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

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Abstract

This paper shows that large, multi-establishment business enterprises face a high cost of management in poor countries and that this cost inhibits the growth of the modern sector. We provide new empirical evidence using a database covering compensation for 300,000 managers and business professionals working at modern firms in 146 countries. We estimate that the elasticity of real management costs with respect to real GDP per worker is 0.1. Modern firms are relatively management-intensive, so this elasticity implies that the relative labor cost of operating a modern firm is 2.5–8 times higher in a developing country than in the United States.

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1 Introduction

A key characteristic of modern economic growth is the systematic transformation of the organization of production (Kuznets, 1973). In developing countries, it is organized along traditional lines: the majority of workers are self-employed or employed in small, slow-growing single-establishment firms whose owners supervise the workers and manage the enterprise on a day-to-day basis.[1] By contrast, most workers in developed countries are employed in modern business enterprises: large, multi-establishment firms with a separation of ownership and management.

This shift in firm organization requires the formation of a class of professional, salaried managers who set strategy, allocate resources, and monitor and coordinate production (Chandler, 1977). In this paper, we document that the real cost of management for modern firms varies little with development, which implies that its relative cost is much higher in developing countries. We establish that this high relative cost deters the adoption and spread of modern business enterprises. We also provide new suggestive evidence as to why management is expensive in developing countries.

We start with the data. An important challenge is that modern business enterprises are uncommon in developing countries, which makes it difficult to obtain data on these firms and their costs. Yet doing so is important to the extent that modern firms face different labor costs, for example if they hire higher-quality managers or pay efficiency wages.[2] Our approach is to use a proprietary database collected and maintained by a global compensation consulting company (the "Company"). The Company specializes in informing large, modern businesses operating in developing and emerging economies – including many prominent multinational firms – how their salaries and compensation packages compare to the typical rate in the local labor market. The Company measures the typical rate using data on what past clients pay similar workers. Its database is a cumulative record of actual compensation paid by modern firms to over 300,000 workers. The database covers mostly managers and business professionals in 146 countries

[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 Hsieh & Klenow (2014) for facts about establishment growth, all relative to development.

[2]Bloom *et al.* (2014) show that management quality is lower in poor countries among domestic firms but not among establishments of foreign multinational firms.

worldwide.

The database has two features that make it particularly useful for comparing the cost of management across countries. First, the Company devotes substantial labor resources to standardizing jobs across firms and countries to a common, detailed scheme so that it can provide clients with "apples-to-apples" comparisons of pay. Second, some clients hire the Company to benchmark pay for establishments in multiple countries in the same year. We can use these clients' data to estimate cross-country variation in pay within a fixed firm and job.

Our main empirical finding is that the real cost of middle management varies little with development. The elasticity of the average compensation of middle managers in the Company's database with respect to GDP per worker, both adjusted to 2017 international dollars, is just 0.16.[3] Controlling for standardized job fixed effects or firm-job-year interactions cuts this estimate in half. We validate these findings using alternative data sources that cover the market for managers among modern firms in developing countries. We also compare these compensation figures to earnings of managers in nationally representative data sets.

Our second contribution is to establish that the high cost of management deters the adoption and expansion of modern business enterprises in developing countries. Qualitatively, the argument is that the low variation in management costs implies a higher relative cost for management (as compared to production, clerical, or supervisory labor) in developing countries. At the same time, modern firms are more management-intensive than traditional firms. The interaction of high relative costs and high relative factor intensity implies that developing countries have a comparative disadvantage that leads them to adopt fewer modern technologies and to produce more using traditional technologies.

Quantitatively, the importance of this effect depends on the magnitude of relative costs and relative factor intensity. The Company's database provides evidence on the cost of management; we use GDP per worker to estimate the cost of non-management workers. We calibrate the factor intensity of modern and traditional technologies using evidence from the literature on firm hierarchies. We map tra-

[3] Brinatti *et al.* (2022) document a similarly low pay elasticity for workers engaging in freelance work on a popular website. This finding is also related to work on the large firm wage premium or the foreign firm wage premium, although we are the first to show that it holds even within-firm across-country. See Oi & Idson (1999) for a review of early work and Alfaro-Urena *et al.* (2021) for more recent findings.

ditional 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. Given this mapping, we calibrate the compensation share of managers and non-managers in traditional and modern firms using evidence for France from Caliendo *et al.* (2015).

We augment this data point with an estimate of the substitutability of managers and non-managers. Evidence from U.S. multinationals operating abroad is consistent with a Cobb-Douglas aggregator. The more limited data within the Company's database points is consistent with a Leontief aggregator. Each case implies substantial shifts in labor costs. For the Cobb-Douglas aggregator, the relative labor cost of operating a modern firm is 2.5 times higher in developing countries than in developed countries. For the Leontief case, this would rise to a factor of 8 times higher. These figures suggest that labor costs should be viewed as a substantial deterrent to the modern firms, along other factors that have a similar differential impact such as access to electricity, financial frictions, or quality of contract enforcement (Fried & Lagakos, forthcoming; Buera *et al.*, 2011; Boehm & Oberfield, 2020).

Finally, we examine why management is relatively expensive in developing countries. We consider two 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.

Our work is most closely tied 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).

We also contribute to the literature on appropriate technology adoption; for classic references, see Basu & Weil (1998), Acemoglu & Zilibotti (2001), and Caselli & Coleman (2006). Most previous work focuses on the adoption of technologies that vary in how intensively they use educated workers. By contrast, we focus on the interrelationship between middle managers and firm structure, building on older work by Chandler (1977) and Stewart (1977). This distinction is quantitatively important because the relative price of educated workers varies little across countries, whereas we find that the relative price of managers varies substantially. These findings imply that firms have a much stronger disincentive to adopt management-intensive as compared to education-intensive technologies. Finally, our work relates to the literature on cross-country differences in human capital (Caselli, 2005; Hendricks & Schoellman, 2018). Rather than focusing on conventional measures such as years of schooling, we show that there is a high cost for a particular set of skills that is an important complement to the productive technologies and economies of scale that modern production makes possible.

