Amplified Gains from Trade and Institutional Reforms: Evidence from Chinese Textile Exporters

Amit K. Khandelwal†
Columbia Business School & BREAD & NBER

Peter K. Schott‡
Yale School of Management & NBER

Shang-Jin Wei§
Columbia Business School & NBER

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Abstract

When the removal of trade barriers coincides with the elimination of inefficient institutions created to manage them, the gains from trade increase. We investigate the change in productivity associated with the removal of quotas on Chinese textile and clothing exporters as well as the elimination of the export licensing regime which managed quota allocation. When quotas were removed in 2005, Chinese export value and quantity surged and export prices declined. These responses are due predominantly to the extensive margin: entrants gained market share at the expense of incumbent state-owned enterprises, and they entered with relatively low prices. We show that these reactions are inconsistent with an ex ante assignment of quota licenses on the basis of firm productivity, and estimate that roughly half of the productivity gain China experienced following quota removal is due to the elimination of the quota licensing regime.

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†Uris Hall, 3022 Broadway, New York, NY 10027, tel: (212) 854-7506, fax: (212) 316-9219, email: ak2796@columbia.edu
‡135 Prospect Street, New Haven, CT 06520, tel: (203) 436-4260, fax: (203) 432-6974, email: peter.schoott@yale.edu
§Uris Hall, 3022 Broadway, New York, NY 10027, tel: (212) 854-9139, fax: (212) 316-9219, email: shangjin.wei@columbia.edu
1 Introduction

Standard models of international trade generally predict small welfare gains from trade liberalization (Arkolakis et al. 2010). Empirical research, on the other hand, often finds substantial increases in productivity or income coinciding with the removal of trade barriers (e.g., Pavcnik 2002 and Feyrer 2010). One explanation for this discrepancy is that removing a particular tariff or non-tariff barrier to trade also eliminates other (un-modeled) policy distortions that evolved to manage the trade barrier. The welfare losses associated with tariffs, for example, can be amplified by corrupt customs agents or bureaucratic “red tape” that substantially increases the time goods spend in transit.\(^1\) If such policies influence how resources are allocated among existing firms, or favor incumbents at the expense of entrants, they can have a sizable effect on aggregate outcomes. Trade liberalization that removes both the trade barrier and the accompanying distortions can yield gains that are larger than the predicted benefit of removing just the trade barrier.

This paper estimates the productivity gain to China from the removal of a particular trade barrier, export quotas, and decomposes that gain into two parts: that which is due to the removal of the trade barrier itself versus that which is accounted for by the (inefficient) export licensing regime that assigned the quotas. We analyze China’s textile and clothing industry before and after the January 2005 expiration of the global Agreement on Textiles and Clothing, previously known (and referred to in this paper) as the Multifiber Arrangement (MFA). Under the MFA, exports of textile and clothing products by China and other developing economies to the United States, the European Union and Canada were subject to quotas. In China’s case, the licenses permitting firms to export a portion of the country’s overall quota were distributed by the government according to a complex (and, to us, unobserved) set of rules that may not have emphasized efficiency. We use firm-level Chinese trade data to examine how the distribution of textile and clothing exports across firms changes as quotas are removed, and to gauge whether these changes are consistent with an allocation of quotas to the most productive firms prior to their removal.

Our assessment of the efficiency with which China assigned export licenses is guided by a model of “efficient allocation” adapted from Irarrazabal et al. (2010), who introduce specific (i.e., per-unit) tariffs into the heterogeneous-firm framework of Melitz (2003) and Chaney (2008). Here, we interpret the specific tariff as a quota license fee which firms must pay in order to access restricted foreign markets. We assume that the government does not know the productivity of firms, and that under efficient allocation it assigns export licenses to firms via a common license fee. Firms self select into the quota-constrained export market based on their productivity, as only the most productive exporters remain profitable net of the fee. We also consider a model of “inefficient allocation”, where the government assigns export licenses to politically favored but less efficient firms. In this model, the most productive firms do not necessarily receive quotas.

In the efficient allocation model, the exports of the most productive incumbents jump disproportionately once quotas are removed. This asymmetric reaction by the intensive margin is driven by removal of the per-unit license fees, which impose a greater distortion on high-productivity firms’ low-priced exports than low-productivity firms’ high-priced exports.\(^2\) The removal of export quotas may also cause less-productive firms to enter the export market: because obtaining a costly export license is no longer necessary, relatively unproductive firms may find it profitable to export the previously constrained goods. This potential contribution by the extensive margin depends upon the density of high-productivity firms. If they are sufficiently numerous, the price decline associated with their post-quota growth can shut low-productivity entrants out of the export market or even induce exit from exporting of the lowest-productivity incumbents. As a result, growth in the quantity-weighted average productivity of exporters following quota removal depends upon the concentration of high-productivity firms and can either rise or fall following the removal of quotas.

\(^1\)Djankov, Freund and Pham (2010) document substantial variation across countries in the time required to export a standard container. Sequeria and Djankov (2010) show that this variation is driven in part by institutions arising from trade barriers: firms choose to export through more distant ports if customs agents at nearby ports are more corrupt. Kaufmann and Wei (2000) show that, contrary to the hypothesis that bribery greases the wheels of commerce, red tape and bribery tend to be positively correlated.

\(^2\)This effect is similar to Alchian and Allen’s (1964) “Washington apples” story, where higher-priced/higher-quality goods are shipped to the furthest destinations to lower the per unit transport cost. Hummels and Skiba (2004) provide evidence of this phenomenon in international trade patterns.
Empirically, we employ a difference-in-differences strategy to examine how Chinese exporters react to the removal of quotas in 2005. In particular, we compare the pre- and post-January 2005 behavior of firms exporting quota-constrained textile and clothing products to exporters of very similar textile and clothing products that are exported quota free. This comparison isolates the effects of potential inefficient quota allocation from other factors that affect Chinese textile and clothing exporters more broadly. Exports of “cotton slips” to the United States, for example, were subject to quotas in 2004, while exports of “silk slips”, were not.³ Contrasting their growth in the years before and after quotas are removed allows us to control for shocks to supply, such as privatization, or shocks to demand, such as changes in the preferences of consumers, that are common to both goods.

As documented by Brambilla et al. (2010) and Harrigan and Barrows (2009), China’s exports of previously constrained textile and clothing products jump in 2005, while their prices decline. In contrast to the efficient allocation model, however, we find here that both trends are driven largely by the extensive margin and, furthermore, that entrants appear to be more productive than incumbents along several dimensions. First, entrants’ prices in the year following quota removal are on average 27 percent lower than incumbents, with the result that net entry accounts for two-thirds of the overall 22 percentage point decline in relative prices. Second, incumbents with the highest market share under quotas experience the largest decline in market share when quotas are removed; according to the model of efficient allocation, these incumbents possess the highest productivity and therefore benefit disproportionately from the removal of license fees. Finally, entrants are drawn almost exclusively from the private sector and gain their market share at the expense of state-owned enterprises (SOEs), which are well-known for their relatively low productivity (Dollar and Wei 2007, Brandt, Tombe and Zhu 2010). These trends suggest that China’s quota-licensing regime favored relatively unproductive SOEs, and that these SOEs were replaced by privately owned firms during quota liberalization.

An alternate interpretation of the price declines following quota removal is that they represent quality downgrading rather than the entry of high-productivity firms. Because quotas exert a relatively large per-unit penalty on low-price/low-quality goods, firms may have an incentive to raise the quality of their exports when quotas are imposed and to reduce export quality when those quotas are removed.⁴ Under this alternate interpretation, the relative price decline associated with the extensive margin in 2005 reflects the entry of low-quality exporters. However, the fact that entrants are drawn from the private sector and appear to be more productive than the state-owned enterprises they supplant is inconsistent with a model of quality choice which assumes a positive relationship between productivity and quality. While a more general model of quality might have high-productivity firms choosing optimally to export low-quality goods, and therefore rationalize a connection between entry by high-productivity firms and quality downgrading, it would still imply inefficient allocation of licenses under quotas.⁵

A back-of-envelope calculation suggests that the expiration of quotas resulted in an 8.8 percent increase in aggregate productivity among China’s textile and clothing exporters. This estimated overall improvement occurs both because trade barriers are removed and because the Chinese government’s bias towards low-productivity SOEs is eliminated. We quantify the relative contribution of this second channel using numerical solutions of the model that estimate productivity growth after quota liberalization assuming both efficient and inefficient ex ante allocation of quotas. We find that 56 percent of the productivity gain associated with quota removal can be attributed to the elimination of the inefficient licensing institution, with the remaining gain due to the removal of the quotas itself.

The results of this paper contribute to several areas of research in economic development and international trade. Our investigation into the ability of trade to affect institutions complements research by Ace-

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³These women’s products correspond to HS codes 62081920 and 62081910, respectively.
⁵High-productivity firms would choose to export low-quality goods if the benefits to quality upgrading exceed the cost. See, for example, Baldwin and Harrigan (2010), Johnson (2010), Mandel (2010), and Kugler and Verhoogen (2010).
moglu, Johnson and Robinson (2005), who argue that the rise of international trade after 1500 increased the power of the merchant class and led to changes in institutions that increased their private property rights. Here, we demonstrate that inefficient institutions can exacerbate the well-known distortions associated with trade barriers, and that trade liberalization may lead to larger-than-expected gains by eliminating these policies (Tang and Wei, 2009). Our quantification of this distortion within China complements Krishna and Tan's (1998) theoretical discussion of the welfare consequences of poor policy implementation under the MFA.

Our findings also relate to the growing set of papers that use micro-data to estimate the effects of market distortions on firms. This research generally focuses on existing firms (i.e., the intensive margin). Here, we focus on the extensive margin, and also identify misallocation using weaker assumptions. Hseih and Klenow (2009), for example, assume identical production functions across time and countries in their comparison of firm productivity distributions in the United States, India and China. Cross-country comparisons in Alfaro et al. (2008) and Restuccia and Rogerson (2010), on the other hand, assume both that the U.S. allocation of factors is distortion free and that entrepreneurial ability is drawn from the same distribution across countries. However, if entrepreneurial ability is shaped by the economic environment (such as the quality of educational institutions), the distribution need not be identical across countries. In the difference-in-differences strategy used here, by contrast, we assume identical technology only across similar types of textile and clothing products within China, e.g., silk versus cotton slips.

The effect of distortions on the extensive margin is studied most widely in the context of credit constraints in developing countries (Banerjee and Duflo, 2005). Banerjee and Duflo (2004), for example, use an exogenous change in the supply of credit to specific firms to identify constraints on obtaining credit among Indian firms. Their results suggest the existence of talented entrepreneurs who are unable to borrow from the formal banking sector. Recent theoretical contributions to this literature have shown that the potential effect of this extensive-margin misallocation on aggregate productivity could be quite large. We find empirical evidence for these large effects in the context of a precisely defined government institution.

The rest of the paper proceeds as follows. Section 2 presents a model of efficient quota allocation that is used to guide the empirical analysis. Section 3 presents a brief summary of the Multifiber Arrangement. Section 4 performs the empirical analysis. Section 5 decomposes that gain into two parts: that which is due to the removal of the trade barrier itself versus the part accounted for by export licensing regime that managed the allocation of quotas. Section 6 concludes.

