, **137**(2), 1091–1138.

GUNER, NEZIH, PARKHOMENKO, ANDRII, & VENTURA, GUSTAVO. 2018. Managers and Productivity Differences. *Review of Economic Dynamics*, **29**, 256–282.

HANUSHEK, ERIC A., & WOESSMANN, LUDGER. 2012. Do Better Schools Lead to More Growth? Cognitive Skills, Economic Outcomes, and Causation. *Journal of Economic Growth*, **17**(4), 267–321.

HJORT, JONAS, LI, XUAN, & SARSONS, HEATHER. 2020. *Across-Country Wage Compression in Multinationals*. NBER Working Paper No. 26788.

HSIEH, TSUN-YAN, LAVOIE, JOHANNE, & SAMEK, ROBERT A. P. 1999. Think global, hire local. *McKinsey Quarterly*, 92–101.

KERR, SARI PEKKALA, KERR, WILLIAM, ÖZDEN, ÇAĞLAR, & PARSONS, CHRISTOPHER. 2016. Global Talent Flows. *Journal of Economic Perspectives*, **30**(4), 83–106.

KUZNETS, SIMON. 1973. Modern Economic Growth: Findings and Reflections. *American Economic Review*, **63**(3), 247–258.

LAGAKOS, DAVID. 2016. Explaining Cross-Country Productivity Differences in Retail Trade. *Journal of Political Economy*, **124**(2), 579–620.

LAGAKOS, DAVID. 2020. Urban-Rural Gaps in the Developing World: Does Internal Migation Offer Opportunities? *Journal of Economic Perspectives*, **34**(3), 174–192.

MALMBERG, HANNES. 2023. *Skill Bias and Development: Evidence from Trade and Industry Data*. Mimeo.

MARTELLINI, PAOLO, SCHOELLMAN, TODD, & SOCKIN, JASON. 2024. The Global Distribution of College Graduate Quality. *Journal of Political Economy*, **132**.

MOSCONA, JACOB, & SASTRY, KARTHIK A. 2022. *Inappropriate Technology: Evidence from Global Agriculture*. mimeo, Harvard University.

PIERI, FABIO, & VATIERO, MASSIMILIANO. 2022. *Firm Hierarchy and the Market for Knowledge*. Centro Studi Luca D'Agliano Development Studies Working Paper Number 482.

PORZIO, TOMMASO. 2017. *Cross-Country Differences in the Optimal Allocation of Talent and Technology*. mimeo, Columbia University.

POSCHKE, MARKUS. 2018. The Firm Size Distribution across Countries and Skill-Biased Change in Entrepreneurial Technology. *American Economic Journal: Macroeconomics*, **10**(3), 1–41.

ROBERT WALTERS. 2017. *Salary Survey*.

ROSSI, FEDERICO. 2022. The Relative Efficiency of Skilled Labor across Countries: Measurement and Interpretation. *American Economic Review*, **112**(1), 235–266.

RUGGLES, STEVEN, FLOOD, SARAH, FOSTER, SOPHIA, GOEKEN, RONALD, PACAS, JOSE, SCHOUWEILER, MEGAN, & SOBEK, MATTHEW. 2021. *IPUMS USA: Version 11.0 [dataset]*. Minneapolis, MN: IPUMS. Available online at https://doi.org/10.18128/D010.V11.0.

SCHOELLMAN, TODD. 2012. Education Quality and Development Accounting. *Review of Economic Studies*, **79**(1), 388–417.

STEWART, FRANCES. 1977. *Technology and Underdevelopment*. London, UK: The Macmillan Press, Ltd.

TAMKOÇ, M. NAZIM. 2023. *Managers, Talent Misallocation and Productivity*. mimeo, World Bank.

TÅG, JOACIM. 2013. Production Hierarchies in Sweden. *Economics Letters*, **121**(2), 210–213.

VERHOOGEN, ERIC. 2023. Firm-Level Upgrading in Developing Countries. *Journal of Economic Literature*, **61**(4), 1410–1464.

WORLD BANK. 2022. *World Development Indicators*. Washington DC: World Bank.

Online Only Appendices

A Data Details

This appendix provides further details on data sources and empirical results.

A.1 Representative Data Sources

The Company's database covers a very particular population of jobs and firms – managers and business professionals at modern business enterprises. It is not well-suited for studying typical firms or their workers in developing countries because those firms do not engage the Company's services and so do not appear in the Company's database. We assemble nationally representative datasets to study employment patterns and compensation among such firms for context.

