Do Trade Policy Differences Induce Sorting? Theory and Evidence From Bangladeshi Apparel Exporters*

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Abstract

This paper provides a new heterogeneous firm model for trade where firms differ in their productivity and experience different market demand shocks. The model incorporates variations in trade policy, trade preferences, and the rules of origin needed to obtain them, to reflect real world differences faced by Bangladeshi garment exporters in the US and EU. We estimate firm's productivity using an extension of the Olley Pakes procedure that accounts for the biases arising from both demand shocks and productivity being unobserved. Predictions of the model are then tested non-parametrically and are shown to be supported empirically.

Keywords: Rules of origin, firm heterogeneity, export performance, demand shocks, productivity.

JEL: F12, F13

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I Introduction

This paper models the responses of heterogeneous firms to differences in trade policies faced by them in different product and export destinations. It presents direct evidence supportive of the model's predictions using a data set of Bangladeshi garments exporters. It focuses on the effect of differences in trade polices, trade preferences, and the rules of origin[1] (*ROOs*) needed to obtain them, on the pattern of firm exports and performance.

To date, most of the literature on trade policy assumes that firms are homogeneous. When firms are homogeneous, they will not make different choices unless they are indifferent between the alternatives and even then, their choices will be random. If firms do make systematically different choices, then homogenous firm models, while useful, miss an essential part of the story. As a result, their predictions and policy prescriptions will be less nuanced[2] and may even be misleading. For example, the correlation between being an exporter and having high TFP used to be interpreted as evidence that exporting raised productivity and that this was the reason to encourage exports. However, work in the late 90's suggested that firm heterogeneity plays a key role: exporters tend to be the more productive firms, so that this policy advice might well be misleading.[3] In this vein, our work suggests that trade preferences granted to developing countries and the associated costs due to *ROOs* may distort their pattern of investment, reduce the average productivity of exporters, and bias export away from the direction of natural comparative advantage. Consequently, even liberal preferences may be far less effective in promoting development than expected.

The empirical application is the apparel sector with two major sub-sectors: garments made from woven cloth, and those made from non-woven material, namely, sweaters and knitwear. Although the EU is the favored export destination for Bangladeshi firms as a whole, it is less so for firms making woven garments. While the EU bias can easily be explained in a standard homogeneous firm setting by the less harsh trade policy of the EU overall, homogenous firm models cannot explain another fact that is clear in the data: namely, firms that export to the US are larger, more productive, and tend to export to more markets than those who export to the EU. This is especially so in the non-woven sector. This calls for a heterogeneous firms setup that models the differences in trade policy stances in the US and EU, as well as across woven and non-woven sectors.

[1] See Krueger (1999), Krishna and Krueger (1995), Ju and Krishna (2005) on modelling *ROOs*.

[2] For example, Bernard, Redding and Schott (2006) argue that trade liberalization forces firms to focus on their core competencies, which provides an additional source of gains from liberalization.

[3] See, for example, Roberts and Tybout (1997), Clerides, Lach and Tybout (1998), Bernard and Jensen (1999), and Aw, Chung and Roberts (2000).

Why look at Bangladesh? First, there are differences across products (garments made from woven cloth and non-woven ones) and export destinations (the EU and the US) that make for an interesting natural experiment as described in the next section. We have a unique firm level data set (with information on output and input prices, costs as well as revenues by export destinations) that lets us take the predictions of our theoretical model regarding the effects of such differences in trade policies to the data. Second, Bangladesh is among the major garment suppliers to both the EU and US markets[4]. Moreover, as one of the poorer developing countries, insights based on its experience are likely to resonate with other such countries.

In our data we find that there are firms who export to the tougher market, but not to easier ones, which contradicts the predictions of the standard heterogeneous firms model as in Melitz (2003). This cannot be thought of as just due to randomness in the data, since such firms tend to be much larger, and this size difference increases with the difference in the toughness of the two markets.[5] In addition, in our data, we also observe some smaller firms with disproportionately large investment. Both these empirical features suggest that a firm's investment and exporting decisions depend not only on productivity, but also on market demand shocks that are firm specific.[6] For this reason we introduce a new dimension of firm heterogeneity into the Melitz (2003) model which we term firm and market specific demand shocks. They parsimoniously capture factors, like business contacts or networks, or even fashion shocks, that make buyers more attracted to one firm rather than another in a particular market.[7]

The presence of firm specific market demand shocks enriches the predictions of the theoretical model and also has implications for the estimation of firm productivity. The standard Olley and Pakes (1996) procedure, which addresses input endogeneity and selection bias, is no longer sufficient, given that there is more than one firm specific time-varying unobservable. We use our model to guide the estimation of productivity taking into account the presence of firm specific market demand shocks. Our work, thus, fits into a new line of research that fine tunes firm productivity estimation in the presence of demand shocks. Recent work in this area includes Katayama, Lu and Tybout (forthcoming), De Loecker (2007), and Foster, Haltiwanger, and Syverson (2008). These papers

[4] According to data obtained from Comtrade, in 2003, Bangladesh supplied \$3.7 and \$1.8 billion worth of apparel products to the EU and US, and ranked 7th and 8th in the two markets, respectively.