2 Theory

In this section we outline a simple, “efficient-allocation” model of exporting under quotas to guide our empirical analysis. We use this model to derive firm-level implications for how export quantities and prices respond to the removal of quotas assuming quota licenses are allocated to the most productive exporters.

The model delivers two key results. First, the removal of quotas induces less productive firms to enter the export market. Second, even with this entry, the preponderance of export quantity increases and export price declines is accounted for by incumbents. The intuition for these results is straightforward. With the elimination of quotas, potential exporters whose costs inclusive of the license fees were previously too high to attract enough foreign consumers to overcome the fixed costs of exporting can now enter

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7A recent exception is Chari (2010) who analyzes the aggregate productivity effects of firm entry and size restrictions under India’s industrial licensing policy.

8The fact that entrepreneurs in developing countries often do not adopt best practices (Bloom and Van Reenan 2007) may indicate that these “technologies” are slow to diffuse across countries.

9Banerjee and Moll (2010), for example, model misallocation due to financial frictions that prevent entrepreneurs from entering markets, while Buera and Shin (2008) and Buera, Kaboski and Shin (2010) quantify the role of financial constraints on productivity and growth in a related calibration exercise.
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the export market. However, the removal of license fees exerts a disproportionately large effect on low-price (high-efficiency) firms than high-price (low-efficiency) firms because they represent a larger fraction of high-efficiency firms’ low prices. In demonstrating these implications, we use numerical solutions where analytic results are not possible.

2.1 Exports Under Quotas

Our model is a re-interpretation of Irarrazabal et al. (2010), which analyzes exporting by heterogeneous firms in a trading system where importing countries make use of both specific (i.e., per unit) and ad valorem tariffs. As in Demidova, Kee and Krishna (2009), we interpret quota license fees as equivalent to per-unit increases in the cost of exporting.

Irarrazabal et al. (2010) is an \( N \)-country version of Melitz (2003) that collapses to Chaney (2008) when specific tariffs are set to zero. We assume that in order to export a quota-bound good from origin country \( o \) to destination country \( d \), firms must pay \( a_{od} \geq 0 \) per unit exported as well as an ad valorem tariff \( \tau_{od} \geq 1 \) of the value of the product exported. Productivities are drawn from the distribution \( G(\varphi) \) with density \( g(\varphi) \), and the price of variety \( \varphi \) in export market \( d \) is given by

\[
p_{od}(\varphi, a_{od}) = \frac{\sigma}{\sigma - 1} \omega_d \left( \frac{\tau_{od}}{\varphi} + a_{od} \right),
\]

where \( \sigma > 1 \) is the constant elasticity of substitution across varieties\(^{10} \) and \( \omega_d \) is the wage in the home country.\(^{11} \) The corresponding export quantities are given by

\[
q_{od}(\varphi, a_{od}) = \left( \frac{\sigma}{\sigma - 1} \omega_d \right)^{-\sigma} \left( \frac{\tau_{od}}{\varphi} + a_{od} \right)^{-\sigma} (P_d)^{\sigma - 1} Y_d
\]

where \( P_d \) and \( Y_d \) are the price index and expenditure in the destination market, respectively.

In this efficient allocation model, a Walrasian auctioneer finds the license price by equating the quota size \( Q_{od} \), determined through bilateral negotiations between the origin \( o \) and destination \( d \) countries, and the aggregate demand for exports: \( \int_{\varphi^*} q_{od}(\varphi, a_{od}) g(\varphi) d\varphi = Q_{od} \). Lower license prices connote less restrictive quotas, and vice versa.

A productivity cutoff,

\[
\varphi_{od}^* = \left[ \lambda \left( \frac{f_{od}}{Y_d} \right)^{\frac{1}{\sigma - 1}} \frac{P_d}{\omega_o \tau_{od}} - \frac{a_{od}}{\tau_{od}} \right]^{-1},
\]

determines the marginal exporter who is indifferent between paying the fixed costs of exporting and remaining a purely domestic firm; \( \lambda = \left( \frac{\sigma - 1}{\sigma} \right) r^{\frac{1}{\sigma - 1}} \) is a constant and \( f_{od} \) is the fixed costs of exporting from country \( o \) to country \( d \).

As in Irarrazabal et al. (2010), there is no closed-form solution for the price index \( P_d = P_d(\varphi_{od}^*) \) in equation (3) when \( a_{od} > 0 \). With \( P_d \) fixed, it is easy to verify that a lower license price implies a lower cutoff for exporting, \( \frac{d\varphi_{od}^*}{da_{od}} > 0 \). If the exporting country is large, the foreign price index will fall with quota liberalization and, depending on the magnitude of the decline, the productivity cutoff \( \varphi_{od}^* \) could rise, implying that the least-productive exporters exit. To fix ideas, we assume for the remainder of this sub-section that the exporting country is small relative to the importer and therefore that the price index is insensitive to changes in the license fee.\(^{12} \) In the numerical analysis below, we relax this restriction.

\(^{10}\)Since firms pay the additive fee and pass this fee on to customers, prices are a constant markup above marginal cost. This contrasts with Berman, Martin and Mayer (2009) who also introduce additive transport costs but have variable markups since the consumer pays the fee.

\(^{11}\)Wages are pinned down by a perfectly competitive outside sector.

\(^{12}\)Berman, Martin and Mayer (2009) adopt a similar, small-country assumption in their model with per-unit costs.
When license fees are zero, the ratio of output quantities between two firms with productivities \( \varphi > \varphi' \) is independent of \textit{ad valorem} trade costs (Melitz, 2003). The existence of such fees, however, breaks this independence because per-unit costs disproportionately raise the price of low-price (high-productivity) firms compared to high-price (low-productivity) firms. As a result, with \( P_d \) fixed, reductions in the license fee induce relatively greater growth in export quantities among higher-productivity incumbents,

\[
\frac{\partial}{\partial a_{od}} \left[ \frac{q_{od}(\varphi, a_{od})}{q_{od}(\varphi', a_{od})} \right] = -\sigma \left[ \frac{\tau_{od}}{\varphi + a_{od}} + \frac{\tau_{od}}{\varphi' + a_{od}} \right]^{-\sigma - 1} \frac{\tau_{od} \left( \frac{1}{\varphi} - \frac{1}{\varphi'} \right)}{\left( \frac{\tau_{od}}{\varphi} + \frac{\tau_{od}}{\varphi'} \right)^2} < 0. \tag{4}
\]

Thus, while the entry of low-productivity firms causes the overall share of incumbents to fall with \( a_{od} \), among incumbent firms the market shares of the largest and most productive firms rise. Removing the license fee contributes to a gain in weighted-average productivity because these high-productivity firms increase their market shares after liberalization.

The simple average productivity of exporters, \( \overline{\varphi}(\varphi^*) \), is given by

\[
\overline{\varphi}(\varphi^*) = \frac{1}{1 - G(\varphi^*)} \int_{\varphi^*} \varphi g(\varphi) d\varphi. \tag{5}
\]

With \( P_d \) fixed, the average productivity of exporters falls in response to quota liberalization,

\[
\frac{\partial \overline{\varphi}}{\partial a} = \frac{1}{1 - G(\varphi^*)} \frac{\partial}{\partial a} \left[ \frac{g(\varphi^*)}{1 - G(\varphi^*)} \overline{\varphi}(\varphi^*) - \varphi^* \right] > 0. \tag{6}
\]

Intuitively, as the license price falls and \( \varphi^* \) declines, less-productive firms enter the export market, driving down the average productivity of all exporters. Given that an individual firm’s productivity is fixed by assumption, there is no change in the average productivity of incumbents.

The response of \textit{quantity-weighted} average productivity to quota reduction is more complex because it depends upon the redistribution of activity among incumbents,

\[
\frac{\partial \overline{\varphi}}{\partial a} = \frac{1}{1 - G(\varphi^*)} \int_{\varphi^*} \frac{\partial}{\partial a} \left[ \frac{g(\varphi)}{Q} \right] \varphi g(\varphi) d\varphi \left( \text{Intensive} \right)
\]

\[
+ \frac{g(\varphi^*)}{1 - G(\varphi^*)} \frac{\partial \varphi^*}{\partial a} \left[ \overline{\varphi}(\varphi^*) - \varphi^* \frac{g(\varphi^*)}{Q} \right] \left( \text{Extensive} \right). \tag{7}
\]

The first term in equation (7) is the change in weighted-average productivity due to the intensive margin. The sign of this term is negative as reductions in the quota license fee increase the relative market share of high-productivity incumbents at the expense of low-productivity incumbents. The sign of the extensive-margin contribution, on the other hand, is positive: a reduction in the license price enables less efficient firms to commence exporting, which drives down the weighted average. The overall effect of a change in the license price on weighted average productivity is ambiguous. It is negative if the right tail of the distribution of firm productivity is relatively thin as low-productivity entrants will account for a larger fraction of growth. It is positive if incumbents account for a larger fraction of growth.

The model’s one-to-one correspondence between productivity and price yields similar relationships with respect to export prices.\(^{13}\) The average price of exports is given by

\[
p(\varphi^*) = \frac{1}{1 - G(\varphi^*)} \int_{\varphi^*} p(\varphi) g(\varphi) d\varphi. \tag{8}
\]

\(^{13}\)In a more general setting in which firms choose the quality as well as level of their output, this one-to-one mapping might break down. We discuss this issue in greater detail below.
Here, the removal of quotas implies an increase in the average price of exports, net of the impact of removing the license fee

$$\frac{\partial \bar{p}}{\partial a} = \frac{\sigma}{\sigma - 1} + \frac{g(\varphi^*)}{1 - G(\varphi^*)} \left[ \frac{\partial \varphi^*}{\partial a} [p - p(\varphi^*)] \right].$$

(9)

The sign of the first term is positive and represents the change in average price among incumbents due to the reduction of the license fee (see also equation (1)). The second term represents the change in the average price due to the extensive margin. This term is negative: as license prices fall, less efficient firms enter the market pushing up the average price. The key insight here is that only incumbents contribute to lower prices following quota reductions.

The response of quantity-weighted average export prices to reductions in the quota is given by

$$\frac{\partial \bar{p}}{\partial a} = \frac{1}{1 - G(\varphi^*)} \int_{\varphi^*}^{1} \frac{\partial [p(\varphi) q(\varphi)/Q]}{\partial a} \varphi g(\varphi) d\varphi$$

$$+ \frac{g(\varphi^*)}{1 - G(\varphi^*)} \frac{\partial \varphi^*}{\partial a} \left[ \bar{p}(\varphi^*) - \frac{q(\varphi^*) p(\varphi^*)}{Q} \right].$$

(10)

The first term represents the intensive margin and its sign is positive: when license prices fall, the prices of all incumbent firms will fall. The extensive-margin term is negative, as less-productive entrants enter the market with relatively high prices. The overall change in the weighted-average export price is ambiguous: if the most productive incumbents’ market share rises enough, it falls, else it rises.

2.2 Numerical Solutions

As noted above, closed form solutions for the model are not possible when the license price is positive ($a_{od} > 0$). As a consequence, we use numerical solutions to derive implications that do not rely upon a “small-economy” assumption.¹⁴ For reasonable parameters, these solutions yield predictions similar to those derived analytically above.

