Gains From Removing Trade Barriers and the Institutions that Manage Them: Evidence from China*

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Abstract

Trade liberalization may also eliminate inefficient institutions created to manage the trade barriers, increasing the gains from trade. We investigate the decline in productivity associated with misallocation of quota licenses among Chinese textile and clothing exporters. When quotas are removed in 2005, Chinese export value and quantity surge and export prices decline. These reactions are driven by the extensive margin: entrants gain market share at the expense of incumbent state-owned enterprises, and enter with relatively low prices. We show that these trends are inconsistent with an assignment of quota licenses on the basis of firm productivity, and estimate that a substantial share of the productivity gain China experienced following quota removal is due to the elimination of its quota licensing institution.

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1 Introduction

Standard models of international trade generally predict relatively small welfare gains from trade liberalization.[1] Empirical research, on the other hand, often finds substantial increases in productivity or income coinciding with the removal of trade barriers.[2] One explanation for this discrepancy is that removing a particular tariff or non-tariff barrier to trade also eliminates (un-modeled) public 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.[3] If such policies influence how resources are allocated among existing firms, or favor incumbents at the expense of entrants, they can have a sizable affect 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 the part accounted for by the export licensing regime that managed the allocation of quotas. We analyze China's textile and clothing industry before and after the 2005 expiration of the global Agreement on Textiles and Clothing (ATC), previously known as the Multifiber Arrangement (MFA).[4] Under the MFA/ATC, 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. 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 of China's assignment of export licenses is guided by a model of "efficient allocation" adapted from Irarrazabal et al. (2010), which introduces 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 "inefficient" allocation, where the government subsidizes the export licenses of politically favored but less efficient firms, for example state-owned enterprises. Under this regime, the most productive firms are not necessarily the ones who export under the quota regime.

In the efficient allocation model, the exports of the most productive incumbents jump disproportionately once quotas are removed. This asymmetric reaction by the "inten-

[1] See, for example, Eaton and Kortum (2002) and Arkolakis et al. (2010).

[2] See, for example, Pavcnik (2002) or Feyrer (2010).

[3] For example, Djankov, Freund and Pham (2010) report that it takes 116 days to move an export container from a factory in Bangui (Central African Republic) to the nearest port and fulfill all customs, administration and port requirements.

[4] 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 world-wide exports (which equaled $487 billion dollars in 2005).

sive" margin is driven by removal of the per-unit license fees, which, under efficient allocation, impose a greater distortion on high-productivity firms' low-priced exports than low-productivity firms' high-priced exports.[5] 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, however, 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 market or even induce exit 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.

Empirically, we employ a differences-in-differences strategy to examine how Chinese exporters react to the removal of quotas in 2005. In particular, we compare the behavior of firms exporting quota-constrained textile and clothing products to exporters of very similar textile and clothing products that are exported quota free. These comparisons isolate 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, are subject to quotas in 2004, while exports of "silk slips", were not.[6] Contrasting their growth in the years before and after quotas are removed allows us to control for shocks to supply or demand, such as privatization, that are common to both goods.

As expected, China's exports of previously constrained textile and clothing products jump in 2005, while their prices decline.[7] In contrast to the efficient allocation model, however, we find 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 21.7 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, these incumbents should 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 (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.

Removal of the Chinese government's bias towards low-productivity SOEs gives rise to an additional source of aggregate productivity growth during quota liberalization. This channel is often ignored by traditional trade models, which presume a productivity maximizing allocation of resources conditional on the trading regime. Our results highlight that removing trade barriers concomitantly eliminates inefficiencies associated with the management of those barriers. We quantify the relative contribution of this channel in our context using numerical solutions of the model to compare productivity growth caused by quota liberalization in the case of efficient allocation to the growth experienced after "inef-

[5]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.

[6]These women's products correspond to HS codes 62081920 and 62081910, respectively.

[7]Brambilla et al. (2010) and Harrigan and Barrows (2009) document the surge in Chinese textile and clothing exports as well as the reallocation of textile and clothing exports across countries following quota removal in 2005.

ficient allocation". In the efficient allocation model, productivity growth is dominated by the intensive margin and aggregate productivity increases XXX percent. Examination of various forms of inefficient allocation give rise to aggregate productivity growth of XXX to XXX percent, and larger contributions by the extensive margin as high-productivity entrants displace low-productivity political favorites. These counter-factual estimates imply that XXX to XXX percent of the overall productivity gain associated with quota liberalization is due to the elimination of China's inefficient export licensing regime.

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.[8] As a result, the relative price decline associated with the extensive margin in 2005 could reflect the entry of low-quality exporters. However, the fact that entrants are drawn from the private sector and are 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[9], and such a model might rationalize a connection between entry by high-productivity firms and quality downgrading, it would still imply inefficient allocation of licenses under quotas.

The research in this paper contributes to the growing set of papers that use micro-data to estimate the effects of market distortions on existing firms. Research in this area often focuses on how resources are allocated among existing firms.[10] Identification of misallocation along the extensive margin, however, has received relatively little empirical attention despite its potentially large importance.[11] Our results also contribute to this literature by relying on weaker assumptions to identify misallocation. 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.[12] In the difference-in-difference strategy used here, by contrast, we assume identical technology only across similar types of textile and clothing products, e.g., silk versus cotton slips.

The affect 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 Dulfo (2004), for example, use an exogenous change in the supply of credit to specific firms to iden-

[8]See Falvey (1979), Krishna (1988) and Feenstra (1988) for early theoretical research on this issue, and Aw and Roberts (1985), Feenstra (1988) and Feenstra and Boorstein (1991) for early empirical investigations of quality upgrading in footwear, autos and steel, respectively. More recently, Harrigan and Barrows (2009) find evidence of quality downgrading in U.S. textile and clothing imports following the removal of MFA/ATC quotas.

[9]This would occur when the benefits to quality upgrading exceed the cost. See Baldwin and Harrigan (2010), Johnson (2010), Mandel (2010), and Kuger and Verhoogen (2010).

[10]See, for example, Hseih and Klenow (2009), Dollar and Wei (2007), Restuccia and Rogerson (2010), Alfaro, Charlton, and Kanczuk (2008), Midrigan and Xu (2010), and Petrin and Sivadasan (2010).

[11]A recent exception is Chari (2010), which analyzes the aggregate productivity effects of firm entry and size restrictions under India's industrial licensing policy.

[12]For example, Bloom and Van Reenan (2007) find that many entrepreneurs in developing countries do not adopt best practices, such as lean manufacturing. One potential explanation is that this entrepreneurial characteristic is itself a technology that is slow to diffuse across countries.

tify 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 affect of this extensive-margin misallocation on aggregate productivity could be quite large.[13] We find empirical evidence for these large effects in the context of a precisely defined government institution.

Our findings also contribute to recent evaluations of the MFA/ATC regime using more aggregate data by Brambilla et al. (2010) and Harrigan and Barrows (2009). Harrigan and Barrows (2009), for example, estimate that the annual cost of the quota constraints on consumers in the United States is approximately 90 dollars per household. Here, we concentrate on how quotas affect the exporting country, and distinguish between losses caused by quotas versus the management of those quotas (Krishna and Tan 1998, Anderson 1987). Our results demonstrate that government policy 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.

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 and 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 discusses alternate interpretations of our findings, including whether the price movements we observed are consistent with quality downgrading. Section 7 concludes.

2 Theory

In this section we outline a simple, "efficient-allocation" model of exporting under quotas to guide our empirical analysis. Our goal is to derive firm-level implications for how exports respond to the removal of quotas assuming they are allocated to the most productive exporters prior to their removal.

The model delivers two key results. The first is that the removal of quotas induces *less* productive firms to enter the export market. The second is that even with this entry, the preponderance of export growth and price declines following quota removal 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 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' prices. In demonstrating these implications, we use numerical solutions where analytic results are not possible.

2.1 Exporting 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. We assume that quota license fees are equivalent to

[13] Banerjee 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.

per-unit increases in the cost of exporting.[14]

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 $a_{od} > 0$ per unit exported as well as an *ad valorem* tariff $\tau_{od} > 1$ of the value of the product exported. The price of variety φ in export market d is given by[15]

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

where $\sigma > 1$ is the constant elasticity of substitution across varieties[16] and ω_d is the wage in the home country.[17] The corresponding export quantities are given by

$$q_{od}(\varphi, a_{od}) = \left(\frac{\sigma}{\sigma - 1}\omega_d \right)^{-\sigma} \left(\frac{\tau_{od}}{\varphi} + a_{od} \right)^{-\sigma} (P_d)^{\sigma-1} Y_d \tag{2}$$

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

We assume the government does not know the productivity of firms and therefore allocates quotas based upon an auction that charges a common price to any firm who wishes to export.[18] The license price is found by equating the quota size Q_{od}, determined through bilateral negotiations between the producer and destination countries, and the sum of exports from o to d: $\int_{\varphi^*} q_{od}(\varphi, a_{od}) g(\varphi) d\varphi = Q_{od}$. Lower license prices connote less restrictive quotas, and *vice versa*.