2 Data

Our empirical analysis makes use of a proprietary database collected and maintained by a global compensation consulting company (the "Company"). Compensation consultants provide clients with information on how the compensation of their employees compares with that of similar workers in the local labor market. Relative to its competitors, the Company's niche is compensation in developing and emerging markets.

As we discuss further below, the typical client for the Company is a modern, multi-establishment organization. Clients that hire the Company thus begin by selecting which establishment or establishments will participate in the market comparison. For each establishment, human resources personnel report the positions that are present and the average compensation by position.

The Company's central business proposition is to return to the client select moments of the distribution of compensation for each position in the local market. For these figures to be meaningful, it is essential that the Company provide "apples-to-apples" comparisons. To this end, the Company does not take the position titles reported by the client at face value. Instead, it employs professional jobs analysts who conduct interviews to learn about the tasks, responsibilities, and skills associated with each position. They use this information to translate each position into their own internal, globally standardized job classification scheme. This step ensures that workers the Company analysts deem "accountants" in any firm or country perform similar tasks and have similar responsibilities and so makes the compensation comparisons meaningful. 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.

The Company's database only records the harmonized job title, not the original title provided by the client. However, we have access to select reports the Company has provided to clients for establishments in developing countries that list both the original position title and the standardized job title. These reports indicate that Company analysts systematically downgrade job titles in developing countries. For example, the client may have a position that it calls senior accountant, but after interviews the Company analysts would deem it to be equivalent only to accountant or junior accountant by global standards.

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 pay. 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. The Company's standardized job classification scheme includes more than 200 titles and includes both a horizontal and vertical dimension (accounting versus human resources; junior accountant versus senior accountant).

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, the average compensation of workers in the position in the establishment, and in many cases also the total number of such workers. All observations pertain to local workers; expatriates are reserved to a separate database, which unfortunately we cannot access.

While there is no other information in the database, we use the firm name to merge on the firm's industry, profit/non-profit status, and headquarters location. For our analysis of the trends in compensation, we restrict attention to for-profit firms and exclude charities and governmental organizations. The remaining firms come from a wide variety of sectors, including banking, consulting, health care, mining and other natural resources, technology, telecommunications, and transport. We have data on pay for more than 300,000 workers from 1,219 firms in 146 countries.

Table 1 provides statistics on how our sample is distributed across countries and firms. For Panel A we aggregate the sample to the country level and merge on GDP per worker in 2017 international dollars from World Bank (2022). This panel shows that we cover a wide range of the income distribution, with a 90-10 ratio of more than a factor of 16. It also shows that the database covers hundreds or thousands of workers in most countries.

TABLE 1: SAMPLE DISTRIBUTION

	Percentiles				
	10th	25th	50th	75th	90th
Panel A: Countries (146)					
GDP p.w., 2017 intl $	4,774	12,231	28,742	51,014	79,499
Workers	280	921	1,504	2,762	4,146
Panel B: Firms (1,219)					
Countries	1	1	1	1	3
Unique Jobs	9	13	18	31	45
Workers	12	24	62	145	375

Table shows the distribution of the sample when aggregated to the level of the country or firm. Percentiles are computed separately for each moment, so the country with the median GDP per worker is different from that with median number of workers. All statistics refer to the final sample of 172,582 country-year-firm-job observations representing 316,452 total workers after imposing sample restrictions discussed in the text.

For Panel B we aggregate the sample to the (parent) firm level. We have 1,219 firms in the database. The first row shows that the majority of firms contribute observations for a single country. However, about twenty percent of firms appear in the database for multiple countries. The top ten percent of firms appear in three or more countries; the top firm contributes observations for 81 different countries. The remaining rows show that the median firm contributes 18 different jobs and provides data on pay for 62 workers.

We emphasize again that these firms are not representative employers in their labor markets. Indeed, given the prevalence of small, traditional firms in developing countries, a representative sample of firms would be of little use in characterizing the cost of management for modern firms. Instead, our sample consists almost entirely of modern business enterprises. The firms that hire the Company tend to be large, multi-establishment firms; three-fourths of our earnings observations come from foreign affiliates of multinational firms. The multinational 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 database consists primarily of workers in middle management and business professional roles, such as managers, accountants, and human resource representatives. There are a smaller number of upper managers as well as some associated support workers (cleaners, guards, and the like).[4] There are few production workers. To help visualize the occupational distribution in our database, we construct a crosswalk to match every job in the Company database to the closest 1-digit International Standard Classification of Occupation, 2008 (ISCO-08) occupation group. We then compute the distribution of employment across these ten bins in the Company database among countries with GDP per worker less than $10,000 in 2017 international dollars.

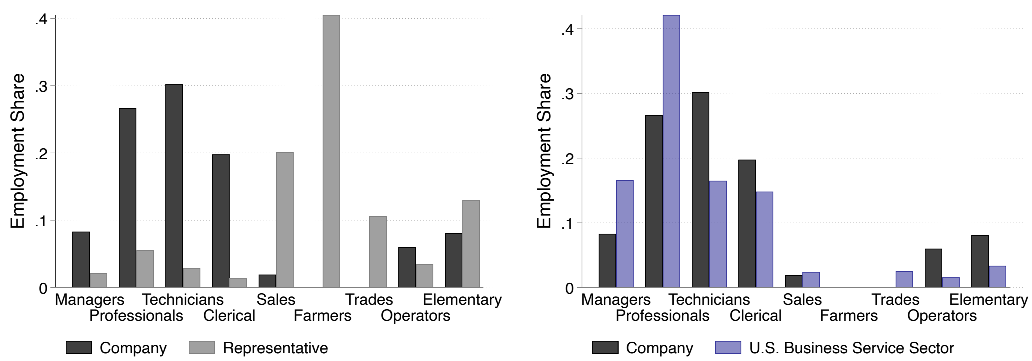
We compare this distribution to one constructed from nationally representative data sets for countries below the same GDP per worker threshold. Details of the data sets are available in Appendix A.1. Figure 1a shows that the two distributions are quite different. Representative data show that the typical worker in developing countries is engaged in sales, farming, trades work, or elementary occupations. By contrast, the workers in developing countries in the Company's database are

[4] We conjecture that this selection represents the firms and establishments with the greatest demand for the Company's services: foreign-owned firms who are uncertain about the market for uncommon, specialized, and highly compensated workers.

focused in management, as well as the business subsets of professional, technical, and clerical occupations.