In Figure 2 we compare the distribution of employment in the Company's database to two relevant benchmarks. Representative data come from the ILOSTAT database produced by the International Labour Organization. They tabulate a number of results from household surveys, labor force surveys, and censuses for countries around the world. The most useful tabulation for our purposes is the number of workers employed by ISCO-08 2-digit occupation category.[16] We aggregate to the 1-digit level.

The data for the U.S. business service sector draws on the 2000 U.S. Census. We obtain census microdata from Ruggles *et al.* (2021). We focus on employed 16–70 year olds with non-zero weights and valid responses to key questions. We limit attention to workers in the business service sector, which is defined as the industries: accounting, tax preparation, bookkeeping and payroll services; computer systems design and related services; management, scientific and technical consulting services; scientific research and development services; advertising and related services; management of companies and enterprises; employment services; and business support services. We use a hand-created crosswalk to assign the original SOC occupation codes to ISCO-08 1-digit equivalents. We compute the employment share of workers by 1-digit ISCO occupation using the appropriate weights

[16] Available as "Employment by sex and occupation - ISCO level 2 (thousands) | Annual", ILO code "EMP_TEMP_SEX_OC2_NB_A", downloaded from https://www.ilo.org/ilostat-files/Documents/Excel/INDICATOR/EMP_TEMP_SEX_OC2_NB_A_EN.xlsx on March 1, 2022.

(perwt).

In Section 3.2, we compare earnings of middle managers and production workers in the Company database to earnings of the same workers in representative data. Published ILO tabulations do not provide average earnings by country and occupation. Instead, we draw on microdata that contain information on earnings and occupation for three countries: Bangladesh, Bolivia, and the United States. We select the first two because they are developing countries with nationally representative surveys that report information on occupation using the ISCO-08 scheme. We use the United States as a natural benchmark.

Our data source for Bangladesh is the 2013 Labour Force and Child Labour Survey, which is a representative sample of 36,242 households in 2013, which we obtained through personal correspondence. Our data source for Bolivia is the 2015–2018 rounds of the quarterly Encuesta Continua de Empleo, a nationally representative rotating panel labor force survey.[17] Our data source for the United States is again the 2000 U.S. Census (Ruggles *et al.*, 2021).

In all three countries we focus on employed wage workers who are 16–70 years old. We categorize middle managers using occupational codes. Bangladesh and Bolivia collect data on monthly earnings. We annualize by multiplying this figure by 12. The United States collects data on annual earnings. We convert all figures to 2017 PPP-adjusted international dollars using the same procedure as for the Company data. We compute the weighted mean of log earnings by country and middle manager status, then exponentiate the figure and take the ratio. These figures are reported in Table 4.

A.2 Substitution Among Labor Types in Company Data

This appendix studies how the mix of workers hired by clients in the Company database varies with respect to relative prices. We regress three different measures of workforce composition on the appropriate measures of relative prices to see whether clients engage in any substitution in response to the large measured relative price variation.

For our first approach we use the fact that the Company gives each job a skill level and ask whether the job levels respond to the relative price of management.

[17] Available online for users who register at http://anda.ine.gob.bo/index.php/catalog/82.

TABLE A.1: RESPONSE OF HIRING PATTERNS TO RELATIVE WAGES

	Aggregate			Within Firm		
	Level	Managers	Top Managers	Level	Managers	Top Managers
Wage/GDP p.w.	0.0308			-0.00557		
	(0.0624)			(0.0125)		
Manager Wage		-0.167			0.00206	
		(0.106)			(0.0125)	
Top Wage			-0.0929			-0.0141
			(0.0527)			(0.0329)
R-squared	0.001	0.020	0.001	0.262	0.325	0.143
N	160,681	160,329	150,354	160,675	160,323	150,348

Level is standard normalized job level from Company's internal scheme. Manager is a dummy for workers with manager rather than non-manager positions, while top managers is a dummy for workers with a medium or high-skilled manager position as compared to a low-skill one (as in Table 3). Wages are the logarithm of relative wage for the corresponding groups in the Company database. Standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We standard normalize the measure of job level to give it interpretable units. We measure the relative cost of management as the log average compensation in the Company database net of the estimated effect of job and year fixed effects minus the log of GDP per worker. Table A.1 column (1) shows the estimates: higher relative costs of management are associated with slightly higher average levels of workers, meaning more skilled and highly compensated workers. Column (4) shows the results from the same specification with firm-year interactions. This specification leverages variation in hiring patterns across affiliates within a given firm. The estimated effect is now slightly negative. Both specifications yield results that are economically and statistically insignificant.

