# Managing Trade: Evidence from China and the US*

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**Abstract**

We combine six micro-datasets to examine the relationship between firm management practices and trade performance in the world's two largest export economies, China and the US. We find consistently similar results across both countries. First, better managed firms are more active exporters. They are systematically more likely to export, sell more products to more destination countries, and earn higher export revenues and profits. Export behavior is strongly associated with management competence even after controlling for domestic activity and measured TFP. Second, better managed exporters have higher prices, higher quality, and lower quality-adjusted prices within narrow destination-product markets. They also source more imported inputs, a wider range of inputs, more expensive inputs, and more inputs from advanced economies. These patterns are consistent with a heterogeneous-firm model in which effective management improves firm performance by increasing both production efficiency and product quality. In particular, better managed firms use more sophisticated inputs and assembly technologies to more efficiently produce goods of higher quality. Poor management practices may thus hinder trade, growth and entrepreneurship in developing countries.

JEL codes: F10, F14, F23, L20, O19, O32.
Keywords: Management practices, export performance, firm heterogeneity, productivity, quality.

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## 1 Introduction

Productivity, management practices and international trade activity vary dramatically across firms and countries. Although higher measured TFP has been associated with export success and superior management with higher profits, measured TFP constitutes a residual black box, while the mechanisms through which management operates remain unknown.

We perform the first analysis of the role of management practices for export performance and in the process shed light on both of these open 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 >10,000 US firms in 2010. Our results thus inform fundamental economic mechanisms that generally shape firm activity and are not specific to particular economic environments.

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. These export outcomes are disproportionately more responsive to management competence than domestic production. In addition, our findings for management survive when we explicitly control for revenue based firm productivity as commonly constructed in the literature.

We then present a collection of independent results that together inform the mechanisms through which management strategies affect firm performance. Better managed exporters charge higher export prices within narrowly defined destination-product markets. We structurally 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 imported inputs by value and a wider range of distinct inputs in terms of product categories and countries of origin. They also source more expensive imported inputs and more inputs from suppliers located in more developed economies.

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 product quality. Superior management enables firms to effectively 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 production efficiency and product quality channels are active, they push marginal costs in opposite direction, such that the net effect of management competence on prices and quantities is theoretically 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.

Our findings address two open questions in two separate but equally 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 et al 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 conceptulizes 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 black-box residual from production function estimates that is moreover subject to various estimation biases. Thus an important open question in the trade literature is what constitutes productivity 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 1912, Syverson 2011). While early measures and studies of firm productivity were motivated by notions of effective management, rigorous empirical analyses became possible only recently when the World Management Surveys began collecting the first systematic data on management practices for large representative firm samples. Evidence indicates that superior management is associated with higher measured firm productivity and profits (e.g. Deming 1950, Roos et al 1990, Bloom et al 2013, Sutton 2007). Yet little is known about the mechanisms through which management operates, although management practices are believed central to lean manufacturing and quality control.

Our results inform 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 product quality increase with management competence. We also unpack the black box of TFPR and identify management practices as a concrete, tangible and directly measured component of TFPQ that accounts for the heterogeneity in firm (export) performance.

This paper also speaks to the active literature on the role of firm heterogeneity for aggregate productivity, welfare and the gains from trade (e.g. Hsieh-Klenow 2009, Arkolakis, Costinot and Rodriguez-Clare 2012, Melitz-Redding 2013). Evidence indicates that reallocations across firms and across products within firms, as well as productivity upgrading within firms contribute significantly to the aggregate adjustment to trade reforms and other macroeconomic shocks (e.g. Pavcnik 2002, Bernard et al 2006, Bustos 2011). Understanding the sources of firm heterogeneity is thus important for understanding aggregate outcomes. Given evidence on the complementarity between manufactured input quality and skilled labor in the producion of output quality (e.g. Verhoogen 2008), the degree of quality differentiation across firms and its interplay with management competence has implications for the differential effects of shocks across the skill distribution.

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 et al 2010, Fieler et al 2015). Poor economies often rely on international trade for growth, and specifically on exporting to large, developed and profitable markets that maintain high quality standards. The paucity of high-quality, specilized 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 managerial 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 trough which superior management can improve export outcomes in Section 5. 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 all firm choices and performance outcomes. We consider the endogenous adoption of management practices in an extension to this benchmark in Section 2.6. We posit that effective management can enhance firm performance by increasing production efficiency and/or product quality. 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 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 total factor productivity (TFP), such that our model closely resembles that in Bernard, Redding and Schott (2010a) (henceforth BRS), Kugler and Verhoogen (2012) and the working-paper version of Manova and Yu (2015). We examine the alternative in which management practices are only one of multiple components of firm productivity in Section 2.6.

## 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 $\Omega_j$ 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. Of note, 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).

## 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 higher-quality goods. We refer to these two mechanisms through which management operates as *production efficiency* and *product quality*.

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 ability level $\varphi \epsilon (0, \infty)$ from a distribution $g(\varphi)$ and a vector of firm-product specific expertise levels $\lambda_i \epsilon (0, \infty)$ from a distribution $z(\lambda)$. We will think of better managed firms as having a higher ability draw $\varphi$. 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 $\lambda$ 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 inventorization, synchronizing and monitoring production targets across manufacturing stages, reducing wasteage, incentivizing workers, etc.

At a marginal cost of $(\varphi\lambda_i)^{\theta-\delta}$ workers, the firm can produce 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 cotton and plastic buttons may entail the same assembly process as sewing a dress using silk and mother-of-pearl buttons, the latter utilizes more expensive materials and is considered of higher quality. Similarly, if workers have heterogeneous skills, more skilled workers that earn a higher wage may be able to produce goods of superior quality. Another interpreation 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 have enhanced capabilities and 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 (made by more skilled workers) or more complex assembly processes. The parameter $\theta$ reflects the degree to which superior management strategies enable firms to produce higher-quality products. Intuitively, effective management can enhance product quality by tightening quality control, facilitating the customization of production parts and their specialized assembly, minimizing costly mistakes, incentivizing workers, etc.

For expositional simplicity, we do not explicitly model firms' input choice but follow Baldwin and Harrigan (2011) in assuming that product quality is fixed by exogenous draws. Endogenizing input quality in a richer framework would however preserve our theoretical predictions. Kugler and Verhoogen (2012) show how the presence of complementarity between firm ability and input quality in the production function for output quality leads to more capable firms optimally using higher quality inputs or adopting 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 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 $\theta$ and $\delta$. This in turn has implications for other firm outcomes as well.

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 $\tau_j$ 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.[1] A firm with management competence $\varphi$ will choose the price and sales quantity of a product with expertise draw $\lambda_i$ 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 quantites.

[1] See Eckel et al. (2011) for an alternative model which incorporates product cannibalization effects.

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 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 absolute prices. In the kinfe-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 $\delta\sigma > \theta$.

### 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 manufacture only goods for which they can earn non-negative profits domestically. Since profits increase in product expertise $\lambda$, for each management ability draw $\varphi$, there is a zero-profit expertise level $\lambda^*(\varphi)$ below which the firm 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 $\varphi$ 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 $\varphi$ 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 $\varphi$ 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 $\varphi$, the expertise cut-off for exporting generally varies across destinations because the market size $R_j$, price index $P_j$, variable $\tau_j$ 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 quality and efficiency 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 given market only if total expected revenues there exceed all associated costs. The export profits in country $j$ of a firm with management competence $\varphi$ 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 draw but worse management practices. Therefore only firms with management level above a cut-off $\varphi_j^*$ will service destination $j$, where $\varphi_j^*$ satisfies:

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

With asymmetric countries, $\varphi_j^*$ 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 $\varphi$'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 $\varphi$ 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 $\varphi^*$ 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.

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

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

**Proposition 3** *Better managed firms have lower quality-adjusted prices. If $\theta > \delta > 0$, better managed firms sell higher-quality products at higher prices. If $\delta > \theta > 0$, better managed firms sell higher-quality products at lower prices. If $\delta = \theta > 0$, better managed firms sell higher-quality products but prices are invariant across firms. If $\delta > \theta = 0$, better managed firms have lower prices but product quality is invariant across firms.*

**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.*

### 2.6 Extensions

We consider a number of extensions to our baseline model. These illustrate the robustness of the testable predictions summarized by Propositions 1-4 that we take to the data.

