Managing Trade: Evidence from China and the US*

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June 2017

Abstract

We present a heterogeneous-firm model in which management ability increases both production efficiency and quality capacity. Better managed firms use more sophisticated inputs and assembly technologies to more efficiently produce goods of higher quality. Combining six micro-datasets on management practices, production and trade in Chinese and American firms, we find support for the model's predictions in both countries. First, better managed firms are more likely to export, sell more products to more destination countries, and earn higher export revenues and profits. Second, better managed exporters have higher prices, higher quality, and lower quality-adjusted prices. They also source more imported inputs, a wider range of inputs, more expensive inputs, and more inputs from advanced economies. The structural estimates from our model indicate that management is important for improving production efficiency and product quality in both countries, but it matters more in China than in the US, especially for product quality. Panel analysis for the US and a randomized control trial in India suggest that management exerts causal effects. Poor management practices may thus hinder trade, growth and entrepreneurship in developing countries.

JEL codes: F10, F14, F23, L20, O19, O32.
Keywords: Management, exports, product quality, productivity.

*Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. We thank Pol Antras, Luis Garicano, Elhanan Helpman, Veronica Rappoport, Stephen Redding, Eric Verhoogen, and Stephen Yeaple for insightful conversations, and conference participants at NBER ITI Spring 2017, Nottingham GEP Conference 2017, RIEF Conference 2017, West Coast Trade Workshop 2017, CEPR ERWIT 2016, AEA Annual Meetings 2016, EEA Annual Congress 2016, Villars Research Workshop in International Trade 2016, Barcelona GSE Summer Forum 2016, Stockholm China Conference on Development, Trade and Investment 2016, NBER-CCER China Conference 2015, CEPR Workshop on Incentives, Management and Organization 2015, SCID/IGC Conference on Trade, Productivity, and Development 2015, Hitotsubashi Conference on International Trade and FDI 2015; Stanford, UC Berkeley, MIT Sloan, UCL, Oxford, Cambridge, Warwick, Nottingham, Birmingham, Sussex, Aarhus, VU Amsterdam, Geneva / Geneva Graduate Institute, Kiel Institute for World Economy, KOF-ETH-UZH Zürich, LMU Munich, Louvain-la-Neuve, Luxembourg, National Bank of Belgium, Oslo, Hong Kong University, Hong Kong University of Science and Technology, and City University of Hong Kong for their comments. Kalina Manova acknowledges support from Stanford SEED and The British Academy.

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1 Introduction

Productivity, management practices and international trade activity vary dramatically across firms and countries (Syverson (2011), Bernard, Jensen, Redding and Schott (2012)). In the academic literature, higher measured TFP has been associated with export success and superior management with higher profits. However, measured TFP is subject to estimation biases and 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 and anecdotes.

In this paper we perform the first 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 theoretical 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 in 1999-2008 and over 10,000 US firms in 2010. We analyze rich trade data in order to establish underlying mechanisms of interest, but we believe that our conclusions extend to the role of management strategies for general firm activity.

We first establish that better managed firms have superior export performance. Companies with more effective management practices are systematically more likely to engage in exporting. Conditional on exporting, they sell more products to more destination countries and earn higher export revenues and profits. In addition, our findings for management survive when we explicitly control for revenue-based firm TFP as commonly constructed in the literature.

We then present a collection of independent 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 narrowly defined destination-product markets. We estimate a model-consistent indicator of product quality, and show that management competence is associated with higher output quality and lower quality-adjusted prices. On the production side, better managed companies use more expensive, higher-quality imported inputs and more inputs from suppliers located in developed economies. They also source a wider range of distinct inputs from more countries of origin.

We propose that these empirical patterns are consistent with management competence being an important component of firms' total factor productivity, whereby more 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. At the same time, advanced management allows firms to process inputs and execute assembly more cheaply. When both the efficiency and quality channels are active, they push marginal costs in opposite directions, such that the net effect of management competence on prices and quantities is ambiguous, but it unambiguously raises product quality, sales and profits. These predictions are preserved when we extend the baseline model to incorporate endogenous input choice, endogenous management practices, or non-management components of TFP.

As we do not observe where good management comes from, we consider the implications of its origins for the interpretation of our empirical results. On the one hand, management competence may be exogenously given, for example by the intrinsic talent of a firm's founder. On the other hand, management practices may be endogenously chosen, for example if the founder hires a manager to implement a desired operational strategy. This process may be deterministic if labor markets are efficient, such that the founder's primitive pins down the management technology. Alternatively, it may be stochastic if there are labor market frictions like asymmetric information, such that observed management has exogenous and endogenous components.

Our main empirical analysis explores the 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 the firm's profit maximization problem. Instead, we view our baseline results as conditional correlations that inform the mechanisms through which management operates. We also provide two additional pieces of evidence that suggest a causal role for management competence. These are based on panel analysis of changes within US firms over time and on a randomized control trial that offered management consulting to Indian firms. Both exercises reveal patterns closely in line with the cross-section.

Our findings address two open questions in two separate, active literatures. A large theoretical and empirical literature in international trade emphasizes the role of firm productivity as a key determinant of firms' export performance (e.g. Melitz (2003), Bernard, Eaton, Jensen and Kortum (2003), Melitz and Ottaviano (2008), Bernard, Jensen, Redding and Schott (2007)). 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 TFPQ, or the ability to manufacture at low marginal costs, 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 in order to produce higher-quality output that sells at higher prices (e.g. Verhoogen (2008), Kugler and Verhoogen (2012), Khandelwal (2010), Manova and Zhang (2012), Johnson (2012)). Yet productivity is typically measured as TFPR, or a revenue-based residual from production function estimates. This makes it subject to estimation bias and complicates the interpretation of trade-TFPR regression analyses (e.g. Ackerberg, Caves and Frazer (2015), De Loecker (2011)). Thus, an important open question in the trade literature is what constitutes productivity, how it should be measured, and what explains its vast variation across firms.

A separate and older literature has examined the relationship between firm management, productivity and performance (e.g. Walker (1887), Taylor (1911), Syverson (2011)). Recently, the World Management Survey and the US Management and Organizational Practices Survey have provided the first large-sample support for the long-held belief that superior management is associated with higher measured firm productivity and profits (e.g. Bloom and Van Reenen (2007), and Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta Eksten and Van Reenen (2014)). One likely route for this management-productivity link emphasized by the management literature is through lean manufacturing and improved quality (e.g. Deming (1981), Womack, Jones and Roos (1990), Drew, McCallum and Roggenhofer (2016), Sutton (2007)). Yet there is no systematic, direct evidence on the mechanisms through which management operates.[1]

Our work informs both of these open questions. We conclude that effective management enhances firm performance by enabling firms to manufacture higher-quality goods more efficiently, such that both production efficiency and quality capability increase with management competence. We also unpack the black box of TFPR and identify management practices as a concrete, tangible and directly measured TFPQ component that accounts for the heterogeneity in firm performance. Studying management practices thus circumvents concerns with estimation biases in trade-productivity regressions and delivers clearer policy lessons.

This paper also speaks to the active literature on the implications of firm heterogeneity for aggregate productivity, welfare and the gains from trade (e.g. Hsieh and Klenow (2009), Arkolakis, Costinot and Rodriguez-Clare (2012), Melitz and 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 (e.g. Pavcnik (2002), Bernard, Eaton, Jensen and Kortum (2003), Bustos (2011), Berthou, Chun, Manova and Sandoz (2016)). Understanding the sources of firm heterogeneity is thus important for understanding aggregate outcomes. In addition, given evidence on the complementarity between manufactured input quality and skilled labor in the production of output quality (e.g. Verhoogen (2008)), quality differentiation across firms and its interplay with management competence also has implications for the differential effects of shocks across the firm size and worker skill distributions.

Finally, our findings reinforce conclusions in the recent literature that access to imported inputs is important to the export success of firms in developing countries (e.g. Goldberg, Khandelwal, Pavcnik and Topalova (2010), Fieler, Eslava and Xu (2014), Manova and Zhang (2012)). Poor economies often rely on international trade for growth, and specifically on exporting to

[1] The most popular management systems - Six-Sigma, Lean, and the Toyota Production System - all emphasize that improving productivity and quality is best achieved by an ongoing focus on reducing defects. In fact, this approach is now so popular that it has spread from manufacturing across most sectors, for example to Lean Retail (Myerson (2014)), Lean Healthcare (Group (2014)) and even Lean Government (Teeuwen (2010)).

large, developed and profitable markets that maintain high quality standards. The paucity of high-quality specialized inputs and equipment in developing countries may thus hinder export activity. Our results suggest that not only limited product availability and product quality, but also poor managerial practices may impede trade, economic growth and entrepreneurship in the world's poorest economies.

The remainder of the paper is organized as follows. The next section theoretically models the role of management competence for firms' export performance. Section 3 introduces the Chinese and US data on firms' balance sheets, trade activity, and management practices. We present baseline results on the relationship between trade and management in Section 4, and explore the mechanisms through which superior management improves export outcomes in Sections 5 and 6. We provide suggestive evidence of management's causal effects in Section 7. The last section concludes.

2 Theoretical Framework

We develop a theoretical model of international trade in which heterogeneous firms choose how many products to manufacture, what markets to enter, and which products to sell in each market. In the baseline set-up firms receive an exogenous draw of management competence which uniquely determines firm choices and performance outcomes. We consider the endogenous adoption of management practices in an extension to this benchmark model in Appendix 2.1. We posit that effective management can enhance firm performance by increasing production efficiency and/or quality capacity. We characterize the relationship between firms' management competence and trade activity under alternative assumptions about the relative importance of these two channels, and derive testable predictions that allow us to empirically assess their relevance. We relegate detailed proofs to Appendix 1.

We incorporate management competence in a partial-equilibrium trade model that features quality and efficiency differentiation across firms and across products within multi-product firms. In our baseline, we treat management effectiveness as equivalent to TFP, such that our model closely resembles that in Bernard, Redding, and Schott (2010), Kugler and Verhoogen (2012), and Manova and Yu (2017). We examine the alternative in which management practices are one of multiple components of firm productivity in Appendix 2.2.

2.1 Set Up

Consider a world with $J+1$ countries. In each country, a continuum of heterogeneous firms produce horizontally and vertically differentiated goods which they sell at home and potentially export abroad. Consumers exhibit love of variety such that the representative consumer in country j has CES utility $U_j = \left[\int_{i\in\Omega_j} (q_{ji}x_{ji})^{\alpha}\, di\right]^{\frac{1}{\alpha}}$, where q_{ji} and x_{ji} are the quality and quantity consumed by country j of variety i, and Ω_j is the set of goods available to j. The elasticity of substitution across products is $\sigma \equiv 1/(1-\alpha) > 1$ with $0 < \alpha < 1$. If total expenditure in country j is R_j, j's demand for variety i is $x_{ji} = R_j P_j^{\sigma-1} q_{ji}^{\sigma-1} p_{ji}^{-\sigma}$, where $P_j = \left[\int_{i\in\Omega_j} \left(\frac{p_{ji}}{q_{ji}}\right)^{1-\sigma} di\right]^{\frac{1}{1-\sigma}}$ is a quality-adjusted ideal price index and p_{ji} is the price of variety i in country j. Quality is thus defined as any objective attribute, subjective taste preference or other demand shock that increases the consumer appeal of a product given its price. Note that a sufficient statistic for unobserved product quality $\ln q_{ji}$ within market j can be constructed from observed price and quantity data as $\sigma \ln p_{ji} + \ln x_{ji}$ (Khandelwal (2010), Khandelwal, Schott, and Wei (2013)).

2.2 Production and Sales Technology

The production technology in the economy is characterized by a production function for physical units of output and a production function for output quality. Firms' management competence affects both their ability to assemble given inputs at low cost and their capacity to make high-quality goods. We refer to these two mechanisms through which management operates as *production efficiency* and *quality capacity*.

In order to begin manufacturing, entrepreneurs have to incur sunk entry costs associated with research and product development. They face uncertainty about their production efficiency and product quality, and observe them only after completing this irreversible investment. At that point they decide whether to exit immediately or to commence production and possibly export.

Upon entry, firms draw a firm-wide managerial ability level $\varphi \in (0,\infty)$ from a distribution $g(\varphi)$ and a vector of firm-product specific "expertise" levels $\lambda_i \in (0,\infty)$ from a distribution $z(\lambda)$. We will think of better managed firms as having a higher ability draw φ.[2],[3] Since the success of research and product development may differ across products within a firm, we assume that $g(\varphi)$ and $z(\lambda)$ are independent of each other and common across firms with continuous cumulative distribution functions $G(\varphi)$ and $Z(\lambda)$ respectively, while λ is i.i.d. across products and firms.

Producing one unit of physical output requires $(\varphi\lambda_i)^{-\delta}$ units of labor whose wage is normalized to 1 to serve as the numeraire. The parameter $\delta > 0$ governs the extent to which good management practices can lower unit input requirements and increase the efficiency with which these inputs are assembled into final goods. Intuitively, effective management can improve production efficiency by optimizing inventory control, synchronizing and monitoring production

[2] As we show in Appendix 2.1, one can endogenize management practices while retaining the key features of the model. For example, entrepreneurs might receive an exogenous talent draw φ, choose a management practice $m(\varphi)$, and face marginal costs and quality that depend on $\varphi m(\varphi)\lambda_i$. If the fixed cost of adopting m is f_m and $df_m/dm > 0$, then $dm(\varphi)/d\varphi > 0$ and exogenously more talented entrepreneurs will adopt superior management practices.

[3] We show in Appendix 2.2 that our theoretical predictions would continue to hold if management is one of multiple draws that jointly determine firm ability φ. For example, firm ability $\varphi = m \cdot \phi$ may depend on the entrepreneur's intrinsic talent ϕ and the manager's competence for implementing effective management practices m. If entrepreneurs and managers do not match perfectly assortatively due to labor market frictions, then $|corr(m,\phi)| \neq 1$. While all firm outcomes would now be pinned down by φ instead of m alone, management competence would have the same effects as in our baseline model *ceteris paribus*.

targets across manufacturing stages, reducing wastage, incentivizing workers, etc.

At a marginal cost of $(\varphi\lambda_i)^{\theta-\delta}$ workers, the firm produces one unit of product i with quality $q_i(\varphi,\lambda_i) = (\varphi\lambda_i)^{\theta}$, $\theta > 0$. One interpretation of this production function is that manufacturing goods of higher quality requires the use of more expensive intermediate inputs of higher quality. For example, while sewing a dress using unskilled labor, cotton and plastic buttons may entail the same assembly process as sewing a dress using skilled labor, silk and mother-of-pearl buttons, the latter utilizes more expensive inputs and is considered higher quality. Another interpretation of this production function is that manufacturing more sophisticated products requires more complex assembly. For example, while a printer made of 50 components might only be able to print, a printer assembled from 150 parts might be able to print, scan and photocopy.

This reduced-form quality production function thus implicitly captures the idea that manufacturing goods of higher quality is associated with higher marginal costs because it requires the use of more skilled workers, more sophisticated inputs or more complex assembly processes. The parameter θ reflects the degree to which superior management enables firms to produce higher-quality products. Intuitively, effective management can enhance product quality by tightening quality control, facilitating specialized assembly, minimizing costly mistakes, etc.

For expositional simplicity, we do not explicitly model firms' input choice in our baseline set-up, but follow Baldwin and Harrigan (2011) in assuming that product quality is fixed by exogenous draws. We establish in Appendix 2.3 that endogenizing input quality in a richer framework would preserve our theoretical predictions. Following Kugler and Verhoogen (2012), we show how complementarity between firm ability and input quality in the production function for output quality would induce more capable firms to use higher-quality inputs or to adopt a more sophisticated technology in order to produce higher-quality goods.

Firms' marginal cost thus reflects two opposing forces: On the one hand, better managed firms have higher production efficiency and lower assembly costs. On the other hand, better managed firms (choose to) produce higher quality using more expensive inputs and/or more complex assembly. The net effect of these two forces on marginal costs is theoretically ambiguous and depends on the relative magnitudes of θ and δ.

We make a number of standard assumptions about firms' production and sales costs that are motivated by salient patterns in the data. Firms incur a fixed operation cost of headquarter services f_h and a fixed overhead cost f_p for each active product line, in units of labor. This will imply that companies with different ability draws will choose to produce a different number of products. Entering each foreign market j is associated with additional headquarter services f_{hj} necessary for complying with customs and other regulations, as well as for the maintenance of distribution networks. Because of this fixed cost, some low-ability sellers in the domestic market will not become exporters or will supply some but not all countries. Finally, exporting entails destination-product specific fixed costs f_{pj} (constant across products within j, but varying across countries), which reflect market research, product customization and standardization, and advertising. There are also variable transportation costs such that τ_j units of a good need to be shipped for 1 unit to arrive. These trade costs will ensure that firms might not offer every product they sell at home in every foreign market they enter.

2.3 Profit Maximization

Firms must decide which products to produce, where to sell them and at what prices in order to maximize profits from their global operations. With monopolistic competition and a continuum of varieties, individual producers take all aggregate expenditures R_j and price indices P_j as given and separately maximize profits in each country-product market.[4] A firm with management competence φ will choose the price and sales quantity of a product with expertise draw λ_i in country j by solving

$$\begin{aligned} \max_{p,x} \pi_{ji}(\varphi,\lambda_i) &= p_{ji}(\varphi,\lambda_i)\, x_{ji}(\varphi,\lambda_i) - \tau_j x_{ji}(\varphi,\lambda_i)(\varphi\lambda_i)^{\theta-\delta} - f_{pj} \\ \text{s.t. } x_{ji}(\varphi,\lambda_i) &= R_j P_j^{\sigma-1} q_{ji}(\varphi,\lambda_i)^{\sigma-1} p_{ji}(\varphi,\lambda_i)^{-\sigma}. \end{aligned} \tag{1}$$

Producers therefore charge a constant mark-up $\frac{1}{\alpha}$ over marginal cost and have the following price, quantity, quality, quality-adjusted price, revenues and profits for product i in market j:

$$p_{ji}(\varphi,\lambda_i) = \frac{\tau_j(\varphi\lambda_i)^{\theta-\delta}}{\alpha}, \qquad x_{ji}(\varphi,\lambda_i) = R_j P_j^{\sigma-1}\left(\frac{\alpha}{\tau_j}\right)^{\sigma}(\varphi\lambda_i)^{\delta\sigma-\theta}, \tag{2}$$

$$q_i(\varphi,\lambda_i) = (\varphi\lambda_i)^{\theta}, \qquad p_{ji}(\varphi,\lambda_i)/q_i(\varphi,\lambda_i) = \frac{\tau_j(\varphi\lambda_i)^{-\delta}}{\alpha}, \tag{3}$$

$$r_{ji}(\varphi,\lambda_i) = R_j\left(\frac{P_j\alpha}{\tau_j}\right)^{\sigma-1}(\varphi\lambda_i)^{\delta(\sigma-1)}, \qquad \pi_{ji}(\varphi,\lambda_i) = \frac{r_{ji}(\varphi,\lambda_i)}{\sigma} - f_{pj}. \tag{4}$$

When j corresponds to the firm's home market, there are no iceberg costs ($\tau_j = 1$) and the destination-product fixed cost f_{pj} is replaced by the product-specific overhead cost f_p. 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 $r_{ji}^{fob}(\varphi,\lambda_i) = R_j(P_j\alpha)^{\sigma-1}(\varphi\lambda_i)^{\delta(\sigma-1)}$.