[5] We document these patterns in Kee and Krishna (2008) and argue that they can be explained by letting firms differ not just in their productivity, but also in the market demand shock they face.

[6] Eaton, Kortum and Kramarz (2008) also use demand shocks to explain why some French firms skip nearby Belgium while exporting to some more distant countries.

[7] Exchange rate fluctuations or trade policy preferences could also be considered to be a special kind of market demand shocks that are common to all firms, but specific to a market.

deal with the issues that arise when only revenue data is available. Given that firm price data are rarely available, it is a common practice in the field to use an industry price index to deflate firms' revenue used in the production function estimation. This practice contaminates the productivity estimates with demand shocks. Katayama, Lu and Tybout (forthcoming) argue that a structural approach that allows for demand and productivity shocks, together with good data on prices, can help a lot here even when only revenue data is available. De Loecker (2007) uses firm-product dummies to control for time-invariant demand shocks in an augmented OP procedure for firm productivity estimation. Foster et al (2008) use a firm's quantity to estimate physical productivity and use a firm's price index to estimate demand shocks. As do Foster et al (2008), we also have firm level price indices in our data set. However, instead of using input cost shares to measure input elasticities in the production function as in Foster et al (2008), we estimate these input elasticities according to a procedure suggested in Ackerberg, Benkard, Berry and Pakes (2007).[8] Our point is that even with firm level price indices it is still essential to incorporate demand shocks into the estimation of TFP itself as investment is not a sufficient proxy for productivity.

Specifically, in our case, investment will depend not only on the unobserved productivity, but also unobserved demand shocks in the multiple export markets firms operate. Hence, investment alone will be an inadequate proxy for productivity. We need controls for each of the market demand shocks as well.[9] We argue that we can use the vector of investment and the shares in each market to control for the vector of productivity and market demand shocks just as investment is used to control for productivity in the work of Olley and Pakes (1996). In our data set, we have sales information of each firm in each of the export markets they operate, which allows us to construct the share of each market in the firm's sales. These export share variables vary by firm, market, and year and are suitable to be used as controls for firm specific market demand shocks. If a firm faces a positive demand shock in the EU market, it will invest more and export more of its products to the EU. As a result, we observe an increase in investment and the EU export share, and a decrease in the US export share. Alternatively, a positive productivity shock will prompt the firm to invest and produce more without changing its export composition. So its export share in each of the markets remains constant while investment increases. Finally, a negative demand shock

[8] Kee (2004) shows that input cost shares equal to input elasticities in the production function only if there are constant returns to scale, which is not clear in our current application.

[9] De Loecker (2007) uses firm-product dummies to control for demand shocks in production function estimation as demand shocks also affect investment. However, such dummies can only control for demand shocks that do not change with time, and will not be suitable in our context to explain the year to year variation in investment of each firm.

in the EU market will cause investment and the EU export share to decrease, together with an increase in the US export share. Thus, when put together, a time varying polynomial function of investment and export shares can proxy for unobserved productivity and market demand shocks. The three-stage approach we use yields very sensible estimates for the production functions and passes the over-identifying restriction tests for whether investment and export shares are sufficient to control for unobserved productivity and market specific demand shocks. Once TFP is estimated, by assuming a CES demand structure and using the estimated firm productivity to instrument for price, we back out each firm's demand shocks in the EU and the US.

We then use the estimated firm productivity and demand shocks to explain the export destinations of the firms within an industry in a given year. Our findings are as predicted by the model. The probability a firm only exports to the EU decreases with increases in productivity, with favorable demand shocks in the US and with adverse demand shocks in the EU. Conversely, the probability a firm exports to both the EU and the US increases with increases in productivity and with favorable demand shocks in the US and the EU. We also find evidence suggesting that those firms that only export to the US (whose presence is impossible without demand shocks) are mainly driven by favorable demand shocks in the US together with adverse demand shocks in the EU, but not by productivity.