#### 2.6.1 Endogenous management

Our baseline model treats management competence as an exogenous draw at the firm level in the spirit of Melitz (2003). One way to rationalize this is by appealing to the process of entrepreurship and firm creation. For example, prospective founder-entrepreneurs may differ in their inherent ability to implement business ideas and manage operations. Alternatively, all founders may have the same capabilities and ex-ante identical entrepreneurial prospects, but they may have to hire an external manager with ex-ante imperfect information about potential managers' skillset. If better managers implement superior management practices, ex-ante identical founders matched with different managers would have ex-post different levels of management competence. Indeed, the corporate finance literature has found evidence that managers bring their own distinct style to running a company (*** cite Schoar et al ***).

On the other hand, management practices may be an endogenously chosen production technology that is determined by a primitive exogenous draw. For instance, ex-ante identical entrepreneurs may have to undertake R&D to develop a new business idea and face uncertainty about its ex-post success. Once the idea is developed and its market potential revealed (e.g. consumer appeal, production costs), entrepreneurs could choose what management practices to adopt to commence production. While more effective management can lower the variable costs of quantity and quality production, it plausibly entails higher sunk costs of adoption and higher fixed costs of use in each period. Entrepeneurs with ex-post better ideas would capitalize on these economies of scale and choose superior magement strategies because they expect to capture a bigger market share.

Endogenizing management practices in this way would retain the key empirical predictions of our baseline model but modify their interpretation. To see this, let entrepreneurs receive an exogenous talent draw $\varphi$ and actively choose a management practice $m(\varphi)$ to maximize profits, where marginal costs and quality now depend on $\varphi m(\varphi)\lambda_i$. One can show that if the fixed cost of adoption $f_m$ satisfies $df_m/dm > 0$, then $dm(\varphi)/d\varphi > 0$ and exogenously more talented entrepreneurs adopt superior management practices. Given the monotonic relationship between $\varphi$ and $m(\varphi)$, Propositions 1-4 would continue to hold. However, instead of capturing a causal effect of management competence on firm performance, these propositions would identify the correlation between management and trade activity as joint outcomes of the firm's maximization problem.

#### 2.6.2 Multiple productivity components

In our baseline model, management is the unique firm-level attribute that, together with the product-specific expertise draws, determines all relevant firm outcomes. It can be shown that our theoretical predictions would continue to hold should multiple draws jointly determine firm-level ability $\varphi$.

To fix ideas, consider the case when firms' production efficiency and quality capacity depend on the combination of two attributes that are imperfectly correlated with each other, $\varphi = m \cdot \phi$ where $|corr(m, \phi)| \neq 1$. These could for example correspond respectively to the intrinsic talent of an entrepreneur or the market potential of her idea ($\phi$) and the manager's competence for implementing effective management practices ($m$). When there is heteregeneity in entrepreneurial talent and managerial competence, labor market frictions such as asymmetric information about individual characteristics would imply that entrepreneurs and managers do not match in a perfectly assortative manner such that $|corr(m, \phi)| \neq 1$. In such an environment, all endogenous outcomes of the firm's maximization problem would now be uniquely pinned down by $\varphi$ instead of $m$ alone. Ceteris paribus, management competence would nevertheless continue to exert the same effects as in our baseline model, such that Propositions 1-4 would remain unchanged.

#### 2.6.3 Endogenous input choice

For expositional simplicity, we do not explicitly model firms' input choice but follow Baldwin and Harrigan (2011) in assuming that product quality is fixed by exogenous draws. Endogenizing input quality in a richer framework would however preserve our theoretical predictions. Kugler and Verhoogen (2012) show how the presence of complementarity between firm ability and input quality in the production function for output quality leads to more capable firms optimally using higher quality inputs or adopting a more sophisticated technology in order to produce higher-quality goods.

# 3 Data

Our analysis makes use of unique, matched firm-level data on production, international trade and management practices for the world's two largest export economies - China and the United States. We exploit six proprietary data sources in total, three for each country, to assemble a data supraset that is unprecedented in its coverage and detail. This section introduces the data, describes how management practices are evaluated, and summarizes key features of firm activity.

## 3.1 US

We employ three comprehensive datasets on the activities of US firms. First, we obtain standard balance-sheet data on a large representative sample of US establishments during 1973-2012 from the US Annual Survey of Manufacturers (ASM). 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.

Second, 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 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 ~8,000 different products in the 10-digit Harmonized System. The raw data enable us to construct transaction-level unit values to proxy goods prices. Trade values, quantities and prices are comparable across transactions within a product as a single unit of accounting is consistently used for all shipments of a given HS-10 category (e.g. dozens, kilograms, etc.). Our empirical analysis accounts for differences in measurement units across HS codes with product fixed effects as needed. 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.

The third and most novel US data source is the Management and Organizational Practices Survey, 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 ~32,000 manufacturing plants in 2010 and 2005. The sample captures 5.6 million employees or more than half of US manufacturing employment.

We link ASM, LFTTD and MOPS using firms' unique tax identifier that is common to all three datasets.[2] We perform our baseline analysis for the resultant cross-section of ∼31,000 US firms 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 (see Appendix Table 1). We exploit recall MOPS data for 2005 and panel ASM and LFTTD data in robustness checks.

## 3.2 China

We exploit three comprehensive datasets on the activities of Chinese firms that closely mirror those for the US. First, we access production data at the firm level for the 1999-2007 period from China's Annual Survey of Industrial Enterprises (ASIE). ASIE provides standard balance-sheet information for all state-owned enterprises and all private companies with sales above 5 million Chinese Yuan, or over 200,000 companies 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 GBT 4-digit classification.

Second, 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 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.[3] 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 occurred. 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.

Finally, we use data on the management practices of 507 Chinese firms collected in 2006-2007 as part of the World Management Survey (WMS). WMS has been assembling standardized measures of managerial practices for over 20,000 manufacturing firms located in 34 countries

[2] A small fraction of firms in the sample operate multiple establishments. For these firms, 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. We use the age, location and primary industry of activity of the firm headquarters.

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

since 2002. It uses stratified randomization to identify representative firm samples in each country, relies on official government endorsements to ensure compliance, and employs double-blind interviewing techniques to guarantee unbiased responses from plant managers. WMS gathers additional information on basic firm characteristics and logistical particulars of each interview. Of these, we use information on firms' primary industry affiliation (out of 82 industries in the SIC 3-digit classification), as well as a set of noise controls about each management interview including its duration and time of day; interviewer dummies; interviewee gender, reliability and competence as perceived by the interviewer.

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. Summary statistics available on request indicate no significant differences between the management practices of the matched and unmatched firms in WMS.

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. 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 of both export and import transactions.

Summary statistics reveal that the matched ASIE-WMS and CCTS-WMS sample containts slightly bigger, more productive and more internationally engaged firms than in the full ASIE and CCTS records. Pairwise correlations among key production and trade indicators, however, point to no systematic differences between firms with and without management data. While our Chinese sample may be much smaller than that for the US, we thus believe that we can establish informative results for both countries that are not driven by sample selection bias.

### 3.3 Measuring Management Practices

While economists have long believed that the organization of production activities inside the firm is critical to lean manufacturing (Walker 1887), classifying and quantifying management practices in a consistent manner has been difficult. As a result, systematic data on firms' management practices have not been available until recently, with management scientists performing isolated case studies that adopt case-specific evaluation methods.

The World Management Survey initiated in 2004 was revolutionary in designing standardized measures of management competence and implementing a rigorous approach to collecting such measures on a large scale. WMS considers multiple aspects of firm management and evaluates the relative effectiveness of different practices within each aspect. Both the management categories and the criteria for assessing performance in each category are based on techniques perfected by McKinsey Consulting to evaluate companies at baseline before offering their management consulting services. Since WMS is conducted via time-consuming phone interviews with plant managers, it covers a large number of countries at the cost of smaller, representative firm samples in each country. Introduced in the US Census, MOPS is modeled after WMS and permits an unprecedented breadth of firm coverage.