If $\theta = 0$ and $\delta > 0$, effective management improves firm performance only by increasing production efficiency but the quality channel is moot. The model then reduces to the original BRS framework in which all firms offer the same product quality level, but better managed firms have lower marginal costs and therefore set lower prices, sell higher quantities, and earn higher revenues and profits. While formally $\delta = 1$ in BRS, this normalization is immaterial when $\theta = 0$.

Conversely, if $\theta > 0$ and $\delta = 0$, management competence benefits firm performance by improving product quality but the production efficiency mechanism is not active. 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.

The most interesting scenario arises when $\theta > 0$ and $\delta > 0$, such that management operates through both the production efficiency and the product quality channels. We focus on this

[4] See Eckel, Iacovone, Javorcik and Neary (2015) and Eckel and Neary (2010) for an alternative model which incorporates product cannibalization effects.

scenario below as it is most relevant empirically. In this case, superior management is unambiguously associated with higher product quality, lower quality-adjusted prices, higher revenues and higher profits. However, the implications for quantity and price levels are theoretically ambiguous. If $\theta > \delta$, as management competence grows, product quality rises sufficiently quickly with the cost of sophisticated inputs and assembly processes to overturn the effects of improved production 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 $\sigma\delta > \theta$.

2.4 Selection into Products and Markets

Consumers' love of variety and the presence of product-specific overhead costs f_p imply that no firm will export a product without also selling it at home. In turn, firms optimally only manufacture goods for which they can earn non-negative profits domestically. Since profits increase with product expertise λ_i, there is a zero-profit expertise level $\lambda^*(\varphi)$ for each management ability draw φ below which firm φ will not make i. This value is defined by:

$$r_d(\varphi, \lambda^*(\varphi)) = \sigma f_p, \tag{5}$$

where d indicates that revenues are calculated for the domestic market.

Recall that product expertise is independently and identically distributed across goods. By the law of large numbers, the measure of varieties that a firm with ability φ produces equals the probability of an expertise draw above $\lambda^*(\varphi)$, or $[1 - Z(\lambda^*(\varphi))]$. Since $d\lambda^*(\varphi)/d\varphi < 0$, better managed firms have a lower zero-profit expertise cut-off and offer more products. One interpretation of this result is that better managed firms bring superior quality control to any product line. This can partially offset using less skilled workers or inputs of lower quality such that output quality and consumer appeal remain high.

Following the same logic, a firm with ability φ will export product i to country j only if its expertise draw is no lower than $\lambda_j^*(\varphi)$ given by:

$$r_j\left(\varphi, \lambda_j^*(\varphi)\right) = \sigma f_{pj}. \tag{6}$$

The measure of products that firm φ sells to j is thus $\left[1 - Z\left(\lambda_{xj}^*(\varphi)\right)\right]$. Since $d\lambda_j^*(\varphi)/d\varphi < 0$, better managed firms export more products than worse run firms to any given destination.

When the exporting expertise cut-off lies above the zero-profit expertise cut-off, $\lambda_j^*(\varphi) > \lambda^*(\varphi)$, there will be selection into exporting. Across products within a firm, not all goods sold at home will be shipped to j. Similarly, across firms supplying a product domestically, not all will be able to market it abroad. Given the overwhelming evidence for both patterns in the prior literature, we assume that $\lambda_j^*(\varphi) > \lambda^*(\varphi)$ holds for all j.

For every management level φ, the expertise cut-off for exporting generally varies across destinations because the market size R_j, price index P_j, variable τ_j and fixed f_{pj} trade costs are country specific. Firms therefore adjust their product range across markets. Each exporter follows a product hierarchy and adds goods in decreasing order of expertise until it reaches the marginal product that brings zero profits. Within a supplier, higher-quality goods are shipped to more countries, earn higher revenues in any given market, and generate higher worldwide sales.

Firms enter a market only if total expected revenues there exceed all associated costs. The export profits in country j of a firm with management competence φ are:

$$\pi_j(\varphi) = \int_{\lambda_j^*(\varphi)}^{\infty} \pi_j(\varphi, \lambda)\, z(\lambda)\, d\lambda - f_{hj}. \tag{7}$$

Export profits $\pi_j(\varphi)$ increase with management ability because better managed firms sell more products in j (i.e. lower $\lambda_j^*(\varphi)$) and earn higher revenues from each good (i.e. higher $\pi_j(\varphi, \lambda)$) than firms with the same product expertise draws but worse management practices. Therefore only firms with management level above a cut-off φ_j^* will service destination j, where φ_j^* satisfies:

$$\pi_j\left(\varphi_j^*\right) = 0. \tag{8}$$

With asymmetric countries, φ_j^* varies across destinations and better managed firms enter more markets because they are above the exporting ability cut-off for more countries. Better managed exporters thus outperform worse run producers along all three export margins: number of export destinations, product scope in each destination, and sales in each destination-product market.

Finally, not all firms that incur the sunk cost of entry survive. Once they observe their management ability and expertise draws, firms begin production only if their expected profits from all domestic and foreign operations are non-negative. Firm φ's global profits are given by:

$$\pi(\varphi) = \int_{\lambda^*(\varphi)}^{\infty} \pi_d(\varphi, \lambda)\, z(\lambda)\, d\lambda + \sum\nolimits_j \left(\int_{\lambda_j^*(\varphi)}^{\infty} \pi_j(\varphi, \lambda)\, z(\lambda)\, d\lambda - f_{hj} \right) - f_h. \tag{9}$$

The first integral in this expression captures the firm's domestic profits from all products above its expertise cut-off for production $\lambda^*(\varphi)$, while the summation represents worldwide export profits from all traded products and destinations.

Total profits increase in φ because better managed firms sell more products domestically, earn higher domestic revenues for each product, and have superior export performance as described above. Companies below a minimum management level φ^* are thus unable to break even and exit immediately upon learning their attributes. This cut-off is defined by the zero-profit condition:

$$\pi(\varphi^*) = 0. \tag{10}$$

2.5 Empirical Predictions

We summarize the key empirical predictions of the model with the following propositions. We take these predictions to the data, which we turn to next.

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 $\theta > 0$, but quality is invariant across firms if $\theta = 0$. Better managed firms set lower quality-adjusted prices if $\delta > 0$, 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 $\theta > 0$, but input quality and assembly complexity are invariant across firms if $\theta = 0$.*

3 Data

Our analysis makes use of unique, matched establishment- or firm-level data for the world's two largest exporters - China and the US - on production (ASIE and ASM), international trade (CCTS and LFTTD), and management practices (WMS and MOPS) respectively. We exploit six proprietary micro-data sources in total, three for each country, to assemble a dataset 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.

3.1 Measuring Management Practices

Systematic data on firms' management practices have only recently become available. Initiated in 2002, the World Management Survey (WMS) is the first to develop standardized measures of management competence and rigorously collect such measures on a large scale: over 20,000 manufacturing firms located in 34 countries. It considers multiple aspects of firm management, and evaluates the relative effectiveness of different practices within each aspect. WMS is conducted via double-blind phone interviews with plant managers, and covers representative firm samples in a large number of countries. Introduced in the US Census in 2010, the Management and Organizational Practices Survey (MOPS) is modeled after WMS and provides an unprecedented breadth of firm coverage for one country.

WMS (MOPS) includes 18 (16) questions about the management of physical capital (*targets* and *monitoring*) and human resources (*incentives*) inside a firm, examples of which appear in Figure 1. A first set of questions pertain to the design, integration and realism of production *targets*. These questions assess to what extent production targets are consistently set across production stages and tightly connected to performance, both in the short-run and long-run, for managers and non-managers. A second set of questions characterize the *monitoring* of progress towards these production targets via the frequent collection, analysis and dissemination of multiple performance metrics. A final set of questions capture 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, with higher values indicating more structured and effective management. For each country, we first standardize the responses to each quation across firms to be mean 0 and have standard deviation 1. We then average across questions to obtain a single *management score* for each firm in order to be comprehensive and agnostic about the relative importance of different managerial practices. Finally, we standardize these management scores across firms in each country to be mean 0 and have standard deviation 1.

The WMS and MOPS are based on the lean manufacturing and modern human resource management practices, as adapted by McKinsey, to focus on core management practices that should benefit firm performance regardless of the industry or economic environment. Our analysis will nevertheless account for the possibility that the relevance of specific management practices might vary across industries with industry fixed effects. We also conduct all estimations separately for China and the US. This addresses potential concerns that the effectiveness of certain management practices might depend on the formal and informal institutions in a country (e.g. labor market flexibility, cultural norms, respect for managerial hierarchy). To the extent that the management surveys are biased towards successful production practices in the West, measurement error would introduce downward bias and work against us finding consistent patterns for both China and the US. In practice, evidence indicates that the introduction of more effective management practices according to WMS criteria significantly improved firm performance in a randomized control trial in India (Bloom, Eifert, Mahajan, McKenzie, and Roberts, 2013).

3.2 United States

We employ three comprehensive datasets on the activities of US firms. First, as mentioned above, US management is assessed using the Management and Organizational Practices Survey (MOPS), the first and only comprehensive, large-scale management dataset of its kind. Introduced as a mandatory part of the US census in 2010, it documents the management practices of about 32,000 manufacturing establishments in 2010 and 2005 (as a recall). The sample captures 5.6 million employees, or more than half of US manufacturing employment. The distribution of the management score across plants is plotted in Figure 2A.

Second, we obtain standard balance-sheet data on a large representative sample of US establishments from the US Annual Survey of Manufacturers (ASM), available from 1973-2012. ASM records the total sales, value added, profits and inputs to production (such as employment, assets, capital expenditures, inputs and materials purchases) for about 45,000 plants that correspond to over 10,000 firms. We also observe firms' age, ownership structure (domestic vs. multinational), location (out of 50 states), and primary industry of activity in the US NAICS 6-digit industry classification. We measure the skill intensity of firms' production technology with the log average wage and the share of workers with a college degree, and firm' capital intensity with log net fixed assets per worker. We construct two proxies for firm productivity, namely log value added per worker and the revenue-based TFP residual from production function regressions à la Levinsohn-Petrin performed separately for each NAICS-6 industry.

Third, we use the US Longitudinal Federal Trade Transaction Database (LFTTD), which contains detailed information about the universe of US international trade transactions in 1992-2012, at over 100 million transactions a year. LFTTD reports the value, quantity, unit (e.g. dozens, kilograms, etc.) and organization (intra-firm vs. 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 8,000 different products in the 10-digit Harmonized System. The raw data enables us to compute transaction-level unit values to proxy goods prices. To ensure comparability, whenever we conduct product level empirical analysis, the product is defined by both the HS code and unit. Given the lumpiness and seasonality of international trade, we analyze annual trade flows at various levels of aggregation such as the firm, firm-product, firm-destination, and firm-product-destination.

We link ASM, LFTTD and MOPS using firms' tax identifier that is common to all three datasets.[5] We perform our baseline analysis for the resultant cross-section of about 31,000 US establishments in 2010 with contemporaneous production, trade and management data. This sample appears representative in that summary statistics for key production and trade variables are not statistically different between firms with and without management data. We analyze recall MOPS data for 2005 and panel ASM and LFTTD data in robustness checks.

3.3 China

We exploit three comprehensive datasets on the activities of Chinese firms that closely mirror those for the US. First, we observe the management practices of 507 Chinese firms collected in 2006-2007 as part of the World Management Survey (WMS). The distribution of the management score across firms is plotted in Figure 2B. Unlike MOPS, WMS is run as a telephone survey, relying on government endorsements and highly-trained interviewers (e.g. MBAs) to achieve a response rate of 45% in China. Firms with 100 to 5000 employees are sampled randomly, and interviews employ double-blind techniques to obtain unbiased responses from plant managers. Finally, WMS gathers additional firm and interview demographics. Of these, we use information

[5] For firms with mutiple establishments, we aggregate the establishment-level ASM and MOPS data to the firm level by summing production variables and averaging management scores across the multiple establishments belonging to the same firm. For the latter, we take the employment-weighted average management across plants within a firm, but our results are robust to using the simple average instead. We use the age, location and primary industry of activity of the firm headquarters.

on firms' primary industry affiliation (out of 82 industries in the SIC 3-digit classification) and a set of controls for potential survey noise (interviews' duration, day of week and time of day; interviewer ID; interviewee gender, reliability and competence as perceived by the interviewer).

Second, we access production data at the firm level for the 1999-2007 period from China's Annual Survey of Industrial Enterprises (ASIE). ASIE is collected by the National Bureau of Statistics and provides standard balance-sheet information for all state-owned firms and all private firms with sales above 5 million Chinese Yuan, or over 200,000 firms a year. In addition to output, profits, value added and inputs to production, we also observe firms' age, ownership structure (private domestic, state-owned domestic, foreign-owned), location (out of 31 provinces), and primary industry of activity in the Chinese SIC 3-digit industry classification.

Third, we utilize comprehensive data on the universe of Chinese firms' cross-border transactions in 2000-2008 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 7,526 different products in the 8-digit Harmonized System.[6] We calculate unit values as the ratio of shipment values and quantities, and analyze trade flows at different levels of aggregation as above. While CCTS does not distinguish between arm's-length and intra-firm transactions, it does indicate the trade regime under which each export and import flow occurs. China recognizes a formal processing trade regime which permits duty-free imports of inputs for further processing, assembly and re-exporting on behalf of a foreign buyer. Each trade transaction is thus carefully labeled as ordinary or processing trade, and firms can and do legally engage in both operation modes.

Of the 507 Chinese firms included in WMS, we are able to match 485 to ASIE using the unique firm identifier that is common to both databases. We obtain the complete ASIE record for each of these 485 firms during 1999-2007, which produces an unbalanced panel of 3,233 observations at the firm-year level.

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 companies in WMS directly to CCTS firms by postcode and translated Chinese-to-English company names. We ensure match quality by manually researching company webpages and reports, etc. With this two-step matching procedure, we 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 the CCTS records.

[6] While the US and China both adhere to a standardized international HS 6-digit product classification system, countries are free to record their foreign trade activity at finer levels of disaggregation that are not readily comparable across nations. Our baseline analysis exploits the granularity of the US and Chinese customs data at the HS-8 digit level, but our results are robust to using aggregated trade flows at the common HS-6 level or the most disaggregated data for the US at the HS-10 digit level.

This is consistent with the fact that about 60% of the matched WMS-ASIE firms report positive exports on their balance sheets, but more firms may appear in the comprehensive CCTS records.

3.4 Summary Statistics

As a first glance at the data, we summarize the substantial variation in management practices, production and trade activity across firms in China and the US in Table 1. Starting with the US, 45% of the 31,000 US establishments in our 2010 matched sample export. The typical exporter sells 19 different HS-8 digit products to 13 destinations and, conditional on using imported inputs, imports 20 distinct products from 6 countries, with large dispersion around these means. These numbers are generally similar for the sample of 485 firms in our baseline 2000-2008 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 using foreign inputs, source 33 different product codes from 6 countries of origin.

Figure 3 illustrates the vast dispersion in average management practices across countries. The US comes out on top, followed closely by Japan, Germany, Sweden, Canada and the UK. At the middle of the WMS country distribution, Chinese firms are on average significantly less well managed than North American and European companies, but better than firms in Latin America, Africa and other emerging giants such as Brazil and India. These cross-country averages mask substantial variation in management practices across firms in each economy, as shown in Figure 2 for China and the US.

Sample means in Table 1 corroborate stylized facts in the prior literature that exporters are on average significantly larger and more productive than non-exporters. We document that exporters are on average also better managed than non-exporters: The unconditional export management premium equals 15% of a standard deviation in China and 38% of a standard deviation in the US. In comparison, the export size premia in China and the US stand at 19% and 186% respectively based on firm output and 36% and 123% based on employment.

4 Management Practices and Export Performance

The empirical analysis proceeds in two steps. We first examine the relationship between firms' management practices and export performance. This exercise constitutes a direct test of Propositions 1 and 2. While it informs some of the mechanisms through which management operates, it remains agnostic about the importance of good management for production efficiency and product quality. In Section 5, we study these issues by confronting Propositions 3 and 4 with the data.

We perform the entire analysis separately for China and the US. Given the vast difference in income, institutional quality and factor market frictions between the two countries, this allows us to assess whether management plays a fundamental role in firm activities, and if so, whether its function depends on the specific economic environment.

4.1 Empirical Strategy

To evaluate the empirical validity of Propositions 1 and 2, we investigate the link between firms' management competence and export performance with the following estimating equation:

$$ExportOutcome_f = \beta Management_f + \Gamma Z_f + \phi_l + \phi_i + \varepsilon_f \quad (11)$$

We consider multiple dimensions of firms' export activity as guided by theory. In different specifications, $ExportOutcome_f$ refers to firm f's exporter status, log global export revenues, and various extensive and intensive margins of exporting. We measure f's managerial competence $Management_f$ with the comprehensive management z-score across all 16 or 18 management practices surveyed.

We account for any systematic variation in supply- and demand-side conditions across firms in the same location l or industry i with a set of fixed effects, ϕ_l and ϕ_i. These capture differences in factor costs, factor intensities, infrastructure, institutional frictions, tax treatment, etc. that might impact export performance. In the case of China, we add dummies for 31 provinces and 82 sectors based on the primary SIC 3-digit affiliation of each manufacturer. In the case of the US, we use indicator variables for 50 states and about 300 NAICS 6-digit industries.

We further condition on a vector of firm characteristics Z_f. In all specifications, Z_f includes the full set of noise controls pertaining to the management surveys to alleviate potential measurement error in $Management_f$. We subsume the role of Chinese firms' ownership type with fixed effects that distinguish between private domestic companies, state-owned enterprises and foreign-owned multinational affiliates (such ownership information is not available for the US). We also report results with an extended set of firm controls Z_f such as firm age, capital and skill intensity, standard productivity measures, and domestic sales. As discussed below, this helps address concerns with omitted variable bias and reverse causality while also shedding light on relevant mechanisms.