FIGURE 1: OCCUPATIONAL DISTRIBUTION OF COMPANY DATA

(a) Developing Countries (Representative) (b) U.S. Business Service Sector



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

This occupational distribution is quite similar to the one that prevails among workers employed in the business service sector in the United States, as shown in Figure 1b. The high degree of similarity leads us to infer that the establishments in the Company's database are primarily local headquarters that coordinate production, sales, or marketing for large firms from the country's capital city or business hub. We have verified that many firms also have production or sales establishments in the same country, but these establishments are not in the database.

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.[5] 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 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 management for modern firms vary with development? We estimate regressions of the form

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

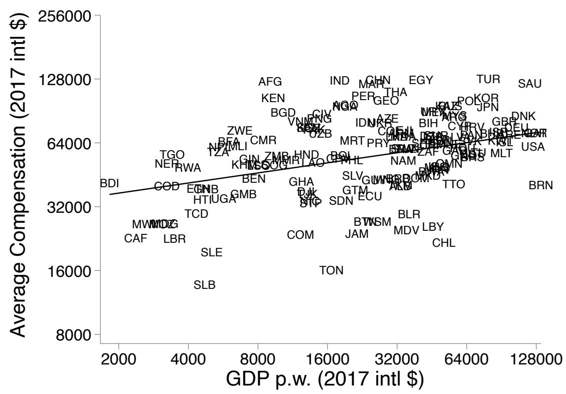
where $w_{c,t,f,j}$ is the total real gross compensation for workers in country c and year t working for firm f in standardized job j, y_c is the real GDP per worker in country c, and X is a vector of controls. The main parameter of interest is η, the elasticity of compensation with respect to GDP per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

[5] 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.

Table 2 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 2 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.

FIGURE 2: MIDDLE MANAGER COMPENSATION AND DEVELOPMENT



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

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 3. We

TABLE 2: 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
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

cannot include firm fixed effects when investigating domestic establishments, so we control for job-year interactions as in column 3 of Table 2. The first column repeats those results for comparison.

TABLE 3: 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 (here, 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. Like most compensation consulting firms, the Company's job classification scheme includes a measure of skill that crosses occupation borders, so that some human resource officers and some accountants can be deemed to be at the same skill level. We aggregate skill levels into four broad groups to avoid disclosing the Company's business information. The bottom skill level includes workers who are not in middle management 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 4: 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
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 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 levels. 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.

The low compensation elasticity for middle managers – equivalently, higher relative compensation for middle managers 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, a self-described "global specialist professional recruitment consultancy."[6] 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 sev-

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

eral 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 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 for modern firms in developing countries. This cost is the key margin we quantify in Section 4.

3.2 Comparisons 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, which is important because such firms are rare in developing countries. By contrast, standard data sources such as censuses or labor force surveys provide information on all workers classified as managers, whether they are working at traditional or modern firms. In this section we compare our results to those in standard, representative data sets.

Conceptually, we think of traditional firms as having few layers in the firm hierarchy as in Garicano & Rossi-Hansberg (2006). Empirically, in the next section we map them to firms with one or two layers: production workers and the managers who directly oversee them, which we label supervisors. Modern firms have several layers in their firm hierarchy: production workers, supervisors, and one or more layers of middle and upper managers (Caliendo *et al.*, 2015). These managers set the firm strategy, formalize business policies, and allocate resources; they are not responsible for the day-to-day supervision of production workers.

Standard data sets ask workers detailed questions about their occupation but few questions about the organization or structure of their firm.[7] As a result, in general the best we can do is to classify workers based on their occupation. Doing so pools together a diverse set of supervisors, managers, and business professionals that perform a wide range of tasks for both modern and traditional firms. Importantly for us, the share of middle and upper managers in this set varies systematically with GDP per capita, firm size, and age (Tamkoç, 2023). Since most firms in developing countries are small, traditional firms, we expect most of the workers who report management occupations to be functionally supervisors or owner-managers of small single-establishment firms. Average compensation of management in representative surveys in developing countries mostly reflects their pay rather than the pay of the small number of middle and upper managers at modern firms.

With this framework in mind, we compare our results on compensation to patterns on earnings found in nationally representative data sets. 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. We divide all earnings for each country by the earnings for non-managers in the representative data.

Table 5 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 facts that modern firms are common and 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

[7]The empirical literature on firm hierarchies uses matched employer-employee data to circumvent this measurement challenge. We use results from this literature in our calibration procedure below.

TABLE 5: LABOR EARNINGS BY OCCUPATION AND SOURCE

	Managers		Non-Managers	
	Company	Representative	Company	Representative
Country				
Bangladesh	15.77	1.68	3.74	1.00
Bolivia	7.81	2.24	2.51	1.00
United States	2.48	2.08	1.65	1.00

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 exponentiated mean log earnings relative to non-managers in representative data.

and upper managers in modern firms are large.[8] It shows the importance of having access to data that allows us to focus on modern firms.

4 Quantifying the Importance of Management Costs

The goal of this section is to quantify the importance of our novel findings about the relative cost of management for the adoption and spread of modern businesses around the world. We start by developing simple models of appropriate technology adoption and trade based on differences in factor costs. In each model, the relative cost of management to production workers interacts with the relative factor intensity of modern versus traditional technologies to help shape the size of the modern sector in each country. In the appropriate technology model it leads developing countries to adopt fewer modern technologies; in the trade model, it leads them to specialize in producing with traditional technologies. We then take this equation to the data to quantify the extent of the labor cost disadvantage that developing countries face in the modern sector.