We consider two countries and one industry. For our baseline results, we assume symmetric country sizes and set $L_{US} = 100$ and $L_{China} = 100$. Iceberg trade costs are chosen so that the share of Chinese textile and clothing exports in U.S. imports and vice versa match the observed shares in 2005 (23 percent and 5 percent, respectively). This parametrization on the iceberg trade costs captures the fact that wages in the United States are higher than in China. The iceberg cost within the home country is set to one, and we assume $\sigma = 4$. We follow the literature in assuming firm productivity is Pareto distributed, $G(\varphi) = 1 - \varphi^{-\gamma}$ with shape parameter $\gamma$. This shape parameter and the fixed cost of exporting are chosen to match the distribution of exports and the fraction of exporters.¹⁵ The calibration yields a shape parameter of 3.8 and a ratio of export fixed cost to domestic fixed cost equal to 2.

Using these parameters, we solve for productivity cutoffs and price indexes in a “no quota” equilibrium. We then re-solve the model under increasing levels of quota restrictiveness to recover the license fees implied by various MFA quotas. Quota restrictiveness is measured as a share of quota-free exports, with

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¹⁴We are grateful to Andreas Moxnes for providing the Matlab code used to derive the numerical solutions in Irrazabaval et al. (2010). We modify their code by adding the quota constraint and solving for an equilibrium license fee given this constraint.

¹⁵The parameters are calibrated using the post-quota distribution of textile and clothing export values. The share of exports accounted for by the 50th, 75th, 90th, 95th and 99th percentiles in 2005 are 2, 8, 16, 29 and 31 percent, respectively. China’s Annual Survey of Industries reports that 45 percent of firms in the textile and clothing sectors (Chinese Industrial Classification 17 and 18) exported in 2005. We explore the implications of using alternative shape parameters and a lognormal productivity distribution in Section 5.
lower shares implying greater restrictiveness. The relative growth of quota-constrained textile and clothing products observed in Table 1, which is discussed in greater detail below, implies a quota restrictiveness of 54 percent.

The solid curve in Figure 1 plots the home country’s change in average productivity after liberalization against quota restrictiveness. Consistent with the comparative static in equation (6), the average change in productivity is negative when quotas of the noted restrictiveness are removed, indicating that entrants have lower productivity than incumbents. The upward slope of the relationship implies greater entry by low-productivity firms following the removal of more restrictive quotas.

The dashed curve in Figure 1 plots the change in weighted-average productivity against quota restrictiveness. As noted in the previous section, this relationship is theoretically ambiguous and depends upon the extent to which the highest-productivity incumbents gain market share following quota removal. The negative slope of the curve reveals that at the chosen parameters, more restrictive quotas imply greater increases in weighted average productivity following quota removal.

The gap between the average and weighted-average productivity curves highlights the relative role of the intensive and extensive margins of adjustment following quota removal. When quotas are allocated to firms based on their productivity, the intensive margin contributes strongly to export growth. Under the baseline parameters used in this simulation and a quota restrictiveness of 54 percent implied by the data, the intensive margin captures more than 99 percent of the growth in export quantity following quota removal.

3 A Brief Summary of the MFA

The Multifiber Arrangement (MFA) and its successor, the Agreement on Textile and Clothing, grew out of restraints imposed by the United States on Japanese imports during the 1950s. Over time, it grew into a broader regime that regulated the exports of clothing and textile products from developing countries to the United States, EU, Canada (the “UEC”), and Turkey. Bargaining over these restrictions was kept separate from multilateral trade negotiations until the conclusion of the Uruguay Round in 1995, when the UEC agreed to eliminate the quotas over four phases. At the beginning of 1995, 1998, 2002 and 2005, the UEC were required to remove textile and clothing quotas representing 16, 17, 18 and the remaining 49 percent of their 1990 import volumes, respectively. The order in which goods were placed into a particular phase varied across importers, though in general countries chose to place their most “sensitive” textile and clothing products into the final phase (Phase IV) to defer politically painful import competition as long as possible (Brambilla et al. 2010). This aspect of the liberalization suggests that the reaction of Phase IV exports relative to a control group is likely stronger than a similar comparison in earlier phases. However, the fact that Phase IV goods were determined in 1995 implies that their choice was not influenced by demand or supply conditions in 2005.

China did not become eligible for quota removal until it joined the WTO at the end of 2001. In early 2002, its quotas on Phase I to III goods were relaxed immediately. Its quotas on Phase IV goods were relaxed according to schedule in 2005. Our empirical analysis focuses on the removal of Phase IV quotas.

We do not observe how China allocated quota licenses to firms. From published descriptions from the Ministry of Commerce, we know that China, like other countries subject to quotas under the MFA, based their allocation predominantly on firms’ past performance (Krishna and Tam 1998). On the other hand, published sources also indicate that 20 to 30 percent of the quota in a subset of MFA goods was allocated

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16 We are unable to locate the list of products under quotas in Turkey, but Turkey accounted for less than 0.5% of China’s textile and clothing exports in 2004.

17 The removal of the MFA quota coincided with China’s obligation under the WTO to confer full trading rights to all enterprises operating within the economy. The products that were subject to export restrictions are listed in China’s WTO accession document (WT/ACC/CHN/49). These products that were subject to limited trading rights prior to 2005 only accounted for 12 percent and 5 percent of OTC and MFA product codes and accounted for only 5 and 3.6 percent of export value, respectively. It therefore appears that only a handful of textile and clothing products were subject to export trading restrictions.
via auction. While we do not observe the rules of the auction or the requirements for participation, we do know that bidders had to have prior approval to export by the Ministry of Commerce.

China’s textile and clothing industry accounts for a substantial share of its overall economy. In 2004, it employed 12.9 million workers, representing 13 percent of manufacturing employment (2005 China Economic Census). Its exports account for 15 percent of the country’s overall exports, and 23 percent of worldwide textile and clothing exports (which equaled $487 billion dollars in 2005).

4 Reallocation Following Quota Removal

We expect quota liberalization to coincide with three outcomes: the entry of less-productive exporters; a reallocation of market share within incumbents to the largest, most productive exporters under the quota regime; and a reduction in incumbents’ export prices due to the removal of license fees. As discussed further in the counter-factual section below, an alternate hypothesis of “inefficient allocation” implies a stronger role for the extensive margin.

4.1 Data

Our empirical analysis relies on data from several sources. The first is Chinese export customs data by firm, eight-digit Harmonized System (HS) category and destination country. For each firm-product-country observation, we observe the total nominal value and quantity traded as well as whether firms fall into one of three ownership categories: state-owned enterprises (“SOEs”), domestically owned private firms (“domestic”) and foreign-owned private firms (“foreign”). Quantity units are available for 99 percent of observations representing 99 percent of export value, and vary across products, e.g., square meters of fabric. We combine the value and quantity data to construct nominal unit values, also referred to as “prices”. As documented in Schott (2004), unit values can be noisy and we therefore follow the literature in trimming outliers for some of our results as noted below.

We partition China’s exports into six mutually exclusive and time-invariant “groups” based on destination market and product type. Destination markets fall into two blocs: the first encompasses the United States (US), the members of the European Union (EU) and Canada and is referred to as “UEC”; the second bloc contains all other countries and is referred as “rest of the world” or “ROW”. Within a country, products are partitioned into three types: textile and clothing products subject to a quota prior to 2005 (MFA), other textile and clothing products not subject to a quota until 2005 (OTC), and non-textile and clothing products like electronics and steel (NTC).

A given product-country is assigned to one of the six resulting \{ROW, UEC\} × \{MFA, OTC, NTC\} groups. Exports to ROW are spread across MFA-ROW, OTC-ROW and NTC-ROW: MFA-ROW contains products subject to quotas in one or more of the US, EU, and Canada; OTC-ROW refers to textile and clothing products that are not subject to quotas by any of the UEC; and NTC-ROW refers to exports of non-textile and clothing products. Likewise, MFA-UEC refers to product-country exports that are subject to quotas; OTC-UEC to product-country exports of textile and clothing products not subject to quotas, and NTC-UEC to the exports of all remaining products to the UEC. Note that it is possible for a given HS product to be part of

18 The customs data separate firms into seven groups. We classify “state-owned” firms as SOEs; “collective-owned”, “other” and “private domestic” firms as domestic, and “foreign-exclusive owned” and two joint venture classifications as foreign.

19 We treat the EU as a single block of countries throughout our analysis given that quotas are set for the union as a whole.

20 Phase I, II and III products, whose quotas were removed prior to 2005, are classified as OTC goods in our analysis. We note that changes to China’s export classification scheme each year results in small changes to the number of products in each type between 2000 and 2005. The set of textile and clothing products are: two-digit HS chapters 50-63; four-digit HS chapter 6406; five-digit HS chapters 30059 and 65059; six-digit HS chapters 701919 and 94049. We identify the quota products among these based on a concordance made available by the Embassy of China’s Economic and Commercial Affairs office. This concordance identifies the set of products subject to quotas in each destination market in 2004.
two different groups. For example, an export of a textile and clothing product subject to a quota only in the United States to the United States is MFA-UEC, but an export of that same product to the EU is OTC-UEC.\textsuperscript{21}

The mutual exclusivity of product-country assignments to groups is an important element of our identification strategy, as we use the OTC-UEC group to construct “difference-in-differences” estimates for the MFA-UEC groups’ reactions to quota elimination. These comparisons assume that the textile and clothing products in the two groups are subject to similar demand and supply shocks. Among the 554 products that are subject to quotas by any of the three countries in 2004, 163 are subject to quotas by all three destinations, while 160, 50, and 6 are subject to quotas solely in the United States, solely in the EU and solely in Canada, respectively.

Some of our results also exploit variation in the extent to which quotas are binding. Following USITC (2002), we define a quota as “binding” if its “fill rate” — exports divided by the respective quota — exceeds some threshold. Using data on the level of U.S., EU and Canadian quotas available from websites maintained by each country, we find that 32 percent of the 1,017 product country observations in the MFA-UEC group have fill rates exceeding 95 percent in 2004.\textsuperscript{22}

### 4.2 Export Growth Following Quota Removal

Chinese export growth in 2005 is disproportionately large for textile and clothing goods released from quotas, and generally occurs at the expense of state-owned enterprises.

As indicated in the top panel of the Table 1, the MFA-UEC group’s 307 percent increase in export value between 2000 and 2005 is the largest among all six groups over this period. By comparison, export growth is 205 and 113 percent for OTC-UEC and MFA-ROW, respectively, and 236 percent for Chinese exports as a whole. The MFA-UEC group’s differentially large 2000 to 2005 growth is due primarily to the 119 percent jump in export value that occurs in the final year of the sample, when quotas are removed. MFA-UEC growth in prior years, by contrast, averages just 17 percent per year.\textsuperscript{23} Likewise, the MFA-UEC group’s 2005 growth is substantially larger than the growth exhibited by OTC-UEC and MFA-ROW.

