

# TRADE AND MANAGEMENT

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*Abstract*—We study how management practices shape export performance using matched production-trade-management data for Chinese and American firms and a randomized control trial in India. Better-managed firms are more likely to export, sell more products to more destinations, and earn higher export revenues and profits. They export higher-quality products at higher prices and lower quality-adjusted prices. They import a wider range of inputs and inputs of higher quality and price, from more advanced countries. We rationalize these patterns with a heterogeneous-firm model in which effective management improves performance by raising production efficiency and quality capacity.

## I. Introduction

PRODUCTIVITY, management practices, and international trade activity vary dramatically across firms and countries (Bernard et al., 2007; Syverson, 2011). In the literature, higher measured total factor productivity (TFP) has been associated with export success and superior management with higher profits. However, measured TFP is subject to many potential biases and, even if perfectly measured, still constitutes a residual black box, while the mechanisms through which management operates remain largely unknown. From a policy perspective, improving firm capabilities is important for stimulating firm performance and aggregate growth, but this requires knowledge of the determinants of firm productivity. While it is widely believed that management strategies play a central role, especially in emerging economies trying to move up the quality ladder (Sutton, 2012), the scant evidence for this is primarily from case studies.

In this paper, we perform what we believe is the first large-scale analysis of the role of management practices for export performance and in the process shed light on these questions. We uncover novel empirical facts and interpret them through the lens of a heterogeneous-firm model that disciplines the estimation approach. We study the world's two largest export economies, China and the United States, and find consistent empirical patterns in both countries despite their very different income levels, institutional quality, and market frictions. In particular, we exploit unique new data on plant-level production, plant-level management practices, and transaction-level international trade activity for 485 Chinese firms from 1999 to 2008 and over 10,000 U.S. firms in 2010.

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We begin with motivating evidence from a randomized control trial (RCT) that offered management consulting to Indian firms. In a study of 31 plants over ten years initiated by Bloom et al. (2013), improving management practices exerted causal positive effects on TFP, qualitative measures of output quality, selection into exporting, and total export revenues. Motivated by these patterns, we introduce a stylized model of international trade that rationalizes the RCT results and delivers a rich set of additional predictions, which we can evaluate with the comprehensive data for China and the United States.

We first establish that better-managed firms have superior export performance along multiple dimensions. Companies with more effective management are systematically more likely to engage in exporting. Conditional on exporting, they sell more products to more destinations and earn higher export revenues and profits. Our findings hold conditional on domestic sales, suggesting that management is disproportionately more important for trade operations.

We then present a set of results that jointly inform the mechanisms through which management strategies affect firm performance. On the sales side, better-managed firms charge higher export prices within narrow destination-product markets. We estimate a model-consistent indicator of product quality, and show that better management is associated with higher output quality and lower quality-adjusted prices. On the production side, better-managed firms use more expensive, higher-quality imported inputs and more inputs from suppliers in developed economies. They also source a wider range of intermediate inputs from more countries of origin.

Finally, we explore the relative and differential returns to good management. Decomposing revenue-based TFPR, we show that the management component has large explanatory power across the full range of firm trade outcomes compared to the non-management TFPR residual. We then unbundle overall managerial competence into practices linked to the supervision of physical capital (“monitoring”) and human resources (“incentives”). Monitoring appears more important than incentive provision in the United States; the two sets of practices play comparable roles in China, with incentives being more consequential in some respects. We find little evidence that the returns to effective management vary across sectors or ownership types.

We propose that these empirical patterns are consistent with management competence being a key component of total factor productivity, whereby effective managerial practices increase both production efficiency and quality capacity. Superior management enables firms to use more sophisticated, higher-quality inputs and more complex assembly technologies that increase output quality. Better management also allows firms to process inputs and execute assembly

more cheaply. These efficiency and quality channels push marginal cost in opposite directions, such that the net effect of management competence on prices and quantities is ambiguous, but it unambiguously raises quality, sales, and profits. These predictions hold in model extensions with endogenous input choice, endogenous management practices, or non-management TFP components.

Our main empirical analysis exploits cross-sectional variation in management and trade activity across Chinese and American firms. We therefore do not distinguish between a causal effect of good management and an equilibrium relationship between joint outcomes of firms' profit maximization. Instead, we view our baseline findings as conditional correlations that inform the mechanisms through which management operates. In a step toward causality, we provide consistent panel evidence based on changes within U.S. firms over time, which is not fully immune to endogeneity concerns. We are able to convincingly establish causal effects for the subset of firm outcomes that are also observed in the India RCT.

Our findings address two open questions in two active literatures. A large theoretical and empirical literature in international trade emphasizes the role of firm productivity as a key determinant of export performance (Melitz, 2003; Bernard et al., 2003). More productive firms have been found to export more products to more destinations, thereby generating higher export revenues and profits. This body of work conceptualizes firm productivity as quantity-based TFPQ, or the ability to manufacture at low marginal cost, such that more productive firms are more successful exporters because they set lower prices. Recent analyses point to the importance of product quality as well, showing that more successful exporters use higher-quality manufactured inputs and more skilled workers to produce higher-quality output that sells at higher prices (Verhoogen, 2008; Kugler & Verhoogen, 2012; Khandelwal, 2010; Manova & Zhang, 2012; Bastos, Silva, & Verhoogen, 2018). Yet productivity is typically measured as TFPR, or a revenue-based residual from production function estimates. This exposes it to estimation bias and complicates the interpretation of trade-TFPR regression results (Akerberg, Caves, & Frazer, 2015; De Loecker, 2015). An important open question in this literature is what constitutes productivity, how it should be measured, and what explains its dispersion across firms. We unpack the black box of TFPR, and identify management practices as a concrete, tangible, and directly measured TFPQ component that circumvents estimation concerns. Moreover, this management component accounts for a large share of the variation in firms' trade performance and delivers clear policy lessons.

A separate and older literature has examined the relationship of firm management, productivity, and performance (Walker, 1887; Syverson, 2011). One likely route for this management-productivity link emphasized by the management literature is through lean manufacturing and improved quality (Drew, McCallum, & Roggenhofer, 2016; Sutton, 2007). Yet there is no systematic, direct evidence on the mech-

anisms through which management operates.<sup>1</sup> We demonstrate that effective management enhances firms' trade performance through both higher production efficiency and stronger quality capability.

This paper also adds to recent research on the impact of trade liberalization on the organization of production inside firms. Evidence indicates that trade reforms incentivize firms to change the number of management layers, adjust the number and wages of managers and workers along the occupational hierarchy, and upgrade management practices (Caliendo & Rossi-Hansberg, 2012; Chen & Steinwender, 2016; Chakraborty & Raveh, 2018). At the same time, improved access to imported inputs is important to the product quality, product scope, and export success of firms in developing countries, because of the limited domestic supply of high-quality specialized inputs and equipment (Goldberg et al., 2010; Fieler, Eslava, & Xu, 2018; Manova & Zhang, 2012). This matters since poor economies often rely on international trade for growth, and specifically on exporting to large, developed, profitable markets that maintain high quality standards. Our results suggest that poor managerial practices may impede trade, growth, and entrepreneurship in the world's poorest economies.

Finally, our findings speak to the literature on the implications of firm heterogeneity for aggregate productivity, welfare, and the gains from trade (Hsieh & Klenow, 2009; Arkolakis, Costinot, & Rodríguez-Clare, 2012; Melitz & Redding, 2013). Evidence indicates that reallocations across firms and across products within firms, as well as productivity upgrading within firms, contribute significantly to the aggregate adjustment to trade reforms and macroeconomic shocks (Pavcnik, 2002; Bustos, 2011). The role of management practices for firm heterogeneity is thus important for understanding trade's aggregate impact, while the associated firm heterogeneity in worker skill and product quality matters for its distributional effects (Helpman, Itskhoki, & Redding, 2010).

The paper is organized as follows. Section II provides RCT evidence for the causal effects of management in India. Section III develops a stylized model that rationalizes this evidence and delivers rich additional predictions. Section IV introduces the unique Chinese and U.S. data on firm management, production, and trade that allow us to evaluate all model predictions. Section V examines the relationship between firms' management strategy and export performance, while section VI analyzes the mechanisms through which management operates. The last section concludes.

## II. Motivating RCT Evidence

We first present motivating evidence that management practices can exert causal effects on firms' production

<sup>1</sup>The most popular management systems in manufacturing (Six-Sigma, Lean, Toyota Production) emphasize that improving productivity and quality is best achieved by reducing defects, and have spread to most sectors, such as lean retail, lean health care, and lean government (Myerson, 2014; Group, 2014; Teeuwen, 2010).

efficiency, quality capacity, and export activity. We exploit a randomized control trial performed by Bloom et al. (2013), who worked with the company Accenture to provide free management consulting services to large firms in the textile industry in Mumbai, India.<sup>2</sup> The study examined three sets of plants over the 2008–2011 period. Eleven plants owned by six firms served as a pure control group and twenty plants owned by eleven firms as the treatment group. In the treated group, fourteen plants were randomly selected to receive the management intervention. They had one month of diagnostic assessment of management practices in place and four months of consulting on 38 core practices across six key areas (factory operations, quality control, inventory control, loom planning, human resources, and sales and orders). The remaining six plants in the treated firms were given only the one-month diagnostic. Detailed monthly production data were collected for all three groups for a further three years. In 2017, Bloom et al. (2020) went back to assess the long-term impact of the intervention. They collected performance metrics for 2014 and 2017, including trade activity that we are the first to analyze.

Three lessons emerge from the India RCT. First, the consulting intervention had a large long-lasting effect on firms' management strategy. The management practice adoption rate in the treatment plants rose from 25.6% to 63.4% in the first year, slipped somewhat over the next eight years to 46%, but remained significantly above the initial level or the control firms.

Second, the management intervention led to a large causal improvement in firms' TFP and product quality. Figures 1a and 1b plot the change in TFP and product defect rates during the experiment against the change in management competence for both treatment and control plants. The intervention triggered a 37.8% rise in management effectiveness on average. This caused a 43% drop in quality defects and was one of the major drivers of the 17% increase in TFP.