The regression results further show that, controlling for firm-market specific demand shocks and other firm attributes, firms that export to both the EU and the US are more productive on average in both industries. Moreover, when ROOs are binding, those firms that satisfy ROOs are significantly more productive. Between industry comparisons also reveal that a greater share of firms export to both the EU and the US markets in wovens than in non-wovens, and while those firms that only export to the EU are less productive, the spread of productivity is larger in non-wovens. These findings provide evidence linking trade preferences and relaxed ROOs to the market access of less productive firms which otherwise would not have been participated in the export market.

Finally, we employ a nonparametric test of stochastic dominance developed in Anderson (1996) to evaluate the predictions of the model on productivity distributions of different groups of firms. Our predictions are shown to be consistent with the data.

Thus, the contribution of this paper is as follows. First, after incorporating the presence of firm and market specific demand shocks, our heterogenous firm model shows how differences in trade policy of the EU and US and in the preferences granted by them to Bangladesh, in combination with the *ROOs* needed to access them, act as a sorting mechanism for firms.[10] Second, in terms of data, our firm level data allows us to construct firm level price indices for output and inputs in contrast to much of the literature that is forced to use industry wide indices, which bias the productivity estimates. Third, in terms of methodology, the extended OP approach allows for market demand shocks that vary across firms, and therefore, relaxes the assumption that investment is an increasing function of productivity alone. Based on the productivity estimates, we take the model to the data and show that the empirical evidence supports the model's predictions. Finally, in the area of trade policy-for-growth, the results of our paper suggest that the promise of market access coming from trade preference is realized only for those sectors that have relaxed *ROOs*. In these sectors, trade preferences and relaxed *ROOs* significantly expand the participation of firms from developing countries, so that firms with lower productivity are able to export. In other words, there is an expansion in the extensive margin due to trade preferences for developing countries resulting in more exporting firms and varieties, though these firms tend to be small and unproductive.

The paper is organized as follows. Section II contains a brief discussion of the trade environment in which the industry operates. Section III describes the data. Section IV lays out the theoretical model and outlines its predictions. The estimation of firm productivity and tests of the model's predictions are presented in Section V. Section VI concludes.

II The Trade Policy Environment

There are three main components of the trade environment, namely, the trade policy of the US and the EU, the trade preferences granted to Bangladesh, and rules of origin upon which preferences are conditional. Both the US and EU had trade restrictions in the Apparel industry in 1999-2003. The US had tariffs of about 20% applied on a Most Favorite Nations (MFN) basis as well as MFA quota restrictions in place in selected apparel categories for most developing countries, including Bangladesh.[11] The quotas were country specific, exporting was contingent on obtaining origin: that is, unless the good was shown to originate from Bangladesh, it could not enter under its quota.[12]

[10] Although there are a number of papers now dealing with heterogeneous firm models in general equilibrium (see, for example, Melitz (2003), Bernard, Eaton, Jensen, and Kortum (2003), Bernard, Redding, and Schott (2007)), this paper is the first to our knowledge that focuses of the results of differential trade policies.

[11] Of the 924 HS 10 digit garment products Bangladesh exported to the US each year (1998-2004), half were subjected to quota restrictions. In terms of value, 74% of garment imports from Bangladesh were from the woven industry (HS62), and the remaining 26% came from the knitwear industry (HS61), which also included sweaters. Roughly 75% of Bangladeshi exports were under quota.

[12] Note that less competitive countries are at less of an disadvantage in the US than they would be in the absence of the quota as the quota in effect guarantees them a niche as long as they are not too inefficient. Their inefficiency

Thus, Bangladesh did not have any trade preferences in the US market and had to compete with garment producers from other countries, such as India and China. However, since there were quotas on other exporters as well, full competition among supplying countries was still not the case.

On the other hand, during the same period, the EU had an MFN tariff rate of 12-15% on the various categories of apparel. Prior to 2001, apparel from Bangladesh entered the EU under the Least Developed Countries (LDCs) status of the General System of Preferences (GSP) program with a tariff preference of 100%. Thus, if the MFN tariff was 12%, under GSP, Bangladesh would face no tariff. There were no official quotas, but exports were under surveillance, so that a surge would likely result in quotas. In 2000, the EU formally announced that they would implement the "Everything-But-Arms" (EBA) initiative in 2001, in which Bangladesh, together with 48 other LDCs, would have access to the EU, duty and quota free, provided that the *ROOs* were satisfied. This effectively removed any inklings of a quota and granted a 100% preference margin for garment exports of Bangladesh to the EU. It significantly improved the market environment, in which Bangladesh garment exporters operated. For this reason, in the empirical section, we allow firms' behavior to differ in the pre- and post-EBA period.