The coefficient of interest β 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. If management corresponds to firms' exogenous productivity draw or one component of it, then β would in principle capture the causal impact of management on export activity. Alternatively, if a primitive firm attribute such as an exogenous productivity draw determines the choice of management technology and export activity, β would 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. Instead, we aim to establish that effective management is a qualitatively and quantitatively important factor in firms' export success (this section), and to examine its role for production efficiency and product quality (Section 5).

While the US MOPS provides management data for a large cross-section of over 10,000 US firms in 2010, WMS covers only about 500 Chinese firms in 2007. In order to fully exploit the information in the Chinese panel data, we therefore estimate specification (11) at the firm-year level, letting all variables but $Management_f$ vary both across firms and over time, and controlling for changes in macroeconomic conditions with year fixed effects ϕ_t. This is motivated by the evidence in Bloom et al (2016) and patterns in our own MOPS data that management practices evolve slowly within firms over time, such that the cross-sectional variation dwarfs the time-series variation.[7] We report standard errors clustered by firm since our key variable $Management_f$ is measured at the firm level.

4.2 Export Status, Revenues and Profits

We first establish that better managed firms are significantly more likely to export. Conditional on exporting, they also earn higher export revenues. These findings provide empirical support for Propositions 1 and 2.

Table 2 presents these baseline results. In Columns (1) and (5), we examine firms' export status by setting the dependent variable $ExportOutcome_f$ equal to 1 if a firm lists positive exports on its balance sheets and 0 otherwise. We estimate equation (11) in the matched ASIE-WMS sample for China and the matched ASM-MOPS sample for the US, respectively.[8] Firms employing more effective management practices are systematically more likely to enter foreign markets.[9]

We explore the relationship between managerial competence and the scale of export operations in the subset of exporting firms in Columns 3 and 7. We re-estimate specification (11) using the log value of global exports as the outcome variable $ExportOutcome_f$ in the matched CCTS-WMS sample for China and the matched LFTTD-MOPS sample for the US.[10] We observe that well-run exporters realize substantially higher sales abroad.[11]

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 in which companies were established from ASIE and ASM. We

[7] The average within-firm change in the management z-score between 2005 and 2010 as reported in 2010 is 0.3. In comparison, the cross-firm mean and standard deviation of the management z-score before standardisation are 0.09 and 0.44 respectively in 2010.

[8] In the case of the US, we observe export status at the plant level from ASM, but all other trade indicators are available at the firm level only from LFTTD. To exploit the full granularity of the data, we run the baseline US regressions for export status at the plant level, but out results are robust to aggregating up to the firm level.

[9] We report results using the Probit estimator, but similar patterns hold with linear estimators such as OLS.

[10] We measure a firm's worldwide exports with the combined value of all its export transactions in the customs records that cover the universe of trade transactions. This arguably gives a more accurate account of exporters' activity than the value of total exports reported on their balance sheets. We have confirmed that the latter produces similar results.

[11] Our results for China indicate that multinational companies are more likely to export and have higher export revenues conditional on trading. However, management plays an independent role from foreign ownership that cannot be attributed to multinational affiliates being better managed. State-owned enterprises do not display markedly different outcomes from private domestic firms.

find some evidence that older manufacturers are more likely to be exporters and generate higher export revenues, although these patterns are significant only for the US. 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.[12] To guard against omitted variable bias, we always include this broader vector of controls Z_f in the rest of the analysis, but note that the point estimates for $Management_f$ are typically qualitatively and quantitatively close with and without these additional controls.

Our findings point to potentially large economic consequences from improving management practices. Based on our estimates with the extended set of controls, a one-standard-deviation rise in the management z-score is associated with a 5% higher probability of exporting and 23% higher export revenues in China; these numbers are 3% and 37% for the US. Given the large management gaps across countries shown in Figure 3, this implies that variations in management competence could account for substantial differences in trade intensity across countries. These magnitudes are also sizeable compared to the role of firm age, skill- and capital intensity (comparative statics in the range of 2% to 28%).

In addition to export status and revenues, Proposition 2 also has implications for firms' export profits. As standard with balance-sheet data, however, we observe firms' consolidated profits from worldwide sales that cannot be broken down by market. In Table 3, we exploit the available information as best we can, and find indicative evidence of a positive link between effective management and export profits. We first confirm that superior managerial practices are associated with higher firm profits, with and without the expanded set of firm controls (Columns 1-2 and 4-5). We then document that this holds even conditioning on domestic sales, calculated as the difference between total output and total exports (columns 3 and 6).

4.3 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 firms' exports with the log number of destination countries they supply, the log number of products they ship to at least one destination, and the log number of total destination-product markets they penetrate. We define products at a very granular level, namely HS 8-digit categories. We re-estimate equation (11) using each export margin in place of $ExportOutcome_f$, and report our findings in Table 4. Appendix Table 1 contains

[12] The positive correlation between average wages and the share of skilled workers across Chinese firms generates multicollinearity in Columns 2 and 4 and accounts for the negative coefficient on the skilled labor share. Both measures of skill intensity enter positively and significantly if we include them one at a time.

symmetric regressions without the wider set of firm controls Z_f.

We consistently observe positive coefficients on $Management_f$ across all specifications, and these are statistically significant in all but one case (the intensive export margin in China). For Chinese firms, a one-standard-deviation 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 destination-product market (Columns 1-4 of Table 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 US. In the case of China, this share reaches 90% when we condition on the full set of firm controls and 75% when we do not.[13]

These results are in line with the theoretical predictions for the margins of firms' export activity summarized in Proposition 2. As a final check on internal consistency, we consider the variation in export sales across a firm's destination-product markets. In our model, exporters add foreign markets in decreasing order of profitability. As a result, better managed firms servicing more markets do so by entering progressively smaller markets where they earn lower sales. This composition effect implies that our intensive-margin results underestimate the relationship between management and exports to any given market. Further analysis supports this. For each firm, we identify its largest destination-product market by sales revenues, and regress log exports to this top market on $Management_f$. We obtain much larger coefficients than those for the intensive margin that are moreover significant for both China and the US (Columns 5 and 10). As we repeat this exercise replacing the outcome variable with log average sales to the top two, top three, etc. export markets, we record progressively lower point estimates as anticipated.

4.4 Exports vs. Domestic Activity

We are interested in whether the positive association between management quality and export performance reflects a general beneficial effect of good management on firm activity. Through the lens of our model, effective management practices improve 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, as with productivity elasticities in workhorse trade models, generally depend on modeling assumptions about demand.[14] In our CES set-up, better 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.

Table 5 corroborates these patterns in data, further validating our model. We compute firms'

[13] These calculations are based on comparing regression coefficients across specifications for different export outcomes, such as Column 8 of Table 2 and Column 8 of Table 4.

[14] For example, the ratio of a firm's sales in two markets is independent of firm productivity with CES but not with linear demand or with non-homothetic preferences (e.g. Melitz (2003), Melitz and Ottaviano (2008)).

log domestic sales by taking the difference between total sales and total exports as reported on companies' balance sheets and matched customs records. Columns 1 and 6 confirm that producers with advanced management practices sell more at home. In the rest of Table 5, we repeat our main regressions for manufacturers' export status, global export revenues and various export margins explicitly controlling for their domestic sales in addition to the extended set of firm characteristics Z_f. We continue to record positive and highly significant coefficients on management practices (except for average exports per destination-product for China as before). Averaging across specifications, the estimated management elasticity of exports rises by 29% for China and declines by 50% for the US.

4.5 Interpretation: Management as Productivity

The results above establish that successful export performance is closely related to the use of sophisticated management practices. We interpret this as evidence that managing capital and labor resources effectively is critical to firm productivity. In other words, management competence is the real-life, tangible counterpart to the theoretical notion in the literature of quantity-based total factor productivity, or TFPQ. In our model, the latter corresponds to the capacity to produce a given quantity and/or quality of output at lower cost. Since TFPQ is not observable, it is typically proxied by revenue-based TFPR, which is constructed from data on sales revenues and input costs (capital, labor, materials). This approach faces two challenges. First, TFPR is a noisy measure of TFPQ because it incorporates input and output prices and mark-ups by construction (Hsieh and Klenow (2009), De Loecker (2011), Bartelsman, Haltiwanger, and Scarpetta (2013)). This introduces bias in regressions of firm outcomes such as export activity on TFPR. Second, TFPR constitutes a residual from production function estimates and is thus a black box with no clear economic content. By contrast, management effectiveness identifies specific practices that firms use in production, such as setting targets, monitoring operations, and incentivizing workers. This unpacks the black box of TFPR residuals to isolate well-defined economic mechanisms. Management measures also circumvent estimation biases associated with TFPR since they are obtained entirely independently from balance-sheet and customs records of firms' production and export activity.

In resolving these issues, interpreting management as TFPQ raises two questions: Where does good management come from? And is management the only component of TFPQ?

Question 1: Where does good management come from? One possibility is that management competence is an exogenous draw at the firm level in the spirit of Melitz (2003), as in our baseline model. Consider the process of entrepreneurship and firm creation. Founder-entrepreneurs may differ in their inherent ability to implement business ideas and manage operations. Alternatively, ex-ante identical entrepreneurs may have to hire managers with imperfect information about managers' objective skill or about the quality of the firm-manager match. Indeed, the corporate finance literature has found evidence that managers bring their own distinct style to running a company (Bertrand and Schoar 2003).

On the other hand, management practices may be an endogenously chosen production technology that is governed by a primitive exogenous draw. This process may be deterministic. For instance, entrepreneurs may have to undertake R&D to develop a product with uncertain prospects. Once its potential is known (e.g. consumer appeal), they may choose what management practices to adopt. If more effective management lowers variable production costs but entails higher fixed costs of adoption and use, entrepreneurs with better ideas would capitalize on economies of scale and implement superior management because they expect to capture a bigger market share. The same would hold if founders have to hire outside managers in an efficient labor market, and more skilled managers that can introduce better management are more expensive.[15] However, the endogenous choice of management strategy may also be stochastic if entrepreneurs face asymmetric information or other frictions in the market for managers. As a result, observed management may have both an exogenous and an endogenous components.

If management is exogenously determined, specification (11) would in principle capture the causal impact of management quality on firm performance. By contrast, if management is a deterministic endogenous choice, β in equation (11) would reflect the equilibrium relationship between two joint outcomes of the firm's maximization problem. While our analysis does not distinguish between these two alternatives, it nevertheless reveals that management matters for firm performance and allows us to establish below the mechanisms through which it operates (namely, production efficiency and quality capacity).

Question 2: Is management the only component of TFPQ? Heterogeneous-firm trade theory traditionally focuses on TFPQ as the single firm attribute that governs all firm outcomes such as input use; output price, quantity and quality; domestic sales, export activity and profits. This generates two stark predictions: a company exports if and only if its productivity exceeds a certain threshold, and exporters' foreign sales increase monotonically with productivity. In practice, evidence for many countries indicates that measured TFPR is positively but not perfectly correlated with available measures for these firm outcomes.

There are two possible explanations for this discrepancy between theory and empirics: (1) measurement error in TFPR productivity and/or in other firm outcomes; and (2) multiple firm attributes jointly determine firm outcomes, with TFPR identifying only one of them. For example, Hallak and Sivadasan (2013) suggest that firms receive two exogenous and imperfectly correlated draws that fix respectively the marginal cost of producing physical units and quality. Since consumers prefer higher-quality goods at lower prices, the composite capability draw at

[15] For similar reasons, reverse causality does not pose classical estimation bias in our case. If higher export revenues and profits induce firms to adopt more advanced management practices because they can amortize the fixed costs of doing so, this would be another manifestation of the economies of scale argument. Likewise, if firms learn about novel managerial practices from their experience with foreign buyers and markets, this could amplify the economies of scale mechanism.

the firm level uniquely decides firm outcomes, but neither individual component does so on its own.

To investigate this, we construct firms' TFPR as in Levinsohn-Petrin (2003) using balance-sheet data on companies' total sales, capital expenditures, labor costs and material purchases, and accounting for differences in production technology across industries and ownership types with appropriate fixed effects. We first examine the conditional correlation between management and TFPR by estimating specification (11) for TFPR as the left-hand side variable. Columns 1 and 7 of Appendix Table 2 demonstrate that TFPR is indeed higher in firms employing more sophisticated management practices. We then replicate our baseline analysis of export status, export revenues, the extensive and intensive margins of exporting including both the management score and TFPR in regressions with the full set of firm controls Z_f (Columns 2-6 and 8-12 of Appendix Table 2). Our results for management remain largely quantitatively and qualitatively unchanged: The point estimates for β are now slightly higher in the case of China and slightly lower in the case of the US, but not significantly different. TFPR also enters positively and significantly in all but one specification. The coefficient on TFPR is systematically 10% lower compared to regressions that include TFPR alone but not management (Appendix Table 3).

These findings are consistent with two interpretations that are not mutually exclusive. On the one hand, management competence and TFPR might constitute two noisy empirical measures for TFPQ. On the other hand, management competence and TFPR might capture two distinct dimensions of TFPQ that are imperfectly correlated with each other and jointly determine firm performance. While we cannot empirically distinguish between these two alternatives, the evidence clearly indicates that management organization importantly shapes firm activity.

5 Management, Efficiency and Quality: Structural Estimates

5.1 Main Results

Having established that advanced managerial practices are associated with superior export performance, we next assess the empirical validity of Propositions 3 and 4 to inform the underlying mechanisms through which management operates. In particular, we are interested in whether effective management boosts export performance by improving firms' production efficiency, by enabling them to manufacture higher-quality products, or both. The results we establish lead us to conclude that management acts through both the efficiency and the quality channels.

We first consider the predictions of Proposition 3 for the relationship between firms' management practices, product quality, and quality-adjusted prices. We exploit the rich dimensionality of our data and examine firms' behavior in finely disaggregated export markets. This allows us to study the role of management while carefully accounting for various observed and unobserved supply and demand conditions with an extensive set of fixed effects. Our two key equations of interest are:

$$\ln(Quality_{fdp}) = \beta^q Management_f + \Gamma^q Z_f + \phi_l^q + \phi_{dp}^q + \varepsilon_{fdp}^q \quad (12)$$

$$\ln(Price_{fdp}/Quality_{fdp}) = \beta^{p/q} Management_f + \Gamma^{p/q} Z_f + \phi_l^{p/q} + \phi_{dp}^{p/q} + \varepsilon_{fdp}^{p/q} \quad (13)$$

Through the lens of our model, the coefficient on management in the quality equation (β^q) identifies the structural parameter θ, which governs the effect of management on product quality. Similarly, the coefficient on management in the quality-adjusted price equation ($\beta^{p/q}$) identifies the structural parameter δ, which captures the effect of management on productive efficiency. Specifications (12) and (13) thus allow us to assess whether management operates through both the quality and the efficiency mechanisms. According to Proposition 3, we should observe $\beta^q > 0$ and $\beta^{p/q} < 0$ if and only if the quality and efficiency channels are active, respectively. Moreover, this interpretation is conservative given the potential for variable mark-ups.[16]

The unit of observation is now the firm–destination–HS8 product for the US and the firm-destination-HS8 product-year for China.[17] $Price_{fdp}$ is the export unit value that firm f charges for product p in destination country d (in year t). We use free-on-board export prices that exclude trade duties, transportation costs and retailers' mark-up, such that $Price_{fdp}$ corresponds to the sum of the exporter's marginal cost and mark-up. We construct model-consistent proxies for firms' export product quality and quality-adjusted price using data on export prices and quantities by firm, product, destination (and year). As discussed in Section 2.1, $\ln q_{ji} \propto \sigma \ln p_{ji}^{fob} + \ln x_{ji}$, and log product quality $\ln q_{ji}$ can be inferred as the sum of the log quantity sold x_{ji} and the log free-on-board price p_{ji}^{fob}, where the latter is adjusted for the elasticity of substitution across varieties σ. We set $\sigma = 5$ as the median value adopted in calibration exercises in the prior literature, but our results are robust to alternative assumptions about this elasticity (Khandelwal, Schott, and Wei (2013)).

We continue to include fixed effects for firms' province or state location ϕ_l and the full set of firm controls Z_f, as well as year fixed effects for China. Instead of the fixed effects for firms' primary industry ϕ_i in equation (11), we now condition on destination-product pair fixed effects ϕ_{dp}. These subsume the variation in total expenditure, consumer price indices and trade costs across countries and products in our model, as well as any observable and unobservable differences in consumer preferences, institutional frictions and other forces outside our model. Specifications (12) and (13) are thus a very stringent test of our theory, as the coefficient on $Management_f$ is identified from the variation across firms within very narrow segments of the global economy, such as Chinese exporters of men's leather shoes to Germany or US exporters of cellular phones

[16] If better managed firms set higher mark-ups, our conclusions for β^q would be unaffected, but p_{ji}^{fob}/q_{ji} would be inflated and we would be less likely to find $\beta^{p/q} < 0$.

[17] All of our results for China hold when we distinguigh between export transactions carried out under the processing or ordinary trade regime. We find similar patterns when we consider the firm–destination–product-trade regime–year quintuplet as the unit of observation and include a complete set of destination–product–trade regime triple fixed effects.

to Japan. We conservatively cluster standard errors by firm to accommodate correlated shocks across destinations and products within firms.

Equations (12) and (13) are in the spirit of prior studies of the relationship between measured firm productivity (TFPR), prices and revenues (e.g. Kugler and Verhoogen (2009), Manova and Zhang (2012)).Since these variables are all constructed from the same raw data on sales and quantities, a common challenge in this literature has been ruling out estimation biases arising from correlated non-classical measurement error in the right- and left-hand side variables. We circumvent this problem by using direct measures of management practices that are entirely independent of the sales and quantity data.

The empirical evidence in Table 6 lends strong support to managerial competence improving both production efficiency and product quality. In both China and the US, we observe that management is associated with significantly higher export quality (Columns 1 and 5) and significantly lower quality-adjusted prices (Columns 2 and 6). Formally, we find that $\theta^{CH} = 0.531$, $\delta^{CH} = 0.385$, $\theta^{US} = 0.048$ and $\delta^{US} = 0.045$. Based on these estimates, upgrading management practices by one standard deviation is associated with a 53% increase in product quality and a 39% decline in quality-adjusted prices in China. In the case of the US, quality and quality-adjusted prices are equally elastic with respect to management competence: a one-standard-deviation rise in the management score is accompanied with a 5% change in both.

Although comparing the level of the effects on quality and efficiency across countries is difficult because of the different management survey methodologies and datasets, the relative effect of management within each country is informative. We draw two key conclusions from our results.

First, management appears to have a larger impact on both productive efficiency and product quality in China than in the US, $\delta^{CH} > \delta^{US}$ and $\theta^{CH} > \theta^{US}$. One possible explanation is diminishing returns to better management, since management practices are substantially worse in China: Initial improvements in management yield large gains, but each additional improvement addresses more and more marginal issues with smaller incremental benefits to quality and efficiency.