A productivity cutoff,

$$\varphi^*_{od} = \left[\lambda \left(\frac{f_{od}}{Y_d} \right)^{\frac{1}{1-\sigma}} \frac{P_d}{\omega_o \tau_{od}} - \frac{a_{od}}{\tau_{od}} \right]^{-1}, \tag{3}$$

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

For $a_{od} > 0$, there is no closed-form solution for the price index $P_d = P_d(\varphi^*_{od})$ in equation 3 (Irarrazabal et al. 2010). To fix ideas, for the remainder of this subsection we assume the price index is insensitive to changes in the license fee, i.e., that the exporting country is "small" relative to the foreign country.[19] 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 falls with quota liberalization. Depending on the magnitude of the decline, the cutoff could rise, implying that the least-productive exporters exit. In the numerical analysis below, we allow for this potential general equilibrium response.

[14] Demidova, Kee and Krishna (2009) also model quota licenses as a specific tariff in their analysis of Bangladeshi garment exporters.

[15] Productivities are drawn from the distribution $G(\varphi)$ with density $g(\varphi)$.

[16] 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.

[17] Wages are pinned down by a perfectly competitive, freely traded transport sector operating under constant returns to scale.

[18] Under full information, the government could allocate quotas by offering the most productive firm the opportunity to fill as much of the quota as feasible given its capacity constraints, and then moving down the productivity distribution until the quota is filled. In this setting, export growth following quota removal occurs entirely along the extensive margin, as lower-productivity exporters enter the previously constrained market.

[19] Berman, Martin and Mayer (2009) adopt a similar, small-country assumption in their model with per-unit costs, which are interpreted as distribution costs.

When license fees are zero, the ratio of output quantities between any two firms with productivities $\varphi > \varphi'$ is independent of *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,

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

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 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,

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

The intuition for this relationship is straightforward. As the license price falls and φ^* declines, less-productive firms enter the export market, driving down the average productivity of all exporters. As an individual firm's productivity is fixed by assumption, there is no change in the average productivity of incumbents.

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

$$\frac{\partial\widetilde{\varphi}}{\partial a} = \underbrace{\frac{1}{1-G(\varphi^*)}\int_{\varphi^*}\frac{\partial\left[q(\varphi)/Q\right]}{\partial a}\varphi g(\varphi)d\varphi}_{\text{Intensive}} \tag{7}$$
$$+\underbrace{\frac{g(\varphi^*)}{1-G(\varphi^*)}\frac{\partial\varphi^*}{\partial a}\left[\widetilde{\varphi}(\varphi^*)-\varphi^*\frac{q(\varphi^*)}{Q}\right]}_{\text{Extensive}}$$

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.[20] The average price of exports is given by

[20]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 examine this issue in greater detail below.

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

Here, the removal of quotas implies an *increase* in the average price of exports, net of the impact of removing the license fee

$$\frac{\partial \overline{p}}{\partial a} = \underbrace{\frac{\sigma}{\sigma - 1}}_{\text{Intensive}} + \underbrace{\frac{g(\varphi^*)}{1 - G(\varphi^*)} \frac{\partial \varphi^*}{\partial a} [\overline{p} - p(\varphi^*)]}_{\text{Extensive}}. \tag{9}$$

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

$$\frac{\partial \widetilde{p}}{\partial a} = \underbrace{\frac{1}{1 - G(\varphi^*)} \int_{\varphi^*} \frac{\partial \left[p(\varphi) q(\varphi)/Q \right]}{\partial a} \varphi g(\varphi) d\varphi}_{\text{Intensive}} \tag{10}$$
$$+ \underbrace{\frac{g(\varphi^*)}{1 - G(\varphi^*)} \frac{\partial \varphi^*}{\partial a} \left[\widetilde{p}(\varphi^*) - \frac{q(\varphi^*) p(\varphi^*)}{Q} \right]}_{\text{Extensive}}$$

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, i.e., $a_{od} > 0$. As a consequence, we use numerical solutions to derive implications that do not rely upon a "small-economy" assumption.[21] 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).[22] The iceberg cost within the home countries are 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 γ. This shape parameter and the fixed cost of exporting are chosen to match the distribution

[21] We are grateful to Andreas Moxnes for providing the Matlab code used to derive the numerical solutions in Irarrazabal et al. (2010). We modify their code by adding the quota constraint. The modified code solves for an equilibrium license fee given this constraint.

[22] In the model, the asymmetric import shares capture the fact that wages in the US are higher than in China.

of exports and the fraction of exporters.[23] The calibration yields a shape parameter of 3.8 and a ratio of export fixed cost to domestic fixed costs 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 and recover the implied license fee after imposing steadily more restrictive quotas. We measure quota restrictiveness in terms of the percent of the exporting country's exports in the quota-free equilibrium, so that lower shares imply greater restrictiveness. We note that in the model imposing a quota restrictiveness of 56 percent yields export growth that we attribute to the removal of quotas in the data.

The solid curve in Figure 1 plots the home country's change in average productivity after liberalization against the restrictiveness of the quota. 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 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.

3 A Brief Summary of the MFA

The Mulifiber Arrangement (MFA) and its successor, the Agreement on Textile and Clothing (ATC), 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 and Canada (the "UEC"). 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 in 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. The fact that Phase IV goods were chosen in 1995 implies that they can be treated as exogenous in our analysis in the sense that they are 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.

China's assignment of quota licenses is opaque. Like other countries subject to quotas under the MFA, the government allocated licenses to firms predominantly on the basis of

[23] We calibrate the parameters using exports of textile and clothing products were subject quotas, but the export distribution in 2005, the year after quotas are removed. The share of exports accounted for by the 50th, 75th, 90th, 95th and 99th percentiles are 2, 8, 16, 14, 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.

past performance, though published sources indicate that 20 to 30 percent of the quota in a subset of MFA was allocated through an auction.[24] We do not know how these auctions were conducted, but do know that only firms with prior approval to export by the Ministry of Commerce were allowed to participate.

4 Reallocation Following Quota Removal

The model of efficient allocation developed above serves as our null hypothesis and guides our empirical analysis. 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 data by firm, eight-digit Harmonized System (HS) category and destination country.[25] For each firm-product-country observation, we observe the total nominal value and quantity traded as well as the information about the ownership of the firm. We use this information to classify firms into three ownership categories: state-owned enterprises ("SOEs"), domestically owned private firms ("domestic") and foreign-owned private firms ("foreign").[26]

Quantity units, available for 99 percent of observations representing 99 percent of export value, vary across products. The availability of both value and quantity permits construction of nominal unit values or "prices" (p), for example, dollars per piece or dollars per square meter of fabric. As documented in previous research, e.g., 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 are separated 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".[27] Within a country, products are partitioned into three types: textile and clothing products subject to a quota in 2004 (MFA), other textile and clothing products not subject to a quota in 2004 (OTC), and non-textile and clothing products like electronics and steel (NTC).[28]

[24] *[Insert website citations here.]*

[25] These data are used by Ahn et al. (2010). They are consistent with aggregate Chinese export totals available elsewhere from public sources. Total exports in our data in 2005, for example, are 777 billion dollars versus 762 billion dollars in Comtrade. The match with Comtrade at lower levels of aggregation, e.g., two-digit HS categories, is also consistent. Chinese trade data are collected using eight-digit HS codes, i.e., they are the most detailed available.

[26] The customs data classify firms into seven ownership categories that we collapse to the three categories. State-owned firms remain classified as "SOEs"; collective-owned, other and private domestic constitute the "domestic" firms; and foreign-exclusive owned, and two joint venture classifications are treated as "foreign".

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

[28] As discussed earlier, quotas were relaxed on some of China's textile and clothing goods in 2002 as part of its entry into the WTO in 2001. As our focus is on the reallocation of exports that occurs after any remaining quotas are removed in 2004, the products retired 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

A given product-country is assigned to one of the six resulting $\{ROW, UEC\} \times \{MFA, OTC, NTC\}$ groups. Exports to ROW belong to MFA-ROW, OTC-ROW or 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 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.[29]

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-difference" 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.

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 a certain percentage. Using data on the level of U.S., EU and Canadian quotas available from websites maintained by each country, we find that 81, 56, and 32 percent of the 1,017 product country observations in the MFA-UEC group have fill rates exceeding 85, 90 and 95 percent in 2004, respectively.[30]

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.[31] Likewise, the MFA-

the number of products in each class 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.

[29] 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.

[30] Data on U.S., EU and Canadian quotas are obtained from *[note sources]*.

[31] As discussed in Brambilla et al. (2009), 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. The relatively high value growth displayed before 2004 in Table 1reflects a combination of this growth in quantity as well as sizable increases in prices.

UEC group's 2005 growth is substantially larger than the growth exhibited by OTC-UEC and MFA-ROW, which increase 32 and 4 percent in 2005, respectively.