WMS and MOPS include 18 questions about various practices related to the management of capital (subdivided into *targets* and *monitoring*) and human resources (*incentives*). Importantly, these questions get at management practices in place in the sense of management strategies and processes adopted in a production facility, rather than the quality of company managers in terms of skill, education or experience. Figure 1 provides examples of specific questions and data forms.

A first group of questions pertain to the design, integration and realism of production *targets*. These questions assess to what extent intermediate targets are consistently set across production stages to optimize the timely meeting of output targets according to demand, the use of various manufactured and labor inputs, and the management of inventories. For example, companies are asked who is aware of production targets in an establishments among senior managers, mid-level managers, and production workers.

A second group of questions characterize the *monitoring* of production activities via the systematic collection, analysis and dissemination of operations data. For instance, plants report how many key performance indicators they monitor, such as metrics on production, cost, waste, quality, inventory, energy use, absenteeism, and deliveries on time. They also indicate how performance is tracked - comprehensively or selectively, continuously or sporadically, signaling whether business objectives are met or not. Figure 2 contrasts the organization of the production floor in a car plant with effective performance metrics to that in a textile plant with dismal performance metrics.

A third group of questions capture the use of various *incentives* mechanisms for the effective management of human capital. These broadly signal how companies identify worker performance, reward high achievers, and improve or otherwise disincentivize underperformers. For example, plants indicate what percent of non-managers received performance-based bonuses when production targets were met. They also record whether staff are promoted primarily based on tenure irrespectively of ability and effort, on performance, or on the active identificaton and development of top performers.

Each management question is scored on a scale of 1 to 5, with higher values indicating more effective management. We aggregate this information to a single "management z-score" in order to be comprehensive and agnostic about the relative importance of different managerial practices. In particular, we standardize the responses to each question across firms and use the arithmetic average of the 18 standardized questions. Unreported results available on request reveal consistent patterns for individual management components.

WMS and MOPS are designed around objectively effective management practices that should benefit firm performance regardless of the specifics of the manufacturing product, technology or 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 to simultaneously address two additional concerns. First, management scores are not readily comparable between WMS and MOPS, but they do permit valid comparisons across firms within each country sample. Second, the relative effectiveness of different management practices might depend on the formal (e.g. labor market flexibility) and informal institutions in a country (e.g. cultural norms, respect for managerial hierarchy). Two observations suggest this might be of limited practical relevance: the improvement in firm performance following a consulting intervention in India that introduced management practices scored highly in MOPS and WMS (Bloom et al. 2013) and the use of such practices by multinationals around the globe, rather than only in developed countries (***). 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.

### 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. 45% of the ~31,000 US firms in our 2010 matched sample pursue exporting. Annual log foreign sales average 13.79 with a standard deviation of 2.77 log points. The typical exporter sells 19 different HS-10 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. 58% of all firms export, with mean log export revenues of 14.80 and associated standard deviation of 2.31 log points. The average exporter ships 9 HS-8 digit products to 13 markets and, conditional on using foreign inputs, sources 33 different products from 6 countries of origin, but patterns once again vary dramatically across firms. These statistics illusrate the extent to which Chinese manufacturers participate in assembling a large number of imported parts and materials into processed goods destined for foreign markets. By contrast, US firms plausibly import both intermediate inputs and processed goods near their final production stages.

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 (Figure 4), with the left tail of poorly ran firms in developing nations the primary factor behind their low average scores. For example, the average management z-score in our Chinese sample is -0.298 with standard deviation of 0.418. By contrast, these figures are 0 and 1 for 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. Exporters have ***% higher value added per worker and 9.4% higher TFPR than non-exporters in China, with the corresponding export productivity premia of ***% and 26% in the US.

# 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 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:

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

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 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 rigorous set of fixed effects, $\phi_l$ and $\phi_i$. 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 affiliattion of each manufacturer. In the case of the US, we use indicator variables for 50 states and $\sim 300$ NAICS 6-digit industries.

We further condition on a vector of firm charateristics $Z_f$. 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 $\beta$ reflects the sign of the conditional correlation between firms' management competence and export performance. Given the fixed-effects structure, it is identified from the variation across companies within narrow segments of the economy. This correlation can be interpreted in two ways through the lens of our model. If management corresponds to firms' exogenous productivity draw or one component of it, then $\beta$ 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, $\beta$ 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 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 $\phi_t$. This is motivated by evidence in *** 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.[4] To the extent that Chinese companies in our sample adjust their management practices over time, the panel version

[4]The average within-firm change in the management z-score between 2005 and 2010 as reported in 2010 is ***. In comparison, the cross-firm mean and standard deviation of the management z-score are *** and *** respectively in 2010.

of equation (11) would isolate the average sensitivity of export performance with respect to management. This would be equivalent to observing $Management_f$ with classical measurement error and tend to bias $\beta$ estimates downwards.

In our baseline regression (11) for the US, we report Huber-White heteroskedasticity robust standard errors because the unit of observation is the firm. Throughout the rest of the analysis, we conservatively cluster errors by firm to account for possible correlated shocks within firms across time, products, and/or partner countries. Clustering at the firm level is also appropriate given that our key variable $Management_f$ is measured at that 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 findings. 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. Firms employing more effective management practices are systematically more likely to enter foreign markets. We report results using the Probit estimator, but similar patterns hold with linear estimators such as OLS.

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.[5] We observe that well run exporters realize substantially higher sales abroad.

These results take into account firms' ownership status because state-owned enterprises and affiliates of foreign corporations might have distinct export incentives and attributes compared to private domestic firms (unreported coefficients available on request). While multinational companies are more likely to export and have higher export revenues conditional on trading, management plays an independent role that cannot be simply explained by foreign-owned firms having more effective managerial practices. SOEs do not display markedly different outcomes from private domestic enterprises.

The strong relationship 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 find some evidence that older manufacturers are more likely to be exporters and generate

[5] 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.

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 (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.[6] To guard against omitted variable bias, we always include the 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 24% higher export revenues in China. The corresponding numbers for the US are 3% and 37%. These magnitudes are sizeable compared to the marginal impacts of foreign ownership (***% and ***% in China) and firm age, skill and capital intensity (comparative statics in the range of ***% to ***%).

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 only firms' total profits 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 pfotis. We first confirm that superior managerial practices are associated with higher firm-wide 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). This strongly suggests that the more active export participation of better managed firms indeed translates into higher export profits. This conclusion would be invalid only in the unlikely scenario that export profits fall with management competence while domestic profits simulateneous rise at a faster pace. Our point estimates suggest that a one-standard-deviation rise in $Management_f$ is associated with 36% and 11% higher firm-level export profits in China and the US respectively.

### 4.3 Extensive and Intensive Export Margins

As a first step to understanding the mechanisms through which management contributes to export success, we next 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

[6] The positive correlation between average wages and the share of skilled workers across Chinese firms appears to generate multicollinearity in Columns 2 and 4 and account 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.

log number of total destination-product markets they penetrate. We define products at a very granular level, namely HS 8-digit categories. Turning to the intensive margin, the difference between the point estimate for a given extensive-margin outcome and that for worldwide exports in Table 2 captures the role of management for a corresponding intensive margin of exporting. We therefore present representative results for log average firm exports per destination-product, but similar patterns hold for log average firm exports per destination or per product. 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 symmetric regressions without the wider set of firm controls $Z_f$.

We consistently observe positive coefficients on $Management_f$ that are highly statistically significant for all export outcomes but 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 detination-product market. For American companies, these magnitudes stand at 13%, 17%, 20% and 18%.

Overall, the extensive margin of market entry accounts for just over half of the contribution of effective 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.[7]

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 available on request corroborates this notion. 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. As we repeat this exercise replacing the outcome variable with log average sales to the top 2, top 3, etc. export markets, we record lower point estimates as anticipated, which eventually become insignificant in the case of China.

### 4.4 Export vs. Domestic Activity

Of interest is 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

[7] These calculations are based on comparing regression coefficients across specifications for different export outcomes, such as Column 8 of Table 2 and Column 6 of Table 4.

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.[8] 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's 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 Intepretation: 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, Bartelsman et al. 2013, De Loecker 2011). 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 new economic questions.

[8] 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 non-homothetic preferences (e.g. Melitz 2003, Melitz and Ottaviano 2008).