Second, the parameters suggest that management has a relatively bigger effect on product quality than on productive efficiency in China compared to the US, $\theta^{CH} - \delta^{CH} > \theta^{US} - \delta^{US} = 0$. We explore this further by directly estimating the following price equation in Columns 3 and 7:

$$\ln(price_{fdp}) = \beta^p Management_f + \Gamma^p Z_f + \phi_l^p + \phi_{dp}^p + \varepsilon_{fdp}^p \tag{14}$$

Our theory implies that $\beta^p = \beta^{p/q} - \beta^q = \theta - \delta$ reflects the relative impact of management on quality vs. efficiency. Consistently with the findings from specifications (12) and (13), there is a significant and positive relationship between prices and management in China (where the relative effect of management on quality is greater than on efficiency) and an insignificant management coefficient in the US. The greater impact of management on quality relative to efficiency in China is intuitive. When quality levels are relatively low (as they are in China compared to the US), a marginal change in managerial competence is likely to have much larger impacts on product quality. This is consistent with the hypothesis of Sutton (2007) that moving up the product quality ladder through improved managerial competencies is critical for emerging economies.

For completeness, Columns 4 and 8 document the elasticity of export quantity with respect to management. In our model, this elasticity is $\delta\sigma - \theta$ and its sign is theoretically ambiguous. In practice, we find that quantity is neutral with respect to the management score in China and increasing in the US.

5.2 Robustness

Our interpretation of the results for export prices and quality can of course be criticized on many counts. We present some robustness checks and extensions in this sub-section.

5.2.1 Demand Elasticity

In order to infer a model-consistent proxy for product quality $\ln q_{ji} \propto \sigma \ln p_{ji}^{fob} + \ln x_{ji}$, we need the price elasticity of demand σ, which with CES preferences corresponds to the elasticity of substitution across varieties in consumption. While our analysis above assumed a standard parameter value from the literature, $\sigma = 5$, our findings are robust to alternative assumptions. We have confirmed that qualitatively similar patterns obtain when we instead set σ equal to 4, 7, or 10. We have also checked that our results remain unchanged when we allow σ to vary across SIC 3-digit industries using the Broda and Weinstein (2006) estimates (Panel A of Appendix Table 4).

5.2.2 Variable Mark-ups

Management practices may affect not only production efficiency and product quality, but also firms' mark-ups and thereby prices. This channel is moot in our model because CES preferences generate constant mark-ups, but it may be important in practice. Consider first the case of no quality differentiation across firms. The prior theoretical literature has shown that in certain environments with variable mark-ups, more productive firms charge lower prices even though they set higher mark-ups (e.g. Melitz and Ottaviano (2008), Eaton and Kortum (2002)). With alternative market structures, however, mark-ups could in principle rise sufficiently quickly with firm productivity to dominate the associated decline in marginal costs and result in higher prices. Our findings for observed prices and inferred quality might then be driven by better managed firms extracting higher mark-ups rather than offering more sophisticated products.

In a first step towards addressing this concern, we confirm that our results hold when we control for firms' market share as a proxy for their ability to impose higher mark-ups (Panel B of Appendix Table 4). We use a Chinese (US) firm's share of total Chinese (US) exports to a given destination-product, $\frac{Exports_{fdp}}{\sum_f Exports_{fdp}}$, as an indicator of its market power in that market. Our results for management remain robust.

6 Input Quality and Assembly Complexity

We next test the predictions of Proposition 4 for the quality of firms' manufactured inputs and the complexity of their assembly technologies. Since we do not directly observe input quality and assembly complexity in the data, we proxy them with a variety of observed input characteristics. We construct these using balance-sheet data on firms' total material purchases and customs records on the universe of firms' imported input purchases by product and country of origin; as common with production data, we cannot access information on firms's domestic inputs.

We estimate specifications of the following two types:

$$InputCharacteristic_f = \beta Management_f + \Gamma Z_f + \phi_l + \phi_i + \varepsilon_f \tag{15}$$

$$InputCharacteristic_{fop} = \beta Management_f + \Gamma Z_f + \phi_l + \phi_{op} + \varepsilon_{fop} \tag{16}$$

As in equation (11), the unit of observation in regression (15) is the firm, and we include the same set of controls (location and industry fixed effects; full set of noise and firm controls). Similar to equation (12), the unit of observation in regression (16) is the firm-country of origin-product, and we include the same set of controls (location fixed effects; country of origin-product pair fixed effects; full set of noise and firm controls). In the case of China, we again exploit the panel and add year fixed effects. We cluster error terms by firm as before.

Through the lens of our model, operationalizing equations (15) and (16) serves a number of purposes. Coefficient β can validate the quality mechanism but not speak to the efficiency mechanism. If $\theta > 0$, better managed firms manufacture higher-quality products using more expensive, more sophisticated inputs and/or more expensive, more complex assembly technologies, and we would observe $\beta > 0$. By contrast, if $\theta = 0$ and the quality channel is moot, we would record $\beta = 0$. In addition, regressions (15) and (16) provide an independent test of the quality mechanism since they exploit input data unrelated to export prices and revenues. This alleviates outstanding concerns with variable mark-ups driving the results for export outcomes. Finally, specifications (15) and (16) constitute a falsification exercise because our model could not readily rationalize $\beta < 0$.

6.1 Input Quality

The quality production technology in our model stipulates that making goods of higher quality is associated with higher marginal costs. One possibility is that this reflects the need for high-quality intermediate inputs.[18] Table 7 provides evidence consistent with better managed firms sourcing more expensive, higher-quality inputs from richer countries of origin. In Columns 1-2 and 6-7, we estimate regression (15) for the log value of imports and the log share of imports

[18] Recall the dress example: A garment producer can choose what materials to use in order to make a dress according to preset designs and assembly steps. He could use cheap cotton and plastic buttons to make a cheap, low-quality dress or expensive silk and mother-of-pearl buttons to make an expensive, high-quality dress.

in total input purchases. For both China and the US, we find that better managed firms have higher imports, consistent with their operating on a bigger scale and using more inputs in absolute terms. Unlike American producers, however, better managed Chinese producers also import a systematically higher share of their inputs, in line with priors about the paucity of specialized, high-quality domestic inputs in China. The insignificant estimates for the US thus serve as a corroborating placebo test.

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

In Columns 4 and 9 of Table 7, we estimate regression (16) for the log unit value of firm imports by product and country of origin. Advanced management practices are accompanied by higher imported input prices in China, but not significantly so in the US. We find similar patterns in Columns 5 and 10 when we apply the structural transformation to import unit values to obtain inferred input quality, in the same manner as we did with inferred export quality. Improving management effectiveness by one standard deviation corresponds respectively to 10% and 58% rises in imported input prices and quality among Chinese manufacturers. These results suggest that at lower levels of management competence and product quality such as the Chinese context, 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 source country. This additional channel might contribute towards the significantly higher elasticity of output quality with respect to management that we documented above for China relative to the US.

6.2 Assembly Complexity

A body of work has proposed that manufacturing more sophisticated products also entails the assembly of a wider range of specialized inputs, possibly through the completion of more manufacturing stages (e.g. Hummels, Ishii and Yi (2001), Yi (2003), Johnson and Noguera (2012)). This provides a second possible rationalization for the quality poduction function in our model.[19] We therefore use the variety of a firms' imported inputs as a proxy for the complexity of their assembly technology. We also account for product differentiation across countries supplying the same product code à la Krugman (1980). In particular, we characterize input variety with the log number of different HS-8 product codes, countries of origin or origin country-product pairs

[19] Recall the printer example: A manufacturer of office equipment can produce printers of varying functionality. She could build a 50-part printer that can print or a 150-part printer than can print, scan and photocopy. While both printers would be made from horizontally but not necessarily vertically differentiated components, the more sophisticated printer would require more complex blueprints and assembly processes.

in a firm's import portfolio, and estimate specification (15) for each of these input variety measures. As the results in Table 8 demonstrate, better managed companies systematically source more distinct inputs from more suppliers, in terms of more origin-product combinations. These patterns moreover obtain when controlling for firms' log number of export product. This ensures that the variety of imported inputs does not rise with management competence because of a commensurate increase in the number of output products, rather than the use of more complex production processes.

In light of Proposition 4, the patterns in Tables 7 and 8 corroborate the idea that effective management enables firms to produce higher-quality products using higher-quality inputs and more complex production processes. Intuitively, this could be attributed to good management improving quality control and reducing the incidence of costly mistakes in manufacturing, both of which are especially relevant when using expensive, high-quality inputs. Superior management may also enhance the processing of specialized inputs that need to be mutually compatible for final assembly, the coordination of multiple production stages, and the implementation of efficient inventory practices. These practices are particularly important when the manufacturing process is more complex.

7 Causal Effect of Management

The model that we presented in Section 2 has a range of empirical implications for the covariation we expect to see between firms' management practices and multiple aspects of their trade activity. These are broadly supported by the data. Although we can extend the model to capture endogenous choice of management practice (see Appendix 2.1), we do not have a way of empirically testing this alternative model as its predictions are observationally equivalent to those of the baseline framework with exogenous management draws.

In this section, we provide two pieces of independent evidence which suggest that management competence indeed exerts a causal effect on firms' production efficiency and quality capacity, and thereby on their export performance: one based on a management intervention in a randomized control trial in India, and one based on the panel dimension of our data for the US.

7.1 RCT Evidence

A growing body of work using randomized control trials (RCT) indicates that some aspects of management have a causal effect on firm TFP, production efficiency and product quality (e.g. see the survey in McKenzie and Woodruff (2013)). Perhaps the best evidence comes from Bloom, Eifert, Mahajan, McKenzie, and Roberts (2013), who worked with the company *Accenture* to provide free management consulting services to large firms (average of 273 employees) in the textile industry in Mumbai, India. The study examined three groups of plants over the 2008-2011 period. Eleven plants owned by 3 firms served as a pure control group, while 20 plants owned by 17 firms constituted the treatment group. In the treated group, 14 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 about 38 core management practices across 6 key areas (factory operations, quality control, inventory control, loom planning, human resources, and sales and orders). The remaining 6 plants in the treated firms were given only the one-month diagnostic without any intervention. All three groups of plants were followed for a further 3 years with monthly visits to collect detailed production data. In 2017, Bloom, Mahajan, McKenzie, and Roberts (2017) went back to these firms to assess the long-term impact of the intervention 8 years on. They collected various follow-up performance metrics for 2014 and 2017, including trade activity that we are the first to analyze here.

Three lessons emerge from the India RCT. First, the consulting intervention had a large positive effect on the management practices that firms actually adopted. Figure 4 plots the share of all 38 core management practices that different plants implemented at the monthly frequency during the first 40 months (2008-2011) and 8 years after the initial intervention (2017). In the first three years, intervention plants in treated firms made rapid improvements compared to both non-intervention plants in treated firms and pure control plants. In the long run, treated firms rolled out more management practices that they had newly adopted in their intervention plants to their non-intervention plants as well, leading to a convergence in management effectiveness across plants within treated firms. Compared to the pure control group, the management intervention had surprisingly persistent effects: Treated firms did not relapse, but neither did they take off.

Second, the management intervention had a large causal impact on firms' TFP, production efficiency and quality control. Bloom et al (2013) report that TFP increased by 20% in treated plants relative to control plants in 2008-2011. In Figure 4, we use their data to plot the percent change in firms' product quality against the concurrent change in their management score over 2008-2011. Both changes are defined as the difference between pre- and post-experiment values (relative to their pre-experiment average), and the quality defects index is the severity-weighted number of defects per roll of fabric. Among treated firms, there is a clear and highly significant negative relationship (p-value 0.001), indicating that the upgrading of management practices led to a sharp decline in the frequency of quality defects. By contrast, no such pattern emerges among non-treated firms. Indeed, the intention-to-treat estimate is an extremely large 56% reduction in defects. No data were collected on quality control in the 2017 follow-up survey due to budgetary restrictions.

Turning to production efficiency, a classic measure in the context of the textile industry is the number of looms per employee, because a weaving worker tending more looms can produce more output per unit of time (Clark 1987). Column 1 of Table 9 demonstrate the significant and persistent impact of the management intervention on the production efficiency of treated firms during 2008-2017. The unit of observation in these regressions is the plant-year, where the pre-treatment period is defined as 2008 and the post-treatment period spans years 2011, 2014 and 2017. The log number of looms per worker is on average 24% higher in treated firms post-treatment (Panel A). Both intervention and non-intervention plants within treated firms benefit, although the efficiency gains are higher among the former (Panel B). These impacts are persistent and stable over time (Panel C).

Third, the management intervention significantly increased firms' export participation in the long run 2008-2017. Plants in treated firms have a 19% higher probability of exporting in the years post treatment, 42% higher export revenues, and a 9% higher share of exports in total sales (Columns 2-4 in Panel A of Table 9). These effects are present for both intervention and non-intervention plant within treated firms, and their economic magnitude not significantly different across the two groups (Panel B). The extensive margin of exporting appears to respond more strongly in the short to medium term, while the intensive margin of export volumes expands more in the medium to long term.

These three pieces of causal RCT evidence highlight how adopting superior management strategies can lead to big improvements in firms' product quality, production efficiency, and ultimately export performance in poor-management environments such as India.

7.2 Panel Evidence

We shed further light on the possible causal effect of firm management on trade activity by exploiting the panel dimension in our data for the US. In Panel A of Table 10, we replicate all of our key results for specifications (11)-(16) when regressing firms' export and import outcomes in year 2011 on their management score in year 2010. Conditioning as before on the full set of state fixed effects, industry fixed effects, noise and firm controls, we establish qualitatively and quantitatively similar results across all specifications.

Using an even more stringent estimation, we show that within-firm improvements in management practices are associated with significant expansion in firms' export performance, rise in their production efficiency and output quality, and upgrading of their imported input quality and complexity. In particular, in Panel B of Table 10 we regress the change in all relevant trade outcomes within firms from 2005 to 2010 on the concurrent change in their management practices.[20] We include state and industry fixed effects, which now absorb not only level differences, but also systematic differences in time trends across space and manufacturing sectors. Controlling for the full set of firm and noise controls as above, we record significant coefficients across the board. Their magnitudes are slightly reduced, consistent with management exerting greater effects on the level of firm performance than on its growth trajectory. Of note, we now document a significant positive coefficient on the price and inferred quality of imported inputs, unlike the insignificant positive estimates in the baseline cross-sectional results. The only point estimate that changes sign in these first-difference regressions is that for the average GDP per capita of firms' source countries. We believe this is because of the rise of China over the 2005-2010 period

[20] In 2010, US firms completing MOPS were asked about their management practices in both 2005 and 2010. In 2015, they likewise reported on their management practices in 2015 and 2010. The contemporaneous and recall data for 2010 line up well, which gives us confidence in using recall data. We cannot perform the panel analysis as easily for the period after 2010 because of changes in firm coverage and product classification systems.

- a country with relatively low income but nevertheless steadily increasing product quality levels over time.

8 Conclusion

This paper examines for the first time the role of management practices for firms' export performance. We provide a theoretical framework which allows management ability to affect both productive efficiency and quality capacity. Good managerial practices thereby enhance export participation, intensity and number of markets served. These results suggest that effective management is an important aspect of firm productivity which has typically been treated as a black box in the prior literature. Empirically, we show that although better management is associated with greater efficiency and quality capacity in both China and the US, it matters relatively more in China and especially for the quality mechanism in China. This is consistent with the idea that enhanced managerial capabilities are critical for helping emerging economies move up the quality ladder and become richer (e.g. Sutton 2007).

Our findings have broader implications for the microeconomics of firm operations and inform active literatures on the nature, origin and welfare consequences of firm heterogeneity. They also speak to policy concerns about the impact of limited management know-how on growth and entrepreneurship in developing economies. A limitation of the work is that we have not examined the reasons for weaker managerial ability in some firms and countries compared to others. We believe that strengthening managerial capabilities is an important policy issue, and researchers are starting to make in-roads into the key question of what determines management and how policy-makers can influence it.

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Managing Trade: Evidence from China and the US*

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June 2017

Abstract

This appendix provides formal proofs for the baseline model presented in the paper and presents three theoretical extensions for endogenous choice of management practice, multiple components of firm ability, and endogenous choice of input and output quality.

1 Proofs for Baseline Model

1.1 Set Up

Consider a world with $J+1$ countries. The representative consumer in country j has CES utility

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

where q_{ji} and x_{ji} are quality and quantity consumed by country j of variety i, and Ω_j is the set of goods available to j. The elasticity of substitution across products is $\sigma = 1/(1-\alpha) > 1$ with $0 < \alpha < 1$. If total expenditure in country j is R_j, j's demand for variety i is

*We thank Xincheng Qiu of Peking University for his excellent research assistance for this appendix.

$$x_{ji} = R_j P_j^{\sigma-1} q_{ji}^{\sigma-1} p_{ji}^{-\sigma} \tag{2}$$

Proof. The utility maximization problem is

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

$$\text{s.t.} \int_{i\in\Omega_j} \left(p_{ji}x_{ji}\right) di = R_j$$

Define the Lagrangian function as

$$L = \left[\int_{i\in\Omega_j} \left(q_{ji}x_{ji}\right)^{\alpha} di\right]^{\frac{1}{\alpha}} + \lambda\left(R_j - \int_{i\in\Omega_j} \left(p_{ji}x_{ji}\right) di\right)$$

F.O.C. implies

$$\frac{\partial L}{\partial x_{ji}} = \left[\int_{i\in\Omega_j} \left(q_{ji}x_{ji}\right)^{\alpha} di\right]^{\frac{1-\alpha}{\alpha}} \left(q_{ji}x_{ji}\right)^{\alpha-1} q_{ji} - \lambda p_{ji} = 0$$

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

Substituting into the constraint yields

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

Note that $\sigma = 1/\left(1-\alpha\right)$, or $\alpha = \frac{\sigma-1}{\sigma}$, so

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

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

Therefore

$$
\begin{aligned}
x_{ji} &= \frac{\left(\lambda\frac{p_{ji}}{q_{ji}}\right)^{\frac{1}{\alpha-1}}\left[\int_{i\in\Omega_j}\left(q_{ji}x_{ji}\right)^{\alpha}di\right]^{\frac{1}{\alpha}}}{q_{ji}} \\
&= R_j\left(\int_{i\in\Omega_j}\left(\frac{p_{ji}}{q_{ji}}\right)^{1-\sigma}di\right)^{-1}q_{ji}^{\frac{\alpha}{1-\alpha}}p_{ji}^{\frac{1}{\alpha-1}} \\
&= R_jP_j^{\sigma-1}q_{ji}^{\sigma-1}p_{ji}^{-\sigma}
\end{aligned}
$$

That is, $x_{ji} = R_jP_j^{\sigma-1}q_{ji}^{\sigma-1}p_{ji}^{-\sigma}$, where $P_j \triangleq \left[\int_{i\in\Omega_j}\left(\frac{p_{ji}}{q_{ji}}\right)^{1-\sigma}di\right]^{\frac{1}{1-\sigma}}$ is a quality-adjusted ideal price index and p_{ji} is the price of variety i in country j. □

A sufficient statistic for unobserved product quality $\ln q_{ji}$ within market j can be constructed from observed price and quantity data as $\sigma\ln p_{ji} + \ln x_{ji}$. To see this, note that $\ln q_{ji} = \frac{1}{\sigma-1}\left\{\ln R_j + (\sigma-1)\ln P_j + \sigma\ln p_{ji} + \ln x_{ji}\right\} = \beta_j + \frac{1}{\sigma-1}\epsilon_{ji}$, where $\beta_j = \ln R_j + (\sigma-1)\ln P_j$ can be absorbed with destination-product fixed effects in a regression and the residual $\epsilon_{ji} = \sigma\ln p_{ji} + \ln x_{ji}$ becomes an estimated quality proxy.