Data in the lower panel of Table 1 indicates that the surge in MFA-UEC export value is accompanied by a similarly large increase in the number of MFA-UEC exporting firms. Between 2004 and 2005, the number of MFA-UEC exporters jumps 96 percent, from 9,523 to 18,628. Here too, this jump is disproportionately large compared to prior years, and to both the 19 percent increase in Chinese exporters overall as well as the 39 and 16 percent increases exhibited by OTC-UEC and MFA-UEC, respectively. The relatively large increase in firms exporting MFA-UEC in 2005 is the first indication of the importance of the extensive margin in China’s response to quota removal.\textsuperscript{24}

MFA-UEC export growth is uneven across ownership types. Table 2 reports export value market shares by firm ownership type and product-destination group in 2004 and 2005 (top and middle panels, respectively), as well as the change in market share between these two years (bottom panel). SOEs have a substantially greater presence in MFA-UEC than in the other five product-destination groups prior to quota removal, but that gap drops markedly once quotas are removed. As indicated in the table, SOEs possess 54

\textsuperscript{21}A more concrete example: “cotton slips” to the United States are subject to quotas in 2004, while exports of “silk slips” are not. Our classification treats exports of cotton slips to the US as “UEC-MFA” and exports of silk slips to the US as “UEC-OTC”. As neither silk nor cotton womens’ slips are subject to quotas in the EU in 2004, exports of both are classified as OTC-UEC. Note that groups do not vary within HS products for exports to ROW as these assignments depend only on quotas in UEC.

\textsuperscript{22}Data on U.S., EU and Canadian fill rates are obtained from OTEXA, Système Intégré de Gestion de Licenses, and Foreign Affairs and International Trade Canada, respectively.

\textsuperscript{23}U.S., EU and Canadian quotas on China’s MFA export quantities grew an average of 2 to 3 percent per year once China was admitted to the WTO in December 2001 (Brambilla et al. 2009). The relatively high value growth displayed before 2004 in Table 1 reflects a combination of this growth in quantity as well as sizable increases in prices.

\textsuperscript{24}A firm may appear in more than one group in Table 1 if it exports in multiple product classes or if it exports to both ROW and UEC. We find that less than 2 percent of MFA-UEC exporters representing an even smaller fraction of MFA-UEC export value are active only in that group. Indeed, depending on the year, 85 to 90 percent of MFA-UEC exporters also export in MFA-ROW. Overlap with other groups, e.g., OTC-UEC is lower, on the order of 80 percent. In our model, we treat multiple-product firms as single-product firms that manufacture different varieties.
percent of the MFA-UEC market in 2004 versus 26 percent for overall exports and 44 percent for OTC-UEC. Once quotas are removed, SOEs’ MFA-UEC market share falls 16 percentage points, to 38 percent, bringing it closer to the 36 percent for OTC-UEC. So, while SOEs lose market shares across all groups, their decline is most pronounced in MFA-UEC.

The results in Tables 1 and 2 highlight three facts about MFA-UEC exports following quota removal. First, post-quota export growth in MFA-UEC is large relative to other groups, particularly its closet comparator, OTC-UEC. Second, MFA-UEC export growth is accompanied by a similarly large relative increase in the number of MFA-UEC exporters. Third, the disproportionately high market share held by SOEs under quotas disappears quickly once quotas are removed. The first fact indicates that the quotas imposed on Chinese exports by the United States, EU and Canada were binding.\footnote{In unreported results, we find even greater growth in exports and exporters among product-country pairs whose fill rates exceed 95 percent.}

The second and third facts suggest that export growth following quota removal is at odds with the efficient-licensing model discussed above, which has export growth following quota removal being concentrated among large and productive incumbents.

### 4.3 Margins of Adjustment

We find that export growth after quota removal is due disproportionately to the extensive margin, and favors privately owned firms at the expense of SOEs.

Export growth can be decomposed into one intensive and two extensive margins. The intensive margin is populated by “incumbents”, which export the same eight-digit HS product to the same country in both 2004 and 2005. The extensive margin is comprised of entrants, which export a product-country pair in 2005 after not having exported it 2004, and exiters, which display the opposite pattern.\footnote{Note that multiple-product exporters may be counted in more than one margin of adjustment, e.g., they may exit one product-country and enter another.}

As illustrated in the top panel of Figure 2, 73 percent of the 10.7 billion dollar growth in MFA-UEC export value between 2004 and 2005 is due to net entry. This contribution is large compared to the 49 percent extensive-margin share observed in the smaller OTC-UEC export value increase over the same period. Results are similar with respect to growth in export quantity, but due to the fact that HS codes vary in terms of the units used to record quantity, we cannot report quantity growth for the MFA-UEC group as a whole. Instead, we first compute and decompose quantity growth for each product-country pair in MFA-UEC, and then, in the bottom panel of Figure 2, report the mean growth and mean contribution of each margin across product-country pairs, excluding outliers.\footnote{We exclude observations outside the 5\textsuperscript{th} and 95\textsuperscript{th} percentiles, which can exhibit very negative or very positive growth rates. The share of growth due to the extensive margin is 87 percent if these observations are included.}

As indicated in the figure, 86 percent of MFA-UEC quantity growth between 2004 and 2005, on average, is driven by the extensive margin, versus an average of 52 percent for OTC-UEC.

Under the efficient allocation model, export growth following quota removal is concentrated among the most productive (and therefore largest) incumbents. In the data, however, we find that SOEs, which are the biggest exporters in terms of average export value per firm, exhibit the sharpest relative declines in market share during quota liberalization.\footnote{Average MFA-UEC export value per firm in 2004 for SOEs and privately owned domestic and foreign firms is 2.1, 0.5 and 0.7 million dollars per year, respectively.}

Figure 3 summarizes incumbent firms’ change in quantity-based market share between 2004 and 2005 against their market share in 2004 using a lowess smoother. The figure plots the change in market share by type of firm for OTC-UEC (dashed) and MFA-UEC (solid). Although the largest firms in 2004 experience the greatest declines in market share in both groups, the declines are more pronounced in MFA-UEC, and most dramatic for SOEs. These patterns are inconsistent with the efficient allocation model which predicts an upward sloping curve, or at least smaller decline in market shares compared to the control group, for the largest MFA-UEC exporters.

Table 3 decomposes the average change in quantity-based market share for MFA-UEC between 2004 and 2005 by margin of adjustment and type of firm ownership. It is constructed by determining the market share...
of each margin within each product-country pair in 2004 and 2005, taking the difference and then averaging across the pairs. The first column summarizes the overall shift in market share from incumbents to net entrants, where the latter now distinguishes between entrants that did not export in 2004 (“new exporters”) versus those that did (“adders”). The first column of the table reveals that incumbents’ quantity-based market share declines an average of 21 percentage points across MFA-UEC product-destination pairs in the year quotas are removed. This decline is (necessarily) offset by a 21 percentage point gain by net entrants. Of this gain, adders and new exporters contribute 65 and 6 percent, respectively, while exiters account for -50 percent.

The remaining columns of Table 3 decompose these overall changes by type of firm ownership; in each row, the sum of the final three columns equals the value in the first column. Three trends stand out. The first, contained in the final row of the table, is a net reallocation of export activity away from SOEs: their quantity-based market share declines an average of 22 percentage points across product-country pairs between 2004 and 2005, with 13 percentage points of this market share being picked up by privately owned domestic firms and 8 percentage points by privately owned foreign firms. Second, there is substantial gross reallocation of market share within firm types. This gross reallocation is highest among SOEs, where exiters and adders contribute -32 and 26 percent market share, new exporters hardly contribute, and the overall negative contribution of net entry reinforces the loss of market share by incumbents. Among privately owned domestic and foreign firms, by contrast, net entry makes a positive contribution that more than offsets incumbents’ loss. Third, while net entry by new exporters is negligible among SOEs, it accounts for 5 and 1 percentage points of the overall 13 and 8 percentage point gains of privately owned domestic and foreign firms.

Comparison of MFA-UEC to the other textile and clothing groups – OTC-UEC in particular – aids our assessment of whether the margin adjustments observed above are related to quota removal or other factors common to textile and clothing products, e.g., the removal of entry barriers and the declining importance of SOEs. Figure 4 displays the deviation between MFA-UEC and OTC-UEC incumbent and net entry margins by firm ownership type. Incumbent SOEs’ loss of market share is 12 percentage points greater in MFA-UEC than in OTC-UEC. The corresponding differences for privately owned domestic and foreign firms are -2 and 0 percentage points, respectively. At the same time, net entry by privately owned firms is 8 percentage points higher in MFA-UEC than in OTC-UEC. All differences except for the incumbent foreign firms are statistically significant at conventional levels.

Together, the data in Figure 4 and Table 3 show that even though incumbents’ exports grew following quota removal, they lost market share to entrants, and that this loss of market share is concentrated among SOEs. These results provide further support for the idea that quota licenses were allocated inefficiently both across and within firm ownership types prior to their removal in 2005.

Our results are potentially sensitive to the possibility that firms without quota allocation export MFA goods on behalf of firms that do. To the extent that customs documents list the name of the quota-holding firm, such subcontracting is unobserved. The manner in which it affects our results depends upon the nature of the subcontractor. While results in this section suggest that the prevalence of subcontracting was limited, we acknowledge that our ability to investigate this issue is limited by the fact that we may not observe the ultimate producer of each export.

The strongest piece of evidence against subcontracting by quota-holding producers is the prevalence of firms that simultaneously export in both MFA-UEC and MFA-ROW under quotas. Given that MFA-ROW exports were not subject to quotas, we assume that producers exporting in MFA-ROW produced the underlying goods in-house, thereby demonstrating their ability to manufacturing MFA products. Given this ability, it is hard to understand why they would subcontract production for MFA-UEC exports. Our data

29 As defined here, adders may or may not remain in the product-country combination they exported in 2004.
30 Price changes explain the difference between the 21 percent decline in SOEs’ average quantity-based market shares in Table 3 and their 16 percent decline in value-based market share in Table 2.
31 As discussed in footnote 17, virtually all MFA products had full trading rights so all firms could directly export an MFA product to ROW if they so chose.
indicate that 86 percent of MFA-UEC exporters, accounting for 96 percent of MFA-UEC export value, are present in both groups in 2004. Furthermore, we find that these shares are even higher among SOEs, the set of firms for which subcontracting might be most likely, given their low average productivity.

A second way to determine whether exporters engaged in subcontracting is to check if their exports exceed their output. Using the 2004 Annual Survey, we investigate the export-to-production ratio among exporters that report textile and apparel as their main line of business. We find that for 95 percent of exporters, production exceeds exports, and that this fraction is even higher among SOEs. Results for 2005 indicate no change in this breakdown once the MFA ended. While this evidence is consistent with low levels of subcontracting, it must be interpreted in light of two limitations of our data. First, the values in the Annual Survey reflect the total exports and total production of firms whose predominant line of business is textiles and clothing; as a result, we are unable to narrow in on exports versus production of just MFA goods for all firms that produce them. Second, information revealed by the exports to production ratio depends on the relative importance of the export market; firms selling large quantities domestically might nevertheless export a relatively small amount of sub-contracted production.