**Question 1: Where does good management come from?** One possibility is that management is an exogenous draw at the firm level in the spirit of Melitz (2003). For example, prospective founder-entrepreneurs may differ in their inherent ability to implement their business idea and manage operations. Specification (11) would then in principle capture the causal impact of management quality on export performance.

Alternatively, management practices may be an endogenously chosen production technology that is determined by a primitive exogenous draw. For instance, ex-ante identical entrepreneurs may have to undertake R&D to develop a new business idea and face uncertainty about the ex-post success of their product. Once the idea is developed and its potential (e.g. consumer appeal) known, entrepreneurs can choose what management practices to adopt to commence production. If more effective management lowers the variable costs of quantity and quality production but entails higher fixed costs of adoption and use, entrepeneurs with ex-post better ideas would choose superior magement strategies because they expect to operate on a larger scale. In equation (11), $\beta$ would then reflect the equilibrium relationship between two joint outcomes of the firm's maximization problem.

Both of these interpretations are consistent with our main conclusion: The management practices in place pin down relevant firm outcomes such as production efficiency, product quality, domestic sales and export behavior. We emphasize the novelty of this message and leave the understanding of the origins of good management to future work.

By the same token, 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 above. The only remaining concern would be whether the thus adopted better management feeds back into improved export performance or constitutes an unrelated side effect of export expansion. Only the former would be consistent with our story, and it is confirmed by the results for the relationship between management, production efficiency and product quality in the next section. This echoes evidence in Bustos (2011) that the rise in export demand following trade liberalization in Argentina incentivized exporters to upgrade their production technology.

An interesting possibility is that firms may learn about novel managerial practices from interactions with foreign buyers and general experience with foreign markets. Such knowledge spillovers could amplify the economies of scale mechanism above. While we cannot directly test for learning from exporting, it is unlikely to fully explain our results for three reasons. First, we control for firm age and thus implicitly for past experience. Second, we condition on firms' ownership status which accounts for multinational affiliates learning from their parent company or related parties abroad. In fact, this also absorbs a non-learning mechanism - foreign headquarters purposefully installing superior managerial practices in a subsidiary in order to improve its performance. Third, our results hold when we control for the share of exports conducted under the formal processing trade regime or when we alternatively break up firms' expor outcomes by trade regime and add regime fixed effects; this exercise is relevant only for China and available on request.

**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 the above-mentioned firm outcomes. Moreover, high-TFPR firms are more likely to export, but the observed productivity distributions for exporters and non-exporters heavily overlap.

There are two possible explanations for this discrepancy between hetrerogeneous-firm theory and empirics: (1) measurement error in TFPR productivity and/or other firm outcomes; and (2) multiple firm attributes jointly determining 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 the marginal cost of producing physical units and quality respectively. Since consumers prefer higher-quality goods at lower prices, the composite capability draw at the firm level uniquely decides firm outcomes, but neither individual component does on its own.

This discussion informs how we interpret the stability of our results for management with and without the extended set of firm controls $Z_f$. In our data, the raw correlations of the management score with average wages, skilled labor shares and fixed assets per worker are ***, *** and *** in China and ***, *** and *** in the US. Were (1) these variables measured withour error and (2) management the sole component of TFPQ, then these correlations would have been 1. Including skill and capital intensity in $Z_f$ would have then resulted in multi-collinearity and reduced $\beta$ towards 0. Hence either (1) or (2) or both must be violated. If management is one of multiple TFPQ components that together pin down production inputs, controlling for skill and capital intensity would lead us to underestimate $\beta$. However, if management is unrelated to TFPQ and export success, while skill and capital intensity directly stimulate exporting and entail different management practices as a side effect, omitting them from the regression could introduce either upward or downward bias. Likewise, non-classical measurement error in either management or inputs would imply that failing to condition on the latter could bias $\beta$ in either direction.

In sum, we cannot reject the possibility that TFPQ comprises components other than management effectiveness. Having said that, the comparative statics reported above indicate an economically sizable elasticity of export outcomes with respect to management practices. These comparative statics are moreover conservative estimates given our extensive set of firm controls.

**Question 3: How does management relate to TFPR?** We conclude by exploring the relationship between measured management capacity and measured total factor productivity. We first confirm that the two are positively and significantly correlated both in China and the US, consistent with prior evidence for other countries (Bloom and Van Reenan 2007, Bloom et al. 2010). We construct firms' TFPR as in Levinsohn-Petrin 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. To obtain a conditional correlation, we estimate specification (11) for TFPR as the left-hand side variable. Columns 1 and 6 of Table 6 demonstrate that TFPR is indeed higher in firms employing more sophisticated management practices.

We next 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 2-5 and 7-10 of Table 6). All of our results for management remain quantitatively and qualitatively unchanged: The point estimates for $\beta$ 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 2).

These findings are consistent with two interpretations in light of the discussion above that are not mutually exclusive. On the one hand, management competence and TFPR might constitute two empirical measures for TFPQ. The patterns in Table 6 could then be attributed to non-classical measurement error in TFPR arising from endogeneity bias in its construction. On the other hand, management competence and TFPR might capture two distinct dimensions of firms' capacity to produce physical output and quality. The results in Table 6 would then signal that these two dimensions are imperfectly correlated with each other and jointly determine firm performance. Regardless, the evidence clearly indicates that management organization importantly shapes firm activity.

# 5 Management, Production Efficiency and Product Quality

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.

Examining these questions poses the serious empirical challenge that we cannot directly observe companies' production costs or output quality. We therefore pursue a variety of empirical strategies motivated by our model to indirectly infer production efficiency and product quality from observable data. While these strategies might not be individually immune to estimation concerns, together they paint a coherent picture that is difficult to attribute to estimation biases or alternative explanations.

### 5.1 Export Prices

We first consider the predictions of Proposition 3 for the relationship between firms' management practices and export 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.

We estimate the following specification:

$$Price_{fdp} = \alpha + \beta Management_f + \Gamma Z_f + \phi_l + \phi_{dp} + \varepsilon_{fdp} \tag{12}$$

The unit of observation is now the firm–destination–HS8 product for the US and the firm-destination-HS8 product-year for China.[9,10] $Price_{fdp}$ gives the log 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 continue to include fixed effects for firms' province or state location $\phi_l$ 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 $\phi_i$ in equation (11), we now condition on destination-product pair fixed effects $\phi_{dp}$. 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. The coefficient on $Management_f$ is identified from the variation in product prices 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 to Japan. We conservatively cluster standard errors by firm to accommodate correlated shocks across destinations and products within firms.

As per Proposition 3, the sign of coefficient $\beta$ is informative about the mechanisms through which managerial practices operate: production efficiency and product quality. If only the first mechanism is active, we expect $\beta < 0$ such that management competence improves production efficiency, lowering marginal costs and prices. Conversely, if only the second mechanism is active, we expect $\beta > 0$ such that management competence enables firms to improve product quality,

[9] The HS 6-digit classification system is universal, but countries may use more finely disaggregated product categories that are not directly comparable. The total number of possible product categories in China and the US is comparable at around 8,000.

[10] 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.

manifesting in higher marginal costs and prices. When both mechanisms are in effect, $\beta$ identifies their net impact and $\beta > 0$ if and only if $\theta > \delta$ in our model. In other words, specification (12) can in principle confirm the presence of either of the two possible management mechanisms but it cannot refute their coexistence. Of note, $\beta = 0$ is consistent with management acting through both mechanisms when their effects on marginal costs and prices exactly cancel out, $\theta = \delta > 0$.

Equation (12) is in the spirit of prior studies of the relationship between firm productivity (TFPR), prices and revenues (e.g. Kugler and Verhoogen 2008, Manova and Zhang 2012). Since these variable 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 measurement error. We circumvent this challenge by using direct measures of management practices that are entirely independent from the price data.

Column 1 of Table 7 shows that better managed Chinese firms charge higher export prices in a given destination-product market than their less well ran Chinese competitors in that market. Through the lens of our model, this suggests that more effective management enables Chinese firms to produce higher-quality products using more expensive, higher-quality inputs. However, we cannot rule out that good management also reduces assembly costs through the efficiency channel.