1.2 Production and Sales Technology

Management operates through two mechanisms: *production efficiency* and *product quality*.

Upon entry, firms draw a firm-wide managerial ability level $\varphi \in (0,\infty)$ from distribution $g(\varphi)$ and a vector of firm-product specific "expertise" levels $\lambda_i \in (0,\infty)$ from distribution $z(\lambda)$. We will think of better managed firms as having a higher ability draw φ. We assume that $g(\varphi)$ and $z(\lambda)$ are independent of each other and common across firms with continuous cumulative distribution functions $G(\varphi)$ and $Z(\lambda)$ respectively, while λ is i.i.d. across products and firms.

At a marginal cost of $(\varphi\lambda_i)^{\theta-\delta}$ workers (whose wage is normalized to 1 to serve as the numeraire), the firm produces one unit of product i with quality $q_i(\varphi,\lambda_i) = (\varphi\lambda_i)^{\theta}$, $\theta > 0$. The parameter $\delta > 0$ governs the extent to which good management practices can lower unit input requirements and increase the efficiency with which these inputs are assembled into final goods. The parameter θ reflects the degree to which superior management enables firms to produce higher-quality products.

Firms incur a fixed operation cost of headquarter services f_h and a fixed overhead cost f_p for each product line, in units of labor. Entering each foreign market j is associated with additional headquarter services f_{hj}. Exporting entails destination-product specific fixed costs f_{pj} (constant across products within j, but varying across countries). There are also variable transportation costs such that τ_j units of a good need to be shipped for 1 unit to arrive.

1.3 Profit Maximization

Individual producers separately maximize profits in each country-product market

$$\max_{p_{ji},x_{ji}} \pi_{ji} = p_{ji}x_{ji} - \tau_j x_{ji} \left(\varphi\lambda_i\right)^{\theta-\delta} - f_{pj} \tag{3}$$

$$\text{s.t. } x_{ji} = R_j P_j^{\sigma-1} q_{ji}^{\sigma-1} p_{ji}^{-\sigma}$$

Proof. Define the Lagrangian function as

$$L = p_{ji}x_{ji} - \tau_j x_{ji} \left(\varphi\lambda_i\right)^{\theta-\delta} - f_{pj} + \mu \left[R_j P_j^{\sigma-1} \left(\varphi\lambda_i\right)^{\theta(\sigma-1)} p_{ji}^{-\sigma} - x_{ji}\right]$$

F.O.C.s

$$\frac{\partial L}{\partial x_{ji}} = p_{ji} - \tau_j \left(\varphi\lambda_i\right)^{\theta-\delta} - \mu = 0$$

$$\frac{\partial L}{\partial p_{ji}} = x_{ji} - \sigma\mu R_j P_j^{\sigma-1} \left(\varphi\lambda_i\right)^{\theta(\sigma-1)} p_{ji}^{-\sigma-1} = 0$$

$$\frac{\partial L}{\partial \mu} = R_j P_j^{\sigma-1} \left(\varphi\lambda_i\right)^{\theta(\sigma-1)} p_{ji}^{-\sigma} - x_{ji} = 0$$

Plug the second condition into the third one

$$p_{ji} = \sigma\mu$$

Substituting into the first condition

$$\mu = \frac{\tau_j \left(\varphi\lambda_i\right)^{\theta-\delta}}{\sigma - 1}$$

Therefore

$$p_{ji}\left(\varphi, \lambda_i\right) = \sigma\mu = \sigma\frac{\tau_j \left(\varphi\lambda_i\right)^{\theta-\delta}}{\sigma - 1} = \frac{\tau_j \left(\varphi\lambda_i\right)^{\theta-\delta}}{\alpha} \tag{4}$$

$$x_{ji}\left(\varphi, \lambda_i\right) = R_j P_j^{\sigma-1} \left(\varphi\lambda_i\right)^{\theta(\sigma-1)} p_{ji}^{-\sigma} = R_j P_j^{\sigma-1} \left(\frac{\alpha}{\tau_j}\right)^{\sigma} \left(\varphi\lambda_i\right)^{\delta\sigma-\theta} \tag{5}$$

$$q_{ji}(\varphi, \lambda_i) = (\varphi \lambda_i)^{\theta} \tag{6}$$

$$\frac{p_{ji}(\varphi, \lambda_i)}{q_{ji}(\varphi, \lambda_i)} = \frac{\tau_j (\varphi \lambda_i)^{-\delta}}{\alpha} \tag{7}$$

$$r_{ji}(\varphi, \lambda_i) = p_{ji} x_{ji} = R_j \left(\frac{P_j \alpha}{\tau_j} \right)^{\sigma-1} (\varphi \lambda_i)^{\delta(\sigma-1)} \tag{8}$$

$$\pi_{ji}(\varphi, \lambda_i) = r_{ji} - \tau_j x_{ji} (\varphi \lambda_i)^{\theta-\delta} - f_{pj} = (1-\alpha) r_{ji} - f_{pj} = \frac{r_{ji}(\varphi, \lambda_i)}{\sigma} - f_{pj} \tag{9}$$

□

1.4 Selection into Products and Markets

Note that the profit $\pi_{ji}(\varphi, \lambda_i)$ increases with product expertise λ_i. So there is a cut-off expertise level $\lambda_j^*(\varphi)$ for each management ability draw φ below which the firm will not export product i to country j:

$$r_{ji}\left(\varphi, \lambda_j^*(\varphi)\right) = \sigma f_{pj}$$

By the law of large numbers, the measure of products that the firm sells to j equals the probability of an expertise draw above $\lambda_j^*(\varphi)$, or $\left[1 - Z\left(\lambda_j^*(\varphi)\right)\right]$. Better managed firms export more products than worse run firms to any given destination, since $\frac{d\lambda_j^*(\varphi)}{d\varphi} < 0$.

Proof. The zero-profit expertise level $\lambda_j^*(\varphi)$ in country j satisfies

$$R_j \left(\frac{P_j \alpha}{\tau_j} \right)^{\sigma-1} \left(\varphi \lambda_j^*(\varphi)\right)^{\delta(\sigma-1)} = \sigma f_{pj}$$

We can solve for

$$\lambda_j^*(\varphi) = \frac{1}{\varphi} \left[\frac{\sigma f_{pj}}{R_j \left(\frac{P_j \alpha}{\tau_j} \right)^{\sigma-1}} \right]^{\frac{1}{\delta(\sigma-1)}}$$

Therefore $\frac{d\lambda_j^*(\varphi)}{d\varphi} < 0$. □

Similarly, there is a zero-profit expertise level $\lambda^*(\varphi)$ for each management ability draw φ below which the firm will not make i for the domestic market:

$$r_d(\varphi, \lambda^*(\varphi)) = \sigma f_p$$

The measure of varieties that a firm with ability φ produces is $[1 - Z(\lambda^*(\varphi))]$. Again, better managed firms have a lower zero-profit expertise cut-off and offer more products, since $\frac{d\lambda^*(\varphi)}{d\varphi} < 0$.

Proof. The zero-profit expertise level $\lambda^*(\varphi)$ in the domestic market satisfies

$$R_d (P_d \alpha)^{\sigma-1} (\varphi \lambda^*(\varphi))^{\delta(\sigma-1)} = \sigma f_p$$

We can solve for

$$\lambda^*(\varphi) = \frac{1}{\varphi} \left[\frac{\sigma f_p}{R_d (P_d \alpha)^{\sigma-1}} \right]^{\frac{1}{\delta(\sigma-1)}}$$

Therefore $\frac{d\lambda^*(\varphi)}{d\varphi} < 0$. □

When the exporting expertise cut-off lies above the domestic zero-profit expertise cut-off, $\lambda_j^*(\varphi) \geq \lambda^*(\varphi)$, there will be selection into exporting. Given the overwhelming evidence in the prior literature, we assume that $\lambda_j^*(\varphi) \geq \lambda^*(\varphi)$ holds for all j.

The export profits in country j of a firm with management competence φ are:

$$\pi_j(\varphi) = \int_{\lambda_j^*(\varphi)}^{\infty} \pi_{ji}(\varphi, \lambda) z(\lambda) d\lambda - f_{hj}$$

Export profits $\pi_j(\varphi)$ increase with management ability φ.

Proof. According to Leibniz's rule

$$\frac{d\pi_j(\varphi)}{d\varphi} = \int_{\lambda_j^*(\varphi)}^{\infty} \frac{d\pi_{ji}(\varphi, \lambda)}{d\varphi} z(\lambda) d\lambda - \pi_{ji}\left(\varphi, \lambda_j^*(\varphi)\right) z(\lambda) \frac{d\lambda_j^*(\varphi)}{d\varphi}$$

Since $r_{ji}(\varphi, \lambda_i) = R_j \left(\frac{P_j \alpha}{\tau_j}\right)^{\sigma-1} (\varphi \lambda_i)^{\delta(\sigma-1)}$, so

$$\frac{\partial r_{ji}(\varphi, \lambda)}{\partial \varphi} = \delta(\sigma - 1) R_j \left(\frac{P_j \alpha}{\tau_j}\right)^{\sigma-1} (\varphi \lambda)^{\delta(\sigma-1)-1} \lambda$$

Note that $\delta > 0$, $0 < \alpha < 1$ and $\sigma > 1$. So $\frac{\partial r_{ji}(\varphi, \lambda)}{\partial \varphi} > 0$. Note that $\pi_{ji}(\varphi, \lambda_i) = \frac{r_{ji}(\varphi, \lambda_i)}{\sigma} - f_{pj}$. So

$$\frac{\partial \pi_{ji}(\varphi,\lambda)}{\partial \varphi} = \frac{1}{\sigma}\frac{\partial r_{ji}(\varphi,\lambda)}{\partial \varphi} > 0$$

We have already proved that $\frac{d\lambda_j^*(\varphi)}{d\varphi} < 0$. Therefore $\frac{d\pi_j(\varphi)}{d\varphi} > 0$. Export profits $\pi_j(\varphi)$ increase with management ability φ. □

Only firms with management level above a cut-off φ_j^* will service destination j, where φ_j^* satisfies:

$$\pi_j\left(\varphi_j^*\right) = 0$$

Firm φ's global profits are given by

$$\pi(\varphi) = \int_{\lambda^*(\varphi)}^{\infty} \pi_d(\varphi,\lambda)\, z(\lambda)\, d\lambda + \sum_j \left(\int_{\lambda_j^*(\varphi)}^{\infty} \pi_{ji}(\varphi,\lambda)\, z(\lambda)\, d\lambda - f_{hj} \right) - f_h \qquad (10)$$

Companies below a minimum management level φ^* are thus unable to break even and exit immediately upon learning their attributes. This cut-off is defined by the zero-profit condition:

$$\pi(\varphi^*) = 0$$

1.5 Empirical Predictions

Proposition 1. *Better managed firms have a higher propensity to export.*

Proof. This proposition follows from the result that export profits $\pi_X(\varphi) = \sum_j \pi_j(\varphi)$ increase with management ability φ. On the intensive margin, we have already established that bilateral export profits increase with management competence, $\frac{\partial \pi_j(\varphi)}{\partial \varphi} > 0$. On the extensive margin, only firms with ability $\varphi \geq \varphi_j^*$ will sell to destination j. For destinations $j = \{1, 2, ..., J\}$, denote

$$\varphi_X^* = \min\{\varphi_1^*, \varphi_2^*, ..., \varphi_J^*\}$$

Since firms with higher φ are more likely to have both $\varphi \geq \varphi_j^*$ for any j and $\varphi \geq \varphi_X^*$, they have a higher propensity to export to any given destination j, as well as a higher propensity to be exporters, i.e. to export to at least one destination.

Proposition 2. *Better managed exporters enter more markets with more products and earn higher export revenues and profits.*

Proof. First, denote the number of destinations a firm enters as $n(\varphi) = \sum_j I\left(\varphi \geq \varphi_j^*\right)$, where

$$I\left(\varphi \geq \varphi_j^*\right) = \begin{cases} 1, & \varphi \geq \varphi_j^* \\ 0, & \text{otherwise} \end{cases}$$

Obviously, a higher φ means that a larger number of destinations j can satisfy $\varphi \geq \varphi_j^*$. Thus $n(\varphi)$ is increasing in φ, i.e. better managed exporters enter more markets.

Second, for any given market j, we already have that $\pi_{ji}(\varphi, \lambda_i)$ and $r_{ji}(\varphi, \lambda_i)$ are increasing in φ. From the zero-cutoff condition we know that $\frac{d\lambda_j^*(\varphi)}{d\varphi} < 0$, such that higher φ is associated with a higher measure of products $N_j(\varphi) = 1 - Z\left(\lambda_j^*(\varphi)\right)$ in any j, i.e.,

$$\frac{dN_j(\varphi)}{d\varphi} = -\frac{dZ\left(\lambda_j^*(\varphi)\right)}{d\varphi} = -\frac{dZ\left(\lambda_j^*(\varphi)\right)}{d\lambda_j^*}\frac{d\lambda_j^*(\varphi)}{d\varphi} > 0$$

Third, we have already shown that bilateral export revenues and profits icnrease with ability, $\frac{dr_j(\varphi)}{d\varphi} > 0$ and $\frac{d\pi_j(\varphi)}{d\varphi} > 0$. Total export sales $r_X(\varphi)$, profits $\pi_X(\varphi)$ and number of products $N_X(\varphi)$ are:

$$r_X(\varphi) = \sum\nolimits_j r_j(\varphi)\, I\left(\varphi \geq \varphi_j^*\right)$$

$$\pi_X(\varphi) = \sum\nolimits_j \pi_j(\varphi)\, I\left(\varphi \geq \varphi_j^*\right)$$

$$N_X(\varphi) = N_l(\varphi)$$

where l denotes the country with lowest cut-off for λ, i.e., $\lambda_l^*(\varphi) \in \arg\min\left\{\lambda_1^*(\varphi), \lambda_2^*(\varphi), \ldots, \lambda_J^*(\varphi)\right\}$. Note that firms export an overlapping set of products to different markets, following a pecking order of products based on λ.

Therefore,

$$\frac{\partial r_X(\varphi)}{\partial \varphi} = \sum\nolimits_j \left[\frac{\partial r_j(\varphi)}{\partial \varphi} I\left(\varphi \geq \varphi_j^*\right) + \frac{\partial I\left(\varphi \geq \varphi_j^*\right)}{\partial \varphi} r_j(\varphi)\right]$$

$$\frac{\partial \pi_X(\varphi)}{\partial \varphi} = \sum\nolimits_j \left[\frac{\partial \pi_j(\varphi)}{\partial \varphi} I\left(\varphi \geq \varphi_j^*\right) + \frac{\partial I\left(\varphi \geq \varphi_j^*\right)}{\partial \varphi} \pi_j(\varphi)\right]$$

$$\frac{\partial N_X(\varphi)}{\partial \varphi} = \frac{\partial N_l(\varphi)}{\partial \varphi}$$

Since $\frac{\partial r_j(\varphi)}{\partial \varphi} > 0$, $\frac{\partial \pi_j(\varphi)}{\partial \varphi} > 0$, $\frac{\partial N_j(\varphi)}{\partial \varphi} > 0$, and $\frac{\partial I\left(\varphi \geq \varphi_j^*\right)}{\partial \varphi} \geq 0$, it is easy to see that $\frac{dr_X(\varphi)}{d\varphi} > 0$, $\frac{d\pi_X(\varphi)}{d\varphi} > 0$ and $\frac{dN_X(\varphi)}{d\varphi} > 0$. □

Proposition 3.

- *Better managed firms offer higher quality if $\theta > 0$. Product quality is invariant across firms if $\theta = 0$.*
- *Better managed firms have lower quality-adjusted prices if $\delta > 0$. Quality-adjusted prices are invariant across firms if $\delta = 0$.*
- *Better managed firms have higher prices if $\theta > \delta$ and lower prices if $\delta > \theta$. Prices are invariant across firms if $\theta = \delta$.*

Proof. From the firm's profit-maximization problem we have

$$p_{ji}(\varphi, \lambda_i) = \frac{\tau_j (\varphi\lambda_i)^{\theta-\delta}}{\alpha}$$

$$q_{ji}(\varphi, \lambda_i) = (\varphi\lambda_i)^{\theta}$$

$$\frac{p_{ji}(\varphi, \lambda_i)}{q_{ji}(\varphi, \lambda_i)} = \frac{\tau_j (\varphi\lambda_i)^{-\delta}}{\alpha}$$

We can obtain

$$\frac{\partial p_{ji}}{\partial \varphi} = (\theta - \delta) \frac{\tau_j (\varphi\lambda_i)^{\theta-\delta-1}}{\alpha}$$

$$\frac{\partial q_{ji}}{\partial \varphi} = \theta (\varphi\lambda_i)^{\theta-1}$$

$$\frac{\partial \left(\frac{p_{ji}}{q_{ji}}\right)}{\partial \varphi} = -\frac{\delta}{\alpha} \tau_j (\varphi\lambda_i)^{-\delta-1}$$

1. If $\theta > 0$, $\frac{\partial q_{ji}}{\partial \varphi} > 0$, i.e., better managed firms offer higher quality.
2. If $\delta > 0$, $\frac{\partial \left(\frac{p_{ji}}{q_{ji}}\right)}{\partial \varphi} < 0$, i.e., better managed firms have lower quality-adjusted prices.
3. The sign of $\frac{\partial p_{ji}}{\partial \varphi}$ depends on $\theta - \delta$. Better managed firms have higher prices if $\theta > \delta$ and lower prices if $\delta > \theta$. Prices are invariant across firms if $\theta = \delta$.