A final check on subcontracting by producing firms focuses on exporters’ exit and decline between 2004 and 2005. If subcontracting were the only way a firm with a quota license was able to fulfill its quota, the firms relying on subcontractors in 2004 would exit or shrink substantially once quotas were removed. In fact, we find in Table 4 that 2004-to-2005 exit and shrink rates are relatively low in MFA-UEC versus OTC-UEC across ownership types. We note that while this this trend, too, is consistent with low levels of subcontracting, it also must be interpreted with caution. To the extent that (potentially less-productive) firms that subcontracted production in 2004 were able to overcome the costs of exporting once the MFA ended, the exit and shrink rates in Table 4 may be biased.

Firms that subcontracted under the MFA may have been intermediaries (e.g., trading firms) rather than producers. This possibility also can lead to over- or under-estimation of the importance of the extensive margin. Its importance is under-estimated if trading companies use more, potentially less-productive, subcontractors after the quotas ended. Like the scenario described above, however, the importance of the extensive margin will be over-stated if subcontractors require quota-holders under the MFA but can export directly once it ends. In fact, we find, in the top panel of Table 5, relatively strong entry of new trading firms between 2004 and 2005 in MFA-UEC versus OTC-UEC.\textsuperscript{32} This growth appears inconsistent with the replacement of traders with producers once the MFA ends, but could reflect increased demand for intermediaries by the relatively unproductive firms who enter the export market once the MFA ends.\textsuperscript{33} The bottom panel of Table 5, however, indicates that the post-MFA relative prevalence of traders is similar to that of non-traders. As with the previous evidence on subcontracting, we acknowledge caveats in interpreting Table 5. First, our classification of firms as trading companies is imperfect, and, in particular, might classify as traders firms that both produce and trade. A large fraction of textile and apparel exporting SOEs, for example, are identified as traders; this assignment is at odds with the evidence presented above from the Annual Survey, which indicates that virtually all SOEs have higher production output than exports. According to our classification, trading companies account for 46 and 48 percent of 2004 OTC-UEC and MFA-UEC exports, which is large relative to the 24 percent overall share of intermediaries in China’s exports. However, if SOEs flagged as traders are in fact producers, and are re-classified as such, the overall export share of traders falls to only 11 and 13 percent for OTC and MFA, respectively, which suggests a limited role of trading companies.

While not airtight, several checks of the data suggest that subcontracting was not pervasive and our measurement of extensive margin accurately reflects the importance of entry into the MFA-UEC export market. One reason why this might have been the case is local governments’ desire to promote employment in state-owned firms for political reasons. A second explanation is that firms may have avoided subcontracting

\textsuperscript{32} As in Ahn et. al (forthcoming), we identify trading firms as firms whose names include the words “trading”, “importer” or “exporter”.

\textsuperscript{33} Ahn et. al (forthcoming) find that less-productive firms that cannot overcome the fixed costs of exporting directly are more likely to use intermediaries to reach export markets.
to ensure receipt of future quotas.\footnote{Although 2004 was the final year of the MFA, there is anecdotal evidence that firms believed that quotas would be reimposed in subsequent years which would mitigate their incentives to subcontract in this year.}

### 4.4 Prices

Chinese MFA-UEC export prices fall relative to the export prices of all other groups the year that quotas are removed. In contrast with the efficient allocation model developed above, these relative price declines are disproportionately due to entrants with lower prices replacing exiters with higher prices.

Figure 5 displays the mean percent change in groups’ export prices between 2004 and 2005. These changes are computed in two steps. First, for each product-country (hc) pair in each year (t), we calculate a weighted-average export price ($\hat{P}_{hct}$) across all exporting firms using their quantity market shares ($\theta_{fhct}$) as weights,

$$\hat{P}_{hct} = \sum_{f} \theta_{fhct} P_{fhct}.$$ \hspace{1cm} (11)

Then, for each product-country pair, we compute the percent change between years $t$ and $t-1$, $\Delta \hat{P}_{hct} = (\hat{P}_{hct} - \hat{P}_{hct-1}) / \hat{P}_{hct-1}$. Each bar in Figure 5 displays the mean of $\Delta \hat{P}_{hct}$ across all product-country pairs in the group, excluding outliers.\footnote{Extreme price changes are found for some product-country combinations, e.g., HS 62101030, “garments of felt or nonwovens, of man-made fibers”, to Suriname, which grew 70,000 percent between 2004 to 2005. In Figure 6 we drop product-country pairs whose price changes are either below or above the first and ninety-ninth percentile, respectively. Though excluding these product-country pairs lowers average export price growth in all groups, it does not undermine any of the substantive patterns discussed in this section.}

As indicated in the figure, export prices in MFA-UEC fell 8 percent on average between 2004 and 2005. In OTC-UEC, by contrast, average export prices grew 14 percent. Thus, relative to its closest comparator group, MFA-UEC export prices fell 22 percent.\footnote{The MFA-UEC price decline in 2005 is also sharp relative to the group’s average price growth of 16 percent between 2003 and 2004.}

Figure 6 compares the normalized export prices of entrants to exiters and incumbents.\footnote{We normalize prices to facilitate comparisons across products with different units.} For incumbents and entrants, the normalized export price is the ratio of the firm’s 2005 export price to the mean quantity-weighted average export price across all firms in the respective product-country in 2004 and 2005, $p_{fhc2005}/\bar{P}_{hc}$, where

$$\bar{P}_{hc} = \frac{1}{2} (P_{hc2004} + P_{hc2005}).$$ \hspace{1cm} (12)

For exiters, the normalized export price is the ratio of the firm’s 2004 export price to the same mean, $p_{fhc2004}/\bar{P}_{hc}$. For all three distributions, we exclude firms whose relative prices are below and above the first and ninety-ninth percentiles of each distribution, respectively.

A key feature of Figure 6 is that the price distribution for exiters lies to the right of that for entrants. This ordering indicates that firms exiting MFA-UEC in 2004 have relatively high prices compared to firms entering the group in 2005. By comparison, Figure 7 reveals that we do not find a similar ordering of entrants’ and exiters’ prices either contemporaneously in OTC-UEC or in MFA-UEC the year before. Indeed, exiters’ prices are lower than entrants’ prices in MFA-UEC in 2004 and are almost indistinguishable from entrants’ prices in OTC-UEC in 2005. A second notable feature of Figure 6 is that MFA-UEC incumbents’ export prices in 2005 have a thin left tail compared to entrants, i.e., they have a lower proportion of very low prices. To the extent that incumbents’ relatively high prices do not reflect variation in quality (more on this below), they provide intuition for incumbents’ loss of market share discussed in the last section. On the other hand, incumbents’ ability to retain as much market share as they did given their relatively high prices may be due...
to long-term contracts, greater knowledge of the market or some other market or policy asymmetry that gives them an advantage over low-priced incumbents.

We quantify the relative importance of each margin for the overall 2004 to 2005 MFA-UEC price change using a decomposition method proposed by Foster et al. (2008) and Griliches and Regev (1995). This decomposition accounts for changes in price and changes in market share by breaking the overall change in the export price of a particular product-country pair into three margins: incumbents, entrants and exiters:

\[
\Delta P_{hct} = \frac{1}{P_{hct-1}} \left[ \sum_{f \in I} \overline{\theta}_{fhc} \left( p_{fhtc} - p_{fcht-1} \right) + \sum_{f \in I} \left( \theta_{fhtc} - \theta_{fcht-1} \right) \left( p_{fhtc} - P_{hc} \right) \right] + \frac{1}{P_{hct-1}} \left[ \sum_{f \in N} \theta_{fhtc} \left( p_{fhtc} - P_{hc} \right) \right] - \frac{1}{P_{hct-1}} \left[ \sum_{f \in X} \theta_{fht-1} \left( p_{fcht-1} - P_{hc} \right) \right].
\]  

(13)

As above, \( \theta \) and \( p \) represent quantity-based market share and export unit values, while \( f \), \( h \) and \( c \) index exporters, eight-digit HS categories and countries. \( I, N \) and \( X \) correspond to the sets of incumbent, entering (new exporters plus adders) and exiting firms, respectively.\(^{38}\) \( \overline{\theta}_{fhc} \) is the average market share of firm \( f \) in \( h \) across both years, i.e., \( \overline{\theta}_{fhc} = \left( \theta_{fhtc} + \theta_{fcht-1} \right) / 2 \). Finally, \( \overline{p}_{fhtc} \) is the average price of firm \( f \) in product-country \( hc \) across years \( t \) and \( t - 1 \). Like \( \overline{\theta}_{fhc} \), it can be computed only for incumbents.

The first term in square brackets captures the intensive margin. Its “within” component, the first term inside the brackets, measures the price change of incumbent exporters holding their market share fixed. The second, “across” component accounts for changes in incumbents’ market shares, weighting those changes by the difference between the firm’s average across-year price and the overall average across-year price \( (\overline{p}_{fhtc} - P_{hc}) \). If incumbents’ prices fall (due to the elimination of the license fee), the within component is negative. If incumbents’ prices are relatively high and their market shares tend to decline, the across component is also negative and both components contribute to a reduction in \( \Delta P_{hct} \).

The second term captures the entry margin; this term is negative if entrants’ prices are lower than the across-year average price. The third term captures the exit margin, and its interpretation is analogous to the entry term: it is positive if exiters have relatively high prices compared to the across-year average; and, because it is \emph{subtracted}, a positive margin implies a negative contribution to price changes.

Table 6 presents the decomposition of MFA-UEC price changes between 2004 and 2005 relative to the corresponding OTC-UEC price changes. All of the differences between the two groups are statistically significant at the 1 percent level with the exception of the exit term for foreign firms. We assume that differencing out changes in OTC-UEC prices controls for inflation – as trade prices are nominal – as well as the other factors such as changes in technology and exchange rate movements that affect all Chinese textile and clothing exports equally. The table is constructed using equation 13 to perform separate decompositions for each group and firm ownership type, and then taking the difference between these decompositions term by term. Each column sums to the final row of the table, while each row sums to the first column. The top panel reports changes in price, while the bottom panel expresses these changes as a percent of the overall 21.7 percent average relative MFA-UEC price decline displayed in the bottom of the first column (as well as Figure 5).\(^{39}\)

The first column of Table 6 reveals that the entrant and exiter margins account for 37 (-0.080/-0.217) and 30 (-0.065/-0.217) percent of the decline in MFA-UEC relative prices between 2004 and 2005. This 67 percent contribution from the extensive margin is twice the 34 (-0.072/-0.217) percent contribution of the intensive margin. This dominance of the extensive margin is inconsistent with our model of efficient allocation of quotas prior to their removal.

\(^{38}\)We do not break entrants into adders versus new exporters given the relatively small market share of new entrants (see Table 3).

\(^{39}\)Results in Table 6 drop the same product-country outliers as Figure 6.
Examination of the within and across terms for the incumbent margin indicate that changes in price as well as changes in market share drive its contribution. The negative within term reveals that MFA-UEC incumbents experienced larger price declines than OTC-UEC incumbents. The negative across term indicates that MFA-UEC incumbents with high prices lost relatively more market share than high-priced OTC-UEC incumbents.

The remaining columns of Table 6 highlight the influence of SOEs. Almost half (48 percent) of the overall decline in MFA-UEC relative prices is due to SOEs. Moreover, SOEs’ contribution is weighted heavily towards the incumbent and exit margins, whereas entry plays the strongest role among privately owned firms.