By contrast, we document no systematic relationship between management practices and export prices across US firms (Column 4). This is consistent with superior managerial techniques leaving marginal costs unaffected by improving production efficiency and product quality in equal measure. It nevertheless remains possible that management practices affect neither efficiency nor quality in US manufacturing, although we do not deem this plausible in light of anecdotal evidence and the prior management literature.

While informative, studying export prices poses two limitations: First, it permits the validation of at most one dominant management mechanism but precludes an evaluation of the presence and magnitude of multiple mechanisms.

Second, 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 imporant 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 (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 China might then be driven by better managed firms extracting higher mark-ups rather than offering more sophisticated products. Turning to the case of quality differentiation across firms, our results for export prices could conflate the impact of management practices on product quality with that on variable mark-ups.

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 extract higher mark-ups (available on request). 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. In line with our priors, this indicator enters positively and significantly in regression (12). However, our estimates for $\beta$ remain unchanged, casting doubt on variable mark-ups as an alternative explanation for our results.

In the rest of Section 5, we pursue a series of other econometric approaches in order to overcome the two estimation challenges associated with export prices.

## 5.2 Export Quality and Quality-Adjusted Prices

We first construct model-consistent proxies for firms' export product quality and quality-adjusted price using data on both export prices and quantities by firm, product and destination. As discussed in Section 2.1, $q^*_{ji} \propto \sigma p^{fob}_{ji} + x_{ji}$ such that product quality $q^*_{ji}$ can be inferred as the sum of the quantity sold $x_{ji}$ and the free-on-board price $p^{fob}_{ji}$, where the latter is adjusted for the elasticity of substitution across varieties $\sigma$. 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 compute quality-adjusted export prices as $p^{fob}_{ji}/q^*_{ji}$.

Estimating specification (12) separately for $q^*_{ji}$ and $p^{fob}_{ji}/q^*_{ji}$ as the outcome variable allows us to assess whether management operates through both the quality and the efficiency mechanisms. According to Proposition 3, we should observe $\beta_q > 0$ in the regression for product quality and $\beta_{p/q} < 0$ in the regression for quality-adjusted prices as long as the quality and efficiency channels are active respectively. This interpretaion is moreover conservative given the potential for variable mark-ups: If better managed firms set higher mark-ups, our conclusions for $\beta_q$ would be unaffected, but $p^{fob}_{ji}/q^*_{ji}$ would be inflated and we would be less likely to find $\beta_{p/q} < 0$. While the two coefficients of interest will by construction sum up to the coefficient in regression (12) for prices, $\beta_q + \beta_{p/q} = \beta$, their sign, magnitude and significance is thus informative and not mechanical.

The empirical evidence in Columns 2, 3, 5 and 6 lends strong support to managerial competence improving both production efficiency and product quality. Moreover, qualitatively similar patterns obtain for China and the US, corroborating our prior that the results for export prices above mask the counteracting effects of the efficiency and quality channels on marginal costs. Based on our point estimates, upgrading management practices by one standard deviation is associated with 14% higher prices among Chinese exporters. This results from a 51% increase in product quality and a 37% decline in quality-adjusted prices. 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 $q^*_{ji}$ and $p^{fob}_{ji}/q^*_{ji}$, for an overall negligible positive effect on $p^{fob}_{ji}$.

One implication of our model is that the management elasticities of quality and quality-adjusted prices rise with $\theta$ and $\delta$, respectively. With alternative formulations of the production function for quantity and quality, however, each of $\theta$ and $\delta$ could in principle affect both $q_{ji}^{*}$ and $p_{ji}^{fob}/q_{ji}^{*}$. In our model, these parameters determine the responsiveness of product quality to marginal costs, and the effectiveness of management practices in transforming high-quality inputs and implementing complex assembly processes at low cost. We agnostically proxy $\theta_i$ and $\delta_i$ with two sector-level indicators of the scope for quality and efficiency differentiation: advertising and R&D intensity ($RD_i$) and relationship specificity ($RS_i$) (Kugler and Verhoogen 2008, Manova and Zhang 2012, Nunn 2007). The share of advertising and R&D expenditures in total sales proxies the investments that firms undertake in order to reduce assembly costs and/or to improve its objective quality (e.g. product design, features, functionality, durability) and its subjective quality (e.g. brand appeal) as perceived by consumers. Relationship specificity reflects the share of differentiated inputs in production and thus proxies the use of customized inputs and complex assembly processes in the making of sophisticated goods.

In unreported results, we examine how the relationship of managerial competence with export quality and quality-adjusted prices varies across sectors with different scope for quality and efficiency upgrading. We expand specification (12) to include the interaction of $Management_f$ with either $RD_i$ or $RS_i$, whose level effect is subsumed by the destination-product fixed effects. We find that in China superior management is more strongly associated with higher quality and lower quality-adjusted prices in sectors more intensive in advertising and R&D and in sectors more intensive in relationship-specific investments. In the US, on the other hand, quality and quality-adjusted prices are equally responsive to management competence across sectors.

The results from this interaction analysis strengthen the case for management operating through both the efficiency and the quality channels. It also helps address concerns with variable mark-ups entering export prices: To the extent that better managed firms are able to set higher mark-ups, this might affect the average effect of management but not its differential role across sectors. Variable mark-ups are thus considerably more likely to bias the coefficient on $Management_f$ than on its interaction term.

### 5.3 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:

$$InputCharacteristic_f = \alpha + \beta Management_f + \Gamma Z_f + \phi_l + \phi_i + \varepsilon_f \tag{13}$$

$$InputCharacteristic_{fop} = \alpha + \beta Management_f + \Gamma Z_f + \phi_l + \phi_{op} + \varepsilon_{fop} \tag{14}$$

As in equation (11), the unit of observation in regression (13) 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 (14) 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 as in specifications (11) and (12).

Through the lens of our model, operationalizing equations (13) and (14) serves a number of purposes. Coefficient $\beta$ 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 (13) and (14) 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 (13) and (14) constitute a falsification exercise because our model could not readily rationalize $\beta < 0$.

It is instructive to consider two examples of production processes that illustrate respectively the roles of input quality and assembly complexity in manufacturing sophisticated products. Take first a garment producer who chooses 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. While both dresses would be executed with the same assembly technology, their quality would be increasing with that of their inputs. Take next a manufacturer of office equipment who 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 fax. While both printers would be made from similar components (that might be horizontally but not vertically differentiated), the more sophisticated printer would require more complex blueprints and assembly processes.

The dress example informs our empirical proxies for input quality. The prior literature has argued that more expensive inputs and inputs produced by more developed countries are of higher quality. Richer, more advanced economies are believed to produce higher-quality products because they have access to more sophisticated know-how, inputs and technology, and because of general equilibrium effects that link non-homothetic preferences on the consumption side with product specialization on the supply side (e.g. Hallak and Schott 2011, Fajgelbaum, Grossman and Helpman 2011). Firms in developing countries are particularly dependent on imported inputs for producing quality products as high-quality inputs are often not available domestically (e.g. Manova and Zhang 2012). Finally, as with export prices, imported input prices can be seen as an indicator of inherent input quality (e.g. Verhoogen 2008, Manova and Zhang 2012).

Table 8 provides evidence consistent with better managed firms sourcing more expensive, higher-quality inputs from richer countries of origin. In Columns 1-2 and 5-6, we estimate regression (13) for the log value of imports and the log share of imports 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 have a systematically higher share of imported materials in production, in line with priors about the paucity of specialized high-quality inputs at home. Columns 3 and 7 confirm that well ran companies in both countries source inputs from richer countries on average. In these specifications, the outcome variable is the weighted average log GDP per capita across a firm's foreign input 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 8 of Table 8, we estimate regression (14) 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. When we apply the structural transformation to import unit values, we likewise observe that inferred input quality rises with managerial competence across Chinese firms, but not across US firms. Improving management effectiveness by one standard deviation corresponds to a ***% rise in imported input quality among Chinese manufacturers, but an insignificant ***% among US producers.