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.[32]

Table 2 reports export value market shares by firm ownership type and product-destination group in 2004 (top panel) and 2005 (middle panel), 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 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.[33] 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 incumbents.

4.3 Margins of Adjustment

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

MFA-UEC export growth following quota removal 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.[34] As illustrated in the top panel of Figure 2, 73 percent of the 10.7 billion dollar growth in

[32]We note that a firm may appear in more than one group in Table 1if it exports in multiple product classes or if it exports to both ROW and UEC. We find that less than 5 percent of MFA-UEC exporters representing an even smaller fraction of MFA-UEC exports are active only in that group. Indeed, depending on the year, 82 to 88 percent of MFA-UEC exporters also export in MFA-ROW. Overlap with other groups, e.g., OTC-UEC is lower, on the order of 50 to 60 percent of firms. In our model, we treat multiple-product firms as single-product firms that manufacture different varieties.

[33]In fact, in unreported results, we find even greater growth in exports and exporters among product-country pairs whose fill rates exceed 95 percent.

[34]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.

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 OTC-UEC 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.[35] Instead, we first compute and decompose quantity growth for each product-country pair in MFA-UEC, and then report the mean growth and mean contribution of each margin across product-country pairs, excluding outliers.[36] As indicated in the bottom panel of Figure 2, 86 percent of MFA-UEC quantity growth between 2004 and 2005 is driven by the extensive margin, versus 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.[37] The top panel of Figure 3 plots incumbent firms' change in quantity-based market share between 2004 and 2005 against their market share in 2004, by type of firm. The bottom panel summarizes these data using lowess smoothing. In contrast to the efficient allocation model, large SOEs lost relatively more market share than large privately owned firms, foreign or domestic.

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. 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").[38] The first column of the table reveals that incumbents' quantity-based market share declines an average of 22 percentage points across MFA-UEC product-destination pairs in the year quotas are removed. This decline is (necessarily) offset by a 22 percentage point gain by net entrants. Of this gain, adders and new exporters contribute 67 and 7 percent, respectively, while exiters account for -51 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 21 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.[39] 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 27 percent market share, new exporters contribute less than half a percent, and the overall negative contribution of net entry reinforces the loss of market share by incumbents. Among privately owned

[35] While it is possible to measure the quantity of many MFA products in "square meter [of fabric] equivalents", that is not true for textile and clothing goods more generally. Likewise, a variety of non-compatible units are used to track the quantities of non-textile-and-clothing products.

[36] We exclude observations outside the 5^{th} and 95^{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.

[37] 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.

[38] As defined here, adders may or may not remain in the product-country combination they exported in 2004.

[39] Price changes explain the difference between the 18 percent decline in SOEs' average quantity-based market shares in Table 3 and their 13 percent decline in value-based market share in Table 2.

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 2 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. At the same time, net entry by privately owned firms is 6 percentage points higher in MFA-UEC than in OTC-UEC.

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.

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 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 ($\overline{P}_{hct}$) across all exporting firms using their quantity market shares (θ_{fhct}) as weights,

$$\bar{P}_{hct} = \sum_f \theta_{fhct} p_{fhct}. \tag{11}$$

Then, for each product-country pair, we compute the percent change between years t and $t-1$, $\Delta\bar{P}_{hct} = \left(\overline{P}_{hct} - \overline{P}_{hct-1}\right)/\overline{P}_{hct-1}$. Each bar in Figure 5 displays the mean of $\Delta\bar{P}_{hct}$ across all product-country pairs in the group, excluding outliers.[40] 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.[41]

Figure 6 compares the normalized export prices of entrants to exiters and incumbents.[42] 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, $p_{fhc2005}/\overline{P}_{hc}$, where

$$\overline{P}_{hc} = \frac{1}{2}\left(\overline{P}_{hc2004} + \overline{P}_{hc2005}\right). \tag{12}$$

[40] 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.

[41] The MFA-UEC price decline in 2005 is also sharp relative to that group's average price *growth* of 16 percent between 2003 and 2004.

[42] We normalize prices to facilitate comparisons across products with different units.

For exiters, the normalized export price is the ratio of the firm's 2004 export price to the same mean, $p_{fhc2004}/\overline{P}_{hc}$. 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. To the extent that these differences do not reflect variation in quality (more on this below), these relatively high prices provide intuition for the loss of incumbent 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 method for analyzing productivity gains 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 "within" and "across" components for each margin:

$$\Delta\bar{P}_{hct} = \frac{1}{\overline{P}_{hct-1}}\Bigg[\underbrace{\sum_{f\in I}\overline{\theta}_{fhc}\left(p_{fhct}-p_{fcht-1}\right)}_{\text{Incumbent: Within}} + \underbrace{\sum_{f\in I}\left(\theta_{fhct}-\theta_{fhct-1}\right)\left(\overline{p}_{fhc}-\overline{P}_{hc}\right)}_{\text{Incumbent: Across}}\Bigg] \tag{13}$$
$$+\frac{1}{\overline{P}_{hct-1}}\Bigg[\underbrace{\sum_{f\in N}\overline{\theta}_{hct-1}\left(p_{fhct}-\overline{P}_{hc}\right)}_{\text{Entrant: Within}} + \underbrace{\sum_{f\in N}\left(\theta_{fhct}-\overline{\theta}_{hct-1}\right)\left(p_{fhct}-\overline{P}_{hc}\right)}_{\text{Entrant: Across}}\Bigg]$$
$$-\frac{1}{\overline{P}_{hct-1}}\Bigg[\underbrace{\sum_{f\in X}\overline{\theta}_{hct-1}\left(p_{fhct-1}-\overline{P}_{hc}\right)}_{\text{Exiter: Within}} + \underbrace{\sum_{f\in X}\left(\theta_{fhct-1}-\overline{\theta}_{hct-1}\right)\left(p_{fhct-1}-\overline{P}_{hc}\right)}_{\text{Exiter: Across}}\Bigg].$$

As above, θ 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.[43] $\overline{\theta}_{hct-1}$ is the mean quantity-based market share across firms in product-country pair hc in year $t-1$, while $\overline{\theta}_{fhc}$ is the average market share of firm f in hc across both years, i.e., $\overline{\theta}_{fhc} = \left(\overline{\theta}_{fhct}+\overline{\theta}_{fhct-1}\right)/2$. Finally, $\overline{p}_{fhc}$ 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 measures the price change of incumbent exporters holding their market share fixed. The

[43] We do not break entrants into adders versus new exporters given the relatively small market share of new entrants (see Table 3).

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 $(\overline{p}_{fhc} - \overline{P}_{hc})$. 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 $\Delta\bar{P}_{hct}$.

The second term in square brackets captures the entry margin. Its within component compares entrants' prices to the across-year average holding their market share fixed at the previous period's average market share across all firms. The across component weights these same price differences according to entrants' relative size upon entry. If entrants have relatively low prices, the first term is negative. If entrants are also relatively small, the second component is positive, mitigating entrants' overall impact on $\Delta\bar{P}_{hct}$.

The third term in square brackets captures the exit margin, and its interpretation is analogous to the entry term. If exiters have relatively high prices compared to the across-year average and are also relatively small upon exit, the within and across components will be positive and negative, respectively. Note that the terms for the exit margin are *subtracted* from the two preceding terms.

Table 4 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).[44]

The first column of Table 4 reveals that the entrant and exiter margins account for 37 (-0.080/-0.217) and 29 (-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.

Examination of the within and across terms indicate that changes in price as well as changes in market share drive these contributions. The negative and equal within and across terms for the intensive margin reveal that MFA-UEC incumbents experienced larger price declines than OTC-UEC incumbents, and that MFA-UEC incumbents with high prices lost relatively more market share than high-priced OTC-UEC incumbents. The entry margin has negative and positive within and across terms, demonstrating that MFA-UEC entrants have relatively low prices compared to OTC-UEC entrants, and that they enter with relatively low market shares compared with OTC-UEC entrants. Despite these relatively low market shares, the net entry term as a whole is negative, indicating that the price declines dominate the relatively low shares upon entry.[45]

Interpretation of the exit margin is more complex. Though both MFA-UEC and OTC-

[44] Results in Table 4 drop the same product-country outliers as Figure 6.

[45] Note that even though the overall market share of entrants may be high, the market share of an individual entrant may be low.

UEC exiters have relatively low prices compared with the across-year mean (see Figures 6 and 7), MFA-UEC exiters' prices and market shares are both high relative to OTC-UEC exiters' prices and market shares. Indeed, MFA-UEC's relative market shares are so high, the across term dominates the within term, with the result that the exiter term overall contributes to the decline in the overall MFA-UEC relative price. Moreover, comparison of the within terms for entry and exit highlights the relatively low prices of entrants compared to exiters.

The remaining columns of Table 4 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 of the UEC, 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:

$$\Delta P_{hct} = \alpha_h + \alpha_c + \beta_1 1\{MFA_{hc}\} + \varepsilon_{hct}, \tag{14}$$

where α_h and α_c represent HS product and country fixed effects and $1\{MFA_{hc}\}$ is an indicator of whether the *product-country* pair is subject to a quota. The dependent variable is either the overall price decline (ΔP_{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 5. 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 4 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 5 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.