Third, the management intervention significantly increased firms' export participation. In panel A of table 1, we explore the intention-to-treat effect with regressions of various export outcomes on a plant-level treatment dummy. Treatment plants were 18.9% more likely to export in the posttreatment period and had significantly higher export revenues conditional on exporting (up to 51.6% increase). We document similarly strong, positive impacts in panel B, where we use the treatment indicator as an instrument for the management score in a two-stage IV specification.

The key determinants of exports were management practices that guarantee quality control. International buyers offer higher prices than domestic consumers but impose higher quality standards that require formal quality control systems. While domestic consumers will accept (at a discount) fabric with slight imperfections—stains, inconsistent coloring,

holes, or bunching—international buyers will not, and defective shipments are returned.

This RCT evidence indicates that upgrading management strategies can improve firms' TFP, product quality, production efficiency, and export performance. This motivates the model in section III. While the India RCT supports causal interpretation, however, it covers a small set of establishments, tracks only basic export outcomes, and does not link efficiency and quality to export success. In sections IV to VI, we therefore exploit significantly richer data for China and the United States to establish a broad set of novel conditional correlations in line with the model's predictions and mechanisms.

### III. Conceptual Framework

We develop a partial-equilibrium, heterogeneous-firm trade model in which management competence enhances firms' trade performance by increasing production efficiency and quality capacity. This model rationalizes the RCT evidence for India and delivers a broad set of additional predictions that we can take to administrative data for China and the United States.

We treat management effectiveness as an exogenous firm draw that is conceptually equivalent to TFP. This formulation lends tractability and transparency, and is consistent with different microfoundations for the role of management, such as monitoring under principal-agent problems, span-of-control trade-offs in hierarchies, and career concerns (Holmstrom, 1982; Gibbons & Roberts, 2013). Since the baseline model shares many properties with Bernard, Redding, and Schott (2010), Kugler and Verhoogen (2012), and, most closely, Manova and Yu (2017), we summarize its key features here, and relegate details and proofs to online appendixes 1 and 2.

#### A. Economic Environment

A continuum of monopolistically competitive firms in country  $j \in J + 1$  can produce and export horizontally and vertically differentiated goods. Given CES utility

$$U_j = \left[ \int_{i \in \Omega_j} (q_{ji} x_{ji})^\alpha di \right]^{\frac{1}{\alpha}}$$

with elasticity of substitution  $\sigma \equiv 1/(1 - \alpha) > 1$ , demand for variety  $i$  in market  $j$  is  $x_{ji} = R_j P_j^{\sigma-1} q_{ji}^{\sigma-1} p_{ji}^{-\sigma}$ , where  $R_j$  is aggregate expenditure,

$$P_j = \left[ \int_{i \in \Omega_j} \left( \frac{p_{ji}}{q_{ji}} \right)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}}$$

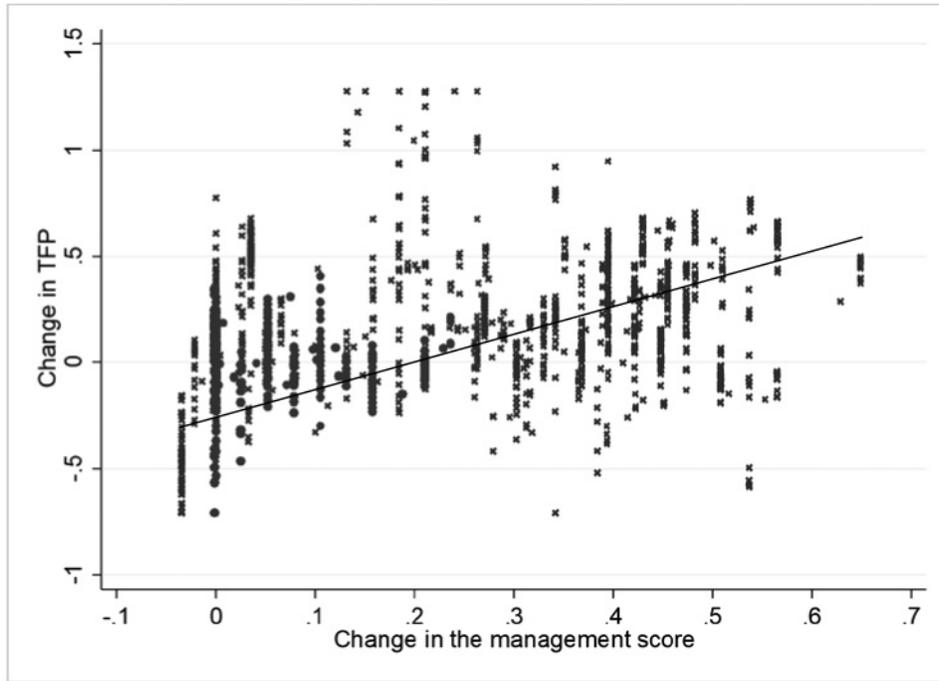
is a quality-adjusted ideal price index, and  $q_{ji}$ ,  $p_{ji}$ , and  $x_{ji}$  are the quality, price, and quantity of variety  $i \in \Omega_j$ . Product quality captures any objective attribute or subjective taste preference that increases consumer appeal at a given price. A sufficient statistic for unobserved quality  $\ln q_{ji}$  can thus be constructed from observed price and quantity data as  $\sigma \ln p_{ji} + \ln x_{ji}$  (Khandelwal, 2010).

Upon paying a sunk entry cost, firms draw firm-wide managerial ability  $\varphi \in (0, \infty)$  from distribution  $g(\varphi)$  and a vector of i.i.d. firm-product-specific expertise levels  $\lambda_i \in (0, \infty)$

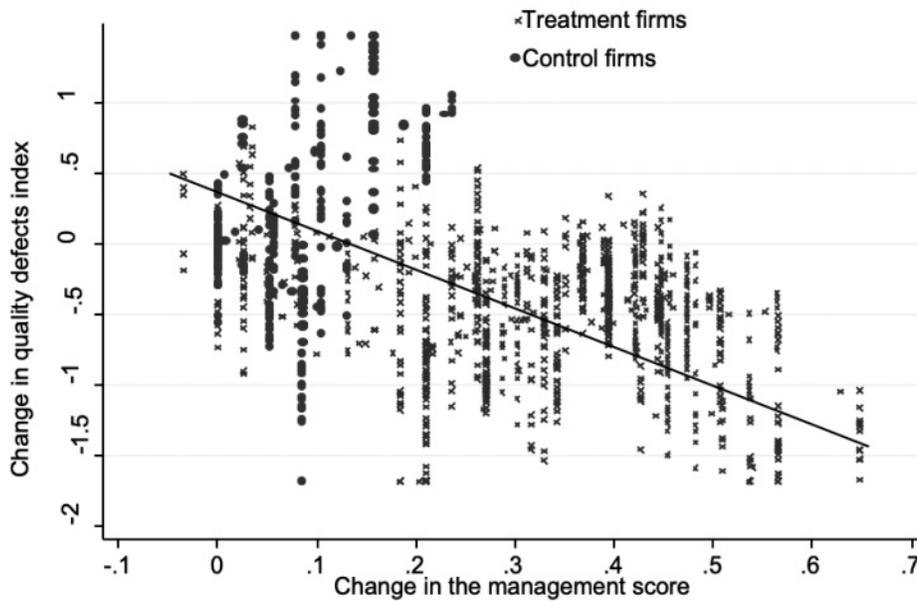
<sup>2</sup>McKenzie and Woodruff (2013) review the literature on the impact of management RCTs.

FIGURE 1.—MOTIVATING EVIDENCE: INDIA RCT, 2008 TO 2011

**A. Management and TFP**



**B. Management and quality defects index**



This figure displays how improvements in firms' management practices relate to improvements in productivity and quality control following a randomized control trial that provided management consulting to plants in the textile industry in India, 2008 to 2011. It plots the firm-by-week change in log TFP and in the log quality defects index against the change in the management score, both relative to their pre-experimental average.

from distribution  $z(\lambda)$ . As we show in online appendixes 3.1 and 3.2, the main model predictions hold if firms could endogenously choose their management practices or managerial strategy were one of multiple components of firm ability.<sup>3</sup>

<sup>3</sup>For example, entrepreneurs might draw exogenous talent  $\phi$ , adopt management practice  $m(\phi)$  at cost  $f_m$ , and face marginal costs and quality that depend on ability  $\varphi = \phi m(\phi) \lambda_i$ . If  $df_m/dm > 0$  and  $d^2 f_m/dm^2 > 0$ , then

Firms' management competence determines both their ability to assemble inputs into final goods (*production*

propositions 1 to 4 hold for both  $\varphi$  and  $m(\phi)$ . With multiple productivity components, firm ability  $\varphi = m \cdot \phi$  may depend on the entrepreneur's talent  $\phi$  and the manager's competence  $m$ . If entrepreneurs and managers do not match perfectly assortatively due to labor market frictions, then  $|\text{corr}(m, \phi)| \neq 1$ . While all firm outcomes would now be pinned down by  $\varphi$ ,  $m$  would have the same effects ceteris paribus.

TABLE 1.—MOTIVATING EVIDENCE: INDIA RCT, 2008–2017

Dep. Variable	Exporter Dummy (1)	Log (1+ Exports) (2)	Log Exports (3)
A. Intention to Treat (Reduced Form)			
Treatment	0.189* (1.78)	0.665** (2.84)	0.416** (3.77)
B. Management Impact (IV 2nd Stage)			
Management	0.899 (1.66)	3.16** (2.44)	1.95** (2.68)
1st Stage (Management on Treatment) F-test	35.5	35.5	20.5
Data frequency	Yearly	Yearly	Yearly
Years	2008,11,14,17	2008,11,14,17	2008,11,14,17
Firms	17	17	12
Plants	31	31	22
# Observations	109	109	66

This table examines the relationship between firms' management practices and trade activity following a randomized control trial that provided management consulting to plants in the textile industry in India, 2008–2017. Results are at the plant-year level, the pre-treatment period is 2008, and the posttreatment period is 2011, 2014, and 2017. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10% using the sample-size appropriate *t*-distribution tables.

efficiency) and their capacity to make high-quality goods (*quality capacity*). Producing one unit of physical output requires  $(\varphi\lambda_i)^{-\delta}$  units of labor with wage normalized to 1. Parameter  $\delta > 0$  governs the extent to which good management lowers unit input requirements. Intuitively, effective management can improve production efficiency by optimizing inventory control, synchronizing and monitoring production targets across manufacturing stages, reducing wastage, incentivizing workers, and so on.