The printer example informs our empirical proxies for assembly complexity. A body of work has proposed that manufacturing more sophisticated products entails the assembly of a wider range of specialized inputs, possibly through the completion of more manufacturing stages (e.g. Hummels et al. 2001, Yi 2003, Johnson and Noguera 2012). 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 numbers of different HS product codes, countries of origin or origin country-product pairs in a firm's import portfolio, and estimate specification (13) for each of these input variety measures. As the results in Table 9 demonstrate, better managed companies systematically source more distinct inputs from more suppliers. We have confirmed that these patterns are robust to controlling for firms' log number of export product codes. 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.

Together, the patterns in Tables 8 and 9 further 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.

# 6 Conclusion

This paper examines for the first time the role of management practices for firms' export performance. We provide a theoretical framework and consistent empirical evidence indicating that superior managerial practices enhance export participation by enabling firms to produce higher-quality products more efficiently. 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. Our findings thus have broader implications for the microeconomics of firm operations and inform active literatures on the nature, origin and welfre consequences of firm heterogeneity. They also speak to policy concerns about the impact of limited managerial know-how on growth and entrepreneurship in developing economies. Studying the importance of effective management for firms' response to macroeconomic shocks, multinational activity and participation in global value chains constitutes a promising direction for future work.

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## 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 | -0.27 | -0.34 | 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 |

**Panel B. Firms' management, export and import activity**

| | China | | US | |
|---|---|---|---|---|
| | Mean | St Dev | Mean | St Dev |
| Management | -0.298 | 0.418 | 0 | 1 |
| # Export Observations | 2,236 | | 13,000 | |
| Log Exports | 14.80 | 2.31 | 13.79 | 2.77 |
| # Export Products | 8.65 | 11.58 | 18.94 | 47.50 |
| # Export Destinations | 12.85 | 14.99 | 12.95 | 16.72 |
| # Import Observations | 2,048 | | 10,000 | |
| Log Imports | 13.87 | 2.97 | 13.93 | 2.96 |
| # Import Products | 33.45 | 51.43 | 19.67 | 43.09 |
| # Import Origins | 6.30 | 5.67 | 6.20 | 8.02 |

This table provides summary statistics for firms' domestic and trade activity. 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 exporters 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 | 0.096** | 0.116*** | 0.638** | 0.566* | 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 | | -0.01 | | 0.145 | | -0.020*** | | 0.193*** |
| | | (-0.76) | | (1.43) | | (-6.04) | | (7.35) |
| Skilled Labor Share | | -0.609*** | | -4.231*** | | 0.027*** | | 0.247*** |
| | | (-3.10) | | (-2.64) | | (7.84) | | (8.81) |
| Log Wage | | 0.041* | | 0.401** | | 0.106*** | | 0.904*** |
| | | (1.82) | | (2.17) | | (9.82) | | (11.84) |
| Age | | 0.03 | | 0.153 | | 0.044*** | | 0.411*** |
| | | (1.53) | | (1.01) | | (11.47) | | (13.29) |
| Fixed Effects | Province, SIC-3 Industry, Ownership, Year | | | | State, NAICS-6 Industry | | | |
| Noise Controls | Y | Y | Y | Y | Y | Y | Y | Y |
| R-squared | 0.41 | 0.43 | 0.40 | 0.43 | 0.26 | 0.27 | 0.33 | 0.37 |
| # observations | 3,233 | 3,123 | 2,236 | 1,935 | 32,000 | 32,000 | 13,000 | 13,000 |

This table examines the relationship between firms' management practices, probability of exporting, and global export revenues. 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. *Skilled Labor Share* is the share of workers with a college degree. *Wage* is log wage per employee. *Age* is log firm age in years. *Noise Controls* are a set of characteristics of the management interview (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-digit 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 plant (US). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

## Table 3. (Export) Profits

| | China | | | US | | |
|---|---|---|---|---|---|---|
| Dep Variable: | Log Profits | | | Log Profits | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Management | 1.309*** | 0.928*** | 0.865*** | 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-6Industry | | |
| 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-digit 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). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

## Table 4. The 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 | 0.451*** | 0.404*** | 0.524*** | 0.042 | 0.478* | 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 export revenue of a firm's highest revenue destination-product in Columbs 5 and 10. A product is HS 8-digit (China) or HS 10-digit (US). All regressions for China include noise controls and fixed effects for firm province, main SIC 3-digit 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). 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 (1) | Exporter Dummy (2) | Log Exports (3) | Log # Dest-Prod (4) | Log Avg Exports per Dest-Prod (5) | Log Dom Sales (6) | Exporter Dummy (7) | Log Exports (8) | Log # Dest-Prod (9) | Log Avg Exports per Dest-Prod (10) |
| Management | 0.747*** | 0.140*** | 0.611* | 0.533*** | 0.078 | 0.344*** | 0.022*** | 0.164*** | 0.072*** | 0.092*** |
| | (5.30) | (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 | 0.64 | 0.43 | 0.44 | 0.398 | 0.45 | 0.49 | 0.27 | 0.45 | 0.43 | 0.35 |
| # observations | 1,935 | 3,123 | 1,935 | 1935 | 1,935 | 13,000 | 32,000 | 13,000 | 13000 | 13,000 |

This table examines the relationship between firms' export activity, domestic sales, and management practices. 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-digit 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). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

## Table 6. Management vs. TFPR

| | China | | | | | US | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Dep Variable: | TFPR | Exporter Dummy | Log Exports | Log # Dest-Prod | Log Avg Exports per Dest-Prod | TFPR | Exporter Dummy | Log Exports | Log # Dest-Prod | Log Avg Exports per Dest-Prod |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Management | 0.211* | 0.138*** | 0.593* | 0.586*** | 0.007 | 0.090*** | 0.026*** | 0.348*** | 0.181*** | 0.167*** |
| | (1.69) | (2.96) | (1.87) | (3.19) | (0.03) | (10.10) | (8.66) | (15.69) | (14.05) | (11.94) |
| TFPR | | -0.010 | 0.257*** | 0.139*** | 0.118* | | 0.037*** | 0.280*** | 0.160*** | 0.120*** |
| | | (-0.82) | (3.35) | (3.29) | (1.94) | | (10.50) | (11.25) | (10.56) | (8.32) |
| 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 | 0.49 | 0.42 | 0.44 | 0.409 | 0.44 | 0.83 | 0.28 | 0.39 | 0.38 | 0.32 |
| # observations | 1,880 | 2,841 | 1,880 | 1880 | 1,880 | 13000 | 32,000 | 32,000 | 32000 | 32,000 |

This table examines the relationship between firms' export activity, management practices and measured productivity. 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-digit 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). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

**Table 7. Management, Production Efficiency and Product Quality**

| | China | | | US | | |
|---|---|---|---|---|---|---|
| Dep Variable: | Log Export Price | Export Quality | Quality-Adj Export Price | Log Export Price | Export Quality | Quality-Adj Export Price |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Management | 0.335** | 1.218* | -0.883* | -0.002 | 0.048*** | -0.045*** |
| | (2.16) | (1.95) | (-1.82) | (-0.65) | (2.60) | (-2.91) |
| Fixed Effects | Province, Dest - Product, Own, Year | | | State, Dest - Product | | |
| Noise Controls | Y | Y | Y | Y | Y | Y |
| Firm Controls | Y | Y | Y | Y | Y | Y |
| R-squared | 0.92 | 0.92 | 0.89 | 0.97 | 0.96 | 0.95 |
| # observations | 58,102 | 58,102 | 58,102 | 290,000 | 290,000 | 290,000 |

This table examines the relationship between firms' management practices, the price, quality and quality-adjusted price of their exports. The dependent variable is the log export unit value, estimated export product quality, or estimated quality-adjusted log export unit value by firm-destination-product. Quality is estimated as demand elasticity (set to 5) x unit value + quantity as in Khandelwal (2010). A product is HS 8-digit (China) or HS 10-digit (US). 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 destination-product pair fixed effects and a full set of firm controls as described in Table 2. Standard errors clustered by firm. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