We note that an alternative interpretation of the price declines noted in this section is quality downgrading, but that any such interpretation remains inconsistent with efficient allocation of quotas under the MFA/ATC. 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 exiters. 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.

It is of course possible that high-productivity entrants choose to export low-price, low-quality goods in 2005.[46] While that scenario rationalizes the relative price and productivity evidence, however, it remains inconsistent with our model of efficient allocation, which has low-productivity firms entering the export market following quota liberalization.

4.5 Productivity

The previous section demonstrated 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 directly observe the productivity of the entrants. However, we do observe a key characteristics–firm ownership–for each firm and can therefore obtain a coarse back-of-envelope calculation of the productivity gain following the removals of quotas.[47]

Existing estimates of Chinese firms' productivity by 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 revenue-based total factor productivity (RTFP) is 41 percent lower for SOEs than for private firms.[48] Using the same data, Brandt and Zhu (2010) estimate even starker gaps – roughly twice the difference in RTFP – between the state and non-state sectors.[49]

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, Van Biesebroeck

[46]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.

[47]In principle, one could merge the customs data with China's Annual Survey of Industrial Production which records firm characteristics such as outputs an 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.

[48]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.

[49]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.

and Zhang (2009), we estimate RTFP using a Tornqvist index number approach,

$$\ln(RTFP_f) = (va_f - \overline{va}) - \widetilde{s}_f(l_f - \bar{l}) - (1 - \widetilde{s}_f)(k_f - \bar{k}), \tag{15}$$

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.[50] The weight on wages is $\widetilde{s}_f = (s_f + \overline{s})/2$, where s_f is the share of wages in total value added by each firm and $\overline{s}$ is the average across firms. The RTFP 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 employee benefits (unemployment insurance, housing subsidies, pension and medical insurance), and the capital is reported capital stock at original purchase prices less accumulated depreciation.

Figure 8 plots the distribution of textile and clothing exporters' RTFP 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. This means that private sector textile and clothing exporters are between 72 and 88 more productive than SOEs.

Table 6 combines these TFP averages with the market share changes noted above to provide a very coarse, back-of-envelope calculation of the productivity gain following 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 across 2004 to 2005, the change in aggregate TFP implied by these market share changes is reported in column three. The implied aggregate TFP growth is 18.5 percent. A similar exercise for OTC-UEC in the right panel implies an aggregate TFP growth of 9.7 percent, yielding a difference-in-difference estimate of the productivity gain caused by quota liberalization of 8.8 percent. This relative gain is consistent with the price-analysis evidence presented above, which indicates that SOEs are substantially less efficient than firms in the private sector.

While this estimate of the productivity gain following quota liberalization is illustrative, it ignores two potential sources of reallocation along the extensive margin. The first is disproportionate growth of high-productivity firms following quota removal, which occurs even if quotas were allocated efficiently prior to their removal. The second is the entry of firms previously excluded from MFA-UEC exports due to inefficient allocation.

The calculation also does not decompose the productivity gain into the direct effect caused by the quotas and the indirect effect due to the inefficient management of the license assignment. In the next section we use numerical solutions of our model to examine the relative magnitude of these gains.

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, includ-

[50] See Van Biesebroeck (2007) for an extensive discussion of various approaches for estimating TFP.

ing asymmetric iceberg transportation costs and the assumption that firm productivity is Pareto distributed.[51]

As noted above, 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 MFA-OTC, 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 an efficient allocation of quota licenses, aggregate TFP among exporters is 6.73. This implies that removing efficiently allocated quotas increases aggregate TFP among exporters by 57 percent. This large gain is driven by the fact that the removal of the licenses disproportionately benefits high productivity firms. Since the distribution of exports is highly skewed, expansion of these firms implies large efficiency gains.

We next examine productivity under an allocation scheme that was not based purely on firm efficiency (the "inefficient allocation" equilibrium). Given that we do not know how the Chinese government allocated export licenses to domestic textile and clothing producers, we develop a model of inefficient allocation and compare its implications under various parameter values to outcomes observed in the actual trade data.

The simplest way to model the inefficient allocation is to assume that the government randomly distributes the quota equally to N firms. We pick a firm i's "political connection" $\pi_i \in U[0,1]$ and choose the N firms with the π's. We consider different correlations of π with firms' productivity. N is chosen to match the growth in the number of exporters observed in the data. Table 1 indicates that relative growth in the number of exporters in MFA-UEC compared to OTC-UEC is 57 percent. According to Figure 3, the contribution of the net extensive margin to export growth in MFA-UEC compared to OTC-UEC was 34 percent. We therefore choose the corresponding inefficient allocation to matches this contribution of the net extensive margin.

Figure 10 plots aggregate TFP against the net extensive margin where each point reflects the correlation of the political connection and firm TFP. The figure shows that as the correlation between the political connection draw and firm productivity is reduced, aggregate TFP falls and there is a greater contribution of the extensive margin growth with quota liberalization. Matching with the observed 34 percent extensive margin growth, we infer that there was roughly a 21 percent correlation between firm productivity and the government assignment. The resulting productivity is 1.50. This means that going from the inefficient allocation to no quotas implies a TFP gain of 605 percent. These numbers imply that simply moving from an inefficient allocation of the quotas to an efficient one would have increased productivity by 350 percent. In other words, moving from the inefficient allocation to an efficient allocation would have contributed to 58 percent of the overall change in firm productivity.

6 Conclusion

To be completed.

[51] We set the Pareto shape parameter equal to 3.8 and an export-to-domestic fixed cost ratio of 2 to match the distribution of exports and fraction of exporters in 2005, respectively. The range of the Pareto distribution is bounded from below by 1. We assume symmetric country sizes and set $L_{US} = 100$ and $L_{China} = 100$ and choose iceberg trade costs 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). The iceberg cost within the home countries are set to one. Finally, we assume an elasticity of substitution, $\sigma = 4$.

A Quality

We investigate quality downgrading by embedding consumer's preference for quality in the CES utility used in in our efficient allocation model.[52] 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,

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

and solve for the firm's relative quality

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

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 (1995), 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

$$\Lambda_{cht} = \sum_f \theta_{fcht} \frac{\lambda_{fcht}}{\bar{\lambda}_{cht}}, \tag{19}$$

where, as above, θ_{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 between years t and $t-1$ as $\Delta\bar{\Lambda}_{hct} = \left(\overline{\Lambda}_{hct} - \overline{\Lambda}_{hct-1}\right)/\overline{\Lambda}_{hct-1}$.

Each bar in Figure 9 displays the mean of $\Delta\bar{\Lambda}_{hct}$ across all product-country pairs in the noted group, excluding outliers.[53] 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.

[52] The following CES utility embeds quality λ is $U = \left(\int_{\omega\in\Omega} (\lambda(\omega)q(\omega))^{(\sigma-1)/\sigma} d\omega\right)^{\sigma/(\sigma-1)}$

[53] We drop product-country pairs whose quality changes are either below or above the first and ninety-ninth percentile, respectively.

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	ROW			US/EU/Can				
	NTC	OTC	MFA	NTC	OTC	MFA		Total
2000	104.8	8.8	27.3	79.5	6.2	4.8		231.4
2001	132.7	8.9	34.3	97.1	6.6	6.2		285.8
2002	153.0	8.9	37.0	112.4	7.9	6.5		325.6
2003	204.7	11.2	46.1	157.3	11.2	7.9		438.5
2004	283.6	13.9	55.8	217.1	14.3	8.9		593.6
2005	383.6	16.6	58.2	279.8	18.8	19.6		776.6
%Growth 2000-5	266	88	113	252	205	307		236
Annual %Growth 2000-4	28	12	20	29	23	17		27
%Growth 2004-5	35	19	4	29	32	119		31

	Number of Firms							
	ROW			US/EU/Can				
	NTC	OTC	MFA	NTC	OTC	MFA		Total
2000	37,500	10,225	11,973	24,044	5,298	3,536		47,413
2001	47,093	11,778	14,878	30,274	6,482	4,253		59,527
2002	61,583	14,447	19,169	39,309	9,652	5,911		78,612
2003	74,926	17,608	23,097	49,049	12,701	7,793		95,688
2004	94,919	22,548	29,216	63,085	16,554	9,523		120,535
2005	112,488	26,287	33,848	77,028	23,001	18,628		143,676
%Growth 2000-5	200	157	183	220	334	427		203
Annual %Growth 2000-4	26	22	25	27	33	28		26
%Growth 2004-5	19	17	16	22	39	96		19

Notes: Panels report annual export value 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 1: Export Value and Number of Exporters, by Product and Destination