At a marginal cost of  $(\varphi\lambda_i)^{\theta-\delta}$  workers, firms can produce one unit of quality  $q_i(\varphi, \lambda_i) = (\varphi\lambda_i)^\theta$ ,  $\theta > 0$ . This captures the idea that manufacturing goods of higher quality is associated with higher marginal costs because it requires higher-quality inputs and more complex assembly processes (Baldwin & Harrigan, 2011). For example, making a high-quality dress using skilled labor, silk, and pearl buttons is more expensive than making a low-quality dress using unskilled labor, cotton, and plastic buttons. Similarly, a 50-part printer is easier to build than a 150-part model that can print, scan, and fax. Online appendix 3.3 formalizes these microfoundations: Production complementarity between firm ability and input quality induces more capable firms to use higher-quality inputs and produce higher-quality outputs (Kugler & Verhoogen, 2012). Parameter  $\theta$  reflects the degree to which superior management enhances firms' capacity to produce higher quality. Intuitively, effective management can tighten quality control, ensure the compatibility of specialized inputs, facilitate complex assembly, and minimize costly mistakes.

**B. Firm Behavior**

Firms maximize profits from their global operations by making optimal entry and sales decisions separately for each country-product market.<sup>4</sup> Producers charge a constant markup  $\frac{1}{\alpha}$  over marginal cost, and have the following price,

<sup>4</sup>See Eckel et al. (2015) for an alternative framework with cannibalization effects across products within firms, in which propositions 1 to 4 would still hold.

quantity, quality, quality-adjusted price, revenues, and profits for product *i* in market *j*:

$$\begin{aligned}
 p_{ji}(\varphi, \lambda_i) &= \frac{\tau_j (\varphi\lambda_i)^{\theta-\delta}}{\alpha}, \\
 x_{ji}(\varphi, \lambda_i) &= R_j P_j^{\sigma-1} \left(\frac{\alpha}{\tau_j}\right)^\sigma (\varphi\lambda_i)^{\delta\sigma-\theta}, \\
 q_i(\varphi, \lambda_i) &= (\varphi\lambda_i)^\theta, \\
 p_{ji}(\varphi, \lambda_i) / q_i(\varphi, \lambda_i) &= \frac{\tau_j (\varphi\lambda_i)^{-\delta}}{\alpha}, \\
 r_{ji}(\varphi, \lambda_i) &= R_j \left(\frac{P_j \alpha}{\tau_j}\right)^{\sigma-1} (\varphi\lambda_i)^{\delta(\sigma-1)}, \\
 \pi_{ji}(\varphi, \lambda_i) &= \frac{r_{ji}(\varphi, \lambda_i)}{\sigma} - f_{pj}, \tag{1}
 \end{aligned}$$

where  $\tau_j$  are iceberg costs and  $f_{pj}$  are destination-product fixed costs. Note that the empirical analysis examines free-on-board export prices and revenues, that is,  $p_{ji}^{fob}(\varphi, \lambda_i) = \frac{(\varphi\lambda_i)^{\theta-\delta}}{\alpha}$  and  $r_{ji}^{fob}(\varphi, \lambda_i) = R_j (P_j \alpha)^{\sigma-1} (\varphi\lambda_i)^{\delta(\sigma-1)}$ .

Management competence exerts two opposing effects on firms' marginal costs and prices through the production efficiency and quality capacity channels. Their net effect is theoretically ambiguous and depends on the magnitudes of  $\theta$  and  $\delta$ . If  $\theta = 0$  and  $\delta > 0$ , effective management improves firm efficiency, but there is no scope for quality differentiation. Better-managed firms then have lower marginal costs, set lower prices, sell higher quantities, and earn higher revenues and profits. Conversely, if  $\theta > 0$  and  $\delta = 0$ , management competence improves product quality, but the efficiency mechanism is moot. Now all firms share the same quality-adjusted prices, revenues, and profits, but better-managed companies charge higher prices, offer higher quality, and sell lower quantities.

When  $\theta > 0$  and  $\delta > 0$ , both management mechanisms are active. In this case, superior management is associated with

higher product quality, lower quality-adjusted prices, higher revenues, and higher profits. However, the implications for price and quantity remain ambiguous. If  $\theta > \delta$ , as management competence grows, product quality rises sufficiently quickly with the cost of sophisticated inputs and assembly to overturn the effects of improved efficiency. As a result, effective management corresponds to higher output prices. If  $\theta < \delta$  by contrast, good management practices translate into lower prices. In the knife-edge case of  $\theta = \delta$ , production efficiency and product quality are equally elastic in management capacity, and prices are invariant across the firm management distribution. Finally, better-managed firms sell higher quantities if and only if  $\sigma\delta > \theta$ .

In sum, well-run companies perform better along multiple dimensions. Since profits rise with managerial competence  $\varphi$  and there are economies of scale (i.e., headquarter-, product-, and market-specific fixed costs), there is a zero-profit expertise level  $\lambda_j^*(\varphi)$  below which firm  $\varphi$  will not sell product  $i$  in country  $j$ , where  $d\lambda_j^*(\varphi)/d\varphi < 0$ . In addition, only firms with management ability above a zero-profit cut-off  $\varphi_j^*$  will serve destination  $j$ , where  $\varphi_j^*$  depends on  $j$ 's market size and trade costs. On the extensive margin, better-managed firms thus optimally manufacture more products, select into exporting, serve more export destinations, and sell more products to each destination. On the intensive margin, they earn higher revenues and profits overall, as well as in each market.

### C. Empirical Predictions

**Proposition 1.** *Better-managed firms are more likely to export.*

**Proposition 2.** *Better-managed firms export more products to more destination markets and earn higher export revenues and profits.*

**Proposition 3.** *Better-managed firms offer higher-quality products if  $\theta > 0$  and the quality channel is active, but quality is invariant across firms if  $\theta = 0$ . Better-managed firms set lower quality-adjusted prices if  $\delta > 0$  and the efficiency channel is active, but quality-adjusted prices are invariant across firms if  $\delta = 0$ . Better-managed firms charge higher prices if  $\theta > \delta$  and lower prices if  $\delta > \theta$ , but prices are invariant across firms if  $\theta = \delta$ .*

**Proposition 4.** *Better-managed firms use more expensive inputs of higher quality and/or more expensive assembly of higher complexity if  $\theta > 0$  and the quality channel is active, but input quality and assembly complexity are invariant across firms if  $\theta = 0$ .*

## IV. Data

Our analysis makes use of unique, matched establishment- or firm-level data for the world's two largest exporters, China and the United States, on production, international trade, and management practices. We exploit six proprietary microdata

sources, three for each country, to assemble a data set that is unprecedented in its coverage and detail. This section describes how management practices are evaluated, introduces the data, and summarizes key features of firm activity.

### A. Measuring Management Practices

Systematic data on firms' management practices have only recently become available. Since 2004, the World Management Survey (WMS) has developed standardized measures of management competence for over 20,000 manufacturing firms in 34 countries. WMS considers multiple aspects of firm management, and evaluates the relative effectiveness of different practices within each aspect. It is conducted via double-blind phone interviews with plant managers, and covers representative firm samples with 100 to 5,000 employees in a large number of countries (Bloom & Van Reenen, 2007). Endorsements by respected institutions and highly trained interviewers (e.g., MBAs) ensure high response rates (e.g., 45% in China). The Management and Organizational Practices Survey (MOPS) is modeled after WMS. It was introduced as a mandatory part of the U.S. Census Annual Survey of Manufacturing (ASM) in 2010, the first and only census management data of its kind.

WMS (MOPS) includes eighteen (sixteen) questions about the management of physical capital (*monitoring* and *targets*) and human resources (*incentives*) inside a firm, examples of which appear in appendix figure 1. A first set of questions pertains to the *monitoring* of progress toward production targets via the frequent collection, analysis, and dissemination of performance metrics. A second set of questions characterizes the design, integration, and realism of production *targets*. These questions assess to what extent targets are consistently set across production stages and tightly connected to performance, in both the short and long run, for managers and non-managers. A final set of questions captures the use of *incentives* mechanisms to identify, promote, and reward high performers with bonuses while sanctioning underperformers.

Each management question is scored on a scale of 1 to 5 in WMS and 0 to 1 in MOPS, where higher values indicate more structured management with greater monitoring, more aggressive targets, and stronger performance incentives. For each country, we first standardize the responses to each question to be mean 0 with standard deviation 1 across firms. We then average across questions to obtain a comprehensive management score for each firm. Finally, we standardize these management scores to be mean 0 with standard deviation 1 across firms in each country.

Appendix figure 2 illustrates the vast dispersion in average management practices across countries in WMS. The United States comes out on top, followed closely by Japan, Germany, Sweden, Canada, and the United Kingdom. In the middle of the country distribution, Chinese firms are on average significantly less well managed than North American and European companies, but score better than firms in Latin

America, Africa, and other emerging giants such as Brazil and India.

WMS and MOPS are based on the lean manufacturing and modern human resource practices used by leading management consultants, to focus on core management practices that should benefit firm performance regardless of the industry or economic environment. Our analysis will account for the possibility that the relevance of specific management practices might vary across industries with industry fixed effects. To the extent that the management surveys are biased toward successful production practices in the West, measurement error would introduce downward bias and work against us finding consistent patterns for both China and the United States.

### B. United States

We employ three comprehensive data sets on the activities of U.S. firms. First, MOPS documents the management practices of about 32,000 manufacturing establishments in 2010 and 2005 (as recall). The sample captures 5.6 million employees, or over half of U.S. manufacturing employment. Appendix figure 3A plots the distribution of the management score across plants. MOPS also includes variables that we use as noise controls, namely, an indicator for filing census forms online, the tenure and seniority of the respondent, and the discrepancy between employment data in MOPS and ASM.

Second, we obtain standard accounting data on U.S. establishments from ASM, available for 1973 to 2012.<sup>5</sup> ASM records the total output, value added, profits, and production inputs (e.g., employment, capital expenditure, energy use, materials purchases) for about 45,000 plants that correspond to over 10,000 firms. We also observe firms' age, location (out of fifty states), and primary industry of activity in the U.S. NAICS six-digit classification.