□

Proposition 4. *If $\theta > 0$, better managed firms use more expensive inputs of higher quality and/or more expensive assembly technologies of higher complexity. If $\theta = 0$, input quality and assembly complexity are invariant across firms.*

Proof. From Proposition 3 we know that better managed firms produce goods of higher quality if and only if $\theta > 0$. While we do not explicitly model firms' endogenous choice of product quality in the baseline model, we assume that producing goods of higher quality entails higher marginal production costs. The implicit microfoundations for this quality production function is that manufacturing higher-quality products requires more expensive inputs of higher quality and/or more costly assembly technologies. □

2 Model Extensions

2.1 Extension 1: Endogenous Management

Let entrepreneurs receive an exogenous talent draw φ and actively choose management practice $m(\varphi)$ to maximize profits, where marginal costs and quality now depend on $\varphi m(\varphi)\lambda_i$. That is, at a marginal cost of $[\varphi m(\varphi)\lambda_i]^{\theta-\delta}$, firms can produce one unit of product i with quality $q_{ji} = [\varphi m(\varphi)\lambda_i]^{\theta}$. One can show that if the fixed cost f_m of adopting and implementing management practice m satisfies $df_m/dm > 0$ and $d^2 f_m/dm^2 > 0$, then $d(m\varphi)/dm > 0$. Given the monotonic relationship between $\varphi m(\varphi)$ and $m(\varphi)$, Propositions 1-4 would then continue to hold.

Proof. In this extension, $\varphi m(\varphi)$ plays the same rule as φ does in the baseline model. Now the firm's maximization problem becomes

$$\max_{p_{ji},x_{ji},m} \pi_{ji}(\varphi,\lambda_i) = p_{ji}x_{ji} - \tau_j x_{ji}(\varphi m(\varphi)\lambda_i)^{\theta-\delta} - f_{pj}$$

$$\text{s.t. } x_{ji}(\varphi,\lambda_i) = R_j P_j^{\sigma-1} q_{ji}(\varphi,\lambda_i)^{\sigma-1} p_{ji}(\varphi,\lambda_i)^{-\sigma}$$

By the same logic as in Section 1.3, the profit-maximization problem implies: (one can get the following results simply by replacing φ with $\varphi m(\varphi)$ in the formula above)

$$p_{ji}(\varphi,\lambda_i) = \frac{\tau_j(\varphi m(\varphi)\lambda_i)^{\theta-\delta}}{\alpha}$$

$$x_{ji}(\varphi,\lambda_i) = R_j P_j^{\sigma-1}\left(\frac{\alpha}{\tau_j}\right)^{\sigma}(\varphi m(\varphi)\lambda_i)^{\delta\sigma-\theta}$$

$$q_{ji}(\varphi,\lambda_i) = (\varphi m(\varphi)\lambda_i)^{\theta}$$

$$\frac{p_{ji}(\varphi,\lambda_i)}{q_{ji}(\varphi,\lambda_i)} = \frac{\tau_j(\varphi m(\varphi)\lambda_i)^{-\delta}}{\alpha}$$

$$r_{ji}(\varphi,\lambda_i) = R_j\left(\frac{P_j\alpha}{\tau_j}\right)^{\sigma-1}(\varphi m(\varphi)\lambda_i)^{\delta(\sigma-1)}$$

$$\pi_{ji}(\varphi,\lambda_i) = \frac{r_{ji}(\varphi,\lambda_i)}{\sigma} - f_{pj}$$

The cut-off expertise level $\lambda_j^*(\varphi,m)$ for exporting to country j satisfies $r_{ji}\left(\varphi,\lambda_j^*(\varphi,m)\right) = \sigma f_{pj}$, such that

$$\lambda_j^*(\varphi,m) = \frac{1}{\varphi m}\left[\frac{\sigma f_{pj}}{R_j\left(\frac{P_j\alpha}{\tau_j}\right)^{\sigma-1}}\right]^{\frac{1}{\delta(\sigma-1)}}$$

Then the export profits in country j of a firm with ability φ and management competence m are:

$$\pi_j(\varphi,m) = \int_{\lambda_j^*(\varphi,m)}^{\infty}\pi_{ji}(\varphi,m,\lambda)\,z(\lambda)\,d\lambda - f_{hj}$$

Following the same logic, the cut-off expertise level $\lambda^*(\varphi,m)$ for selling in the domestic market is given by: $r_d(\varphi,\lambda^*(\varphi,m)) = \sigma f_p$, which implies

$$\lambda^*(\varphi,m) = \frac{1}{\varphi m}\left[\frac{\sigma f_p}{R_d(P_d\alpha)^{\sigma-1}}\right]^{\frac{1}{\delta(\sigma-1)}}$$

Therefore firm φ's global profit maximization problem is:

$$\max_m \pi(\varphi,m) = \int_{\lambda^*(\varphi,m)}^{\infty}\pi_{di}(\varphi,m,\lambda)\,z(\lambda)\,d\lambda + \sum\nolimits_j\left(\int_{\lambda_j^*(\varphi,m)}^{\infty}\pi_{ji}(\varphi,m,\lambda)\,z(\lambda)\,d\lambda - f_{hj}\right) - f_h - f_m$$

where

$$\pi_{di}(\varphi,m,\lambda) = \frac{1}{\sigma}R_d(P_d\alpha)^{\sigma-1}(\varphi m\lambda_i)^{\delta(\sigma-1)} - f_p \triangleq A_d(\varphi m\lambda_i)^{\delta(\sigma-1)} - f_p$$

$$\pi_{ji}(\varphi,m,\lambda_i) = \frac{1}{\sigma}R_j\left(\frac{P_j\alpha}{\tau_j}\right)^{\sigma-1}(\varphi m\lambda_i)^{\delta(\sigma-1)} - f_{pj} \triangleq A_j(\varphi m\lambda_i)^{\delta(\sigma-1)} - f_{pj}$$

where $A_d \triangleq \frac{1}{\sigma}R_d(P_d\alpha)^{\sigma-1}$and $A_j \triangleq \frac{1}{\sigma}R_j\left(\frac{P_j\alpha}{\tau_j}\right)^{\sigma-1}$. The first order condition with respect to m implies that

$$
\begin{aligned}
\frac{\partial \pi(\varphi, m)}{\partial m} &= \left(\int_{\lambda^*(\varphi,m)}^{\infty} \frac{\partial \pi_{di}(\varphi, m, \lambda)}{\partial m} z(\lambda)\, d\lambda - \pi_{di}(\varphi, m, \lambda^*) z(\lambda^*) \frac{\partial \lambda^*(\varphi, m)}{\partial m}\right) \\
&+ \sum\nolimits_j \left(\int_{\lambda_j^*(\varphi,m)}^{\infty} \frac{\partial \pi_{ji}(\varphi, m, \lambda)}{\partial m} z(\lambda)\, d\lambda - \pi_{ji}\left(\varphi, m, \lambda_j^*\right) z\left(\lambda_j^*\right) \frac{\partial \lambda_j^*(\varphi, m)}{\partial m}\right) - \frac{\partial f_m}{m} \\
&= \int_{\lambda^*(\varphi,m)}^{\infty} \frac{\partial \pi_{di}(\varphi, m, \lambda)}{\partial m} z(\lambda)\, d\lambda + \sum\nolimits_j \left(\int_{\lambda_j^*(\varphi,m)}^{\infty} \frac{\partial \pi_{ji}(\varphi, m, \lambda)}{\partial m} z(\lambda)\, d\lambda\right) - \frac{\partial f_m}{m} \\
&= \int_{\lambda^*(\varphi,m)}^{\infty} A_d \delta(\sigma - 1) \frac{(\varphi m \lambda)^{\delta(\sigma-1)}}{m} z(\lambda)\, d\lambda \\
&+ \sum\nolimits_j \left(\int_{\lambda_j^*(\varphi,m)}^{\infty} A_j \delta(\sigma - 1) \frac{(\varphi m \lambda)^{\delta(\sigma-1)}}{m} z(\lambda)\, d\lambda\right) - \frac{\partial f_m}{m} \\
&= 0
\end{aligned}
$$

This helps to solve for the firm's optimal management competence level m as an implicit function of φ. Define the implicit function as $F(\varphi, m)$, where

$$
\begin{aligned}
F(\varphi, m) \equiv & \int_{\lambda^*(\varphi,m)}^{\infty} A_d \delta(\sigma - 1) \frac{(\varphi m \lambda)^{\delta(\sigma-1)}}{m} z(\lambda)\, d\lambda \\
& + \sum\nolimits_j \left(\int_{\lambda_j^*(\varphi,m)}^{\infty} A_j \delta(\sigma - 1) \frac{(\varphi m \lambda)^{\delta(\sigma-1)}}{m} z(\lambda)\, d\lambda\right) - \frac{\partial f_m}{m} \\
& \triangleq F_d(\varphi, m) + \sum\nolimits_j F_j(\varphi, m) - \frac{\partial f_m}{m}
\end{aligned}
$$

Note that for all the results to hold in the extension, all we need is to prove that $\varphi \cdot m(\varphi)$ is increasing in m. That is, we need to prove

$$
\frac{d(\varphi m)}{dm} = \frac{d\varphi}{dm} m + \varphi = \varphi \left(\frac{d\varphi}{dm} \frac{m}{\varphi} + 1\right) > 0
$$

By the Implicit Function Theorem, we have

$$
\frac{d\varphi}{dm} = -\frac{\partial F / \partial m}{\partial F / \partial \varphi}
$$

Therefore, all we need is to prove

$$
\frac{\partial F / \partial m}{\partial F / \partial \varphi} < \frac{\varphi}{m}
$$

Firstly,

$$\frac{\partial F}{\partial \varphi} = F_{1d}(\varphi, m) + \sum_j F_{1j}(\varphi, m)$$

where

$$F_{1d}(\varphi, m) = A_d \delta(\sigma-1)(\varphi m)^{\delta(\sigma-1)-1}\left[\delta(\sigma-1)\int_{\lambda^*(\varphi,m)}^{\infty} \lambda^{\delta(\sigma-1)} z(\lambda)\, d\lambda - \varphi(\lambda^*)^{\delta(\sigma-1)} z(\lambda^*)\frac{\partial \lambda^*(\varphi, m)}{\partial \varphi}\right]$$

$$F_{1j}(\varphi, m) = A_j \delta(\sigma-1)(\varphi m)^{\delta(\sigma-1)-1}\left[\delta(\sigma-1)\int_{\lambda_j^*(\varphi,m)}^{\infty} \lambda^{\delta(\sigma-1)} z(\lambda)\, d\lambda - \varphi\left(\lambda_j^*\right)^{\delta(\sigma-1)} z\left(\lambda_j^*\right)\frac{\partial \lambda_j^*(\varphi, m)}{\partial \varphi}\right]$$

Note that

$$\frac{\partial \lambda^*(\varphi, m)}{\partial \varphi} = -\frac{\lambda^*(\varphi, m)}{\varphi} < 0$$

$$\frac{\partial \lambda_j^*(\varphi, m)}{\partial \varphi} = -\frac{\lambda_j^*(\varphi, m)}{\varphi} < 0$$

Therefore $\frac{\partial F}{\partial \varphi} > 0$.

Secondly,

$$\frac{\partial F}{\partial m} = F_{2d}(\varphi, m) + \sum_j F_{2j}(\varphi, m) - \frac{d^2 f_m}{dm^2}$$

where

$$F_{2d}(\varphi, m) = A_d \delta(\sigma-1)(\varphi m)^{\delta(\sigma-1)}\frac{1}{m}\left[\frac{\delta(\sigma-1)-1}{m}\int_{\lambda^*}^{\infty} \lambda^{\delta(\sigma-1)} z(\lambda)\, d\lambda - (\lambda^*)^{\delta(\sigma-1)} z(\lambda^*)\frac{\partial \lambda^*}{\partial m}\right]$$

$$F_{2j}(\varphi, m) = A_j \delta(\sigma-1)(\varphi m)^{\delta(\sigma-1)}\frac{1}{m}\left[\frac{\delta(\sigma-1)-1}{m}\int_{\lambda_j^*}^{\infty} \lambda^{\delta(\sigma-1)} z(\lambda)\, d\lambda - \left(\lambda_j^*\right)^{\delta(\sigma-1)} z\left(\lambda_j^*\right)\frac{\partial \lambda_j^*}{\partial m}\right]$$

Since $\frac{\partial F}{\partial \varphi} > 0$ and $\frac{d^2 f_m}{dm^2} > 0$, we have

$$\frac{\partial F/\partial m}{\partial F/\partial \varphi} < \frac{F_{2d}(\varphi, m) + \sum_j F_{2j}(\varphi, m)}{F_{1d}(\varphi, m) + \sum_j F_{1j}(\varphi, m)}$$

Note that for all $k \in \{1, 2, \ldots, J\} \cup \{d\}$,

$$\frac{\partial \lambda_k^*}{\partial \varphi} = -\frac{\lambda_k^*}{\varphi} \text{ and } \frac{\partial \lambda_k^*}{\partial m} = -\frac{\lambda_k^*}{m}$$

Then we have

$$\begin{aligned}
\frac{F_{2k}(\varphi,m)}{F_{1k}(\varphi,m)} &= \frac{A_k\delta(\sigma-1)(\varphi m)^{\delta(\sigma-1)}\frac{1}{m}\left[\frac{\delta(\sigma-1)-1}{m}\int_{\lambda_k^*}^{\infty}\lambda^{\delta(\sigma-1)}z(\lambda)\,d\lambda-(\lambda_k^*)^{\delta(\sigma-1)}z(\lambda_k^*)\frac{\partial\lambda_k^*}{\partial m}\right]}{A_k\delta(\sigma-1)(\varphi m)^{\delta(\sigma-1)-1}\left[\delta(\sigma-1)\int_{\lambda_k^*}^{\infty}\lambda^{\delta(\sigma-1)}z(\lambda)\,d\lambda-\varphi\left(\lambda_j^*\right)^{\delta(\sigma-1)}z(\lambda_k^*)\frac{\partial\lambda_k^*}{\partial\varphi}\right]}\\
&= \frac{\varphi\left[\frac{\delta(\sigma-1)-1}{m}\int_{\lambda_k^*}^{\infty}\lambda^{\delta(\sigma-1)}z(\lambda)\,d\lambda+(\lambda_k^*)^{\delta(\sigma-1)}z(\lambda_k^*)\frac{\lambda_k^*}{m}\right]}{\left[\delta(\sigma-1)\int_{\lambda_k^*}^{\infty}\lambda^{\delta(\sigma-1)}z(\lambda)\,d\lambda+\varphi\left(\lambda_j^*\right)^{\delta(\sigma-1)}z(\lambda_k^*)\frac{\lambda_k^*}{\varphi}\right]}\\
&= \frac{\varphi\left[(\delta(\sigma-1)-1)\int_{\lambda_k^*}^{\infty}\lambda^{\delta(\sigma-1)}z(\lambda)\,d\lambda+(\lambda_k^*)^{\delta(\sigma-1)}z(\lambda_k^*)\lambda_k^*\right]}{m\left[\delta(\sigma-1)\int_{\lambda_k^*}^{\infty}\lambda^{\delta(\sigma-1)}z(\lambda)\,d\lambda+\left(\lambda_j^*\right)^{\delta(\sigma-1)}z(\lambda_k^*)\lambda_k^*\right]}\\
&< \frac{\varphi}{m}
\end{aligned}$$

Therefore

$$\frac{\partial F/\partial m}{\partial F/\partial\varphi} < \frac{F_{2d}(\varphi,m)+\sum_j F_{2j}(\varphi,m)}{F_{1d}(\varphi,m)+\sum_j F_{1j}(\varphi,m)} < \frac{\varphi}{m}$$

Now we have proved that $\frac{d(\varphi m)}{dm} > 0$, i.e., $\varphi m(\varphi)$ is increasing in m. Note that in this extension, $\varphi m(\varphi)$ plays the same rule as φ does in the baseline model. We can conclude directly that a high m (superior management practices) in the baseline model is equivalent to a larger $\varphi m(\varphi)$ in the extension. Therefore, all the propositions for better managed firms hold in this extension. □

2.2 Extension 2: Multiple Ability Components

The theoretical predictions of our baseline model would continue to hold if management is one of multiple draws that jointly determine firm ability φ. For example, firm ability $\varphi = m \cdot \phi$ may depend on the entrepreneur's intrinsic talent ϕ and the manager's competence for implementing effective management practices m. If entrepreneurs and managers do not match perfectly assortatively due to labor market frictions, then $|corr(m,\phi)| \neq 1$. While all firm outcomes would now be pinned down by φ instead of m alone, management competence would have the same effects as in our baseline model *ceteris paribus*. Propositions 1-4 would now hold for φ unconditionally, for ϕ conditional on m, and for m conditional on ϕ. The last result is the conditional relationship that remains relevant for our empirical analysis.

2.3 Extension 3: Endogenous Quality

For expositional simplicity, we do not explicitly model firms's choice of product quality in the baseline model but follow Baldwin and Harrigan (2011) in assuming that product quality is fixed by exogenous draws. Endogenizing firms' choice of input and output quality in a richer framework would however preserve our theoretical predictions. What is sufficient for this to occur is that output quality - and by extension firm profits - is supermodular in firm ability and either the quality of manufactured inputs or the complexity of the assembly process used in production. We illustrate this point using a specific formulation for the microfoundations for endogenous quality choice as developed in Kugler and Verhoogen (2012).

We assume that there is complementarity between firm ability and input quality in the production function for output quality, which leads to more capable firms optimally using higher quality inputs in order to produce higher-quality goods.

In particular, using an input of quality c_{ji}, the firm can produce one unit of product i with the following CES production function for output quality

$$q_{ji} = \left[\frac{1}{2}\left(\left(\varphi\lambda_i\right)^b\right)^\rho + \frac{1}{2}\left(c_{ji}^2\right)^\rho\right]^{\frac{1}{\rho}} \tag{11}$$

at a marginal cost of c_{ji}. In this setting, input quality, c_{ji}, and firm-specific management, φ (as well as firm-product specific expertise, λ_i) are complements. The parameter b can be interpreted as the scope for quality differentiation. The quadratic specification for c_{ji} is not crucial but adopted for tractability.