	Value Market Share, 2004						
	ROW			US/EU/Can			
	NTC	OTC	MFA	NTC	OTC	MFA	Total
SOE	0.26	0.28	0.32	0.21	0.44	0.54	0.26
Domestic	0.15	0.28	0.32	0.13	0.29	0.24	0.17
Foreign	0.58	0.44	0.35	0.65	0.26	0.23	0.57
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Value Market Share, 2005						
	ROW			US/EU/Can			
	NTC	OTC	MFA	NTC	OTC	MFA	Total
SOE	0.23	0.24	0.27	0.18	0.36	0.38	0.22
Domestic	0.18	0.32	0.38	0.15	0.34	0.32	0.19
Foreign	0.60	0.44	0.35	0.67	0.30	0.30	0.59
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Difference in Value Market Share, 2005						
	ROW			US/EU/Can			
	NTC	OTC	MFA	NTC	OTC	MFA	MFA
SOE	-0.04	-0.04	-0.05	-0.03	-0.08	-0.16	-0.04
Domestic	0.02	0.04	0.06	0.02	0.05	0.09	0.02
Foreign	0.01	0.00	-0.01	0.02	0.04	0.07	0.02

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

Margin	All	SOE	Domestic	Foreign
Incumbents	-0.22	-0.17	-0.04	-0.02
Net Entry				
Exiters	-0.51	-0.32	-0.14	-0.05
Adders	0.67	0.27	0.26	0.13
New Exporters	0.07	0.00	0.05	0.02
Total Net Entry	0.22	-0.05	0.17	0.10
Total	0.00	-0.21	0.13	0.08

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

Sources of MFA-UEC Relative Price Declines				
Margin	All	SOE	Domestic	Foreign
Incumbent (I)				
Within	-0.037	-0.021	-0.009	-0.007
Across	-0.033	-0.022	-0.008	-0.004
Total	-0.070	-0.043	-0.017	-0.011
Entrant (N)				
Within	-0.384	0.022	-0.157	-0.249
Across	0.309	-0.046	0.128	0.226
Total	-0.075	-0.024	-0.029	-0.023
Exiter (X)				
Within	-0.213	-0.105	-0.076	-0.033
Across	0.272	0.137	0.100	0.035
Total	0.059	0.032	0.025	0.002
Total (I+N-X)	-0.204	-0.099	-0.070	-0.036

Percent of Total Price Decline				
Margin	All	SOE	Domestic	Foreign
Incumbent (I)				
Within	18	10	4	4
Across	16	11	4	2
Total	34	21	8	5
Entrant (N)				
Within	188	-11	77	122
Across	-151	23	-63	-111
Total	37	12	14	11
Exiter (X)				
Within	-104	-51	-37	-16
Across	133	67	49	17
Total	29	16	12	1
Total (I+N-X)	100	48	34	18

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 4: Decomposition of MFA-UEC vs OTC-UEC Export Price Declines Between 2004 and 2005

	Total	Intensive	Extensive	Total	Intensive	Extensive	Total	Intensive	Extensive
$1\{MFA_{ch}\}$	-0.216 ***	-0.072 ***	-0.145 ***	-0.210 ***	-0.101 ***	-0.109 ***	-0.162 ***	-0.090 ***	-0.072 **
	0.018	0.007	0.016	0.033	0.016	0.026	0.037	0.017	0.030
R-squared	0.0415	0.0339	0.0246	0.51	0.463	0.512	0.516	0.466	0.518
Observations	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603
Fixed effects	None	None	None	HS	HS	HS	HS,Country	HS,Country	HS,Country
Margin Contribution	.	0.33	0.67	.	0.48	0.52	.	0.56	0.44
	Total	Intensive	Extensive	Total	Intensive	Extensive	Total	Intensive	Extensive
$1\{MFA_{ch}\}$ x $1\{\text{Fill Rate}_{ch}<0.95\}$	-0.206 ***	-0.071 ***	-0.135 ***	-0.206 ***	-0.102 ***	-0.104 ***	-0.159 ***	-0.091 ***	-0.068 **
	0.019	0.007	0.017	0.034	0.017	0.027	0.038	0.018	0.031
$1\{MFA_{ch}\}$ x $1\{\text{Fill Rate}_{ch}>0.95\}$	-0.271 ***	-0.075 ***	-0.196 ***	-0.236 ***	-0.095 ***	-0.140 ***	-0.187 ***	-0.084 ***	-0.104 **
	0.027	0.010	0.023	0.046	0.020	0.038	0.050	0.021	0.042
R-squared	0.042	0.034	0.026	0.510	0.463	0.513	0.517	0.466	0.518
Observations	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603
Fixed effects	None	None	None	HS	HS	HS	HS,Country	HS,Country	HS,Country
Margin Contribution									
Non-Binding		0.35	0.65		0.49	0.51		0.88	0.43
Binding		0.28	0.72		0.41	0.59		0.45	0.55

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 5: Relative MFA-UEC Export Price Declines Between 2004 and 2005

		MFA-UEC		OTC-UEC	
Ownership	Average Relative TFP	2004-05 Market Share Change	TFP Change	2004-05 Market Share Change	TFP Change
State-Owned Enterprises	0.82	-21%	-0.174	-11%	-0.088
Private Enterprises	1.76	13%	0.234	9%	0.155
Foreign Enterprises	1.54	8%	0.125	2%	0.030
Overall			0.185		0.097

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 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.