We find very similar results using a more stringent comparison of price changes within HS categories. This comparison exploits variation in the sets of products subject to quotas in the three countries, thereby allowing us to control for demand shocks in destination markets and product-specific supply shocks that might influence price changes. As noted above, products subject to a quota in one of the UEC countries are not necessarily subject to quotas in the other two countries. This feature of the data permits the following OLS difference-in-differences specification:

\[
\Delta P_{hct} = \alpha_h + \alpha_c + \beta_1 [MF_A_{hct}] + \varepsilon_{hct},
\]

where \(\alpha_h\) and \(\alpha_c\) represent HS product and country fixed effects and \(1 \{MF_A_{hct}\}\) is an indicator of whether the product-country pair is subject to a quota. The dependent variable is either the overall price decline \(\Delta P_{hct}\) or the net price decline associated with the intensive or extensive margin. The regression is restricted to MFA-UEC and OTC-UEC product-country observations.

Results are displayed in Table 7. The first three columns of the top panel report the results of estimating equation (14) without fixed effects. These columns reproduce the results shown in the first column of Table 6 and, as indicated in the final row of the panel, reproduce the result that the extensive margin accounts for 67 percent of the total price decline.

The next three columns of the top panel report results inclusive of product fixed effects. As indicated in the table, we continue to find a sizable and statistically significant average price decline even when these declines are identified solely across UEC countries within products. The principal difference between these results and those without fixed effects is the smaller contribution of the extensive margin, which indicates that HS products subject to quotas in all three countries of the UEC (and therefore excluded from this regression) experience relatively greater net entry. The final three columns of the top panel include both product and country fixed effects, where the latter control demand shocks common to all products within a country. The estimated total price change remains statistically significant but declines in magnitude; the relative contribution of the extensive margin falls to 44 percent.

The bottom panel of Table 7 partitions the product-country observations subject to a quota according to whether they are “binding”, i.e., whether their fill rates are above 95 percent. Unsurprisingly, the estimated total price price declines are larger for binding quotas across the left, middle and right panels. We also find that the relative contribution of the extensive margin is higher for binding quotas. Even when product and country fixed effects are added to the regression, the extensive margin accounts for the majority (55 percent) of the total price decline. This outcome is inconsistent with our model of efficient allocation, in which quota removal causes low-productivity, high-price firms to enter the export market.

An alternative interpretation of the price declines noted in this section is quality downgrading. Because quotas exert a relatively large per-unit penalty on low-price, low-quality goods, firms may have an incentive to reduce export quality when quotas are removed. Under this interpretation, the price declines associated with the extensive margin between 2004 and 2005 merely reflect the entry of low-productivity, low-price firms in 2005 and the exit of high-productivity, high-price firms in 2004. This interpretation, however, is inconsistent with the relative productivity of entrants and exitors that we observe in the data. We find that entrants are drawn predominantly from the private sector, and they enter at the expense of SOEs, which, as discussed in greater detail in the next section, generally are found to have productivity that is 70 to 90 percent lower than their private-sector counterparts. In the appendix, we explore the extent to
which quality fell by inferring the quality of exports from a CES utility framework. Using the intuition from Khandelwal (2010) and Hallak and Schott (2011), we infer quality from prices and quantity information. Relative to OTC-UEC, we do observe relative quality downgrading among MFA-UEC exports, however the decline is not statistically significant.

It is of course possible that high-productivity entrants choose to export low-price, low-quality goods in 2005. While that scenario rationalizes the both relative price and productivity evidence, it still remains inconsistent with our model of efficient allocation, which has low-productivity firms entering the export market following quota liberalization.

Thus, irrespective of whether or not quality fell, the data patterns remain inconsistent with efficient allocation of quotas under the MFA/ATC.

### 4.5 Productivity

The previous section demonstrates that entrants exported at lower prices than exiter and incumbent firms. According to our model, these entering firms should be relatively more productive. Unfortunately, we are unable to observe the productivity of entrants directly due to difficulties associated with matching the Chinese trade and production data. However, we do observe a key characteristic – firm ownership – for each firm and can therefore obtain a coarse back-of-envelope calculation of the productivity gain following quota removal.

Existing estimates of Chinese firms’ productivity indicate that state-owned enterprises are substantially less efficient than privately owned domestic or foreign firms operating in China. Using the Annual Survey of Industrial Production collected by China’s National Bureau of Statistics, Hseih and Klenow (2009) find that total factor productivity (TFP) is 41 percent lower for SOEs than for private firms. Using the same data, Brandt and Zhu (2010) estimate even starker gaps – roughly twice the difference in TFP – between the state and non-state sectors.

Neither of these studies report differences between exporting and non-exporting firms. Here, we use the same Annual Survey data to compare the TFP of SOE and private exporters, making use of a variable in the Annual Survey which indicates whether or not a firm is an exporter. We restrict our comparison to exporting firms whose major line of business is textiles or clothing (industry codes 17 or 18) in 2005. Following Brandt et al. (2009), we estimate TFP using a Tornqvist index number approach,

\[
\ln(TFP_f) = (va_f - \bar{va}) - \bar{s}_f(l_f - \bar{l}) - (1 - \bar{s}_f)(k_f - \bar{k}),
\]

where \(va, l, \) and \(k\) are in logs and denote value added, wages and fixed assets (net of depreciation) for each firm, and where a bar over a variable denote an average across all textile and clothing exporters. The weight on wages is \(\bar{s}_f = (s_f + \bar{s})/2\), where \(s_f\) is the share of wages in total value added by each firm and \(\bar{s}\) is the average across firms. The TFP measure for a given firm is relative to a hypothetical firm with the average output and inputs. Following Brandt et al. (2009), wages are defined as reported firm wages plus

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40 The quality-based versions of Melitz (2003) predict that firms’ decisions to choose higher quality levels depends on the industry’s ratio of the marginal benefit to marginal cost of quality upgrading (see Baldwin and Harrigan (2009), Kugler and Verhoogen (2010), Johnson (2009), and Mandel (2010)). Indeed, evidence in Johnson (2010), Khandelwal (2010) and Verhoogen and Kugler (2008) indicate that apparel industry is an example of an industry where choosing higher quality does not necessarily imply higher profits. the apparel industry.

41 In principle, one could merge the customs data with China’s Annual Survey of Industrial Production which records firm characteristics such as outputs as inputs. However, in practice, such matching must be done using firm names (rather than a numerical identifier), which yields low match rates. Of the 37,986 firms that export a textile and clothing product in 2004, we have thus far succeeded in matching 7,157 firms, or 18.8 percent, to the Annual Survey.

42 These data combine a census of a non-state-owned firms with revenue greater than 5 million yuan with a census of all state-owned enterprises.

43 The differences between the two estimates may be due Hsieh and Klenow’s (2009) use of firm-level data versus Brandt and Zhu’s (2010) employment of aggregate data.
employee benefits (unemployment insurance, housing subsidies, pension and medical insurance), and the capital is reported capital stock at original purchase price less accumulated depreciation.

Figure 8 plots the distribution of textile and clothing exporters’ TFP relative to the hypothetical average firm by type of ownership. It illustrates the large difference in productivity between SOEs and their private-sector counterparts. The average SOE is 18 percent less productive than the hypothetical mean, while privately owned domestic and foreign firms are 76 and 54 percent more productive than this mean. As a result, privately owned domestic and foreign firms in the textile and clothing sector are 88 and 72 percent more productive than SOEs, respectively.

In Table 8, we combine these relative TFP estimates with the market share changes by ownership type noted above to provide a very coarse, back-of-envelope calculation of the productivity gain associated with quota removal. The first column of the table reports average TFP relative to the hypothetical mean for each ownership type. The left panel reports the 2004 to 2005 change in market share of each ownership type for MFA-UEC from Table 2. Assuming all firms within an ownership type have the same TFP relative to hypothetical average, and firms’ TFP is constant between 2004 to 2005, the change in aggregate TFP implied by these market share changes is reported in column three. Overall, we estimate TFP growth of 18.5 percent. A similar exercise for OTC-UEC in the right panel implies aggregate TFP growth of 9.7 percent, yielding a difference-in-difference productivity gain of 8.8 percent.

In Section 5, we use our model to decompose this 8.8 percent productivity gain into the part due to the direct removal of the quotas versus the part due to the dismantling of the inefficient quota allocation.

5 Decomposing Productivity Gains

In this section we use a model of “inefficient allocation” to decompose the overall productivity gain following the removal of quotas into the part that is due to the removal of the quotas versus the part that is accounted for by the removal of the export licensing regime. This model uses the same basic structure as the efficient-allocation model above, including asymmetric iceberg transportation costs and the assumption that firm productivity follows a Pareto distribution.

Using the parameters noted in Section 2.2, the baseline model with no quotas (“no-quota” equilibrium) yields aggregate TFP among China’s exporters to the U.S. of 10.53. According to Table 1, MFA-UEC exports grew 87 percent more than OTC-UEC exports, which we attribute to the removal of the quotas. In the simulations, we therefore impose a quota that is 54 (1/1.87) percent of the “no-quota” equilibrium exports from China to the United States. Under the efficient allocation model, we find that the aggregate TFP among exporters is 6.73. This means that going from an efficient allocation of quota licenses to the no-quota equilibrium results in a TFP gain among exporters of 57 percent. This estimated gain is large because removing quotas disproportionately benefits high productivity firms and the distribution of exporters’ productivity is highly skewed.

The inefficient allocation imposes the same quota restrictiveness as the efficient allocation model, but now, the government allocates market share to $N$ exporters based on a “political connection” draw. For this simulation, we need to choose $N$ and determine how to allocate market share to these $N$ firms. Firms’ political connections are drawn from a standard uniform distribution, possibly correlated with firms’ productivity. We assume that the government allocates licenses based on these draws, starting with the firm that has the highest draw and working its way down to the firm with the $N$th largest draw. In order to choose $N$, we need two pieces of information. First, we need to know the relative growth of MFA-UEC firms compared with OTC-UEC firms between 2004 and 2005. In the data, we observe this relative growth to be 57 percent (Table 1). Second, we need to know the number of exporters under the no-quota equilibrium, which is generated from the “no-quota” simulation. We scale this number down by 57 percent to yield $N$.

To determine the amount of quota allocated to each firm, we use the empirical distribution of export
values observed in 2004. For a given correlation between firms’ political and productivity draws, we can compute the contribution of the extensive margin to quantity growth between the inefficient allocation and the “no-quota” equilibrium. Our goal is to match the 34 percent relative quantity growth of the extensive margin following quota liberalization observed Figure 2, which as discussed extensively in the previous sections, is a key statistic that identifies misallocation. We then search over possible correlations between political connection and productivity in order to match the observed contribution of the extensive margin.