Proof. Now the firm's maximization problem becomes

$$\max_{p_{ji},x_{ji},c_{ji}} \pi\left(\varphi, \lambda_i\right) = p_{ji}x_{ji} - \tau_j x_{ji} c_{ji} - f_{pj}$$

$$\text{s.t. } x_{ji} = R_j P_j^{\sigma-1} q_{ji}^{\sigma-1} p_{ji}^{-\sigma}$$

Substituting the constraint into the objective function, this is equivalent to solving

$$\max_{p_{ji},c_{ji}} \pi_{ji}\left(\varphi, \lambda_i\right) = R_j P_j^{\sigma-1}\left[\frac{1}{2}\left(\varphi\lambda_i\right)^{b\rho} + \frac{1}{2}c_{ji}^{2\rho}\right]^{\frac{\sigma-1}{\rho}} p_{ji}^{-\sigma}\left(p_{ji} - \tau_j c_{ji}\right) - f_{pj}$$

The first order conditions with respect to p_{ji} and c_{ji} yield the following equations respectively:

$$p_{ji} = \frac{\sigma}{\sigma - 1} \tau_j c_{ji} \tag{12}$$

$$(\sigma - 1)\, c_{ji}^{2\rho - 1} \left(p_{ji} - \tau_j c_{ji}\right) = \tau_j \left[\frac{1}{2} \left(\varphi \lambda_i\right)^{b\rho} + \frac{1}{2} c_{ji}^{2\rho}\right] \tag{13}$$

Substituting Equation 12 into Equation 13 gives the following expression for endogenous input quality as a function of firm ability::

$$c_{ji} = \left(\varphi \lambda_i\right)^{\frac{b}{2}} \tag{14}$$

Combining Equation 14 and Equation 11, the endogenous level of output quality becomes $q_{ji} = \left(\varphi \lambda_i\right)^b$. When $\theta = b$ and $\delta = \frac{b}{2}$, this corresponds exactly to firms producing one unit of product i with quality $q_{ji} = \left(\varphi \lambda_i\right)^{\theta}$ at a marginal cost of $c_{ji} = \left(\varphi \lambda_i\right)^{\theta - \delta}$, as the production function in our baseline model. This demonstrates how endogenizing firm's choice of product quality would deliver similar empirical predictions as the framework with exogenous quality. In particular, better managed firms would endogenously choose to use higher-quality inputs and produce higher-quality goods. □

Table 1. Summary Statistics

Panel A. Firm characteristics of exporters and non-exporters

	China		US	
	Exporters	Non-exporters	Exporters	Non-exporters
# Observations	1,875	1,358	14,000	17,000
Management	0.06	-0.09	0.12	-0.26
Log Gross Output	11.72	11.55	10.6	9.55
Log Employment	6.46	6.15	4.76	3.96
TFPR	4.86	4.77	4.3	4.07
Log Value Added / L	3.73	3.95	5.04	4.78

Panel B. Firms' management, export and import activity

	China		US	
	Mean	St Dev	Mean	St Dev
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 tables 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). US: all plants in the matched MOPS-ASM sample for 2010 (Panel A) and all exporting plants in the matched MOPS-LFTTD sample for 2010 (Panel B).

Table 2. Export Status and Export Revenues

	China				US			
Dep Variable:	Exporter Dummy		Log Exports		Exporter Dummy		Log Exports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management	0.040**	0.048***	0.260**	0.231*	0.042***	0.031***	0.488***	0.373***
	(2.30)	(2.75)	(2.14)	(1.81)	(13.92)	(10.13)	(21.72)	(16.79)
Capital Intensity		-0.010		0.145		-0.020***		0.193***
		(-0.76)		(1.43)		(-6.04)		(7.35)
Wage		0.041*		0.401**		0.106***		0.904***
		(1.82)		(2.17)		(9.82)		(11.84)
Age		0.030		0.153		0.044***		0.411***
		(1.53)		(1.01)		(11.47)		(13.29)
Fixed Effects	Province, SIC-3 Industry, Own, 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. In Columns 1-2 and 5-6, the sample includes all firms in the matched sample with balance sheet and management data, and the dependent variable is a binary indicator equal to 1 for exporters. In 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 firm exports. *Management Score* is the average standardized score across 18 questions about firms' management practices. *Capital Intensity* is log net fixed asset per worker. *Wage* is log labor cost per employee. *Age* is log firm age in years. All columns control for the share of workers with a college degree; noise controls (interview duration and time of day; interviewer dummies; interviewee gender, reliability and competence as perceived by the interviewer). All regressions for China include fixed effects for firm province, main SIC-3 industry, year, and ownership status (private domestic, state-owned, foreign-owned). All regressions for the US include fixed effects for firm state and main NAICS-6 industry. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 3. Profits

	China			US		
Dep Variable:	Log Profits			Log Profits		
	(1)	(2)	(3)	(4)	(5)	(6)
Management	0.546***	0.387***	0.361***	0.431***	0.340***	0.111***
	(6.98)	(5.70)	(5.43)	(32.61)	(27.01)	(10.21)
Log Dom Sales			0.097***			0.671***
			(5.85)			(64.28)
Fixed Effects	Province, SIC-3 Industry, Own, Year			State, NAICS-6 Industry		
Noise Controls	Y	Y	Y	Y	Y	Y
Firm Controls	N	Y	Y	N	Y	Y
R-squared	0.45	0.55	0.57	0.71	0.75	0.85
# observations	2,520	2,438	2,438	13,000	13,000	13,000

This table examines the relationship between firms' management practices and profits. The dependent variable is firms' log profits. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. Columns 2-3 and 5-6 also include a full set of firm controls as described in Table 2. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 4. Extensive and Intensive Margins of Exports

	China					US				
Dep Variable:	Log # Dest	Log # Prod	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod	Log # Dest	Log # Prod	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Management	0.185***	0.166***	0.215***	0.017	0.196*	0.134***	0.165***	0.195***	0.177***	0.320***
	(2.80)	(3.33)	(2.89)	(0.20)	(1.74)	(13.08)	(15.32)	(15.13)	(12.75)	(16.05)
Fixed Effects	Province, SIC-3 Industry, Own, 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 exported 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. A product is HS 8-digit. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 5. Export vs. Domestic Activity

	China					US				
Dep Variable:	Log Dom Sales	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Dom Sales	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Management	0.475***	0.058***	0.250*	0.219***	0.032	0.344***	0.022***	0.164***	0.072***	0.092***
	(2.97)	(3.32)	(1.96)	(2.96)	(0.37)	(29.43)	(6.92)	(7.35)	(5.54)	(6.46)
Log Dom Sales		-0.025***	-0.035	-0.007	-0.028		0.028***	0.605***	0.358***	0.247***
		(-7.33)	(-1.46)	(-0.43)	(-1.50)		(9.87)	(33.62)	(33.85)	(21.83)
Fixed Effects	Province, SIC-3 Industry, Own, 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	0.98	0.43	0.44	0.40	0.45	0.49	0.27	0.45	0.43	0.35
# observations	1,935	3,123	1,935	1,935	1,935	13,000	32,000	13,000	13,000	13,000

This table examines the relationship between firms' management practices, export activity, and domestic sales. All dependent variables are defined in Tables 3 and 4. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10%

Table 6. Production Efficiency and Product Quality

Dep Variable:	Log Export Quality	Log Qual-Adj Export Price	Log Export Price	Log Export Quantity	Log Export Quality	Log Qual-Adj Export Price	Log Export Price	Log Export Quantity
Structural Parameter:	θ^{CH}	$-\delta^{CH}$	$\theta^{CH} - \delta^{CH}$		θ^{US}	$-\delta^{US}$	$\theta^{US} - \delta^{US}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management	0.531*	-0.385*	0.146**	-0.200	0.048***	-0.045***	0.003	0.034***
	(1.95)	(-1.82)	(2.16)	(-1.49)	(2.60)	(-2.91)	(0.68)	(2.83)
Fixed Effects	Province, Dest-Product, Own, 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	0.92	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 the log export unit value, estimated log export product quality, estimated quality-adjusted log export unit value, or log export quantity by firm-destination-product. Quality is estimated as demand elasticity (set to 5) x unit value + quantity as descrbed in the text. *Structural Parameter* is the model parameter identified from the reduced form coefficient on the management variable. A product is HS 8-digit. All regressions for China include noise controls and fixed effects for firm province, destination-product pair, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and destination-product pair. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm. US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 7. Imported Input Quality

	China					US				
Dep Variable:	Log Imports	Log $\frac{\text{Imports}}{\text{Inputs}}$	Log Avg Origin Income	Log Import Input Price	Log Import Input Quality	Log Imports	Log $\frac{\text{Imports}}{\text{Inputs}}$	Log Avg Origin Income	Log Import Input Price	Log Import Input Quality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Management	0.550***	0.222*	0.046**	0.101**	0.576***	0.344***	-0.003	0.037***	-0.001	0.016
	(4.32)	(1.86)	(2.11)	(2.36)	(3.03)	(11.83)	(-0.03)	(3.89)	(-0.34)	(0.67)
Fixed Effects	Province, SIC-3 Industry, Own, 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
Origin-Prod FE	--	--	--	Y	Y	--	--	--	Y	Y
R-squared	0.56	0.50	0.38	0.81	0.78	0.31	0.27	0.21	0.97	0.94
# 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 the log of firm imports in Columns 1 and 6, the log of firm imports as a share of total intermediate inputs in Columns 2 and 7, the log average GDP per capita across origin countries in Columns 3 and 8, the log import unit value by firm-origin country-product in Columns 4 and 9, and the log estimated import product quality in Columns 5 and 10. Quality is estimated as demand elasticity (set to 5) x unit value + quantity as described in the text. A product is HS 8-digit. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. Columns 4-5 and 9-10 include origin country-product pair fixed effects. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm in Columns 1-5 and 9-10 and robust in Columns 6-8. US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 8. Assembly Complexity

	China			US		
Dep Variable:	Log # Origins	Log # Import Prod	Log # Origin-Prod	Log # Origins	Log # Import Prod	Log # Origin-Prod
	(1)	(2)	(3)	(4)	(5)	(6)
Management	0.168***	0.123*	0.145**	0.058***	0.079***	0.087***
	(4.24)	(1.82)	(2.09)	(7.41)	(6.81)	(6.97)
Log # Export Products	0.245***	0.387***	0.441***	0.426***	0.561***	0.632***
	(7.69)	(6.97)	(7.77)	(66.14)	(58.70)	(60.40)
Fixed Effects	Province, SIC-3 Industry, Own, 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. A product is HS 8-digit. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 9. India RCT: Change in Management, Production Efficiency and Trade Activity (2008-2017)

Dep Variable:	Log Looms per Employee	Exporter Dummy	Log Exports	Exports/Sales (%)
	(1)	(2)	(3)	(4)
Panel A. Long-run performance				
Treatment x (Year ≥ 2011)	0.236**	0.189*	0.416**	8.81**
	(0.109)	(0.106)	(0.109)	(3.84)
Panel B. Intervention and non-intervention plants				
Intervention x Treatment x (Year ≥ 2011)		0.144	0.373**	7.70*
		(0.118)	(0.127)	(3.85)
Non-Intervention x Treatment x (Year ≥ 2011)		0.333**	0.747***	12.38**
		(0.124)	(0.052)	(4.46)
Panel C. Treatment impact by period				
Treatment x (Year ≥ 2011)		0.036	0.168*	1.219
		(0.024)	(0.078)	(0.753)
Treatment x (Year = 2014)		0.294*	0.281	11.98*
		(0.144)	(0.197)	(5.92)
Treatment x (Year = 2017)		0.183	0.533**	11.64*
		(0.208)	(0.241)	(6.68)
F-test Treat x (Year=2014) & Treat x (Year=2017)		0.054	0.095	0.161
Years	2008,11,14,17	2008,11,14,17	2008,11,14,17	2008,11,14,17
Firms	17	17	17	17
Plants	31	31	31	31
# Observations	109	109	109	109

This table examines the relationship between firms' management practices, production efficiency and trade activity following a randomized control trial that provided management consulting to plants in the textile industry in India, 2008-2017. All observations are at the plant-year level. The pre-treatment period is 2008, and the post-treatment period spans 2011, 2014, and 2017. The sample includes 14 intervention plants in treated firms that received both initial diagnostics and management consulting, 6 non-intervention plants in treated firms that received only initial diagnostics, and 11 control plants that received neither. See Bloom et al. (2013) and Bloom et al. (2017) for experiment details. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 10. US Panel: Management and Trade Activity over Time

	Export Performance				Production Efficiency and Product Quality			Imported Input Quality and Assembly Complexity				
Dep Variable:	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Avg Export Quality	Log Avg Qual-Adj Export Price	Log Avg Export Price	Log Imports	Log Avg Origin Income	Log Avg Import Price	Log Avg Import Quality	Log # Origin-Prod
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A. Lags: Trade Activity 2011 and Managament 2010												
Management	0.029***	0.395***	0.208***	0.187***	0.053***	-0.059***	-0.006	0.374***	0.038***	-0.003	0.045**	-0.048***
	(9.48)	(18.10)	(16.19)	(13.62)	(3.25)	(-4.19)	(-1.61)	(13.23)	(3.86)	(-0.81)	(2.21)	(-2.62)
Fixed Effects	State, NAICS-6 Industry											
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.29	0.39	0.33	0.32	0.97	0.96	0.98	0.33	0.21	0.97	0.93	0.91
# observations	31,000	13,000	13,000	13,000	13,000	13,000	13,000	10,000	10,000	10,000	10,000	10,000
Panel B. First Differences: Δ Trade Activity 2005→2010 and Δ Managament 2005→2010												
Management	0.004***	0.055***	0.031***	0.025**	0.024**	-0.024**	0.001	0.050***	-0.018***	-0.001	0.057***	0.031***
	(3.19)	(4.12)	(4.28)	(2.53)	(2.25)	(-2.49)	(0.41)	(2.76)	(-2.88)	(-0.53)	(4.48)	(3.69)
Fixed Effects	State, NAICS-6 Industry											
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.10	0.06	0.07	0.06	0.042	0.04	0.08	0.09	0.09	0.07	0.07	0.08
# observations	31,000	13,000	13,000	13,000	13,000	13,000	13,000	10,000	10,000	10,000	10,000	10,000

This table examines the relationship between firms' management practices, export and import activity in the panel for US firms. All variables are defined in Tables 2, 4, 6, 7, and 8. In Panel A, the dependent variable is for year 2011, while the management variable is for year 2010. In Panel B, both the dependent and management variables are within-firm changes from 2005 to 2010. All regressions include noise controls, fixed effects for firm state and main NAICS-6 industry, and a full set of 2010 firm controls as described in Table 2. Robust standard errors. Sample includes all firms with matched data in 2010. Sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Figure 1A. Management and Organizational Practices Survey US: Examples

Example 1: Targets

8 In 2005 and 2010, who was aware of the production targets at this establishment? *Check one box for each year*

	2005	2010
Only senior managers	☐	☐
Most managers and some production workers	☐	☐
Most managers and most production workers	☐	☐
All managers and most production workers	☐	☐

Example 2: Monitoring

2 In 2005 and 2010, how many key performance indicators were monitored at this establishment?

Examples: Metrics on production, cost, waste, quality, inventory, energy, absenteeism and deliveries on time.

Check one box for each year	2005	2010
1-2 key performance indicators	☐	☐
3-9 key performance indicators	☐	☐
10 or more key performance indicators	☐	☐
No key performance indicators (If no key performance indicators in both years, SKIP to **6**)	☐	☐

Example 3: Incentives

14 In 2005 and 2010, what was the primary way **managers** were promoted at this establishment?

Check one box for each year	2005	2010
Promotions were based solely on performance and ability	☐	☐
Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	☐	☐
Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)	☐	☐
Managers are normally not promoted	☐	☐

This figure provides examples of the 18 questions in the MOPS survey for the US that span the management of physical capital resources (subdivided into setting targets and monitoring production) and of human capital resources (incentives design).

Figure 1B. World Management Survey China: Examples

Example 1: Targets

Score	(1): Goals are exclusively financial or operational	(3): Goals include non-financial targets, which form part of the performance appraisal of top management *only*	(5): Goals are a balance of financial and non-financial targets. Senior managers believe the non-financial targets are often more inspiring and challenging than financials alone

Example 2: Monitoring: How is performance tracked?

Score	(1): Measures tracked do not indicate directly if overall business objectives are being met. Certain processes aren't tracked at all	(3): Most key performance indicators are tracked formally. Tracking is overseen by senior management	(5): Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools

Example 3: Incentives: How does promotion work?

Score	(1) People are promoted primarily upon the basis of tenure, irrespective of performance (ability & effort)	(3) People are promoted primarily upon the basis of performance	(5) We actively identify, develop and promote our top performers

This figure provides examples of the 18 questions in the WMS survey for China that span the management of physical capital resources (subdivided into setting targets and monitoring production) and of human capital resources (incentives design).