[8] 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 iimply that the manager earnings premium would be twice as large in our poorest countries as in our richest.

4.1 Appropriate Technology Model

We start by demonstrating differences in optimal technology adoption. We consider a static model of an economy that has access to the world technology frontier but is closed to trade. There is a unit continuum of differentiated varieties of intermediate goods, with individual varieties indexed by k. Each variety can be produced via traditional or modern methods.

Varieties vary exogenously in their productivity when produced by modern and traditional organizations, which we denote by $z_M(k)$ and $z_T(k)$, respectively. Modern business enterprises are more advantageous for products 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). For example, cement, steel, or flour can be manufactured using continuous or batch technologies that enable substantial productivity gains but require management to coordinate the high volume of inputs, production, and outputs. Firms in these industries are organized along modern lines essentially everywhere today. By contrast, products that lack these characteristics – those that are labor-intensive, do not use complex machinery, are produced at low volume, or that can be sold easily through existing wholesalers – have smaller or no productivity gains when produced by modern organizations. For example, apparel production or plumbing services have largely resisted modern production even in developed countries.

As described in the last section, traditional methods involve small firms with few layers in the firm hierarchy and few or no middle and upper managers. We thus think of output as being linear in production and supervisory labor. This implies a unit cost function for producing variety k using traditional methods of $c_T(k) = w_p/z_T(k)$, where w_p is the cost of production and supervisory labor. Modern methods involve larger firms with several layers in the firm hierarchy, including one or more layers of middle and upper management. For illustrative purposes, we think of the production function as being a Cobb-Douglas aggregator that combines production and supervisory labor with parameter $1-\alpha$ and management labor with weight α. This gives the usual unit cost function for producing variety k using modern methods $c_M(k) = w_p^{1-\alpha} w_m^{\alpha}/z_M(k)$, where w_m is the cost of management.

Firms producing each variety take the world technology frontier $(z_T(k), z_M(k))$ and labor costs (w_p, w_m) as given and choose the technology that allows them to produce at lowest cost. A given variety is produced using modern methods if

$$\left(\frac{w_m}{w_p}\right)^{\alpha} < \frac{z_M(k)}{z_T(k)}.$$

This condition is more likely to hold if the relative cost of management is low and the productivity of modern production for the variety is high.

To aggregate, we assume that industry productivities are draws from independent Fréchet distributions with scale parameters Z_T and Z_M and a common dispersion parameter θ. It follows that the ratio of the share of industries that choose the modern technology to the share that chose the traditional one is given by

$$\mathscr{R} = \left(\frac{Z_M}{Z_T}\right)^{\theta} \left(\frac{w_m}{w_p}\right)^{-\alpha\theta}.$$

We compare this ratio to a benchmark economy – empirically, the United States – that has access to the same world technology frontier and hence the same Z_T and Z_M but different factor prices. Denoting the corresponding variables for the benchmark economy by $*$, we arrive at a simple expression for the relative adoption of modern technologies (as compared to traditional ones) in an economy (as compared to the benchmark):

$$\frac{\mathscr{R}}{\mathscr{R}^*} = \left(\frac{w_m/w_p}{w_m^*/w_p^*}\right)^{-\alpha\theta}. \tag{2}$$

The relative size of the modern sector depends on the relative cost of management interacted with the relative management-intensity of the modern sector.

Two notes are in order at this point. First, the parameter θ also plays a role in equation (2). It controls the dispersion of productivity, with larger values of θ indicating less dispersion. Intuitively, as productivities become more dispersed, a given difference in factor prices leads to smaller differences in modern technology adoption. Second, as noted above, we have abstracted from a number of other potential shifters of the size of the modern sector. It is straightforward to add such factors to our theory, but the Company data provide novel data on labor costs that we focus on instead. Given these points, our approach going forward is to measure the labor cost disadvantage developing countries face in adopting modern technologies, which is captured by $\left(\frac{w_m/w_p}{w_m^*/w_p^*}\right)^{-\alpha}$. We show that this advantage is large, but do not claim that it is the only factor or that it can account for all of the differences in the adoption of modern technologies.

4.2 Factor Costs and Trade

The same interaction of relative factor costs and relative factor intensity captures a measure of comparative advantage that guides production and trade patterns in Heckscher-Ohlin models of trade. To illustrate this, we build on a simple but tractable model proposed in Morrow (2010). We again think of two economies, with variables for the benchmark economy denoted by $*$. As before, the economies differ in their factor prices (w_m, w_p) and (w_m^*, w_p^*). The economies can trade frictionlessly. However, we abstract from the technology adoption problem: instead, each economy produces a single variety using modern production and a single variety using traditional production with productivity Z_M and Z_T.

A competitive final goods producer in each country sources each of the four intermediate goods and combines them to produce final output. The final goods producer's technology has a nested form. In the inner nest, the modern variety of each country is aggregated with by a CES function with elasticity of substitution σ, and likewise for traditional varieties. In the outer nest, composite modern and traditional services are aggregated via a Cobb-Douglas function. All markets are competitive.

The differences in factor costs lead each country to tilt its production and exports towards the sector in which it has a comparative advantage. Denote by $\mathcal{R}$ the relative output of the modern good. Then using the CES demand structure and the factor costs, it follows that

$$\frac{\mathcal{R}}{\mathcal{R}^*} = \left(\frac{w_m/w_p}{w_m^*/w_p^*}\right)^{-\alpha\sigma}. \tag{3}$$

The relative output of the modern variety (as compared to the traditional one) in an economy (as compared to the benchmark) depends again on the interaction of relative factor costs and relative factor intensity. The expression closely parallels equation (2), with the elasticity of substitution playing a similar role here as the dispersion of productivities did in that equation.[9]

4.3 Quantitative Evaluation

Each of the two models shows that the interaction of relative factor costs and relative factor intensity can help explain low adoption and utilization of modern technologies in developing countries. In this section we quantify the importance of this effect using the data on management costs in the Company's database. Specifically, we quantify the relative labor costs of operating a modern as compared to a traditional firm in each country, $(w_m/w_p)^{-\alpha}$. The magnitude depends on relative factor costs and relative factor intensity; we discuss measurement of each in turn.