A Rules of Origin

ROOs specify constraints that must be met in order to obtain origin and thereby qualify for country specific quotas or trade preferences.[13] They can take a variety of forms. The important thing to note is that, whatever the form, if *ROOs* are binding then the choice of inputs used in production differs from the unconstrained level. Hence, costs are higher if *ROOs* are met. Since more restrictive *ROOs* constrain choices more than do less restrictive ones, an increase in restrictiveness raises the minimized level of costs. Thus, from an analytical viewpoint, *ROOs* raise the production costs of the product when they are binding.[14] On the other hand, they may provide access to the market at a lower tariff and this benefit has to be traded off against the cost.

US *ROOs* regarding apparel products are governed by Section 334 of the Uruguay Round Agreements Act.[15] For the purpose of tariffs and quotas, an apparel product is considered as

reduces the price of their quota licenses, while the quota licenses of a very competitive country would be highly priced.

[13]For a relatively comprehensive and up to date survey see Krishna (2006).

[14]In the same spirit, though formally not in the model, meeting ROOs in Bangladesh forces producers to rely on poorer quality domestic inputs (which make a lower quality garment with a lower price) rather than higher quality imported ones in order to obtain preferences.

[15]For details, please, refer to the following website:
http://www.washingtonwatchdog.org/documents/usc/ttl19/ch22/subchIII/ptB/sec3592.html

originating from a country if it is wholly assembled in the country. No local fabric requirement is necessary. Thus, the products of a firm are not penalized if the firm chooses to use imported fabrics. All apparel products are subjected to non-preferential tariffs of about 20%, and prior to January 2005, selected apparel categories were subjected to country-specific quota restrictions.

On the other hand, EU *ROOs* on apparel products are considerably more restrictive. According to Annex II of the GSP (Generalized System of Preferences) guidebook, which details *ROOs* of all products, for an apparel product to be considered originated from a country, it must start its local manufacturing process from yarn[16], i.e., the use of imported fabrics in apparel products would result in the product failing to meet the *ROOs* for the purpose of tariff and quota preferences under GSP or EBA for the case of LDCs. It would, thus, be subject to MFN tariffs of about 12% to 15%.

Within the garment industry, there are two major sub-industries, namely, non-woven (knitwear and sweaters) and woven garments. Due to current production techniques, non-woven firms are able to manufacture garments from yarn. Thus, they can easily satisfy the *ROOs* of the EU and can obtain tariff preferences at low cost. However, firms making garments from woven material (woven firms) mostly assemble cut fabrics into garments. Given the limited domestic supply of woven cloth[17], it commands a premium price, so that woven garment makers can meet *ROOs* only by paying a roughly 20% higher price for cloth which translates into a significantly higher cost of production as cloth is a lions share of the input cost. The cost of cloth to FOB price is roughly $70-75\%$ for shirts, dresses, and trousers[18], so that this directly translates into a 15% cost disadvantage.[19] In contrast, US *ROOs* do not discriminate against the origin of fabrics: assembly is all that is required. Nor does the US give tariff preferences to Bangladeshi garments, and the presence of country specific quotas in most categories makes meeting *ROOs* mandatory for exports. Thus, an item exported to the US may be considered as a product of Bangladesh and imported under the quota allocation of Bangladesh. However, the same item may fail to meet the *ROOs* of the EU and would not qualify for the 12-15% tariff preference under the EBA initiative. In a nutshell, the EU is an easier market, especially in non-wovens, as neither quotas, nor domestic

[16] For the details, please, refer to the following websites:
EBA user guide: http://europa.eu.int/comm/trade/issues/global/gsp/eba/ug.htm; Annex II on GSP: http://europa.eu.int/comm/taxation_customs/common/publications/info_docs/customs/index_en.htm.

[17] Of 1320 million meters of total demand in 2001, only 190 was supplied locally in wovens, while 660 of 940 million meters of knit fabric was supplied locally according to a study by the company, Development Initiative, in 2005.

[18] See Table 33 in Development Initiative (2005).

[19] In contrast, India has the ability to meet its woven cloth needs domestically at competitive prices so that its firms can avail themselves of GSP preferences in the EU. As a result, Bangladeshi firms find themselves at a disadvantage in woven garments.

cloth usage requirements constrain exporting under preferences.

III The Data

We use two data sets. The first has complete customs data on all exporting garment firms in Bangladesh. This data was provided by the Bangladesh export authority. The second data set has much more information, but is on a smaller set of exporters. It comes from a firm level survey which was conducted under the auspices of the World Bank and the Government of Bangladesh.[20] The firms in our survey data are also matched with the firms in the exporters data set. This allows us to perform a number of cross checks on the results based on the firm level survey data.