Third, we use the U.S. Longitudinal Federal Trade Transaction Database (LFTTD), which contains detailed information about the universe of U.S. international trade transactions from 1992 to 2012, at over 100 million transactions a year. LFTTD reports the value, quantity, unit (e.g., dozens, kilograms) and organization (intrafirm versus arm's length) of all firm-level exports (free on board) and all firm-level imports (cost, insurance, and freight included) by country and product for around 7,000 different products in the ten-digit Harmonized System and around 5,000 product categories at the HS eight-digit level. We proxy prices with transaction-level unit values, and define products by both their HS code and unit to ensure comparability. Given the lumpiness and seasonality of international trade, we work at the annual frequency.

<sup>5</sup>MOPS was part of the 2009–2013 ASM panel in 2010, so all MOPS establishments were surveyed annually from 2009 to 2013. In prior years, establishments were surveyed in the Economic Census in years ending in 2 or 7 and if they were part of that year's ASM panel. Since ASM oversamples larger establishments, it tends to include a large share of export activity.

We link ASM, LFTTD, and MOPS using firms' common tax identifier.<sup>6</sup> We perform our baseline analysis for the cross-section of about 32,000 U.S. establishments in 2010 with contemporaneous production, trade, and management data. Firms in this matched sample are on average bigger and better performing than firms without management data, but appear representative in that the relationship between standard productivity, size, and performance metrics is the same in both subsamples.

### C. China

We also exploit three comprehensive firm data sets for China. First, WMS reports the management practices of 507 Chinese firms in 2006 to 2007. Appendix figure 3B plots the distribution of the management score across firms. We use WMS data on firms' primary industry (out of 82 SIC three-digit industries) and a set of survey noise controls (interview duration, day of week, and time of day; interviewer ID; interviewee gender, reliability, and competence as perceived by the interviewer).

Second, we access firm-level production data for 1999 to 2007 from China's Annual Survey of Industrial Enterprises (ASIE). ASIE is collected by the National Bureau of Statistics, and provides standard accounting information for all state-owned firms and all private firms with sales above 5 million Chinese yuan, for over 200,000 firms a year. In addition to output, profits, value added, and production inputs, we also observe firms' age, ownership structure (private domestic, state owned, foreign owned), location (out of 31 provinces), and primary industry of activity.

Third, we utilize comprehensive data on the universe of Chinese firms' cross-border transactions from 2000 to 2008 from the Chinese Customs Trade Statistics (CCTS), spanning over 100 million transactions a year. CCTS is collected by the Chinese Customs Office, and reports the value and quantity of firm exports (free on board) and imports (cost, insurance, and freight included) in U.S. dollars by product and trade partner for 243 destination/source countries and about 7,500 products in the eight-digit Harmonized System.<sup>7</sup> While CCTS does not distinguish between arm's-length and intra-firm flows, it indicates the trade regime of each transaction (ordinary or processing trade).

Of the 507 Chinese firms in WMS, we are able to match 485 to ASIE using a common firm identifier. We obtain the complete ASIE record for these 485 firms from 1999 to 2007, which produces an unbalanced panel of 3,233 firm-year observations.

<sup>6</sup>We sum ASM production variables across establishments within multi-establishment firms. We take the employment-weighted average MOPS management score across plants within a firm; all results hold for the simple average. We use the age, location, and industry of the firm headquarters.

<sup>7</sup>While the HS six-digit classification is consistent across countries, finer levels of disaggregation are not. Our baseline results at the HS-8 level hold at the HS-6 level, as well as at the most disaggregated HS-10 level (available for the United States).

TABLE 2.—SUMMARY STATISTICS

A. Characteristics of Exporters and Non-exporters				
	China		United States	
	Exporters	Non-exporters	Exporters	Non-exporters
# Observations	1,875	1,358	14,000	18,000
Management	0.06	-0.09	0.12	-0.26
Log Gross Output	11.72	11.55	10.60	9.55
Log Employment	6.46	6.15	4.76	3.96
TFPR	4.86	4.77	4.30	4.07
Log Value Added / L	3.73	3.95	5.04	4.78

B. Firms' Management, Export, and Import Activity				
	China		United States	
	Mean	SD	Mean	SD
Management	0	1	0	1
# Export Observations	2,236		13,000	
Log Exports	14.80	2.31	13.79	2.77
# Export Products	8.65	11.58	18.94	47.50
# Export Destinations	12.85	14.99	12.95	16.72
# Import Observations	2,048		10,000	
Log Imports	13.87	2.97	13.93	2.96
# Import Products	33.45	51.43	19.67	43.09
# Import Origins	6.30	5.67	6.20	8.02

This table provides summary statistics. China: All firms in the matched WMS-ASIE sample for 1999–2007 (panel A) and all exporters in the matched WMS-CCTS sample for 2000–2008 (panel B). United States: All plants in the matched MOPS-ASM sample for 2010 (panel A) and all exporting firms in the matched MOPS-LFTTD sample for 2010 (panel B).

Since CCTS maintains an independent system of firm registration codes, it cannot be mapped directly into ASIE or WMS. We follow standard practice in the literature and match CCTS to ASIE using an algorithm based on firms' name, address, and phone number. Using ASIE as a bridge, we match 296 companies from WMS to CCTS. We then match 58 of the remaining unmatched firms in WMS directly to CCTS by postal code and name. We ensure match quality by manually researching company web pages and reports. We thus locate detailed CCTS trade data for 354 of the 507 WMS companies, for a match rate of 70%. Of these 354 firms, 11% only export, 17% only import, and 72% both export and import according to CCTS. This is consistent with the fact that about 60% of the matched WMS-ASIE firms report positive exports on their accounts, while more firms may appear in the comprehensive CCTS records.

#### D. Summary Statistics

Table 2 summarizes the substantial variation in management practices, production, and trade activity across firms in China and the United States. Starting with the United States, 45% of the 32,000 establishments in our 2010 matched sample export. The typical exporter sells 19 different HS-8 digit products to thirteen destinations and, conditional on importing inputs, buys 20 distinct products from six countries, with large dispersion around these means.<sup>8</sup> These numbers are generally similar for the sample of 485 firms in our baseline

2000 to 2008 panel for China, where 58% of all firms export. On average, Chinese exporters ship 9 HS-8 digit products to 13 markets and, conditional on importing inputs, sources 33 different products from six origins.

Table 2 corroborates stylized facts in the literature that exporters are on average larger and more productive than non-exporters. We document that exporters are on average also better managed: the unconditional export management premium equals 15% of a standard deviation in China and 38% of a standard deviation in the United States. In comparison, the export size premiums in China and the United States stand at 19% and 186%, respectively, based on firm output and 36% and 123% based on employment.<sup>9</sup>

#### V. Management and Export Performance

In this section, we first examine the relationship between firms' management practices and export performance. This exercise constitutes a direct test of propositions 1 and 2. To inform the efficiency and quality mechanisms through which management operates, in section VI we then confront propositions 3 and 4 with data.

We perform the entire analysis separately for China and the United States. Given the vast difference in income, institutional quality, and factor market frictions between the two countries, this allows us to assess whether management plays

at which such data are collected in ASM and LFTTD, respectively. The ASM statistics look similar at the firm level.

<sup>9</sup>Average firm size is bigger for China than the United States because WMS covers a randomized sample of Chinese firms above a size threshold, while MOPS has comprehensive coverage of U.S. firms.

<sup>8</sup>For the United States, we report summary statistics for production at the establishment level and trade activity at the firm level, since this is the level

a fundamental role in firm activities, and if so, whether its function depends on the specific economic environment. To the extent that the management surveys are biased toward successful production practices in the West, measurement error would introduce downward bias and work against us finding consistent patterns for both China and the United States.

### A. Empirical Strategy

We evaluate the empirical validity of propositions 1 and 2 with the following estimating equation for the link between firms' management competence and export performance:

$$\text{ExportOutcome}_f = \beta \text{Management}_f + \Gamma Z_f + \phi_l + \phi_i + \varepsilon_f. \quad (2)$$

We consider multiple dimensions of export activity as guided by theory. In different specifications,  $\text{ExportOutcome}_f$  refers to firm  $f$ 's export status, log global export revenues, and various extensive and intensive margins of exporting. We measure  $f$ 's managerial competence  $\text{Management}_f$  with the comprehensive management  $z$ -score.

We account for any systematic variation in supply and demand conditions across firms in the same location  $l$  or industry  $i$  with fixed effects,  $\phi_l$  and  $\phi_i$ . These capture differences in, for example, factor costs, factor intensities, infrastructure, institutional frictions, and tax treatment that might have an impact on export performance. In the case of China, we add dummies for 31 provinces and 82 SIC three-digit sectors. In the case of the United States, we use indicators for fifty states and about 300 NAICS six-digit industries.

We further condition on a vector of firm characteristics  $Z_f$ . We always include the full set of survey noise controls to alleviate potential measurement error in  $\text{Management}_f$ . We subsume the role of Chinese firms' ownership type with fixed effects for private domestic, state-owned, and foreign-owned companies; such data are not available for the United States. We also report results with an extended set of firm controls  $Z_f$  such as age, capital, and skill intensity.

The coefficient of interest  $\beta$  reflects the sign of the conditional correlation between firms' management competence and export performance. Given the fixed-effects structure, it is identified from the variation across companies within narrow segments of the economy. This correlation can be interpreted in two ways through the lens of our model. On the one hand, management excellence may be an exogenous productivity draw or one component of it as in our baseline model, such as managers' exogenous ability or style (Bertrand & Schoar, 2003). In this case,  $\beta$  would capture the causal impact of management on export success. On the other hand, a primitive firm attribute may determine both the choice of management technology and trade activity, for example, if exogenously different entrepreneurs endogenously hire managers of different skill levels. Estimates of  $\beta$  would then reflect the equilibrium relationship between a production input and output

that are joint outcomes of the firm's maximization problem. These two alternatives are isomorphic for our purposes, and we do not seek to distinguish between them.<sup>10</sup>

MOPS spans over 10,000 U.S. firms in 2010, and we estimate equation (2) in this cross-section. By contrast, WMS covers about 500 Chinese firms in 2007. In order to fully exploit the Chinese panel customs and production data, we estimate specification (2) at the firm-year level, controlling for macroeconomic conditions with year fixed effects  $\phi_t$ . This is motivated by the evidence in Bloom et al. (2019) and patterns in our own MOPS data that management practices evolve slowly within firms over time. We cluster standard errors by firm since  $\text{Management}_f$  is measured at the firm level.