The data on the cost of management comes from the Company database. We take reported compensation of managers and residualize for job-year interactions to eliminate the effects of wage growth or cross-country differences in the composition of the pool of workers in the Company database. We estimate the cost of production and supervisory labor by assuming that it is one-third of PPP GDP per worker. The fact that both types of workers earn wages that are proportional to GDP per worker is consistent with the evidence in Section 3.2 on earnings trends in representative surveys. The proportion of one-third leads the relative earnings of managers to production workers to be in line with the evidence in Table 5 and consistent with the data sources that we use to calibrate relative factor intensity.

The second component of our calculation is the relative management intensity of modern technologies. We cannot estimate this parameter using the Company database because it contains little, incomplete information about production or supervisory workers. Instead, we draw on outside evidence provided by the literature that investigates the production hierarchy of firms.[10] Our main evidence comes from the work of Caliendo *et al.* (2015), who use French data with two critical characteristics. First, it is a matched employer-employee data set, which allows them to link a firm to all its workers. Second, the French data include a unique occupational coding scheme that characterizes where a worker falls in the firm hierarchy, ranging from production and clerical workers at the bottom to supervi-

[9] The correspondence between the two models is well-known in the trade literature (Arkolakis *et al.*, 2012).

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

sors, senior staff and top managers, and finally owners who draw a salary at the top. This second characteristic allows them to differentiate workers by where in the firm hierarchy. The two characteristics combined allow them to differentiate firms based on the number of layers they have in their firm hierarchy.

Caliendo *et al.* (2015) shows that most firms follow a natural hierarchy, in two senses. First, most firms employ consecutively ordered layers of workers. This means that if they employ only two layers, then tend to be production and supervisory workers, not production and middle management. Second, within most firms the lower layers have higher employment shares but lower average wages. The authors, as well as subsequent empirical work, also shows that the organization of the firm matters for a number of outcomes and that growing and shrinking firms re-organize themselves in a manner that is consistent with the theory (Tåg, 2013; Caliendo *et al.*, 2020; Bonilla & Polanec, 2021; Friedrich, 2022; Pieri & Vatiero, 2022).

We map traditional firms in our theory to firms with one or two layers in their production hierarchy in the French data. These firms have only production and clerical workers and their supervisors. We map modern firms in our theory to firms with three or more layers in their production hierarchy. Such firms have production and clerical workers, supervisors, as well as middle management, upper management, and owners who draw a salary. Note that this way of mapping the model to the data implies that traditional firms do not have any middle or upper managers, consistent with our simple specification above. This mapping implies that just over half of French firms are modern. However, the modern firms are much larger and so account for 95 percent of value added. The main data point we take from this literature is the compensation share of management in modern firms, which is 28 percent.[11]

In the two models we assumed that modern firms use a Cobb-Douglas production function to aggregate managerial with production and supervisory labor. In this case, the compensation share implies that $\alpha = 0.28$. However, this assumption was used for its analytical tractability and hence deserves further investigation. Unfortunately, the literature on firm hierarchies focuses on European countries and so does not provide comparable figures from countries with very different in-

[11] Computed using the data underlying their Figure 5, which the authors kindly shared with us. Tåg (2013) reports similar figures for Sweden.

come levels and relative prices. Instead, we turn to two alternative data sources that provide data on the hiring patterns of modern firms over a wider range of development.

First, we make use of data collected by the Bureau of Economic Analysis on the business activities of majority-owned foreign affiliates of U.S. multinational enterprises. Through year 2007, they collected and tabulated data on total labor compensation as well as total compensation of managerial, professional, and technical labor by country. 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 workers, somewhat higher than the figure for French firms in Caliendo *et al.* (2015). More importantly, this figure 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. We match 53 countries with compensation statistics to their PPP GDP per worker. 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 percent higher than the poorest. Altogether, the near-constancy of these shares suggests that a Cobb-Douglas aggregator may be a reasonable approximation.

Second, we return to the Company data. The Company dataset contains incidental data on some non-managers. We use this to ask whether the share of managers hired is a function of the relative price of management. We also examine variation in hiring patterns within the pool of managers, such as whether the share of upper to middle managers responds to the relative price of upper to middle managers, or whether the average “level" of managers responds to the relative price. In short, we find no evidence of any response on any of these margins, either at the aggregate level or when looking across establishments within a firm. None of the estimated effects are statistically significant and many of the point estimates have the wrong sign. In short, firms seem to hire the same bundle of managers and a few non-managers around the world despite large variation in the relative price; see Appendix A.2. This evidence would be consistent with a Leontief labor aggregator.

We estimate the relative labor cost for each country for both the Cobb-Douglas and Leontief cases. Consistent with equations (2) and (3), we normalize all values by a benchmark economy, which we take to be the United States. The figures then capture the relative labor cost of operating a modern as compared to a traditional firm for a given country, relative to the same ratio for the United States. Figure 3 plots the value for each country against its PPP GDP per worker.

FIGURE 3: RELATIVE LABOR COSTS AND DEVELOPMENT

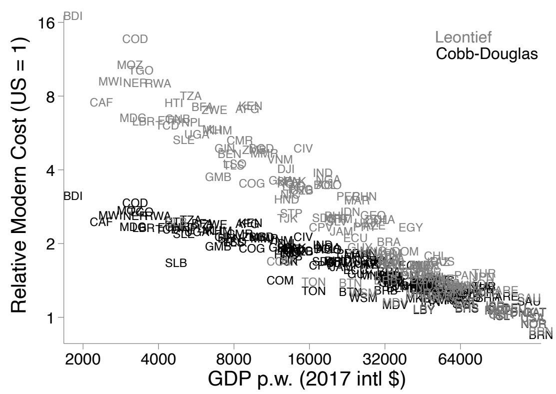


Figure 3 has two main features. First, in each case the relative labor cost of operating a modern firm is decreasing in development. This result captures that the cost of management is nearly constant in development while the cost of production and supervisory labor moves one-for-one with GDP per worker by construction. Second, the magnitude of the decline is large. For the Cobb-Douglas case, the poorest countries face a relative labor cost of operating a modern firm that is more than twice that of the United States. For the Leontief case, the same figure is greater than a factor of 8. Table 6 reports the estimates of the elasticity of total relative labor cost of operating a modern firm with respect to GDP per worker implied by Figure 3. The elasticity is already large at -0.26 in the Cobb-Douglas case and would be yet larger, -0.62, in the Leontief case. To summarize, the cost of management is important because management is an essential ingredient for modern firms; quantitative evaluations of this effect suggest that the total labor cost of operating a modern relative to a traditional firm is 2.5–8 times larger in developing countries than in the United States.