## Table 8. Imported Input Quality

| | China | | | | | US | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Dep Variable: | Log $\frac{\text{Imports}}{\text{Inputs}}$ (1) | Log Imports (2) | Log Avg Origin Income (3) | Log Import Unit Value (4) | Import Quality (5) | Log $\frac{\text{Imports}}{\text{Inputs}}$ (6) | Log Imports (7) | Log Avg Origin Income (8) | Log Import Unit Value (9) | Import Quality (10) |
| Management | 0.543* | 1.341*** | 0.113** | 0.245** | 1.312*** | -0.003 | 0.344*** | 0.037*** | -0.001 | 0.016 |
| | (1.86) | (4.32) | (2.14) | (2.53) | (3.03) | (0.027) | (11.83) | (3.89) | (-0.34) | (0.67) |
| Fixed Effects | Province, SIC-3 Industry, Ownership, Year | | | | | State, NAICS-6 Industry | | | | |
| Noise Controls | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Firm Controls | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Origin-Prod FE | -- | -- | -- | Y | Y | -- | -- | -- | Y | Y |
| R-squared | 0.50 | 0.56 | 0.38 | 0.81 | 0.78 | 0.27 | 0.31 | 0.21 | 0.97 | 0.94 |
| # observations | 1,778 | 1,778 | 1,780 | 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 as a share of total intermediate inputs in Columns 1 and 6, the log of firm imports in Columns 2 and 7, the log average income across origin countries in Columns 3 and 8, the log import unit value by firm-product-origin country in Columns 4 and 9, and estimated import product quality in Columns 5 and 10. Quality is estimated as demand elasticity (set to 5) x unit value + quantity as in Khandelwal (2010). A product is HS 8-digit (China) or HS 10-digit (US). All regressions for China include noise controls and fixed effects for firm province, main SIC 3-digit 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 and 8 include oridin 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 1-4 and 8 and robust in Columns 5-7. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

**Table 9. Imported Input 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 | 0.410*** | 0.299* | 0.353** | 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) | 58.7 | 60.4 |
| 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 (China) or HS 10-digit (US). All regressions for China include noise controls and fixed effects for firm province, main SIC 3-digit 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). 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 | ☐ | ☐ |

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?**

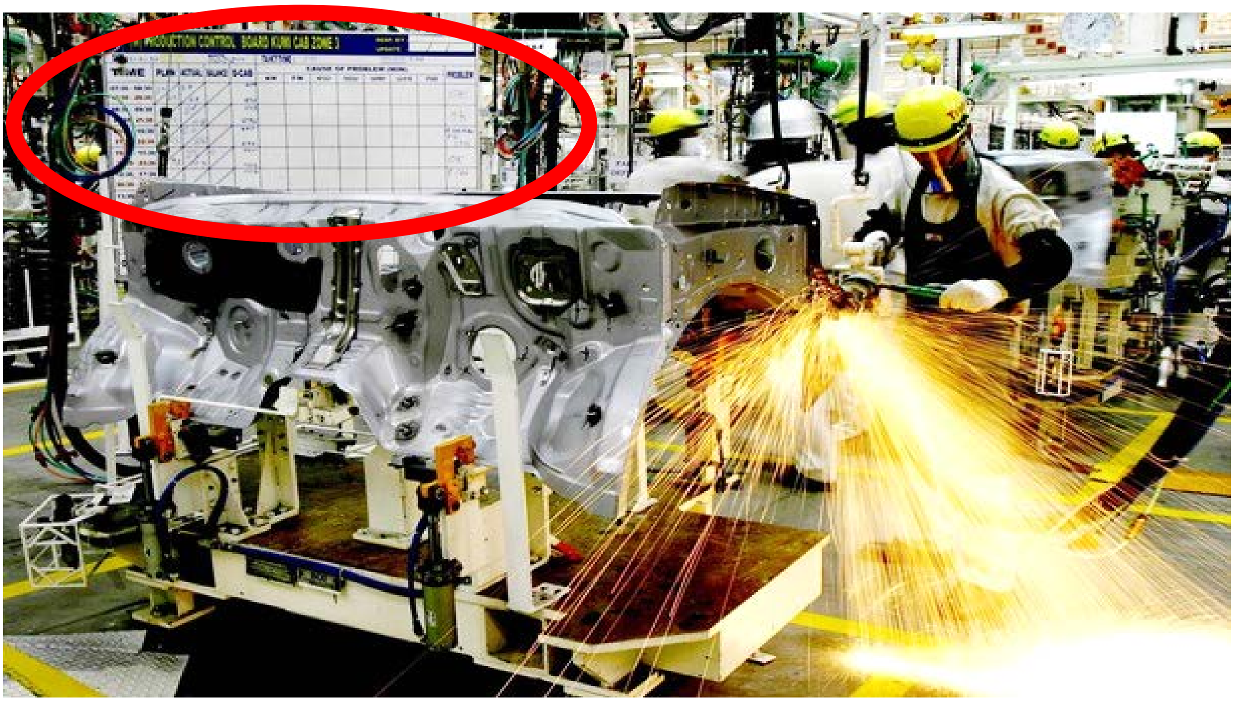
| Score | (1): Measures tracked do not indicate directly if overall business objectives are being met. Certain processes aren't tracked at all | (3): Most key performance indicators are tracked formally. Tracking is overseen by senior management | (5): Performance is continuously tracked and communicated, 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 |
|---|---|---|---|

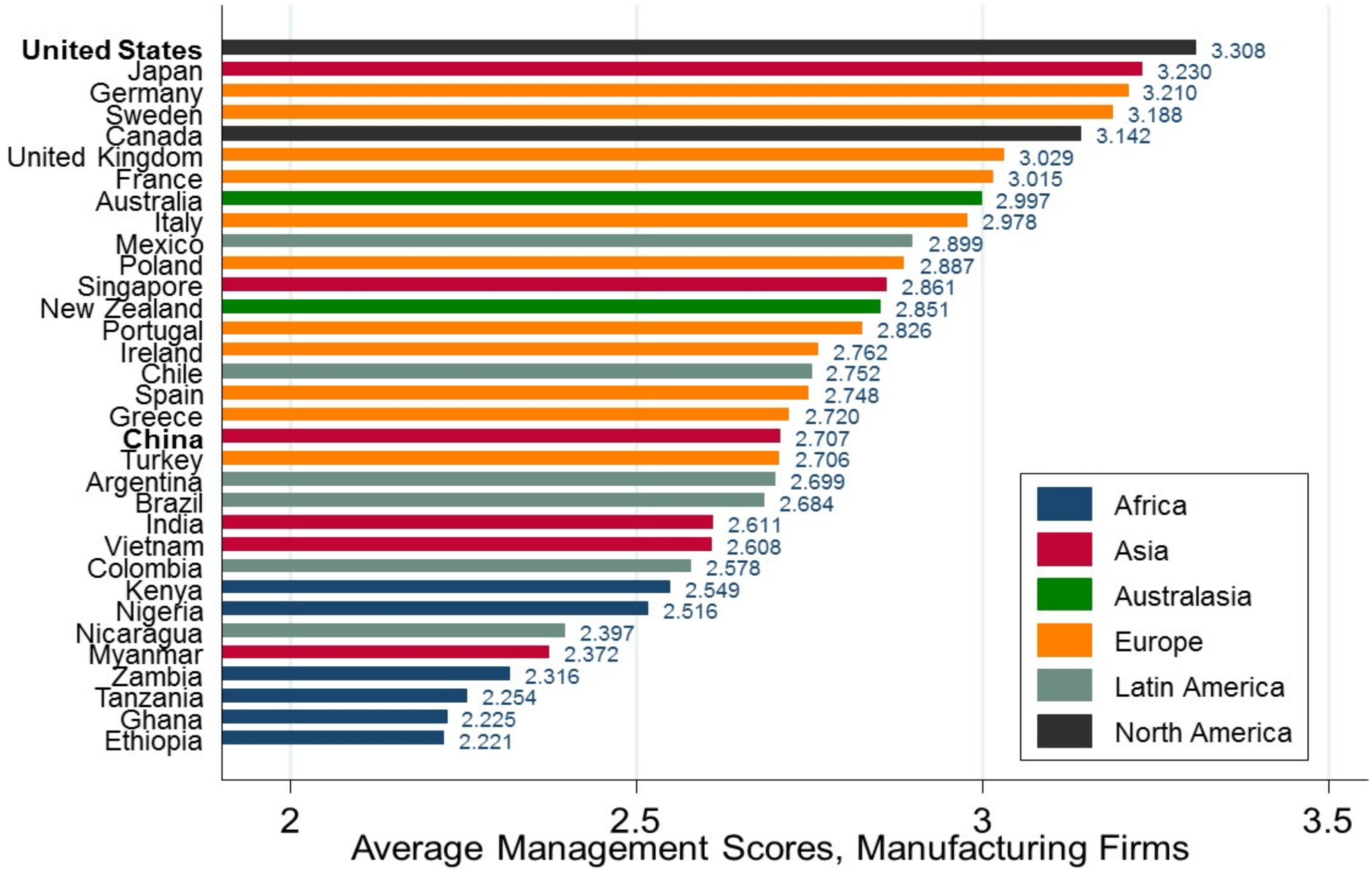
## Figure 2. What Effective Management Looks Like