### B. Export Status, Revenues, and Profits

We first establish in table 3 that better-managed firms are significantly more likely to export and earn higher export revenues conditional on exporting. In columns 1 and 5, we examine firms' export status by setting the dependent variable  $\text{ExportOutcome}_f$  to 1 if a firm reports any exports and 0 otherwise. We estimate equation (2) in the matched ASIE-WMS sample for China and the matched ASM-MOPS sample for the United States.<sup>11</sup> Firms with more effective management practices are systematically more likely to enter foreign markets.<sup>12</sup> In columns 3 and 7, we then re-estimate specification (2) using the log value of global exports as the outcome variable  $\text{ExportOutcome}_f$  in the matched CCTS-WMS sample of Chinese exporters and the matched LFTTD-MOPS sample of U.S. exporters.<sup>13</sup> Well-run exporters realize substantially higher sales abroad.

The strong association between management competence and export activity persists when we add an extended set of firm characteristics  $Z_f$  in columns 2, 4, 6, and 8. We control for firm age using information on the year of establishment from ASIE and ASM. We find some evidence that older U.S. manufacturers export more. We further condition on firms' production technology as reflected in their capital intensity (log net fixed assets per worker) and skill intensity (share of workers with a college degree; log average wage). The results corroborate prior evidence in the literature that more skill- and capital-intensive firms are more active exporters, although the point estimates are not always precisely estimated. To guard against omitted variable bias, we always

<sup>10</sup>Reverse causality does not pose classical estimation bias: If higher export demand or learning from foreign partners induces firms to upgrade management, this would be consistent with our argument (Atkin, Khandelwal, & Osman, 2017).

<sup>11</sup>For the United States, we observe export status at the plant level from ASM and all other trade outcomes at the firm level from LFTTD. We run the baseline regressions for export status at the plant level, and note that corresponding coefficient magnitudes are 30% to 50% higher at the firm level.

<sup>12</sup>We report OLS results, but similar patterns hold with other estimators such as probit or logit.

<sup>13</sup>We measure firms' global exports based on the customs records that cover the universe of trade transactions. Similar results hold for total exports as reported in production surveys.

TABLE 3.—EXPORT STATUS AND EXPORT REVENUES

Dep. Variable	China				United States			
	Exporter Dummy		Log Exports		Exporter Dummy		Log Exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management	0.040** (2.30)	0.048*** (2.75)	0.260** (2.14)	0.232* (1.81)	0.042*** (13.92)	0.031*** (10.13)	0.488*** (21.72)	0.373*** (16.79)
Capital Intensity		-0.010 (-0.76)		0.145 (1.43)		-0.020*** (-6.04)		0.193*** (7.35)
Wage		0.041* (1.82)		0.401** (2.17)		0.106*** (9.82)		0.904*** (11.84)
Age		0.030 (1.53)		0.153 (1.01)		0.044*** (11.47)		0.411*** (13.29)
Fixed Effects	Province, SIC-3 Industry, Ownership, Year				State, NAICS-6 Industry			
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.41	0.43	0.40	0.43	0.26	0.27	0.33	0.37
# observations	3,233	3,123	2,236	1,935	32,000	32,000	13,000	13,000

This table examines the relationship between firms' management practices, probability of exporting, and global export revenues. Columns 1–2 and 5–6: The sample includes all Chinese firms and U.S. establishments in the matched sample with balance sheet and management data, and the dependent variable is a binary indicator equal to 1 for exporters. Columns 3–4 and 7–8: The sample includes all exporters in the matched sample with trade and management data, and the dependent variable is log total exports. All columns control for the share of workers with a college degree and management survey noise controls. All regressions for China include fixed effects for firm province, main SIC-3 industry, year, and ownership type. All regressions for the United States include fixed effects for firm state and main NAICS-6 industry. Standard errors clustered by firm (China) and robust (United States). U.S. sample sizes rounded for disclosure reasons. *T*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

include this broader vector of controls  $Z_f$  in the rest of the analysis.

Our findings point to potentially large economic consequences from improving management practices. Based on the estimates with the extended set of controls, a 1 SD rise in the management *z*-score is associated with 5% higher probability of exporting and 23% higher export revenues in China; these numbers are 3% and 37% for the United States. Given the large management gaps across countries in appendix figure 2, this implies that variations in management competence could account for substantial differences in trade intensity across countries. These magnitudes are also sizable relative to the role of firm age, skill-, and capital intensity (comparable statistics for these are in the range of 2% to 28%).

In appendix table 1, we corroborate the baseline findings for the United States with more stringent specifications that exploit available panel data.<sup>14</sup> We first find similar results when we regress export outcomes in year 2011 on firms' management score in 2010. We then regress the change in trade activity from 2005 to 2010 on the concurrent change in firms' management competence. Within-firm upgrading of management practices is associated with significant improvements in export performance, controlling for state and industry fixed effects that now absorb divergent time trends. Point estimates are typically an order of magnitude smaller, consistent with management exerting greater effects on performance levels than growth rates.

In addition to export status and revenues, proposition 2 also has implications for firms' export profits. While ASIE and ASM report firms' consolidated global profits, in appendix table 2 we exploit the available information as best we can to provide indicative evidence of a positive link be-

tween effective management and export profits. We confirm that superior managerial practices are associated with higher total profits. Moreover, this holds even conditioning on domestic sales, calculated as the difference between total turnover and total exports.

### C. Extensive and Intensive Export Margins

As a first step to understanding the mechanisms through which management contributes to export success, we decompose exporters' trade activity into the number of foreign markets they enter and the sales they make in each market. We find that better-managed firms have the capacity both to serve more export markets and to sell more in individual markets.

We measure the extensive margin of firm exports with the log number of destinations they supply, the log number of products they ship to at least one country, and the log number of destination-product markets they penetrate. We quantify the intensive margin with average log exports per destination-product. We define products at the granular HS eight-digit level. We re-estimate equation (2) using each export margin in place of  $ExportOutcome_f$ , and report our findings in table 4. Appendix table 3 contains symmetric regressions without the wider set of firm controls  $Z_f$ .

We consistently observe positive significant coefficients on  $Management_f$  across all specifications (except for the intensive margin in China). For Chinese firms, a 1 SD improvement in managerial competence is associated with 19% more export destinations, 17% more export products, 22% more destination-product markets, and 2% higher exports in the average market (columns 1–4). For American companies, these magnitudes stand respectively at 13%, 17%, 20%, and 18% (columns 6–9). Overall, the extensive margin of market entry accounts for just over half of the contribution of management to firm exports in the United States and about 90% in China.

<sup>14</sup>In 2010 (2015), MOPS asked U.S. firms about their management practices in both 2005 and 2010 (2010 and 2015). The contemporaneous and recall data for 2010 line up well.

TABLE 4.—EXTENSIVE AND INTENSIVE MARGINS OF EXPORTS

Dep. Variable	China					United States				
	Log # Dest (1)	Log # Prod (2)	Log # Dest-Prod (3)	Log Avg Exports per Dest-Prod (4)	Log Exports Top Dest-Prod (5)	Log # Dest (6)	Log # Prod (7)	Log # Dest-Prod (8)	Log Avg Exports per Dest-Prod (9)	Log Exports Top Dest-Prod (10)
Management	0.185*** (2.80)	0.166*** (3.33)	0.215*** (2.89)	0.017 (0.20)	0.196* (1.74)	0.134*** (13.08)	0.165*** (15.32)	0.195*** (15.13)	0.177*** (12.75)	0.320*** (16.05)
Fixed Effects	Province, SIC-3 Industry, Ownership, Year					State, NAICS-6 Industry				
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.44	0.42	0.40	0.45	0.43	0.37	0.33	0.37	0.32	0.36
# observations	1,935	1,935	1,935	1,935	1,935	13,000	13,000	13,000	13,000	13,000

This table examines the relationship between firms' management practices and the extensive and intensive margins of their exports. The dependent variable is firms' log number of export destinations in columns 1 and 6, log number of HS eight-digit export products in columns 2 and 7, log number of destination-product pairs in columns 3 and 8, log average exports per destination-product in columns 4 and 9, and log exports in a firm's highest-revenue destination-product in columns 5 and 10. All columns include a full set of fixed effects and firm and noise controls as described in table 3. Standard errors clustered by firm (China) and robust (United States). U.S. sample sizes rounded for disclosure reasons. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

These results are in line with the theoretical predictions for the margins of firms' export activity summarized in proposition 2. As a check on internal consistency, we consider the variation in export sales across a firm's destination-product markets. In the model, exporters add foreign markets in decreasing order of profitability. As a result, better-managed firms serve more markets by entering progressively smaller markets where they earn lower sales. Further analysis supports this composition effect. For each firm, we identify its largest destination-product market by sales revenues and regress log exports to this top market on *Management<sub>f</sub>*. We obtain much larger coefficients than those for the intensive margin that are significant for both China and the United States (columns 5 and 10). As we replace the outcome variable with log average sales to the top two, top three, and so on export markets, we record progressively lower point estimates as anticipated.

D. Exports versus Domestic Activity

In theory, effective management improves firm performance both at home and abroad, such that better-managed firms have higher domestic sales, higher probability of exporting, and higher export revenues. The elasticities of these three outcomes with respect to management differ, and generally depend on modeling assumptions about demand. In our CES setup, strong management increases firm revenues proportionately in all markets served, but it also induces entry into more markets. As a result, total exports rise faster with management competence than domestic sales.

Appendix table 4 corroborates these predictions in the data. Better-managed firms do sell more at home, with domestic sales twice as elastic as exports with respect to management in China and about on par in the United States. When we then control for log domestic sales in the regressions for firms' export status, global export revenues, and various export margins, we continue to record positive significant coefficients on *Management<sub>f</sub>* (except for the intensive margin in China as before).

VI. Management Mechanisms

Having established that advanced managerial practices are associated with superior export performance, we next examine the mechanisms through which management operates. We first provide evidence for the production efficiency and quality capacity channels. We then consider the relationship between management competence and TFP. We conclude by exploring whether the returns to management vary across management dimensions and segments of the economy.