We conclude this section by putting these figures into context in three ways.

TABLE 6: ELASTICITY OF RELATIVE LABOR COSTS AND DEVELOPMENT

	Cobb-Douglas	Leontief
Log GDP p.w.	-0.255***	-0.617***
	(0.00780)	(0.0186)
R-squared	0.882	0.885
N	146	146

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

First, we compare them to the existing literature on appropriate technology adoption. Our implied labor cost shifter is much larger than what is typical in the existing literature, which focuses on educated versus uneducated workers (Basu & Weil, 1998; Acemoglu *et al.*, 2001; Caselli & Coleman, 2006). The main reason is that we find that the relative cost of management has a strong negative covariance with development, whereas the relative wage of educated workers either has a weak negative covariance or no covariance (Banerjee & Duflo, 2005; Rossi, 2022). A smaller reason is that we find that the labor aggregator for modern firms is either isoelastic or treats managers and non-managers as complements, whereas most estimates of the elasticity of substitution between educated and less educated workers imply that they are substitutes.

Second, we compare our results to existing work that seeks to understand the systematic differences in the organization of production between developing and developed countries. The most closely related paper in this literature is Fried & Lagakos (forthcoming), which models modern production as being electricity-intensive and many firms in developing countries as facing high electricity prices. For example, firms in Sub-Saharan Africa that use generators for power face an electricity price that is roughly six times higher than firms that purchase electricity from the grid in the United States.[12] Their calibration implies that the relative electric cost from operating a modern versus traditional technology is 63 percent higher in developing countries even if firms there can only access electric through generators. This leads us to believe that management cost is quantitatively signifi-

[12] Fried & Lagakos (forthcoming) cite a figure of roughly 40 cents per kilowatt-hour for generator power in Sub-Saharan Africa in 2014; the U.S. Energy Information Administration quotes an industrial price of 7.1 cents per kilowatt-hour for the same year (U.S. Energy Information Administration, 2023, Table 5.6).

cant relative to another key input. Related work suggests that the larger fixed costs and higher capital utilization in manufacturing makes it more intensive in external financing and that developing countries may also have more financial frictions, which works through the same channel, although the theory does not lend itself to a straightforward quantification as electricity does (Buera *et al.*, 2011). Along the same lines, the size and scale of modern firms may raise their their need to use courts to enforce contracts while at the same time developing countries have worse contract enforcement (Boehm & Oberfield, 2020).

Third, we re-emphasize that the cost of management is one piece of the tradeoff firms face when deciding whether to adopt or expand the use of modern technologies. In addition to the costs of other inputs that are relevant for modern production technologies, firms also have to weigh the relative productivity of modern production, which varies by industry. Our results should be read as implying that management costs are an important factor in this tradeoff, not a determinant factor.

5 Understanding Middle Manager Compensation

So far we have established that the cost of middle management for modern firms varies little with development. This fact implies large variation in the relative cost of middle management, which is a significant deterrent to the adoption and expansion of modern business enterprises. We now discuss several candidate explanations for these empirical patterns.

5.1 Quality Differences

Our first hypothesis is that modern firms in developing countries hire higher-quality workers and particularly higher-quality managers than traditional firms. This explanation is particularly powerful if high-quality managers are scarce and therefore expensive. We have two reasons to expect that this is the case. First, secondary- and tertiary-educated workers are generally scarce in developing countries (Barro & Lee, 2013). Adding to this, a limited number of developing countries have participated in internationally standardized achievement tests such as the OECD PISA. The average scores from these developing country participants are much lower than those from developed countries (Hanushek & Woessmann, 2012;

Cubas *et al.*, 2016).[13]

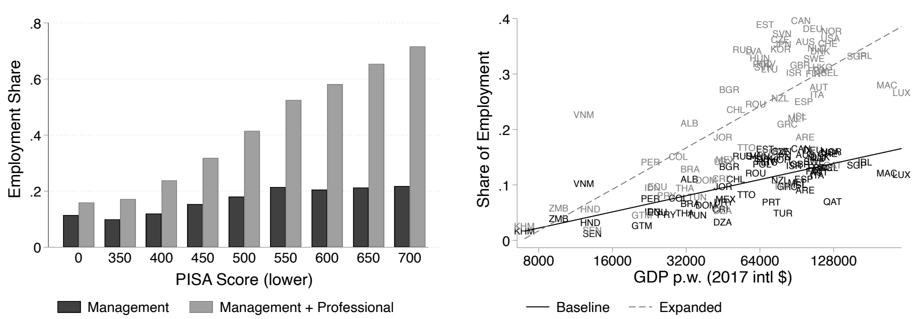
Cross-country test score differences are large but also somewhat abstract. To put them into context, we note that the average secondary school student in many developing countries scores at reading level 1b on PISA assessments. PISA characterizes reading level 1b as “Tasks at this level require the reader to locate a single piece of explicitly stated information in a prominent position in a short, syntactically simple text ..." (OECD, 2014, p. 191). They also provide a sample assessment question for students who read at this level. The question asks students to read Aesop’s fable “The Miser and his Gold", which is a one-paragraph story that opens with the sentence, "A miser sold all that he had and bought a lump of gold, which he buried in a hole in the ground by the side of an old wall." Students are asked, “How did the miser get a lump of gold?" (OECD, 2014, p. 212).