Figure 2. Management Practices across Firms

Figure 2A. MOPS US

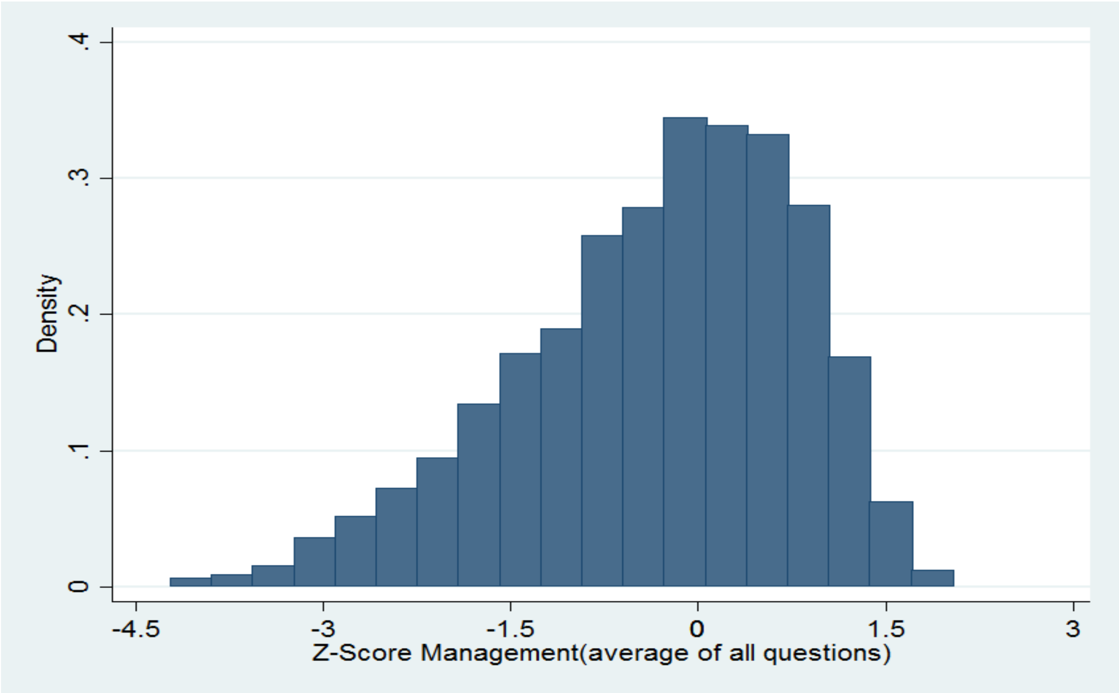
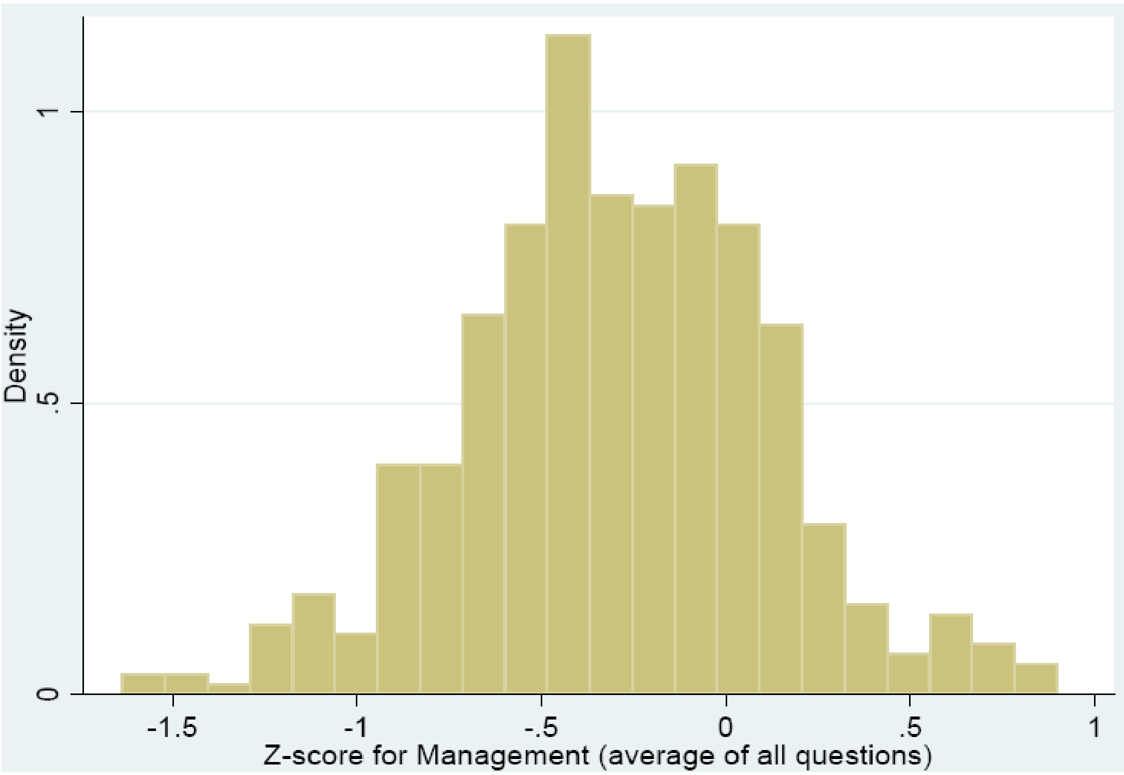
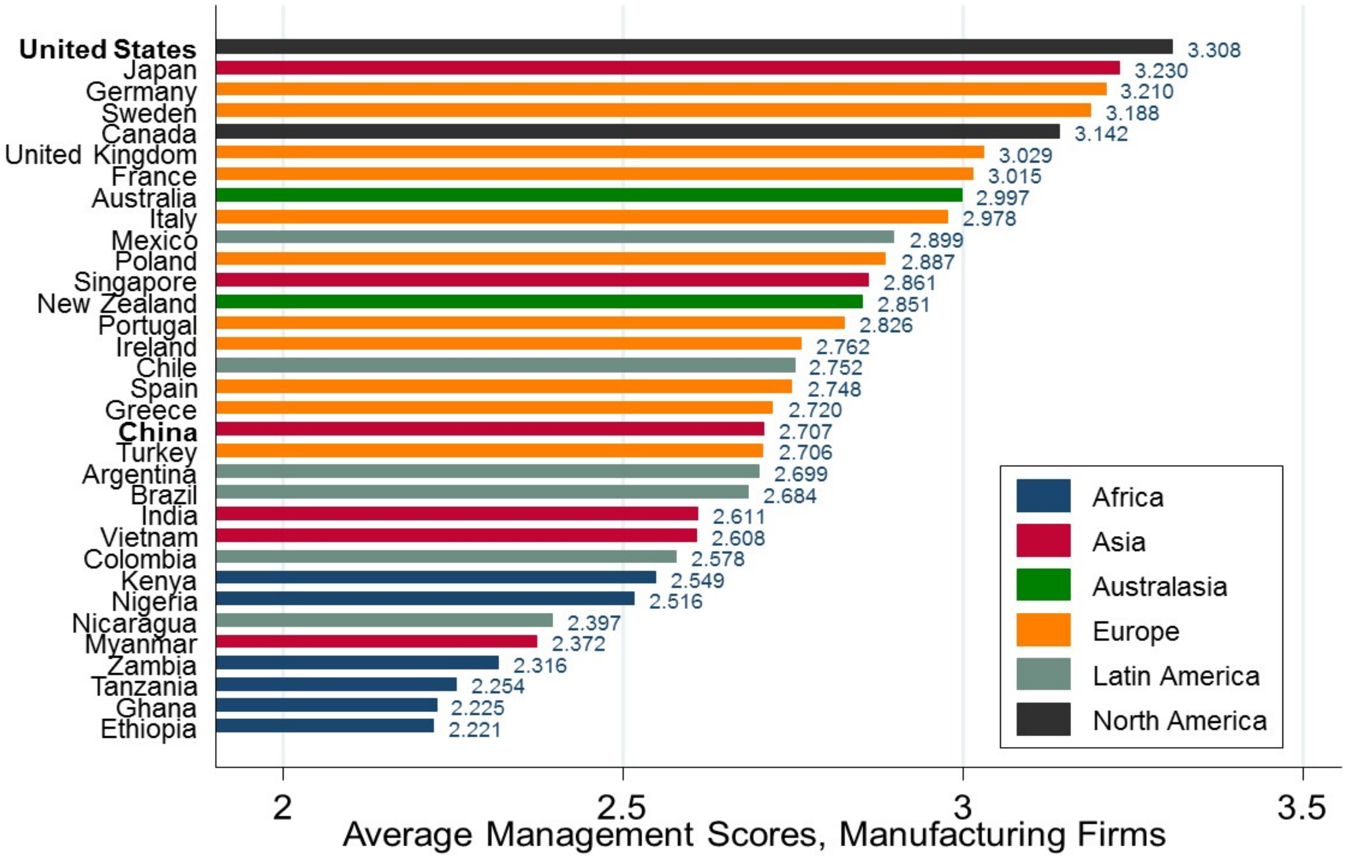


Figure 2B. WMS China



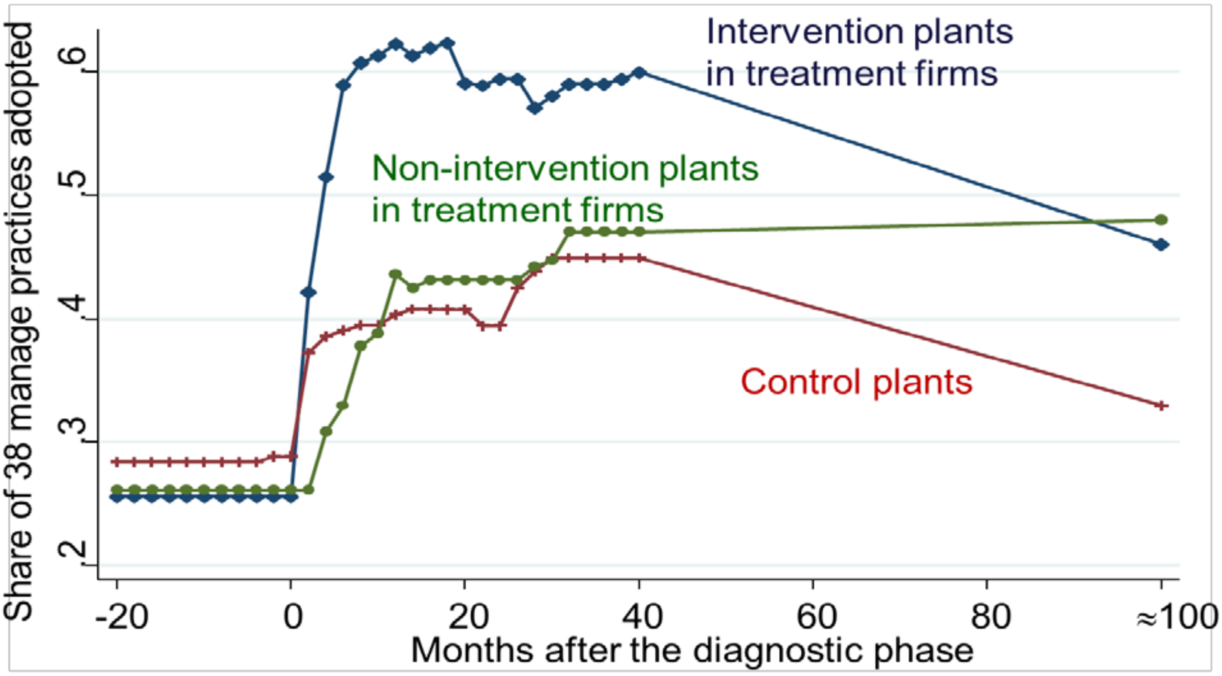
This figure plots the MOPS management score distributions for the US (top) and the WMS management score distribution for China (bottom). The management scores have been averaged across 18 questions and normalized to a mean of 0 and standard deviation of 1 in each country.

Figure 3. Average WMS Management Practices across Countries



This figure plots the WMS average management score across all firms in a country, averaged over all WMS waves from 2004 to 2014. Each firm is scored on 18 questions and each question is marked on a scale of 1 to 5, such that the overall firm and country scores have a range of 1 to 5.

Figure 4. India RCT: Change in Management Practices (2008-2017)



This figure shows the lasting improvement in firms' management practices following a randomized control trial that provided management consulting to plants in the textile industry in India, 2008-2017. It plots the share of 38 core management practices that three types of plants have adopted at the monthly frequency: 14 intervention plants in treated firms that received both initial diagnostics and management consulting, 6 non-intervention plants in treated firms that received only initial diagnostics, and 11 control plants that received neither. See Bloom et al. (2013) and Bloom et al. (2017) for experiment details.

Figure 5. India RCT: Change in Quality Defects vs. Change in Management (2008-2011)

This figure displays the relationship between the improvement in firms' management practices and quality control in production following a randomized control trial that provided management consulting to plants in the textile industry in India, 2008-2011. It plots the firm-by-week change in the log quality defects index against the firm-by-week change in the management score, both relative to their pre-experiment average. The quality defects index measures the severity-weighted number of defects per roll of fabric. Treatment firms denoted with blue X symbols and control firms denoted with red ● symbols. See Bloom et al. (2013) for experiment details.

Appendix Table 1. Extensive and Intensive Margins of Exports: No Firm Controls

	China					US				
Dep Variable:	Log # Dest	Log # Prod	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod	Log # Dest	Log # Prod	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Management	0.159**	0.152***	0.200***	0.062	0.226**	0.179***	0.213***	0.257***	0.231***	0.418***
	(2.51)	(3.06)	(2.72)	(0.75)	(2.11)	(17.44)	(19.67)	(19.76)	(16.62)	(20.8)
Fixed Effects	Province, SIC-3 Industry, Own, Year					State, NAICS-6 Industry				
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	N	N	N	N	N	N	N	N	N	N
R-squared	0.43	0.41	0.40	0.38	0.39	0.33	0.29	0.33	0.28	0.32
# observations	2,236	2,236	2,236	2,236	2,236	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 exported 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. A product is HS 8-digit. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Appendix Table 2. Management vs. TFPR

	China						US					
Dep Variable:	TFPR	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod	TFPR	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Management	0.086*	0.054***	0.243*	0.240***	0.003	0.204*	0.090***	0.026***	0.348***	0.181***	0.167***	0.106***
	(1.69)	(2.94)	(1.87)	(3.19)	(0.03)	(1.79)	(10.10)	(8.66)	(15.69)	(14.05)	(11.94)	(5.43)
TFPR		-0.006	0.257***	0.139***	0.118*	0.212***		0.037***	0.280***	0.160***	0.120***	0.165***
		(-0.49)	(3.35)	(3.29)	(1.94)	(2.88)		(10.50)	(11.25)	(10.56)	(8.32)	(8.60)
Fixed Effects	Province, SIC-3 Industry, Own, Year						State, NAICS-6 Industry					
Noise Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.49	0.43	0.44	0.41	0.44	0.44	0.83	0.28	0.39	0.38	0.32	0.44
# observations	1,880	2,800	1,880	1,880	1,880	1,880	13,000	32,000	13,000	13,000	13,000	13,000

This table examines the relationship between firms' management practices, total factor productivity, and export activity. All dependent variables are defined in Tables 2 and 4. *TFPR* is revenue-based TFP measured as in Levinsohn-Petrin. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Appendix Table 3. Export Activity and TFPR: No Management

	China					US				
Dep Variable:	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TFPR	-0.006	0.274***	0.155***	0.118*	0.227***	0.040***	0.307***	0.174***	0.133***	0.260***
	(-0.45)	(3.54)	(3.53)	(1.95)	(3.05)	(11.49)	(12.09)	(11.36)	(9.08)	(11.52)
Fixed Effects	Province, SIC-3 Industry, Own, 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	0.42	0.44	0.39	0.44	0.43	0.28	0.38	0.37	0.31	0.36
# observations	2,802	1,880	1,880	1,880	1,880	32,000	13,000	13,000	13,000	13,000

This table examines the relationship between firms' total factor productivity and export activity. All dependent variables are defined in Tables 3 and 4. *TFPR* is revenue-based TFP measured as in Levinsohn-Petrin. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm (China) and robust (US). US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Appendix Table 4. Production Efficiency and Product Quality: Robustness

Panel A. Sector-specific demand elasticity (Broda-Weinstein)

	China				US			
Dep Variable:	Log Export Quality	Log Qual-Adj Export Price	Log Export Price	Log Export Quantity	Log Export Quality	Log Qual-Adj Export Price	Log Export Price	Log Export Quantity
Structural parameter(s)	θ^{CH}	$-\delta^{CH}$	$\theta^{CH} - \delta^{CH}$		θ^{US}	$-\delta^{US}$	$\theta^{US} - \delta^{US}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management	0.332*	-0.185	0.149**	-0.203	0.042***	-0.046***	0.003	0.034***
	(1.96)	(-1.48)	(2.16)	(-1.49)	(2.99)	(-3.68)	(0.68)	(2.83)
Fixed Effects	Province, Dest-Product, Own, 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	0.97	0.96	0.97	0.83
# observations	58,101	58,101	58,101	58,101	290,000	290,000	290,000	290,000

Panel B. Controlling for market power

	China				US			
Dep Variable:	Log Export Quality	Log Qual-Adj Export Price	Log Export Price	Log Export Quantity	Log Export Quality	Log Qual-Adj Export Price	Log Export Price	Log Export Quantity
Structural parameter(s)	θ^{CH}	$-\delta^{CH}$	$\theta^{CH} - \delta^{CH}$		θ^{US}	$-\delta^{US}$	$\theta^{US} - \delta^{US}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Management	0.531*	-0.385*	0.146**	-0.200	0.040**	-0.044***	-0.004	0.058***
	(1.95)	(-1.82)	(2.16)	(-1.49)	(2.36)	(-2.99)	(-1.01)	(4.69)
Market Share	0.001	-0.001	0.000	0.001	0.038*	-0.040*	-0.002*	0.048*
	(0.94)	(-1.01)	(0.28)	(1.43)	(1.78)	(-1.78)	(-1.72)	(1.78)
Fixed Effects	Province, Dest-Product, Own, 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	0.97	0.96	0.98	0.84
# observations	58,101	58,101	58,101	58,101	290,000	290,000	290,000	290,000

This table examines the robustness of the relationship between firms' management practices, the price, quality, quality-adjusted price and quantity of their exports. All variables, controls and fixed effects are as described in Table 6 with two exceptions. In Panel A, quality and quality-adjusted prices are constructed using demand elasticity set to industry-level values from Broda-Weinstein (2006). In Panel B, an additional control is added for firms' market power: the share of each firm in total Chinese exports by destination-product-year (Columns 1-4) or in total US exports by destination-product (Columns 5-8). Standard errors clustered by firm. US sample sizes rounded for disclosure reasons. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Appendix Table 5. Management Components

	Exports				Quality and Price		Imports		
Dep Variable:	Exporter Dummy	Log Exports	Log # Dest-Prod	Log Avg Exports per Dest-Prod	Log Export Quality	Log Export Price	Log Imports	Log Avg Origin Income	Log # Origin-Prod
	(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(12)
Panel A. China									
Monitoring	0.061***	0.012	0.087	-0.076	0.558*	0.180**	0.727***	0.059**	0.373***
	(2.68)	(0.08)	(0.93)	(-0.73)	(1.84)	(2.54)	(4.09)	(2.19)	(3.89)
Incentives	-0.030	0.266*	0.162**	0.104	-0.008	-0.032	-0.168	-0.013	-0.195**
	(-0.58)	(1.96)	-2.15	-1.06	(-0.03)	(-0.52)	(-1.04)	(-0.42)	(-2.09)
Fixed Effects	Province, SIC-3 Industry, Own, Year								
Noise, Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country-Product FE	--	--	--	--	Y	Y	--	--	--
R-squared	0.43	0.43	0.40	0.45	0.9	0.92	0.57	0.38	0.61
# observations	3,123	1,935	1,935	1,935	58,101	58,101	1,778	1,778	1,778
Panel B. US									
Monitoring	0.022***	0.307***	0.157***	0.150***	0.050**	-0.005	0.347***	0.045***	0.101***
	(6.99)	(13.11)	(11.29)	(10.37)	(2.56)	(-1.10)	(11.38)	(4.52)	(7.67)
Incentives	0.013***	0.141***	0.077***	0.064***	0.017	0.001	0.081***	-0.003	0.011
	(4.63)	(6.57)	(6.04)	(4.72)	(1.03)	(0.16)	(2.86)	(-0.29)	(0.88)
Fixed Effects	State, NAICS-6 Industry								
Noise, Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country-Product FE	--	--	--	--	Y	Y	--	--	--
R-squared	0.27	0.39	0.37	0.32	0.96	0.97	0.31	0.21	0.53
# observations	32,000	13,000	13,000	13,000	290,000	290,000	10,000	10,000	10,000

This table examines the role of different components of firms' management practices. All variables are defined in Tables 2, 4, 6, 7, and 8. All regressions for China include noise controls and fixed effects for firm province, main SIC-3 industry, year, and ownership status. All regressions for the US include noise controls and fixed effects for firm state and main NAICS-6 industry. Columns 5-7 and 10-11 include country-product pair fixed effects. All columns also include a full set of firm controls as described in Table 2. Standard errors clustered by firm, except for Columns 1-4, 8-9 and 12 for the US where they are robust.