A. Efficiency and Quality

To assess if effective management improves firms' production efficiency, quality capacity, or both, we evaluate the empirical validity of propositions 3 and 4. We establish robust patterns consistent with management acting through both the efficiency and quality channels.

*Structural estimates.* We first analyze the link between firms' management practices, product quality, and quality-adjusted prices according to proposition 3. We exploit the rich dimensionality of the data, and examine firms' behavior in finely disaggregated export markets. This allows us to study the role of management while accounting for supply and demand conditions with an extensive set of fixed effects:

$$\ln(Quality_{fdp}) = \beta^q Management_f + \Gamma^q Z_f + \phi_l^q + \phi_{dp}^q + \epsilon_{fdp}^q, \tag{3}$$

$$\ln(Price_{fdp}/Quality_{fdp}) = \beta^{p/q} Management_f + \Gamma^{p/q} Z_f + \phi_l^{p/q} + \phi_{dp}^{p/q} + \epsilon_{fdp}^{p/q}. \tag{4}$$

Through the lens of the model, coefficient  $\beta^q$  identifies structural parameter  $\theta$ , which governs the effect of management on product quality. Similarly, coefficient  $\beta^{p/q}$  identifies structural parameter  $\delta$ , which captures the effect of management on productive efficiency. From proposition 3,  $\beta^q > 0$

TABLE 5.—PRODUCTION EFFICIENCY AND PRODUCT QUALITY

Dep. Variable Structural Parameter	China				United States			
	Log Export Quality $\theta^{CH}$ (1)	Log Qual-Adj Export Price $-\delta^{CH}$ (2)	Log Export Price $\theta^{CH} - \delta^{CH}$ (3)	Log Export Quantity (4)	Log Export Quality $\theta^{US}$ (5)	Log Qual-Adj Export Price $-\delta^{US}$ (6)	Log Export Price $\theta^{US} - \delta^{US}$ (7)	Log Export Quantity (8)
Management	0.531* (1.95)	-0.385* (-1.82)	0.146** (2.16)	-0.200 (-1.49)	0.048*** (2.60)	-0.045*** (-2.91)	0.003 (0.68)	0.034*** (2.83)
Fixed Effects	Province, Dest-Product, Ownership, Year				State, Dest-Product			
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.90	0.89	0.92	0.79	0.96	0.95	0.97	0.83
# observations	58,101	58,101	58,101	58,101	290,000	290,000	290,000	290,000

This table examines the relationship between firms' management practices and the price, quality, quality-adjusted price, and quantity of their exports. The dependent variable is log export product quality in columns 1 and 5, quality-adjusted log export unit value in columns 2 and 6, log export unit value in columns 3 and 7, and log export quantity in columns 4 and 8, by firm-destination-product. All regressions for China include fixed effects for firm province, destination-product pair, year, and ownership type. All regressions for the United States include fixed effects for firm state and destination-product pair. All columns also include a full set of firm and noise controls as described in table 3. Standard errors clustered by firm. U.S. sample sizes rounded for disclosure reasons. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

and  $\beta^{p/q} < 0$  if and only if management operates through the quality and the efficiency channel, respectively. Note this interpretation is conservative given the potential for variable markups.<sup>15</sup>

The unit of observation is now the firm-destination-HS8 product(-year).  $Price_{fdp}$  is the export unit value that firm  $f$  charges for product  $p$  in destination  $d$  (in year  $t$ ). We use free-on-board export prices that exclude duties, transportation costs, and retailers' markup, such that  $Price_{fdp}$  corresponds to the sum of  $f$ 's marginal cost and markup. We construct model-consistent proxies for firms' export product quality and quality-adjusted price from their export prices and quantities by product, destination, (and year). Since  $\ln q_{ji} \propto \sigma \ln p_{ji}^{fob} + \ln x_{ji}$ , log quality  $\ln q_{ji}$  can be inferred as the sum of log quantity  $x_{ji}$  and log free-on-board price  $p_{ji}^{fob}$ , adjusted for the elasticity of substitution across varieties  $\sigma$ . We set  $\sigma = 5$  (the median in the literature), but our results are robust to alternative values (Khandelwal, Schott, & Wei, 2013).

We continue to include location fixed effects  $\phi_l$  and firm controls  $Z_f$ , as well as year fixed effects for China. Instead of fixed effects for firms' primary industry, we now condition on destination-product pair fixed effects  $\phi_{dp}$ .<sup>16</sup> These subsume variation in total expenditure, consumer price indices, and trade costs across countries and products in the model, as well as differences in consumer preferences, institutional frictions, and other forces outside the model. In the stringent specifications (3) and (4), the coefficient on  $Management_f$  is thus identified from the variation across firms within narrow segments of the global economy, such as Chinese exporters of men's leather shoes to Germany or U.S. exporters of cell phones to Japan. We conservatively cluster standard errors

<sup>15</sup>If better-managed firms set higher markups, our conclusions for  $\beta^q$  would be unaffected, but  $p_{ji}^{fob}/q_{ji}$  would be inflated and we would be less likely to find  $\beta^{p/q} < 0$ .

<sup>16</sup>All results for China hold when we distinguish between processing and ordinary exports and include a complete set of destination-product-trade regime triple fixed effects.

by firm to accommodate correlated shocks across destinations and products within firms.

Equations (3) and (4) are in the spirit of prior studies of the relationship between measured firm productivity (TFPR), prices, and revenues (Kugler & Verhoogen, 2009; Manova & Zhang, 2012). Since these variables are all constructed from the same sales and quantity data, however, ruling out estimation bias due to correlated measurement error in the right- and left-hand-side variables has been a challenge. We circumvent this problem by using direct measures of management practices that are independent of the sales and quantity data.

The evidence in table 5 lends strong support to managerial competence improving both production efficiency and product quality. In both China and the United States, management is associated with significantly higher export quality (columns 1 and 5) and significantly lower quality-adjusted prices (columns 2 and 6). Formally,  $\theta^{CH} = 0.531$ ,  $\delta^{CH} = 0.385$ ,  $\theta^{US} = 0.048$ , and  $\delta^{US} = 0.045$ . Based on these estimates, upgrading management by 1 SD entails a 53% increase in product quality and a 39% decline in quality-adjusted prices in China. These numbers are both 5% for the United States, such that quality and quality-adjusted prices are equally elastic with respect to management competence. These patterns hold in panel data for the United States (appendix table 1): lagged management practices are correlated with current efficiency and quality, and managerial improvements are associated with efficiency and quality upgrading.

The results suggest that management may matter more for both productive efficiency and product quality in China than in the United States,  $\delta^{CH} > \delta^{US}$  and  $\theta^{CH} > \theta^{US}$ . One possible explanation is diminishing returns to management, since management practices are on average worse in China. The estimates also indicate that management may have a relatively bigger effect on quality than on efficiency in China compared to the United States,  $\theta^{CH} - \delta^{CH} > \theta^{US} - \delta^{US} = 0$ . We explore this further with the following estimating equation for prices:

$$\ln(Price_{fdp}) = \beta^p Management_f + \Gamma^p Z_f + \phi_l^p + \phi_{dp}^p + \varepsilon_{fdp}^p \quad (5)$$

The relationship between prices and management is indeed significantly positive in China and insignificantly different from 0 in the United States (columns 3 and 7). This suggests that when quality levels are relatively low, improvements in managerial competence are likely to boost product quality much more than efficiency. This is consistent with the hypothesis of Sutton (2007) that moving up the quality ladder through better management practices is critical for emerging economies.

The elasticity of export quantity with respect to management is theoretically ambiguous,  $\delta\sigma - \theta \geq 0$ . In practice, it is indistinguishable from 0 in China and positive in the United States (columns 4 and 8).

*Robustness.* We perform several specification checks to alleviate concerns with alternative interpretations of the results for export prices and quality. First, qualitatively similar patterns obtain when we infer product quality using alternative values for the price elasticity of demand  $\sigma = \{4, 7, 10\}$  instead of the baseline  $\sigma = 5$ . The results also hold when we allow  $\sigma$  to vary across SIC three-digit industries using estimates from Broda and Weinstein (2006) (panel A of appendix table 5).

Second, management practices may affect not only production efficiency and product quality but also markups; this channel is moot in our model because CES preferences imply constant markups. The prior literature has shown that in environments with variable markups and no quality differentiation, more productive firms charge lower prices even though they set higher markups (Melitz & Ottaviano, 2008). With alternative market structures or strategic behavior, however, markups could in principle rise sufficiently quickly with productivity to dominate the associated decline in marginal cost and result in higher prices. Under quality differentiation, variable markups might therefore confound the inference of quality from price and quantity data and lead us to under- or overestimate the role of management effectiveness for firms' quality capacity and production efficiency. To alleviate this concern, we confirm that the results change little when we control for firms' market share as a proxy for their ability to extract higher markups (panel B of appendix table 5). We use a Chinese (U.S.) firm's share of total Chinese (U.S.) exports to a given destination-product,  $\frac{Exports_{fdp}}{\sum_f Exports_{jdp}}$ , as an indicator of its market power there.

### B. Input Characteristics

We next test the predictions of proposition 4 for the quality of firms' intermediate inputs and the complexity of their assembly technology. We proxy the latter with input characteristics that we construct from data on firms' total material purchases (ASM/ASIE) and imported input purchases by product and country of origin (LFTTD/CCTS). As is common with production data, we do not observe detailed information on domestic inputs.

We estimate specifications of the following two types:

$$InputCharacteristic_f = \beta Management_f + \Gamma Z_f + \phi_l + \phi_i + \varepsilon_f, \quad (6)$$

$$InputCharacteristic_{fop} = \beta Management_f + \Gamma Z_f + \phi_l + \phi_{op} + \varepsilon_{fop}. \quad (7)$$

As in equation (2), the unit of observation in regression (6) is the firm, and we include the same controls (location and industry fixed effects, noise, and firm controls). Similar to equation (3), the unit of observation in regression (7) is the firm-origin country-product, and we condition on the same controls (location fixed effects, origin-product pair fixed effects, noise, and firm controls). We continue to cluster errors by firm and to exploit the panel for China with year fixed effects.