We hypothesize that students reading at or below this level are not capable of storing, retrieving, and processing information at the level necessary to act as middle managers in modern business enterprises. To formalize this idea, we develop novel empirical results utilizing the Longitudinal Surveys of Australian Youth (LSAY). The important feature of this dataset is that it tracks students who take the PISA exams in Australia as late as age 25, allowing us to measure how PISA test scores map into subsequent occupational choices in a fixed country with fixed wages. Details are available in Appendix A.3.

FIGURE 4: TEST SCORES AND OCCUPATIONAL CHOICES

(a) Australian Data

(b) Cross-Country Projections



[13] See also Schoellman (2012) and Martellini *et al.* (2022) for alternative evidence that education quality in general and college quality in particular is lower in poor countries.

Figure 4a shows the main result from the LSAY, which is the share of workers making various occupational choices by test score bin. The black bars show the share of workers in each bin who join middle manager occupations, which rises from 10 to 20 percent. While there is a notable trend, this probably understates the importance of test scores for the capacity to be a manager because many high-scoring Australians choose other education-intensive occupations. To make this point, the gray bars show the share choosing manager or professional occupations, which rises from 15 to over 70 percent as a function of test scores.

Essentially all Australians attend school through age 15, when PISA is administered. Further, the average reading score is sufficiently high (503 in the 2018 round) to generate a substantial number of potential and actual managers. The situation in many developing country is very different: most workers do not attend school long enough to even be eligible for PISA and the test scores among those who do so are much lower.

We perform two calculations to show that this likely limits the number of high-quality managers. First, we use the data from Barro & Lee (2013) to compute the share of each country's working age population that has some secondary or more schooling, while assuming that the rest lack the literacy skills necessary to become effective middle managers. Second, we use each country's distribution of PISA reading scores multiplied by the fraction of Australians in each test score bin who become middle managers (black bars) or middle managers and professionals (gray bars). These calculations reflect the number of workers who would become managers if faced with Australian relative wages and the number of workers with the necessary basic skills to be potential managers.

Figure 4b plots the results of each calculation against GDP per worker. Developing countries have a very low manager employment share under either calculation. For example, Cambodia's share of 2–3 percent suggests that it has few workers with the literacy skills to work in a modern business enterprise. To further add to this point, Figure A.2 in the appendix shows the distribution of test scores among the potential managers in the expanded calculation. A large majority of potential managers in the least developed countries score in the lowest test score bin. This finding complements the previous work of Bloom *et al.* (2014), who find that average management quality is strongly correlated with development. These findings could reflect that educational systems fail to provide graduates with the necessary skills to function as high-quality managers. Literacy skills are an important building blocks for language skills, which are important for transferring knowledge within multinational firms (Guillouet *et al.*, 2022). More generally, an important role for skill is also consistent with 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 poor countries (Kerr *et al.*, 2016; Martellini *et al.*, 2022). These flows can exacerbate the shortage of skilled managers. On the other hand, 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 4); 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 poor 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.*, 2020; 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 consistent with the presence of recruitment consultancies in developing countries.

Second, modern firms may find it optimal to pay (higher) efficiency wages in poor 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 middle managers 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.[14] They show evidence that

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

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 2 , Column 5). However, we note that our results do not appear to be driven particularly by multinational firms (Table 3).

6 Conclusion

This paper consists of two main exercises. First, we use the proprietary database of a compensation consulting company to document that the real cost of middle management for modern firms varies little or not at all with development, implying very high relative costs of middle management in poor countries. Second, we quantify the importance of the high relative cost of management for the adoption of modern business enterprises in a model of technology adoption.

Our finding of high skill prices in developing countries contrasts with much of the existing literature, which has focused on educational wage premia and has found that they are relatively similar in developing and developed countries. Our results show that at least one alternative measure of the skill premium – the wage premium for middle managers at modern firms – is much higher in developing than in developed countries. Thus, apart from showing that some skill prices in poor countries are sufficiently high to constrain development, 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.

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Online Only Appendices

A Data Details

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

A.1 Representative Data Sources

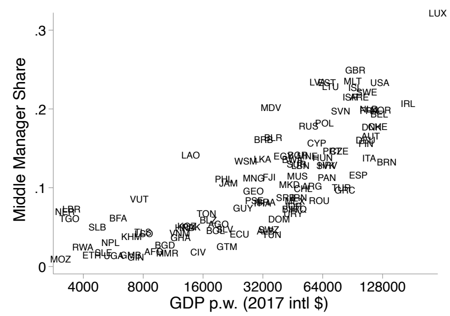
The Company's database covers a very particular population of jobs and firms – managers and business professionals at modern business enterprises. It is not well-suited for studying typical firms or their workers in developing countries because those firms do not engage the Company's services and so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

Most of our results draw on 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.[15] We aggregate workers into middle managers and non-middle managers using the definition in Table A.2, omitting a few countries with missing values for the codes of interest. Figure A.1 plots the employment share of middle managers against GDP per worker for all available countries. The poorest countries have an employment share of middle managers of less than 10 percent. Richer countries generally have employment shares around 20 percent, while Luxembourg is a clear outlier with a roughly 33 percent employment share.

In Figure 1 we compare the distribution of employment in the Company's database to two relevant benchmarks. Representative data come from the same ILOSTAT tabulation, except that we aggregate occupation codes 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

[15] 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.

FIGURE A.1: MIDDLE MANAGEMENT SHARE AND DEVELOPMENT



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 (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.[16] Our data source for the United States is again the 2000 U.S. Census (Ruggles *et al.*, 2021).

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

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 5.

A.2 Substitution Among Labor Types in Company Data

In Section 4.3 we discuss briefly estimates of the degree of substitution among different types of workers in the Company database; this appendix provides further details. Throughout we focus on the Company database. 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. 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, following the same measurement concepts as in Section 4.3. 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 com-

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 4). Wages are the logarithm of relative wage for the corresponding groups in the Company database. Standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

pensation 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 managers despite large differences in relative costs, either at the aggregate or across affiliates within a given firm.