**Example of Effective Performance Metrics: Car Plant in the US**



**Example of No Performance Metrics: Textile Plant in India**

**Figure 3. Average WMS Management Practices across Countries**



## Figure 4. Management Practices across Firms

**Figure 4A. MOPS US**

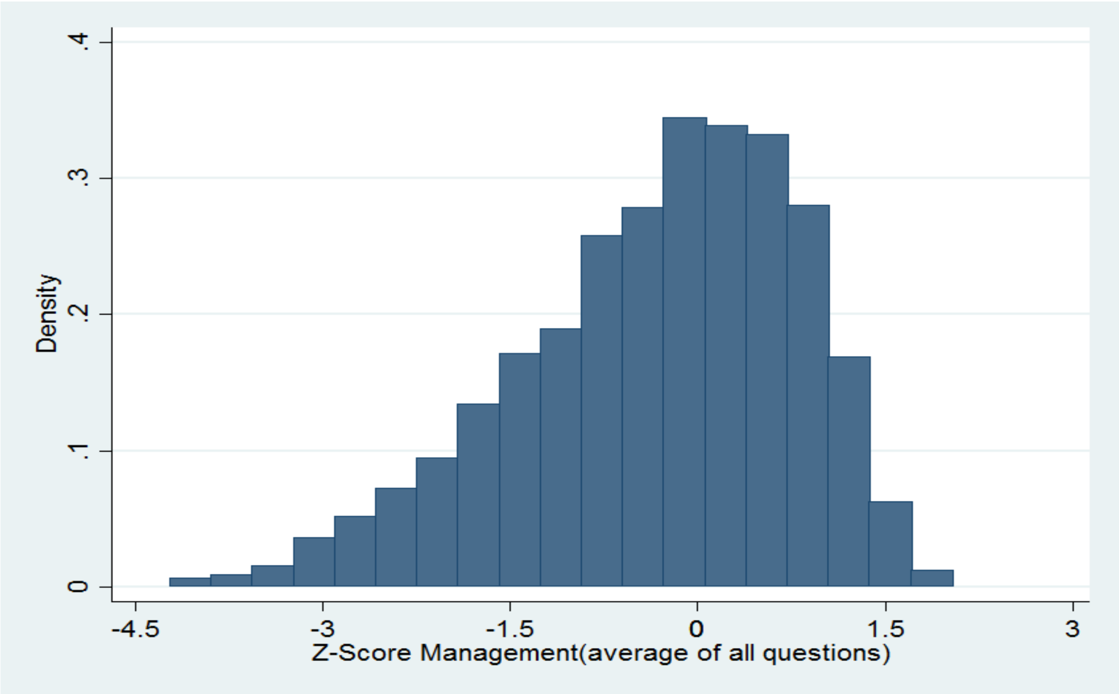
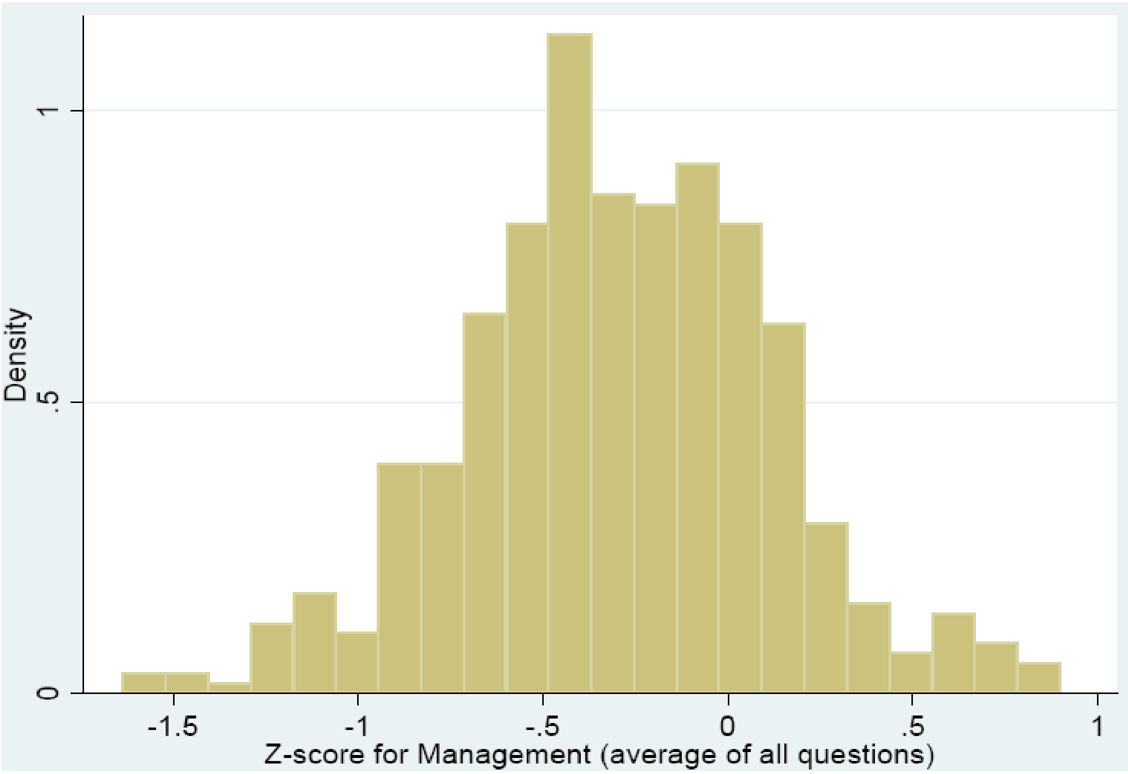



**Figure 4B. WMS China**



## Appendix Table 1. The 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 | 0.387** | 0.372*** | 0.487*** | 0.151 | 0.552** | 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 5, log number of exported products in Columns 2 and 6, log number of destination-product pairs in Columns 3 and 7, and log average exports per destination-product in Columns 4 and 8. A product is HS 8-digit (China) or HS 10-digit (US). All regressions for China include noise controls and fixed effects for firm province, main SIC 3-digit 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). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

**Appendix Table 2. 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, Ownership, Year | | | | | State, NAICS-6 Industry | | | | |
| Noise Controls | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Firm Controls | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| R-squared | 0.42 | 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' export activity and measured productivity. 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-digit 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). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

## Appendix Table 3. Management Components

| | China | | US | |
|---|---|---|---|---|
| Dep Variable: | Exporter Dummy (1) | Log Exports (2) | Exporter Dummy (3) | Log Exports (4) |
| Operations & Monitor | 0.080*** | 0.365* | 0.021*** | 0.323*** |
| | (3.19) | (1.92) | (6.39) | (13.39) |
| Targets | 0.048* | 0.161 | 0.004 | 0.024 |
| | (1.80) | (0.89) | (1.29) | (1.07) |
| People | 0.041 | 0.469** | 0.013*** | 0.138*** |
| | (1.38) | (2.38) | (4.34) | (6.42) |
| Fixed Effects | Y | Y | Y | Y |
| Noise Controls | Y | Y | Y | Y |
| Firm Controls | Y | Y | Y | Y |

This table examines the role of different components of firms' management practices. Each cell reports a coefficient estimate from a different regression. All dependent variables are defined in Table 2. All regressions for China include noise controls and fixed effects for firm province, main SIC 3-digit industry, year, and ownership status (private domestic, state-owned, foreign-owned). 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). T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.