Table 6: Aggregate TFP Gain Following Quota Removal

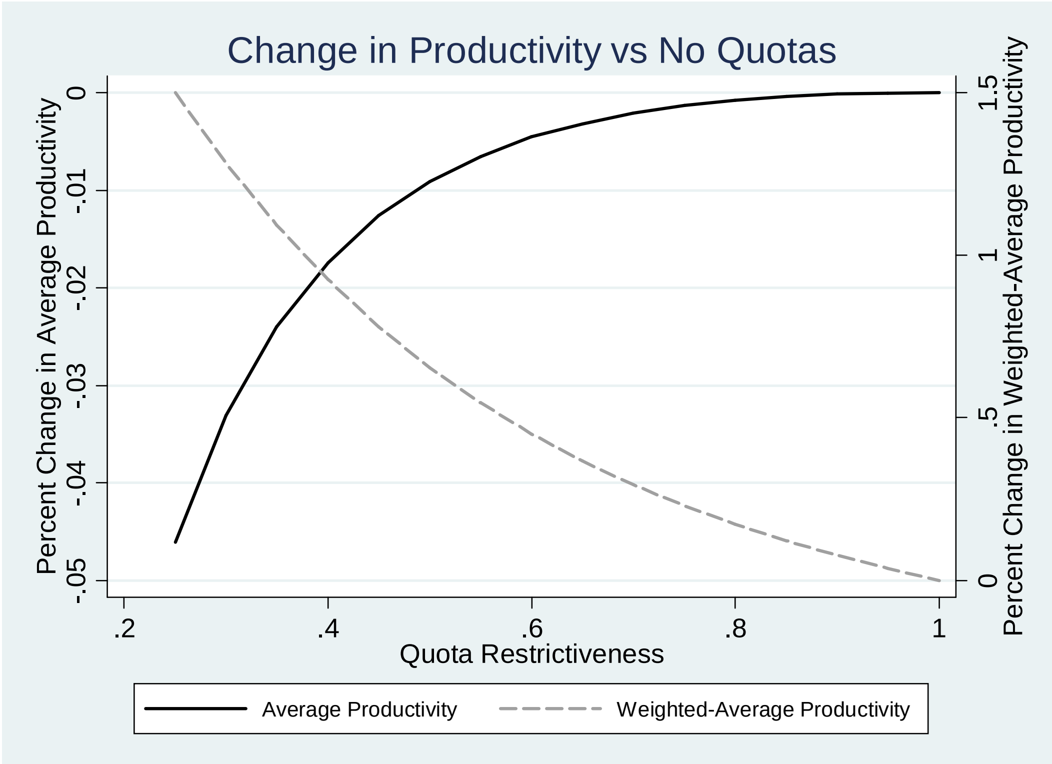

Figure 1: Numerical Solution: Change in Exporters' Average Productivity

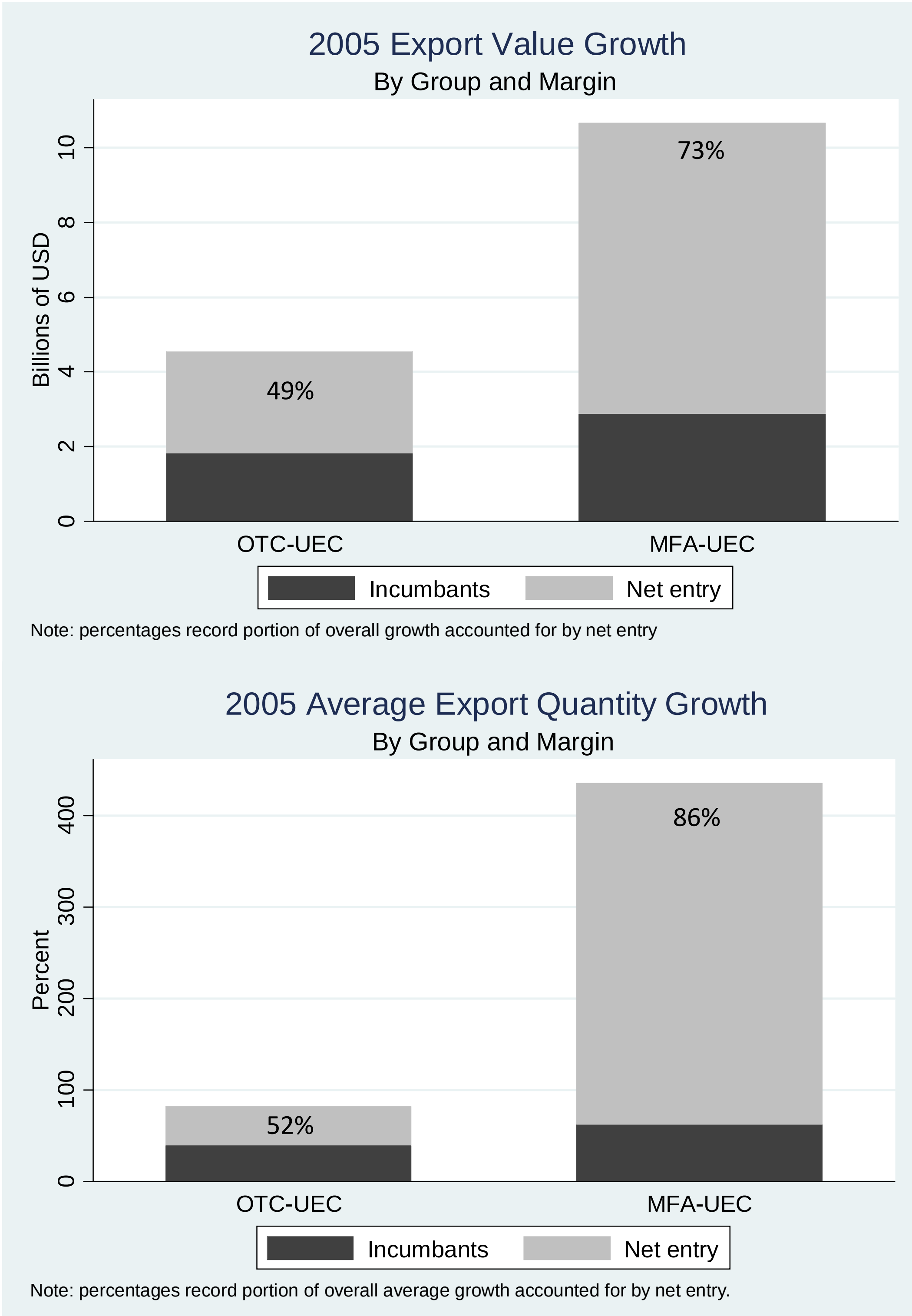

Figure 2: Export Growth by Year, Group and Margin

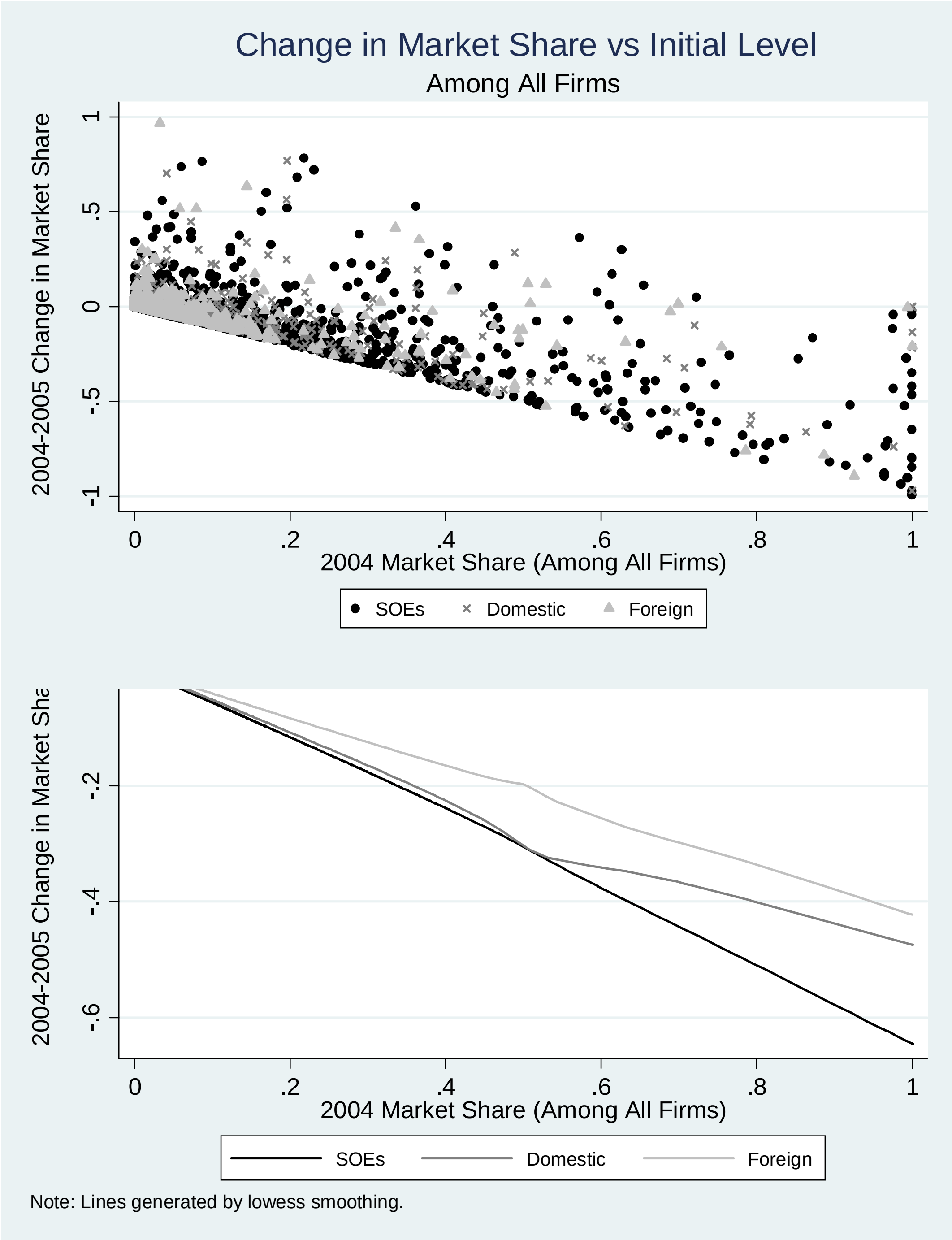

Figure 3: MFA-UEC Incumbents's 2004-5 Change in Market Share vs Initial 2004 Level

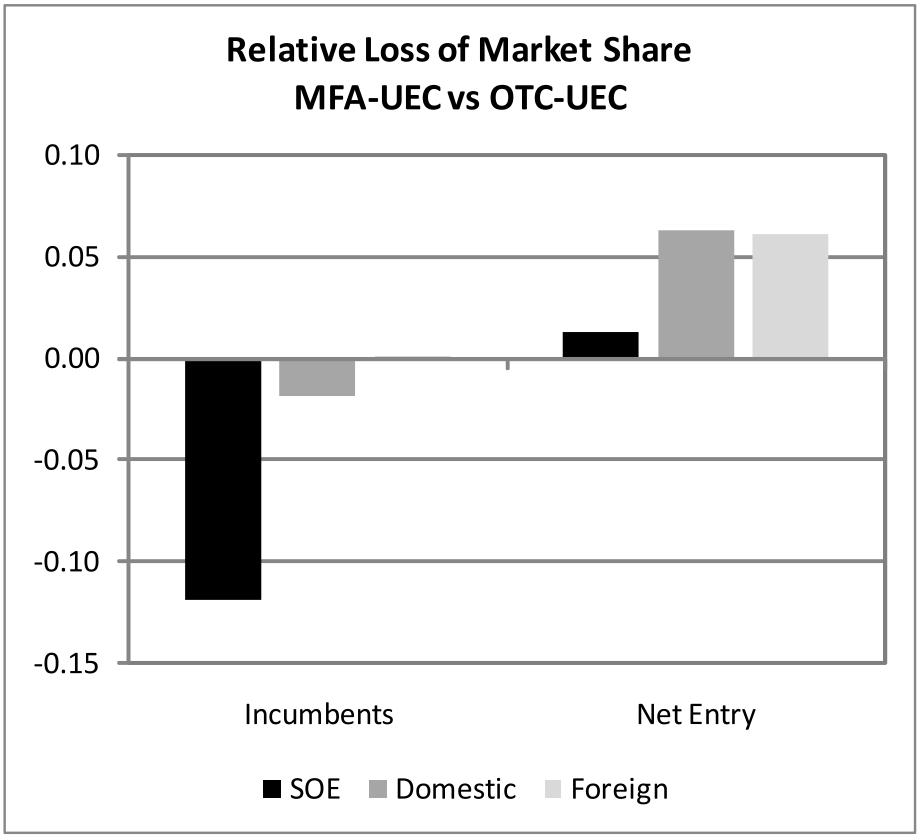

Figure 4: Average 2004 to 2005 Change in Quantity-Based Market Share, MFA-UEC vs OTC-UEC