*Input quality.* In the model, producing goods of higher quality is associated with higher marginal costs. One possibility is that this reflects the need for higher-quality intermediate inputs. Table 6 provides evidence consistent with better-managed firms sourcing more expensive, higher-quality inputs from richer countries of origin ( $\theta > 0$ ).<sup>17</sup> In columns 1, 2, 6, and 7, we estimate regression (6) for the log value of imports and the log share of imports in total input purchases. In both China and the United States, better-managed firms have higher imports, consistent with their operating on a bigger scale and using more inputs overall. Better-managed Chinese producers also import a bigger share of their inputs, in line with priors about the paucity of specialized, high-quality domestic inputs in China. By contrast, the insignificant estimates for the United States serve as a corroborating placebo test.

Columns 3 and 8 confirm that well-run companies source inputs from richer, more developed economies. Such economies are believed to produce higher-quality, more sophisticated goods because they employ advanced technologies and more skilled workers (Schott, 2004). In these specifications, the outcome variable is the weighted average log GDP per capita across a firm's supplier countries, using imports as weights. A 1 SD rise in management competence is associated with 4% to 5% higher average origin-country income.

In columns 4 and 9, we estimate regression (7) for the log unit value of firm imports by product and country. Advanced management practices are accompanied by higher imported input prices in China but not in the United States. In columns 5 and 10, we find that better-managed firms use higher-quality imported inputs, where we infer

<sup>17</sup>As we show in appendix 2.3, one justification for the quality production function in our model is complementarity between input quality and management competence in the production of output quality. We find some evidence consistent with this mechanism in unreported results for the United States.

TABLE 6.—IMPORTED INPUT QUALITY

Dep. Variable	China					United States				
	Log Imports (1)	Log Imports Inputs (2)	Log Avg Origin Income (3)	Log Import Input Price (4)	Log Import Input Quality (5)	Log Imports (6)	Log Imports Inputs (7)	Log Avg Origin Income (8)	Log Import Input Price (9)	Log Import Input Quality (10)
Management	0.550*** (4.32)	0.223* (1.86)	0.046** (2.11)	0.101** (2.36)	0.576*** (3.03)	0.344*** (11.83)	−0.003 (−0.03)	0.037*** (3.89)	−0.001 (−0.34)	0.051** (2.55)
Fixed Effects			Province, Ownership, Year					State		
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	—	—	Y	Y	Y	—	—
Origin-Prod FE	—	—	—	Y	Y	—	—	—	Y	Y
R-squared	0.57	0.50	0.38	0.81	0.78	0.31	0.27	0.21	0.97	0.93
# observations	1,778	1,778	1,778	76,626	76,626	10,000	10,000	10,000	140,000	140,000

This table examines the relationship between firms' management practices and imported input quality. The dependent variable is log firm imports in columns 1 and 6, log share of imports in total intermediate inputs in columns 2 and 7, log average GDP per capita across origin countries in columns 3 and 8, log import unit value by origin country-product in columns 4 and 9, and log import product quality by origin country-product in columns 5 and 10. All columns include a full set of fixed effects and firm and noise controls as described in table 3, except columns 4–5 and 9–10 include fixed effects for origin country-product pair instead of firm main industry. Standard errors clustered by firm in columns 1–5 and 9–10 and robust in columns 6–8. U.S. sample sizes rounded for disclosure reasons. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

imported-input quality in the same way as export product quality. Improving management effectiveness by 1 SD corresponds to 10% and 58% higher imported-input price and quality in China, but only 0% and 5% in the United States. Appendix table 1 provides consistent panel evidence for the United States: lagged management practices are strongly correlated with current input sourcing strategies, and improvements in management quality are associated with input quality upgrading within firms over time.

These results suggest that at lower levels of management competence and product quality, good management can help firms to not only more effectively source and process inputs from advanced countries, but also to better identify high-quality suppliers within each country. This additional channel might contribute to the higher elasticity of output quality with respect to management documented above for China relative to the United States.

*Assembly complexity.* An alternative rationalization for higher marginal costs of producing higher-quality goods is that it requires the coordination of multiple production stages and efficient inventorization to assemble a wider range of specialized inputs (Johnson & Noguera, 2012). We proxy the complexity of firms' assembly technology with the variety of their imported inputs, measured as the log number of HS-8 products, origin countries, or origin country-product pairs in a firm's import portfolio. As table 7 demonstrates, better-managed companies indeed source more distinct inputs from more suppliers, after conditioning on their log number of export products.

In light of proposition 4, the patterns in tables 5 and 6 support the idea that effective management enables firms to produce higher-quality products using higher-quality inputs and more complex production processes.

### C. Management and TFP

The results indicate that successful export performance is associated with sophisticated management practices. We now

explore the relationship between management competence and firm productivity.

Unlike the theoretical notion of quantity-based total factor productivity TFPQ, standard TFPR measures are constructed from data on sales revenues and input costs. TFPR thus incorporates input and output prices and markups (De Loecker, 2015), which introduces bias in regressions of firm outcomes such as export activity on TFPR. As a production function residual, TFPR also constitutes a conceptual black box. Separately, TFPQ is the single attribute that determines all firm outcomes in many models, while in practice, TFPR is positively but imperfectly correlated with many firm metrics (Bartelsman, Haltiwanger, & Scarpetta, 2013). This points to either measurement error in TFP, multiple firm attributes playing a role, or both (Hallak & Sivasadan, 2013).

We view management competence as a measurable, tangible counterpart to the theoretical concept of TFPQ, or an important component of TFPQ. On the one hand, management practices are measured independently from firms' production and trade activity and immune to the estimation and black-box concerns with standard productivity measures. On the other hand, TFPR is in principle more comprehensive and reflects both management and non-management dimensions to productivity, albeit measured with error.

We investigate the relationship between observed management practices and estimated TFPR in table 8. We construct  $TFPR_f$  as in Levinsohn and Petrin (2003) using survey data on firm sales, capital expenditures, labor costs, and material purchases, and accounting for differences in production technology across industries and ownership types. Column 1 confirms that the conditional correlation between  $Management_f$  and  $TFPR_f$  is indeed strongly positive. Columns 2 and 3 then replicate regression (2) for  $TFPR_f$  in place of  $Management_f$ . TFPR enters positively and significantly, except for Chinese firms' export status.

We next decompose  $TFPR_f$  into two components by regressing it on  $Management_f$  with no other controls: the projection onto  $Management_f$  and the residual term  $nonManagementTFPR_f$ . In columns 4 to 12, we regress the full range of firms' export and import outcomes on both

TABLE 7.—ASSEMBLY COMPLEXITY

Dep. Variable	China			United States		
	Log # Origins (1)	Log # Import Prod (2)	Log # Origin-Prod (3)	Log # Origins (4)	Log # Import Prod (5)	Log # Origin-Prod (6)
Management	0.168*** (4.24)	0.123* (1.82)	0.145** (2.09)	0.058*** (7.41)	0.079*** (6.81)	0.087*** (6.97)
Log # Export Products	0.245*** (7.69)	0.387*** (6.97)	0.441*** (7.77)	0.426*** (66.14)	0.561*** (58.70)	0.632*** (60.40)
Fixed Effects	Province, SIC-3 Industry, Ownership, Year			State, NAICS-6 Industry		
Noise Controls	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y
R-squared	0.61	0.64	0.67	0.56	0.51	0.53
# observations	1,566	1,566	1,566	10,000	10,000	10,000

This table examines the relationship between firms' management practices and imported input complexity. The dependent variable is firms' log number of origin countries in columns 1 and 4, log number of imported products in columns 2 and 5, and log number of origin country-product pairs in columns 3 and 6. All columns also include a full set of fixed effects and firm and noise controls as described in table 3. Standard errors clustered by firm (China) and robust (United States). U.S. sample sizes rounded for disclosure reasons. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

TABLE 8.—MANAGEMENT VERSUS TFPR

Dep. Variable	Export Performance						Quality and Efficiency			Imported Input Quality and Assembly Complexity		
	TFPR (1)	Exporter Dummy (2)	Log Exports (3)	Exporter Dummy (4)	Log Exports (5)	Log # Prod-Dest (6)	Log Export Quality (7)	Log Qual-Adj Exp Price (8)	Log Export Price (9)	Log Avg Origin Income (10)	Log Imp Input Quality (11)	Log # Origin-Prod (12)
<b>A. China</b>												
Management	0.150*** (3.48)			0.053* (1.74)	0.261** (2.36)	0.250** (2.08)	0.520* (1.69)	-0.363 (-1.63)	0.157 (0.74)	0.047*** (3.09)	0.620*** (3.07)	0.194 (1.60)
TFPR		-0.001 (-0.07)	0.274*** (3.54)									
Non-Manage TFPR				-0.006 (-0.57)	0.257*** (4.07)	0.139*** (3.67)	0.242*** (2.62)	-0.192*** (-2.66)	0.049** (2.05)	-0.034** (-2.44)	0.410*** (67.17)	0.117*** (3.83)
R-squared	0.43	0.42	0.44	0.43	0.44	0.41	0.90	0.89	0.92	0.38	0.78	0.60
# observations	2,800	2,802	1,880	2,800	1,880	1,880	54,565	54,565	54,565	1,731	70,270	1,731
Share of 1 SD in outcome explained by 1 SD in attribute												
Management				10.7%	11.3%	19.0%	5.4%	4.8%	7.1%	9.1%	4.5%	12.2%
Non-Manage TFPR				1.5%	12.1%	11.5%	2.7%	2.8%	2.4%	7.1%	3.3%	8.1%
Ratio				7.4	0.9	1.7	2.0	1.7	2.9	1.3	1.4	1.5
<b>B. United States</b>												
Management	0.090*** (10.10)			0.031*** (9.72)	0.364*** (17.21)	0.191*** (14.81)	0.042*** (2.96)	-0.046*** (-3.72)	-0.004 (-1.08)	0.037*** (4.12)	0.050** (2.01)	0.199*** (13.64)
TFPR		0.040*** (11.49)	0.307*** (12.09)									
Non-Manage TFPR				0.037*** (10.56)	0.273*** (10.79)	0.156*** (9.82)	0.025** (2.14)	-0.024** (-2.45)	0.001 (0.38)	0.003 (0.37)	0.035*** (2.12)	0.142*** (8.38)
R-squared	0.83	0.28	0.38	0.28	0.41	0.39	0.97	0.96	0.98	0.21	0.93	0.34
# observations	32,000	32,000	13,000	32,000	13,000	13,000	290,000	290,000	290,000	10,000	140,000	10,000
Share of 1 SD in outcome explained by 1 SD in attribute												
Management				6.2%	13.1%	11.6%	0.5%	0.7%	0.1%	4.3%	0.7%	12.8%
Non-Manage TFPR				16.3%	22.2%	21.3%	0.7%	0.8%	0.1%	0.8%	1.1%	20.5%
Ratio				0.4	0.6	0.5	0.7	0.9	1.8	5.5	0.6	0.6

This table examines the relationship between firms' management practices, total factor productivity, and trade activity. *Non-Management TFPR* is the residual from the regression of TFPR on management and no other controls or fixed effects. All columns include a full set of fixed effects and firm and noise controls as described in table 3, except columns 7-9 and 11 include fixed effects for destination or origin country-product pair instead of firm main industry. Standard errors bootstrapped 600 times in panel A and 1,000 times in panel B. U.S. sample sizes rounded for disclosure reasons. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

$Management_f$  and  $nonManagementTFPR_f$  to assess their absolute and relative contribution.<sup>18</sup> The bottom three rows show what percent share of a 1 SD spread in each trade outcome can be explained by a 1 SD spread in each productivity component. We refer to this metric as *explanatory power* and also report its ratio across the two TFPR components.