For our second and third approaches we estimate how relative hiring patterns respond to relative wages. In the second approach we use a linear probability model to estimate the effect of the relative cost of management on the probability a worker is a manager. The relative cost of management is the average log compensation of managers in the Company database minus the average compensation of non-managers in the Company database, where each measure of compensation is net of the estimated effect of job and year fixed effects. As columns (2) and (5) show, there is no consistent effect or statistically significant effect of manager compensation on the share of managers

Finally, for the third approach we use a linear probability model to estimate the

effect of the relative cost of managers with an above median versus below median level on the probability that a manager has above median skills. In this case we take the global distribution of skills and define a fixed, global cutoff for which managers are above versus below median. The relative cost of above-median managers is the average log compensation of above median managers minus the relative log compensation of below median managers, where each measure of compensation is net of the estimated effect of job and year fixed effects. As columns (3) and (6) show, there is again no consistent effect or statistically significant effect of the price of above-median managers on the share of above-median managers.

We emphasize again that the Company's database is an incomplete record of its clients' hiring patterns. In particular it contains few production and supervisory workers, and so the results in columns (2) and (5) should be treated with caution. Among the workers captured, the stylized fact is that there is no consistent evidence of substitution to cheaper, less skilled workers, either at the aggregate or across affiliates within a given firm, despite large differences in relative costs.

B Details on Effect of Heterogeneous Labor Intensity

To build intuition, start with the Cobb-Douglas framework developed in Section 4.1 and assume that both modern and traditional production face the same non-labor costs, $P_M = P_T = P$. We allow each sector to face heterogeneous labor intensity $s_{L,T}$ and $s_{L,M}$ and assume that $s_{L,T} > s_{L,M}$. The industries that choose modern production is given by a modified version of equation (2):

$$\frac{z_{i,M}}{z_{i,T}} \geq e^{\tau} \left(\frac{w_m}{w_p}\right)^{(\alpha_M - \alpha_T)s_{L,M}} \left[\frac{w_p^{1-\alpha_T} w_m^{\alpha_T}}{P}\right]^{s_{L,M} - s_{L,T}}.$$

There are three terms on the right-hand side. The first captures the effect of distortions. The second captures the relative cost of management interacted with the relative management intensity of modern production. This is the term that we quantify in our main analysis. The third term captures the additional effect of allowing for heterogeneous labor intensity.

This interpretation of this term is very similar to that of the second term. We have assumed that traditional production is more labor-intensive than modern

production, which implies that modern production must be more intensive in the other factors, whose cost is captured by P. This term captures the relative cost of the other factors to labor interacted with the difference in relative factor intensity – in this case, between labor and other factors. Generally, labor is more expensive relative to other inputs in developed countries. Given this, allowing for $s_{L,T} > s_{L,M}$ would imply that the third, novel term is increasing with development, generating an additional force for the adoption of modern technologies in developed countries.

This same logic carries over to the general framework of Section 4.4. Label the first two factors as management and production labor. Then we can rewrite equation (5) as

$$\begin{aligned}\frac{d\log\frac{c_M}{c_T}}{dy} &= \left[s_{M,m}(\Theta) - s_{T,m}(\Theta)\right]\frac{d\log(w_m/w_p)}{dy} \\ &+ \left[s_{M,m}(\Theta) + s_{M,p}(\Theta) - s_{T,m}(\Theta) - s_{T,p}(\Theta)\right]\frac{d\log(w_p)}{dy} \\ &+ \sum_{f=3}^{F}\left[s_{M,f}(\Theta) - s_{T,f}(\Theta)\right]\frac{d\log(\Theta_f)}{dy}.\end{aligned}$$

This expression decomposes the effect of a marginal change in development on the relative cost of operating a modern firm into three terms. The first term captures the interaction between relative management intensity of modern production and the effect of development on the relative cost of management. The second term captures the interaction between relative labor intensity of modern production and the effect of development on labor cost. The third term captures the interaction between the relative intensity of modern production in all other factors and the effect of development on their costs.

If modern and traditional production have the same labor share, then $s_{M,m}(\Theta) + s_{M,p}(\Theta) = s_{T,m}(\Theta) + s_{T,p}(\Theta)$ and the second term drops out of the expression. If instead traditional production is more labor intensive, then $s_{M,m}(\Theta) + s_{M,p}(\Theta) - s_{T,m}(\Theta) - s_{T,p}(\Theta) < 0$. Since wages rise with development, $\frac{d\log(w_p)}{dy} > 0$ and this force tends to push for lower relative costs in the modern sector. At the same time, modern production must then put a higher weight on the remaining, non-labor factors. However, as long as the price of labor rises faster than the weighted average of non-labor factors with development, then it remains the case that heteroge-

neous labor intensity is a force that lowers the relative cost of modern production in developed countries and hence helps explain why developed countries have more modern production.