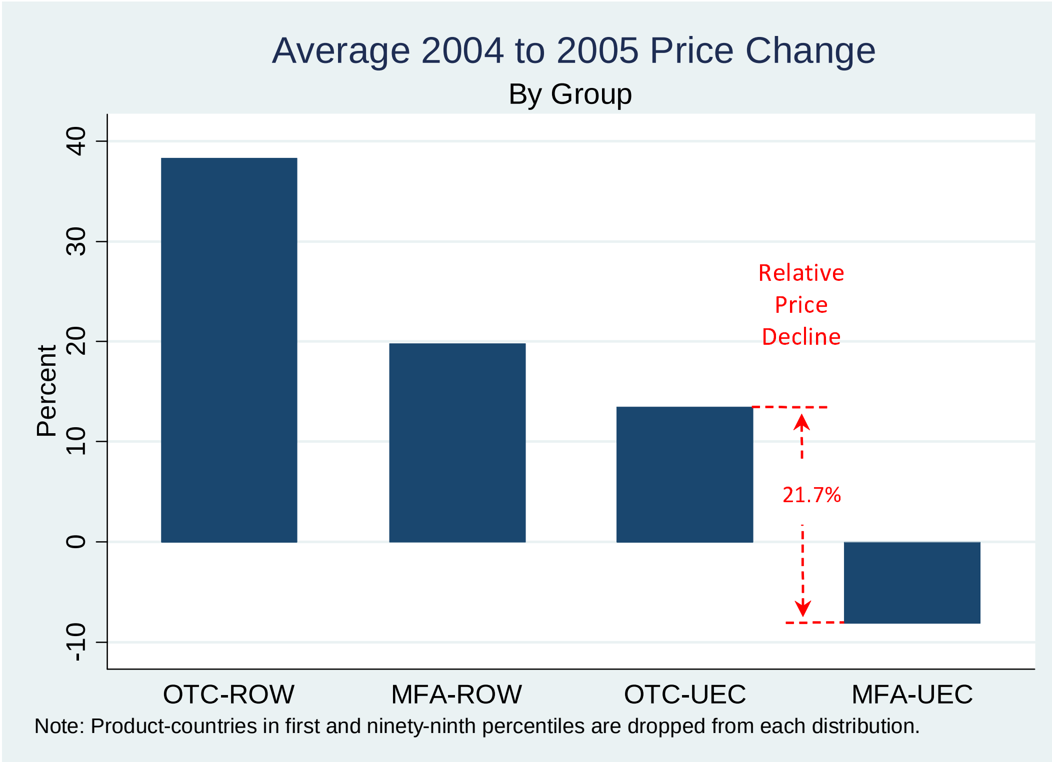

Figure 5: Average Export Price Growth Across Product-Country Pairs, by Group

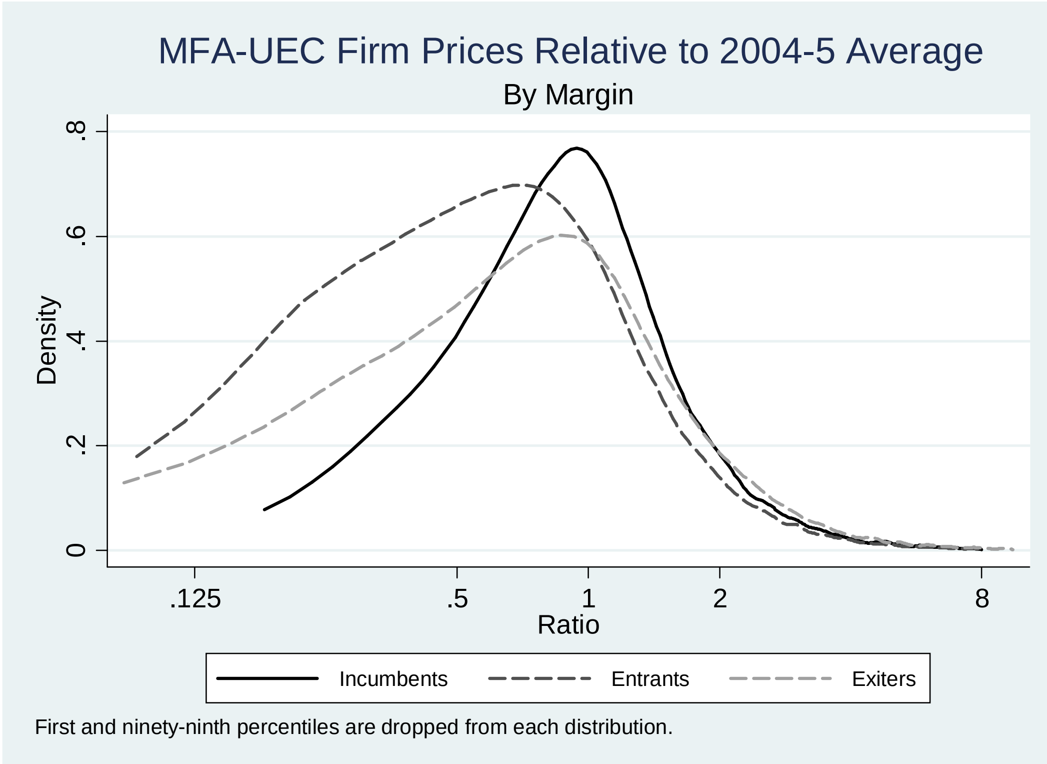

Figure 6: MFA-UEC Export Prices Relative to the Average Export Price Across All Firms in 2004 and 2005 (P_{hc}), by Margin