<sup>18</sup>We bootstrap standard errors to account for how *nonManagementTFPR\_f* is constructed.

We find that both productivity dimensions matter in an absolute sense, especially given the large set of fixed effects included. The estimates for  $Management_f$  are similar to the baseline and always highly economically and statistically significant: its explanatory power is 4.5% to 19% (China) and 0.5% to 13.1% (United States) depending on the trade outcome. In a few instances,  $nonManagementTFPR_f$  is imprecisely estimated or plays a negligible role. The relative explanatory power of  $Management_f$  varies from 0.9 to 7.4

TABLE 9.—MANAGEMENT COMPONENTS

Dep. Variable	Export Performance			Quality and Efficiency			Imported Input Quality and Assembly Complexity		
	Exporter Dummy (1)	Log Exports (2)	Log # Prod-Dest (3)	Log Export Quality (4)	Log Qual-Adj Exp Price (5)	Log Export Price (6)	Log Avg Origin Income (7)	Log Imp Input Quality (8)	Log # Origin-Prod (9)
A. China: Estimation with Both Components									
Monitoring	0.069*** (2.92)	0.126 (0.75)	0.120 (1.06)	0.057 (0.19)	0.014 (0.06)	0.071 (1.06)	0.017 (0.53)	0.277 (0.98)	0.408*** (3.59)
Incentives	-0.033 (-0.58)	0.129 (0.86)	0.118 (1.15)	0.526* (1.92)	-0.432** (-2.03)	0.093 (1.40)	0.032 (0.96)	0.331 (1.24)	-0.168 (-1.53)
# observations	3,123	1,935	1,935	58,101	58,101	58,101	1,778	76,626	1,778
B. China: Estimation with Single Component									
Monitoring	0.060*** (3.48)	0.216 (1.63)	0.202** (2.55)	0.330 (1.27)	-0.211 (-1.03)	0.119* (1.95)	0.041* (1.89)	0.521*** (2.67)	0.287*** (4.04)
Incentives	0.032* (1.79)	0.212* (1.78)	0.197*** (2.77)	0.558** (2.28)	-0.424** (-2.23)	0.134** (2.18)	0.044** (1.97)	0.527*** (2.88)	0.114 (1.61)
# observations	3,123	1,935	1,935	58,101	58,101	58,101	1,778	76,626	1,778
C. US: Estimation with Both Components									
Monitoring	0.022*** (6.99)	0.307*** (13.11)	0.157*** (11.29)	0.050** (2.56)	-0.050*** (-3.88)	-0.005 (-1.10)	0.045*** (4.52)	0.052** (2.57)	0.101*** (7.67)
Incentives	0.013*** (4.63)	0.141*** (6.57)	0.077*** (6.04)	0.017 (1.03)	-0.006 (-0.06)	0.001 (0.16)	-0.003 (-0.29)	0.014 (0.86)	0.011 (0.88)
# observations	32,000	13,000	13,000	290,000	290,000	290,000	10,000	140,000	10,000
D. US: Estimation with Single Component									
Monitoring	0.026*** (8.64)	0.335*** (15.05)	0.173*** (13.19)	0.038*** (2.63)	-0.037*** (-2.94)	0.001 (0.30)	0.044*** (4.64)	0.057*** (2.84)	0.201*** (13.65)
Incentives	0.019*** (6.97)	0.224*** (11.02)	0.120*** (9.98)	0.010 (0.83)	-0.012 (-1.11)	-0.002 (-0.55)	0.010 (1.07)	0.027* (1.74)	0.104*** (7.62)
# observations	32,000	13,000	13,000	290,000	290,000	290,000	10,000	140,000	10,000

This table examines the role of the *Monitoring* and *Incentives* components of firms' management practices. All columns include a full set of fixed effects and firm and noise controls as described in table 3, except columns 4–6 and 8 include fixed effects for destination or origin country-product pair instead of firm main industry. Standard errors clustered by firm, except for columns 1, 2, 7, and 9 for the United States where they are robust. U.S. sample sizes rounded for disclosure reasons. *t*-statistics in parentheses. Significant at \*\*\*1%, \*\*5%, and \*10%.

times that of  $nonManagementTFPR_f$  for China, with an average ratio of 2.3. The two productivity components are of more comparable relevance in the United States, where the ratio varies from 0.4 to 5.5 with a mean of 1.3.

#### D. Differential Returns to Management

A policy-relevant question is whether some managerial practices are more beneficial to firm performance than others. Also of interest is whether effective management is especially crucial to firm success in certain environments or segments of the economy. We now explore several dimensions along which the returns to managerial competence may vary. While we find some degree of differential returns, it is limited in terms of magnitude or significance.

*Management components.* We first unpack the role of different management practices. The baseline management score aggregates information across sixteen questions in the MOPS U.S. survey and eighteen questions in the WMS China survey. We group and average these questions into two subcomponents:  $Monitoring_f$  reflects the management of physical capital, production inputs, and production processes through the setting of operation targets and monitoring progress toward these targets, while  $Incentives_f$  captures the management of human resources through the provision of effort- and performance-based incentives.

In table 9, we regress each trade outcome on  $Monitoring_f$  and  $Incentives_f$  to gauge their absolute and relative significance. We generally find qualitatively similar patterns for both sets of management practices when considered one at a time. Monitoring strategies appear quantitatively more important for firms' overall export performance and specific efficiency and quality channels in the United States. By contrast, monitoring and incentives play comparable roles for overall export activity in China, with incentives being more consequential for certain efficiency and quality dimensions. Given the high correlation between  $Monitoring_f$  and  $Incentives_f$ , the significance and differential magnitude of the estimated elasticities are typically dampened in horse-race specifications with both management components.

*Country and industry heterogeneity.* China and the United States have very different levels of economic development, institutional efficiency, and average management competence, but the export performance of Chinese and American firms is equally sensitive to good management in terms of export entry and revenues. This points to a fundamental role for management rather than idiosyncrasies of specific contexts. Yet the efficiency and quality returns to management at the firm-product and firm-product-destination levels can be significantly bigger in China than in the United States, consistent with diminishing returns to management in improving production efficiency and quality capacity.

Unreported analysis confirms that our results are not driven by differences in the composition of Chinese and U.S. trade flows. Similar patterns obtain when we weight U.S. export (import) regressions at the firm-product and firm-country-product level by the number of Chinese exporters (importers) in each HS-6 product or country-product market.

We also assess whether the importance of management strategies varies systematically across products or industries (unreported). We expand specifications for export and import prices, quality, and quality-adjusted prices at the firm-product-country level to include the interaction of  $Management_f$  with various product and industry characteristics. Based on the Rauch (1999) indicator for product differentiation at the HS-6 level, management practices matter more for firm efficiency and quality in differentiated rather than homogeneous goods in China, while the opposite holds for the United States. However, these patterns are often not statistically significant. Using industry measures at the ISIC-3 level from Braun (2003), management competence appears more closely associated with improved efficiency and quality in less capital-intensive and in more skill-intensive sectors in China. The opposite, if less significant, pattern emerges for the United States. We observe no systematic variation across sectors with different advertising and R&D intensity.

*Ownership structure.* Finally, we consider the relationship between firms' ownership structure, management practices, and trade activity. This informs the potential for productivity-enhancing spillovers in managerial know-how from multinational to domestic firms, as well as concerns about poor management practices in state-owned firms.

The Chinese customs data distinguish between private domestic firms (DOM), state-owned enterprises (SOE), and affiliates of foreign multinationals (MNC). On average, MNCs are better managed than DOMs, which are in turn better managed than SOEs. In unreported regressions, we find some variation in the management elasticity of different trade outcomes across ownership types, but it is rarely statistically significant.

The U.S. customs data identify each firm-country-product level transaction as intra-firm or arm's-length. We label firms with at least one intra-firm transaction as multinational, whether they be U.S. or foreign owned. On average, MNCs are better managed than DOMs, and the management elasticity of different trade outcomes is generally higher for MNCs.

## VII. Conclusion

This paper examines for the first time the role of management practices for firms' trade activity. We theoretically and empirically establish that management competence enhances firms' production efficiency and quality capacity, and thereby performance. It enables firms to more effectively source foreign inputs and process them into higher-quality outputs, which in turn improves export performance. Moreover, man-

agement practices have large explanatory power compared to the residual non-management component of TFP.

We find that better management is associated with greater efficiency and quality in both China and the United States, and that it matters relatively more in China, especially for the quality channel. Given the striking differences in economic and institutional development between these countries, our results suggest that management capability plays a fundamental role that is not specific to particular economic environments. They also speak to policy concerns about the impact of limited management know-how on structural transformation in developing economies.

More broadly, our findings shed light on the nature and consequences of firm heterogeneity. A promising avenue for future work is uncovering the reasons for weaker managerial ability in some firms and countries compared to others and the scope for policy interventions in this context.

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