A.3 Details on Longitudinal Surveys of Australian Youth

The Longitudinal Surveys of Australian Youth is a long-running research project that tracks the progress of students through school and into the early workforce. It is managed and funded by the Australian Government Department of Education, Skills and Employment, with support from various levels of the Australian government. Since 2003, the initial wave of the survey has been integrated with the Organization for Economic Cooperation and Development (OECD) Programme for International Student Assessment (PISA). Thus, the initial wave contains PISA scores for about 14,000 15-year old students per wave. Respondents are tracked for up to ten years, to age 25, with information on progress through schooling and then entry into the labor market collected over time.

Given the ten-year time horizon for the data, three waves of the survey are completed: the 2003, 2006, and 2009 cohorts (Australian Government Department of Education & Employment, 2020a,b,c). We collect data from all three waves and pool them for our analysis. Each contains similar information in terms of PISA test scores and employment and occupation outcomes at later waves. Pooling helps especially with increasing our sample size for students with low PISA test scores, which is important given low average test scores in developing countries.

We focus on reading test scores since literacy is important for management roles. PISA does not assign each worker a unique score. Instead, it assigns five "plausible values" per subject, which is designed to account for sampling variation in test scores. We implement the preferred approach of repeating the analysis for each potential score and then averaging the outcomes.

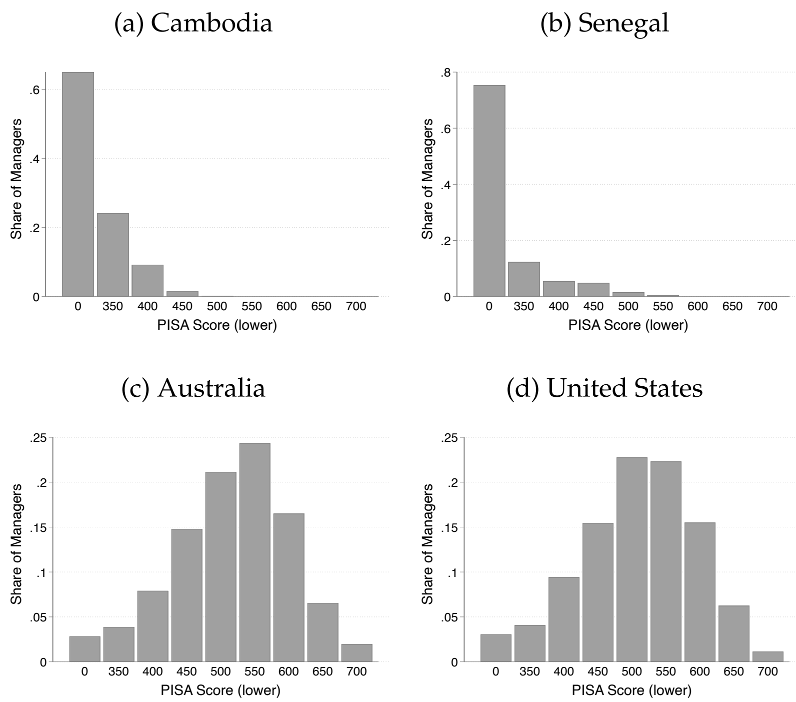
Our primary outcome of interest is adult occupation. We use the occupation at age 25 whenever possible. Some young adults lack an occupation because they are not working, do not provide enough occupational detail to permit coding, or have attrited from the survey. To combat this, we iterate backwards from age 25 for those who lack a valid occupation and explore whether they provide one at an earlier age. If they do, we use the latest possible occupation, although we disregard occupations provided before age 21.

We translate occupations into middle manager and professional roles. The

LSAY uses the ANZSCO first edition occupation coding scheme, which is a modified but recognizable version of ISCO coding schemes. Table A.3 gives the mapping from this scheme into management occupations. We define professionals as anything in the 1-digit category 2: Professionals.

Our analysis simply computes the share of workers in various test score ranges who make the occupational choices. All analyses are weighting using the provided longitudinal weights that adjust for attrition.

FIGURE A.2: COUNTERFACTUAL DISTRIBUTION OF TEST SCORES



A.4 Occupational Codes for Middle Managers

This appendix provides the occupational codes that are included in middle management in various data sources.

TABLE A.2: CODES FOR MIDDLE MANAGERS: ISCO-08

Codes	Title
11	Chief Executives, Senior Officials and Legislators
12	Administrative and Commercial Managers
13	Production and Specialized Services Managers
14	Hospitality, Retail and Other Services Managers
24	Business and Administration Professionals
33	Business and Administration Associate Professionals

Codes reported at the 2-digit level. All remaining valid codes are considered non-managers.

TABLE A.3: CODES FOR MIDDLE MANAGERS: ANZSCO 1ST ED

Codes	Title
1111–1113	Chief Executives, General Managers and Legislators
1311–1399	Specialist Managers
1411–1499	Hospitality, Retail and Service Managers
2211–2212	Accountants, Auditors and Company Secretaries
2221–2223	Financial Brokers and Dealers, and Investment Advisers
2231–2233	Human Resource and Training Professionals
2244	Intelligence and Policy Analysts
2245	Land Economist and Valuers
2247	Management and Organization Analysts
2249	Other Information and Organization Professionals
2251–2254	Sales, Marketing and Public Relations Professionals
5111	Contract, Program and Project Administrators
5122	Practice Managers
5211	Personal Assistants
5512	Bookkeepers
5522	Credit and Loans Officers
5991	Conveyancers and Legal Executives
5992	Court and Legal Clerks
5995	Inspectors and Regulatory Officials
5996	Insurance Investigators, Loss Adjusters and Risk Surveyors

Codes refer to ANZSCO first edition, used to code occupations of young adults in the LSAY. All remaining valid codes are considered non-managers.

Online Appendix References

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