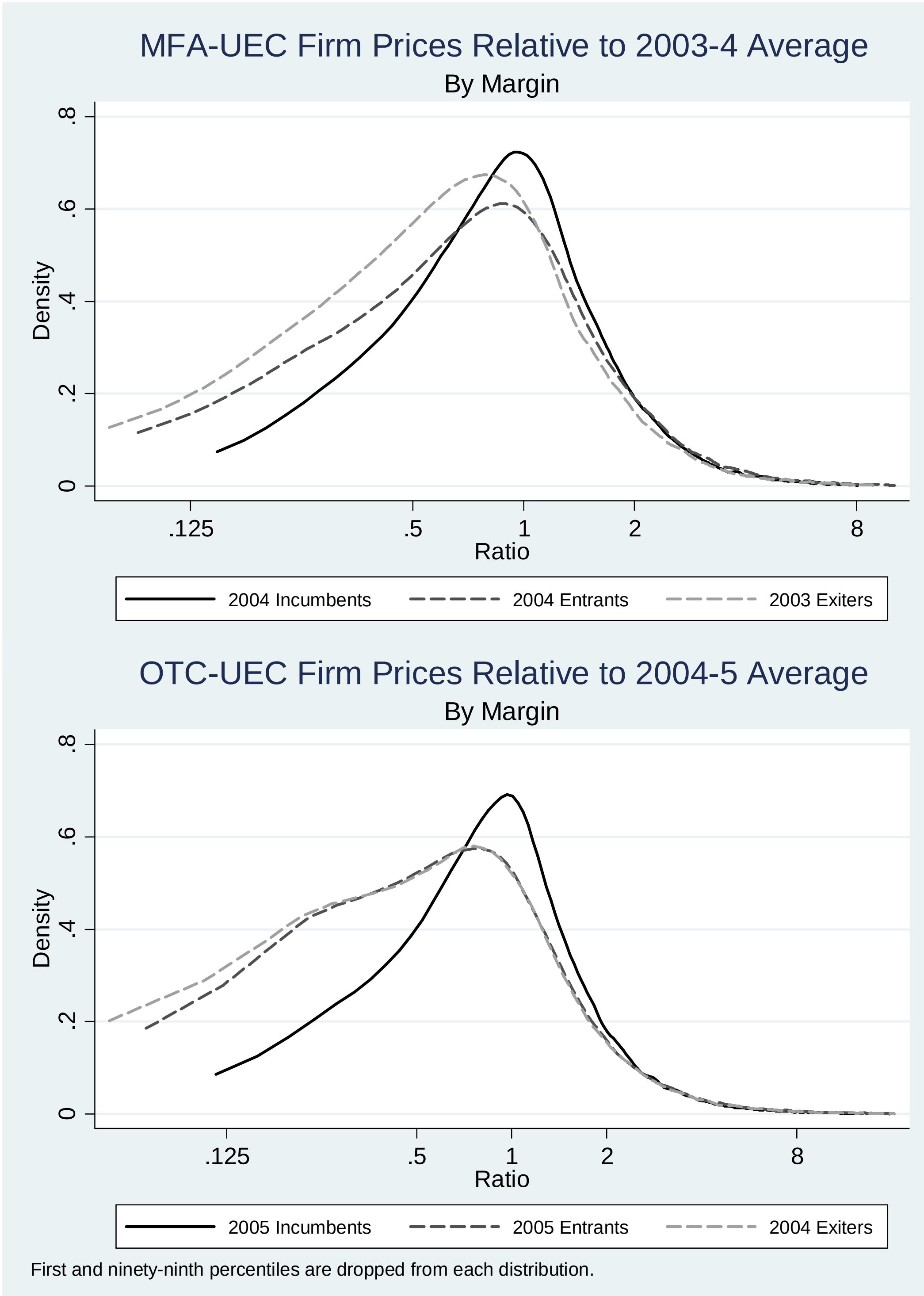

Figure 7: Exiters versus Entrants in 2005 OTC-UEC and 2004 MFA-UEC

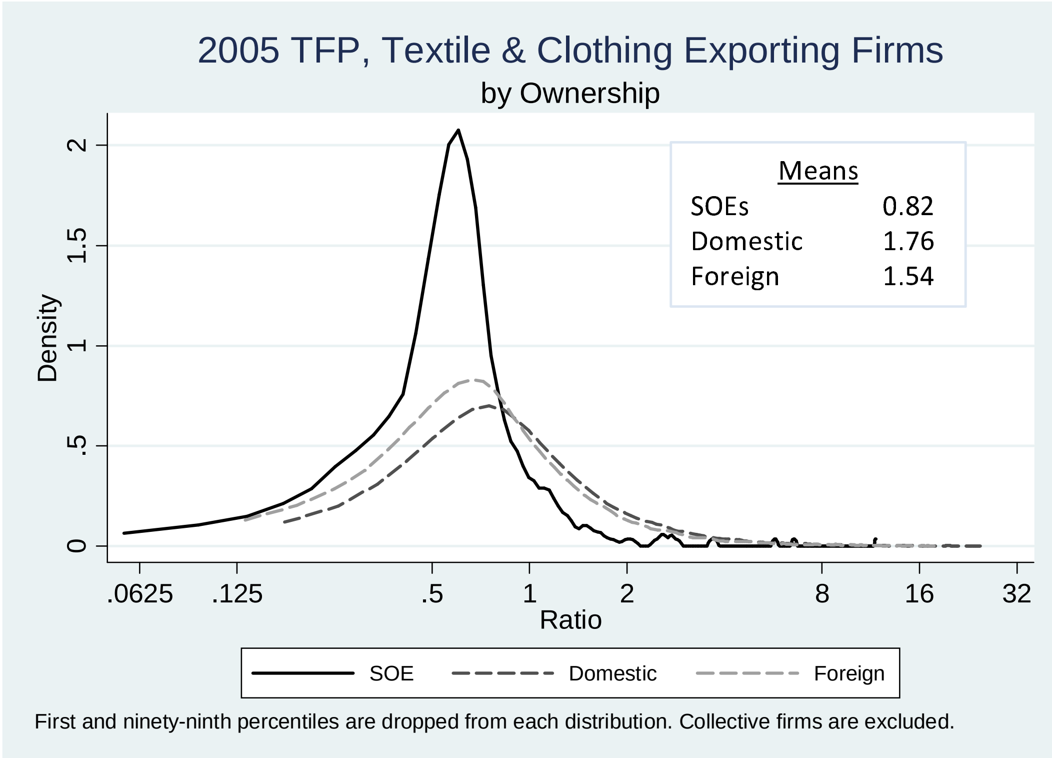

Figure 8: Textile and Apparel Producers' TFP, 2005

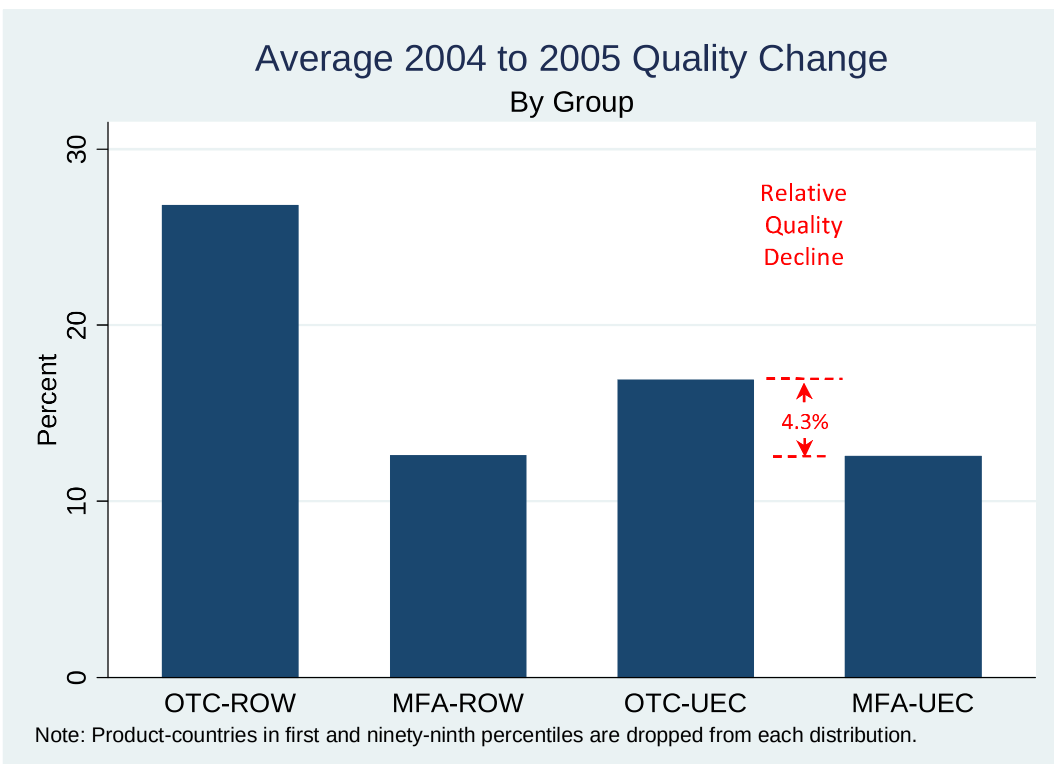

Figure 9: Average Export Quality Growth Across Product-Country Pairs, by Group

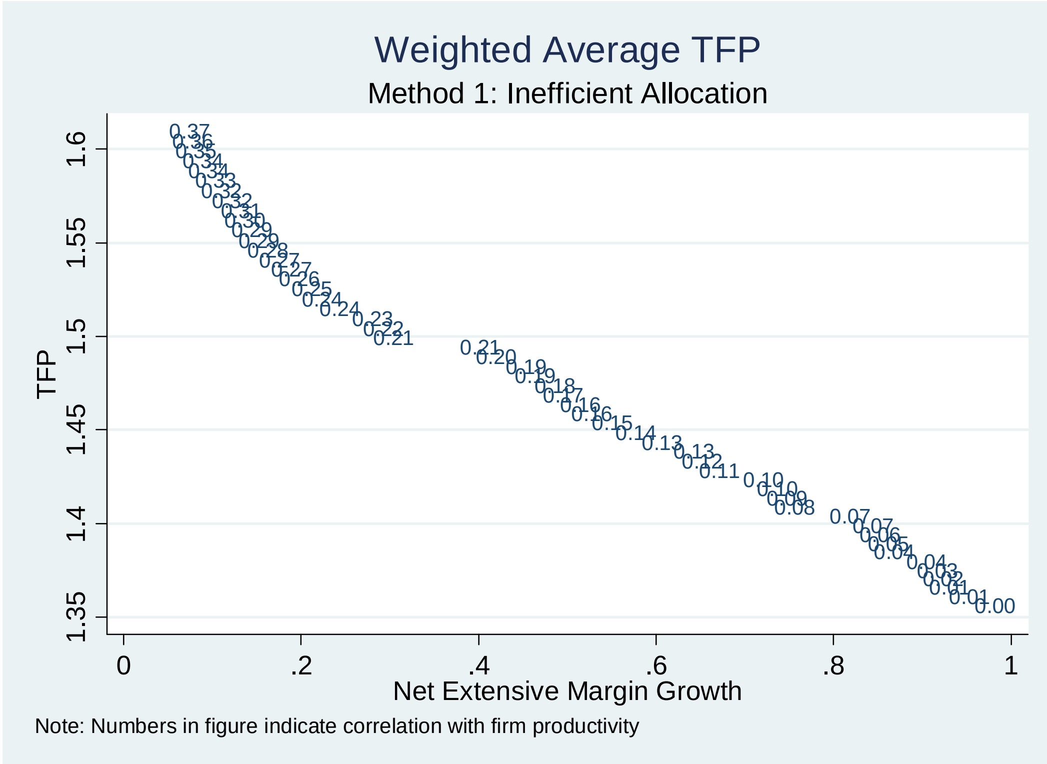

Figure 10: Counterfactual TFP under Inefficient Allocation