For each correlation, Figure 9 plots aggregate TFP among exporters under inefficiently allocated quotas against the contribution of the net extensive margin to export quantity growth as inefficiently allocated quotas are removed. Each point in the figure represents the associated correlation of the political connection and firm TFP draws. As indicated in the figure, aggregate TFP falls and the contribution of the extensive margin rises as the correlation between the two draws falls. Intuitively, as the correlation of the two draws rises, the penalty for inefficient allocation declines. An extensive margin growth of 34 percent (along the x-axis), implies a 26 percent correlation between the two draws. The corresponding TFP estimate (y-axis) is 1.86. Thus, removing inefficiently allocated quotas raises aggregate TFP by a factor of 4.7, from 1.86 to 10.53. Moving from an inefficient to an efficient allocation of quota licenses contributes 56 percent of this productivity improvement ((6.73 - 1.86)/(10.53 - 1.86)). In other words, the productivity gains from trade are more than twice what they would have been had the quota licenses been efficiently allocated prior to liberalization. This is evidence that misallocating resources can have even larger aggregate TFP effects than the quota itself.

6 Conclusion

We evaluate productivity gains from a specific trade liberalization episode—the removal of textile quotas on Chinese exporters. Following liberalization, we observe substantial reallocation away from inefficient incumbent firms towards efficient entrants which implies large productivity gains among these textile exporters. These patterns of adjustment are at odds with predictions of a model under which quota licenses were allocated based on firm productivity.

This episode highlights two key themes that have been under-studied in the literature. First, while many studies have emphasized misallocation of resources among the set of active firms, we observe misallocation along the extensive margin. Explicit government policy kept quota licenses out of the hands of the most productive textile exporters and once this institution was dismantled, these firms enter the export market. The removal of the licensing institution highlights the second key implication of our analysis. Theoretical models in international trade typically presume an efficient allocation of resources, irrespective of trade barriers. However, institutions that evolve to manage trade barriers are often corrupted by government bureaucrats which impose additional distortions in addition to the trade barrier itself. Trade liberalization that dismantles such institutions delivers additional gains from trade beyond just the removal of the trade barrier. Our counterfactual analysis suggests that moving from an inefficient quota allocation to an efficient one delivers more than twice the TFP gains than the removal of the trade barrier itself. That is, the efficiency...
cost of the quota on the Chinese exporters could be been reduced by more than half through internal reforms of the licensing system.

Our results provide one explanation for why empirical findings of the gains from trade, for instance in Feyrer (2010) or Pavcnik (2002), are often large compared to the gains predicted in standard models of international trade (e.g., Arkolakis et. al 2010). These models ignore the fact that countries must create institutions to manage the trade barriers they impose, and that these institutions may impose inefficiencies in addition to those directly caused by the trade barrier. The results in this paper suggest that an interesting avenue for future research would be incorporate these types of distortions within trade models which may enhance our understanding of the gains from trade.

A Quality

We investigate quality downgrading by embedding consumer’s preference for quality in the CES utility used in our efficient allocation model.\(^{46}\) The demand for a particular firm \(f\)’s export of product \(h\) to country \(c\) at time \(t\) is given by:

\[
q_{fcht} = \lambda_{fcht}^{\sigma-1} p_{fcht}^{-\sigma} P_{ct}^{\sigma-1} Y_{ct} \tag{16}
\]

We remove the common destination-year price index and market size by dividing by the average demand within a country-product-time triplet,

\[
\frac{q_{fcht}}{\bar{q}_{cht}} = \left( \frac{\lambda_{cht}}{\lambda_{cht}} \right)^{\sigma-1} \left( \frac{p_{cht}}{\bar{p}_{cht}} \right)^{-\sigma} \tag{17}
\]

and solve for the firm’s relative quality

\[
\frac{\lambda_{fcht}}{\lambda_{cht}} = \left( \frac{q_{cht}}{\bar{q}_{cht}} \right)^{\frac{1}{\sigma-1}} \left( \frac{p_{cht}}{\bar{p}_{cht}} \right)^{\frac{\sigma}{\sigma-1}} \tag{18}
\]

Assuming an elasticity of substitution \(\sigma = 4\), we infer the quality of each exported variety. The intuition behind this approach is similar to Hummels and Klenow (2005), Khandelwal (2010) and Hallak and Schott (2011): conditional on price, a variety with a higher market share is assigned higher quality. By imposing an elasticity of substitution, we avoid having to estimate demand before inferring quality.

We use our estimates of firm-level quality to assess the extent to which quality grows differentially in MFA-UEC following quota removal. As with prices (equation 11), we define aggregate quality to be

\[
\Lambda_{cht} = \sum_{f} \theta_{fcht} \frac{\lambda_{fcht}}{\lambda_{cht}} \tag{19}
\]

where, as above, \(\theta_{fcht}\) denotes the quantity market share of firm \(f\) in product-country pair \(hc\) in year \(t\). Then, for each product-country pair, we compute the percent change in quality between years \(t\) and \(t-1\) as

\[
\Delta \lambda_{hct} = (\bar{\lambda}_{hct} - \bar{\lambda}_{hct-1}) / \bar{\lambda}_{hct-1}.
\]

Each bar in Figure 10 displays the mean of \(\Delta \lambda_{hct}\) across all product-country pairs in the noted group, excluding outliers.\(^{47}\) As indicated in the figure, MFA-UEC export quality rose an average of 13 percent between 2004 and 2005, versus 17 percent for OTC-UEC. Regression results analogous to equation (14), however, reveal this difference to be statistically insignificant at conventional levels. So, we do not find conclusive evidence of quality downgrading based on this measure.

\(^{46}\)The following CES utility embeds quality \(\lambda\) is \(U = \int_{\omega \in \Omega} (\lambda(\omega)q(\omega))^{(\sigma-1)/\sigma} \lambda(\omega) \omega^{\sigma/(\sigma-1)} \)

\(^{47}\)We drop product-country pairs whose quality changes are either below or above the first and ninety-ninth percentile, respectively.
Trade and Misallocated Resources

Our approach to inferring quality changes differs from an alternative approach taken by Harrigan and Barrows (2009). They define quality downgrading as a shift in consumption from high- to low-priced product categories. This method, also used by Aw and Roberts (1986) and Boorstein and Feenstra (1991), compares a unit-value index, which is a quantity-weighted average of prices, to an exact price index, which uses value weights. If the unit-value index of a country’s exports decreases by more than the exact price index, exports have shifted towards cheaper categories and average quality is said to have fallen. Harrigan and Barrows (2009) estimate that the quality of the most restricted of China’s textile and clothing exports to the U.S. fell after quotas were removed because U.S. consumers shifted their expenditure to relatively low-priced products. We adopt a different approach for two reasons. First, the “across-product” evidence of quality downgrading does not account for potentially changing quality within products, which our data can address directly. Second, as discussed extensively in the text, lower prices may also reflect firm efficiency, which must be disentangled from quality. Given these two key differences, we stress that our lack of strong evidence of quality downgrading is consistent with evidence of quality downgrading of China’s exports to the United States after quota were removed found in Harrigan and Barrows (2009).

References


### Table 1: Export Value and Number of Exporters, by Product and Destination

<table>
<thead>
<tr>
<th>Year</th>
<th>Export Value ($Billion)</th>
<th>Number of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ROW</td>
<td>US/EU/Canada</td>
</tr>
<tr>
<td></td>
<td>NTC  OTC  MFA</td>
<td>NTC  OTC  MFA</td>
</tr>
<tr>
<td>2000</td>
<td>104.8  8.8  27.3</td>
<td>79.5  6.2  4.8</td>
</tr>
<tr>
<td>2001</td>
<td>132.7  8.9  34.3</td>
<td>97.1  6.6  6.2</td>
</tr>
<tr>
<td>2002</td>
<td>153.0  8.9  37.0</td>
<td>112.4  7.9  6.5</td>
</tr>
<tr>
<td>2003</td>
<td>204.7  11.2  46.1</td>
<td>157.3  11.2  7.9</td>
</tr>
<tr>
<td>2004</td>
<td>283.6  13.9  55.8</td>
<td>217.1  14.3  8.9</td>
</tr>
<tr>
<td>2005</td>
<td>383.6  16.6  58.2</td>
<td>279.8  18.8  19.6</td>
</tr>
<tr>
<td>%Growth 2000-5</td>
<td>266  88  113</td>
<td>252  205  307</td>
</tr>
<tr>
<td>Annual %Growth 2000-4</td>
<td>28  12  20</td>
<td>29  23  17</td>
</tr>
<tr>
<td>%Growth 2004-5</td>
<td>35  19  4</td>
<td>29  32  119</td>
</tr>
</tbody>
</table>

Notes: Panels report annual export value (in billions of dollars) and number of exporters by type of product and destination. NTC, OTC and MFA represent non-textile-and-clothing, other textile and clothing, and quota-constrained textile and clothing goods, respectively (see text). ROW refers to rest of world, while US/EU/Canada refers to exports to one of these three countries. Final rows of each panel report percent growth from 2000 to 2004 and from 2004 to 2005, respectively.
<table>
<thead>
<tr>
<th>Type</th>
<th>Value Market Share, 2004</th>
<th>Value Market Share, 2005</th>
<th>Difference in Value Market Share, 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NTC</td>
<td>OTC</td>
<td>MFA</td>
</tr>
<tr>
<td>SOE</td>
<td>0.26</td>
<td>0.28</td>
<td>0.32</td>
</tr>
<tr>
<td>Domestic</td>
<td>0.15</td>
<td>0.28</td>
<td>0.32</td>
</tr>
<tr>
<td>Foreign</td>
<td>0.58</td>
<td>0.44</td>
<td>0.35</td>
</tr>
<tr>
<td>Total</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: Table reports export-value market share by type of firm, product and destination market in 2004 and 2005, as well as the change in market share between 2004 and 2005.

Table 2: 2004 versus 2005 Export Value Market Shares, by Type of Firm, Product and Destination
Trade and Misallocated Resources

<table>
<thead>
<tr>
<th>Margin</th>
<th>All</th>
<th>SOE</th>
<th>Domestic</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incumbents</td>
<td>-0.21</td>
<td>-0.16</td>
<td>-0.03</td>
<td>-0.02</td>
</tr>
<tr>
<td>Net Entry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exiters</td>
<td>-0.50</td>
<td>-0.32</td>
<td>-0.13</td>
<td>-0.05</td>
</tr>
<tr>
<td>Adders</td>
<td>0.65</td>
<td>0.26</td>
<td>0.25</td>
<td>0.14</td>
</tr>
<tr>
<td>New Exporters</td>
<td>0.06</td>
<td>0.00</td>
<td>0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>Total Net Entry</td>
<td>0.21</td>
<td>-0.06</td>
<td>0.17</td>
<td>0.10</td>
</tr>
<tr>
<td>Total</td>
<td>0.00</td>
<td>-0.22</td>
<td>0.13</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Notes: Table decomposes 2004 to 2005 changes in MFA-UEC export quantity market share by margin of adjustment (see text). Rows 3 to 5 sum to row 6. Final row is sum of rows 1 and 6. First column is sum of remaining columns.

Table 3: Decomposition of 2004 to 2005 Changes in MFA-UEC Market Share

<table>
<thead>
<tr>
<th></th>
<th>OTC-UEC</th>
<th>MFA-UEC</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOE</td>
<td>0.249</td>
<td>0.223</td>
<td>-0.026</td>
</tr>
<tr>
<td>Domestic</td>
<td>0.310</td>
<td>0.290</td>
<td>-0.020</td>
</tr>
<tr>
<td>Foreign</td>
<td>0.222</td>
<td>0.199</td>
<td>-0.023</td>
</tr>
<tr>
<td>2004 Value &lt; 2005 Value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTC-UEC</td>
<td>0.343</td>
<td>0.224</td>
<td>-0.119</td>
</tr>
<tr>
<td>MFA-UEC</td>
<td>0.343</td>
<td>0.224</td>
<td>-0.119</td>
</tr>
<tr>
<td>Diff</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>2004 Value &gt;= 2005 Value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTC-UEC</td>
<td>0.408</td>
<td>0.552</td>
<td>0.144</td>
</tr>
<tr>
<td>MFA-UEC</td>
<td>0.408</td>
<td>0.552</td>
<td>0.144</td>
</tr>
<tr>
<td>Diff</td>
<td>0.076</td>
<td>0.115</td>
<td>0.078</td>
</tr>
</tbody>
</table>

Notes: Table displays the share of 2004 exporters that exit versus experience export value decline or growth in 2005, by ownership type and group. Exit, shrink and growth rates sum to 1 within group and ownership types.

Table 4: 2004-5 Export Value Growth, by Group, Margin and Ownership Type

<table>
<thead>
<tr>
<th></th>
<th>Incumbents</th>
<th>MFA-UEC Enters</th>
<th>Share</th>
<th>OTC-UEC</th>
<th>MFA-UEC Enters</th>
<th>Share</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOE</td>
<td>1,309</td>
<td>455</td>
<td>0.26</td>
<td>1,745</td>
<td>350</td>
<td>0.17</td>
<td>0.09</td>
</tr>
<tr>
<td>Domestic</td>
<td>1,481</td>
<td>2,184</td>
<td>0.60</td>
<td>2,548</td>
<td>2,129</td>
<td>0.46</td>
<td>0.14</td>
</tr>
<tr>
<td>Foreign</td>
<td>20</td>
<td>88</td>
<td>0.81</td>
<td>41</td>
<td>78</td>
<td>0.66</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Notes: Table displays the share of trading (top panel) and non-trading (bottom panel) firms in 2005 by ownership type and group according to whether they are incumbents or entrants. Final column displays the difference between the MFA-UEC and OTC-UEC shares in columns 3 and 6.

Table 5: 2004-5 Export Value Growth, by Group, Margin and Ownership Type
## Sources of MFA-UEC Relative Price Declines

<table>
<thead>
<tr>
<th>Margin</th>
<th>All</th>
<th>SOE</th>
<th>Domestic</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incumbent (I)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>-0.038</td>
<td>-0.021</td>
<td>-0.010</td>
<td>-0.007</td>
</tr>
<tr>
<td>Across</td>
<td>-0.034</td>
<td>-0.022</td>
<td>-0.008</td>
<td>-0.004</td>
</tr>
<tr>
<td>Total</td>
<td>-0.072</td>
<td>-0.042</td>
<td>-0.018</td>
<td>-0.011</td>
</tr>
<tr>
<td>Entrant (N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-0.080</td>
<td>-0.025</td>
<td>-0.032</td>
<td>-0.022</td>
</tr>
<tr>
<td>Exiter (X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.065</td>
<td>0.035</td>
<td>0.028</td>
<td>0.002</td>
</tr>
<tr>
<td>Total (I+N-X)</td>
<td>-0.217</td>
<td>-0.102</td>
<td>-0.078</td>
<td>-0.036</td>
</tr>
</tbody>
</table>

### Percent of Total Price Decline

<table>
<thead>
<tr>
<th>Margin</th>
<th>All</th>
<th>SOE</th>
<th>Domestic</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incumbent (I)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>17</td>
<td>10</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Across</td>
<td>16</td>
<td>10</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>20</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Entrant (N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>12</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Exiter (X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>16</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Total (I+N-X)</td>
<td>100</td>
<td>47</td>
<td>36</td>
<td>16</td>
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</tbody>
</table>

Notes: Top panel decomposes 2004 to 2005 relative MFA-UEC versus OTC-UEC price changes by margin of adjustment and ownership. Bottom panel reports the contribution of each change as a percent of the overall change, i.e., incumbents plus entrants less exiters. Results exclude product-country pairs with total price changes below and above the first and ninety-ninth percentiles, respectively.

Table 6: Decomposition of MFA-UEC vs OTC-UEC Export Price Declines Between 2004 and 2005
<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Intensive</th>
<th>Extensive</th>
<th>Total</th>
<th>Intensive</th>
<th>Extensive</th>
<th>Total</th>
<th>Intensive</th>
<th>Extensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1{\text{MFA}_{ch}})</td>
<td>-0.216***</td>
<td>-0.072***</td>
<td>-0.145***</td>
<td>-0.210***</td>
<td>-0.101***</td>
<td>-0.109***</td>
<td>-0.162***</td>
<td>-0.090***</td>
<td>-0.072**</td>
</tr>
<tr>
<td></td>
<td>0.018</td>
<td>0.007</td>
<td>0.016</td>
<td>0.033</td>
<td>0.016</td>
<td>0.026</td>
<td>0.037</td>
<td>0.017</td>
<td>0.030</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.0415</td>
<td>0.0339</td>
<td>0.0246</td>
<td>0.51</td>
<td>0.463</td>
<td>0.512</td>
<td>0.516</td>
<td>0.466</td>
<td>0.518</td>
</tr>
<tr>
<td>Observations</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
<td>2,603</td>
</tr>
<tr>
<td>Fixed effects</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
<td>HS,Country</td>
<td>HS,Country</td>
<td>HS,Country</td>
</tr>
<tr>
<td>Margin Contribution</td>
<td>.</td>
<td>0.33</td>
<td>0.67</td>
<td>.</td>
<td>0.48</td>
<td>0.52</td>
<td>.</td>
<td>0.56</td>
<td>0.44</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Intensive</th>
<th>Extensive</th>
<th>Total</th>
<th>Intensive</th>
<th>Extensive</th>
<th>Total</th>
<th>Intensive</th>
<th>Extensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1{\text{MFA}<em>{ch}} \times 1{\text{Fill Rate}</em>{ch}&lt;0.95})</td>
<td>-0.206***</td>
<td>-0.071***</td>
<td>-0.135***</td>
<td>-0.206***</td>
<td>-0.102***</td>
<td>-0.104***</td>
<td>-0.159***</td>
<td>-0.091***</td>
<td>-0.068**</td>
</tr>
<tr>
<td></td>
<td>0.019</td>
<td>0.007</td>
<td>0.017</td>
<td>0.034</td>
<td>0.017</td>
<td>0.027</td>
<td>0.038</td>
<td>0.018</td>
<td>0.031</td>
</tr>
<tr>
<td>(1{\text{MFA}<em>{ch}} \times 1{\text{Fill Rate}</em>{ch}&gt;0.95})</td>
<td>-0.271***</td>
<td>-0.075***</td>
<td>-0.196***</td>
<td>-0.236***</td>
<td>-0.095***</td>
<td>-0.140***</td>
<td>-0.187***</td>
<td>-0.084***</td>
<td>-0.104**</td>
</tr>
<tr>
<td></td>
<td>0.027</td>
<td>0.010</td>
<td>0.023</td>
<td>0.046</td>
<td>0.020</td>
<td>0.038</td>
<td>0.050</td>
<td>0.021</td>
<td>0.042</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.042</td>
<td>0.034</td>
<td>0.026</td>
<td>0.510</td>
<td>0.463</td>
<td>0.513</td>
<td>0.517</td>
<td>0.466</td>
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</tr>
<tr>
<td>Fixed effects</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>HS</td>
<td>HS</td>
<td>HS</td>
<td>HS,Country</td>
<td>HS,Country</td>
<td>HS,Country</td>
</tr>
<tr>
<td>Margin Contribution</td>
<td></td>
<td></td>
<td></td>
<td>0.35</td>
<td>0.65</td>
<td></td>
<td>0.49</td>
<td>0.51</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>0.28</td>
<td>0.72</td>
<td></td>
<td>0.41</td>
<td>0.59</td>
<td></td>
<td>0.88</td>
<td>0.45</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Notes: Top panel reports OLS regression of overall product-country price change or the change due to the intensive or net extensive margin on an indicator of whether the product-country is subject to a quota. Bottom panel reports results of a similar regression but with separate indicator variables of whether the product-country is subject to a binding quota, i.e., whether the fill rate exceeds 95 percent. Middle panels include product fixed effects and right panels include product and country fixed effects. The final row of the top and bottom panels report the contribution of the intensive and extensive margins to the total estimated average price change. Regression sample restricted to MFA-UEC and OTC-UEC product-country pairs; most of these pairs drop out when adding product and country fixed effects. Standard errors are clustered at the product level. Significance: * 0.10; ** 0.05; *** 0.01.
Table 8: Aggregate TFP Gain Following Quota Removal

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State-Owned Enterprises</td>
<td>0.82</td>
<td>-21%</td>
<td>-0.174</td>
<td>-11%</td>
<td>-0.088</td>
</tr>
<tr>
<td>Private Enterprises</td>
<td>1.76</td>
<td>13%</td>
<td>0.234</td>
<td>9%</td>
<td>0.155</td>
</tr>
<tr>
<td>Foreign Enterprises</td>
<td>1.54</td>
<td>8%</td>
<td>0.125</td>
<td>2%</td>
<td>0.030</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>0.185</td>
<td></td>
<td>0.097</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Table decomposes aggregate productivity by ownership for MFA-UEC (panel 2) and OTC-UEC (panel 3). See text for a description of how productivity measures are calculated. The first column reports mean TFP relative to the industry mean for each ownership type. These averages correspond to the averages reported in the corresponding figure. The 2004-05 changes in market share in the first column of panels 2 and 3 are taken from Table 2. The second and third columns in each panel multiply the change in market share with the average productivity measure. The final row in each panel is the sum of first three rows.

Figure 1: Numerical Solution: Change in Exporters’ Average Productivity
Figure 2: Export Growth by Year, Group and Margin
Figure 3: MFA-UEC Incumbents’s 2004-5 Change in Market Share vs Initial 2004 Level

Figure 4: Average 2004 to 2005 Change in Quantity-Based Market Share, MFA-UEC vs OTC-UEC
Average 2004 to 2005 Price Change
By Group

Note: Product-countries in first and ninety-ninth percentiles are dropped from each distribution.

Figure 5: Average Export Price Growth Across Product-Country Pairs, by Group

MFA-UEC Firm Prices Relative to 2004-5 Average
By Margin

First and ninety-ninth percentiles are dropped from each distribution.

Figure 6: MFA-UEC Export Prices Relative to the Average Export Price Across All Firms in 2004 and 2005, by Margin
Figure 7: Exiters versus Entrants in 2005 OTC-UEC and 2004 MFA-UEC
First and ninety-ninth percentiles are dropped from each distribution. Collective firms are excluded.

Figure 8: Textile and Apparel Producers’ TFP, 2005

Figure 9: Counterfactual TFP under Inefficient Allocation
Average 2004 to 2005 Quality Change
By Group

Note: Product-countries in first and ninety-ninth percentiles are dropped from each distribution.

Figure 10: Average Export Quality Growth Across Product-Country Pairs, by Group