A Firm Level Export Data

The customs data set contains data on exports for *all* firms that applied for Country of Origin Certificates in 2004. This certificate is required by the importing countries to verify the origin of the good and is needed to export and apply for trade preferences. Thus, this data set consists of the whole population of exporting firms in the garment industry of Bangladesh. It has information on the 2387 garment firms exporting in 2004. The total value of exports was US$11.6 billion, with more than 400 million dozen garments exported. Overall, in terms of value, nearly 79% of garments were exported to the EU, 10% to the US, and the remaining 11% went to other countries such as Canada and Australia. Of the 2387 firms, 1967 (82%) exported under the GSP (mostly to the EU), and hence, met GSP *ROOs*. 1039 (43.5%) of the firms exported to the US, of which 709 (29.7%) exported under quota allocations, and 1231 (51.6%) firms exported to other countries.[21]

If we consider the distribution of firms by number of export destinations, we find that of all exporting firms, 47% only supply to one market, 34% supply to two markets, 14% to three markets, and 5% to all four markets. Figure 1 presents the choice of export markets of Bangladesh garment exporters according to the number of export markets the firms supply. It is very clear that the EU is the most popular destination, especially among firms that have only one export market. Among the 1109 firms that only supply to one market, nearly 850 firms (76%) concentrate on the EU. The US market appears to be the toughest to break into: among this group of firms, less than 8% only

[20] The same data set is also used in Kee (2006) to study the horizontal productivity spillover effects of FDI firms in the garment industries in Bangladesh.

[21] The composition of US imports is biased towards knitwear, which are cheaper than sweaters so that the value share of the US is less than its share in terms of firms or output.

export to the US with and without quota. Thus, there seem to be significant differences in firms exporting to the EU and the US. Firms exporting to the US tend to export to many markets, while those that sell to the EU tend to sell only to the EU.

Eaton, Kortum and Kramarz (2004) and (2008) study the export performance of French firms. Their work suggests that the number of markets a firm supplies is positively correlated with its value added per worker which reflects the productivity of the firm. This is consistent with the evidence in our data. Figure 2 plots the unit value of garment exports against the total export value or the number of export destinations. Firms that export to more destinations have higher average unit values and are larger in size.[22] Both are positively correlated with value added per worker. In this way, our data is consistent with their conjectures.

B Firm Level Survey Data

The firm level survey was conducted from the period of November 2004 to April 2005. It covers a stratified random sample of 350 firms, which is about 10% of the total population of the garment firms currently operating in Bangladesh. After cleaning the data to exclude outliers and firms with incomplete information, there are a total of 292 firms in the unbalanced final panel of 1211, who provided retrospective information about their operations from 1999 to 2003. In this unbalanced panel, the composition of sub-industries of non-woven versus woven is 35% and 65%, respectively.[23]

Table 1 presents the sample means of the key variables by the sub-industries and export destinations (EU vs US). Firm capital stock, K_{jt}, is constructed by summing real investment, I_{jt}, over the years using the perpetual inventory method with an annual depreciation rate, δ, of 10%:

$$\begin{aligned} K_{jt} &= K_{jt-1}(1-\delta) + I_{jt-1}, \\ K_{j0} &= \frac{1}{2}\left(F_{j1} + \bar{I}_j \sum_{\tau_j=0}^{T_j-1} (1-\delta)^{\tau_j}\right), \end{aligned}$$

with initial capital stock, K_{i0}, being constructed using an average of the firm's first year fixed asset, F_{j1}, and the sum of investment prior to the first year from the year firm j is established. For the purpose of this calculation, we assumed that the average investment in the first two years the

[22] The differences in unit values and total size among firms with different number of markets are statistically significant.

[23] How does this firm survey data compare to the customs data set? For the five year sample period, it slightly over-samples the US firms, which tend to be larger, and under-samples the smaller firms that only export to the EU.

firm is observed in the data is a good approximation to the average investment of this firm in the years before it is observed. Firms' real investment, I_{jt}, is obtained by deflating nominal investment from the firm survey by the GDP deflator of domestic fixed capital formation of Bangladesh in the respective years. Thus, by construction, K_{jt} is a fixed factor in year t that only depends on information in year $t-1$, and is not affected by any changes in t.

Three things stand out in Table 1. First, the woven firms use significantly more materials than the non-woven firms, suggesting that their production functions differ. We, thus, estimate the two production functions separately. Second, we focus on two groups of firms, those that only export to the EU, "Only EU Exporters" (or OEU), and those that "Also Export to the US", i.e., who sell to both the EU and the US (or AUS). OEU firms are smaller than AUS firms in both industries in all dimensions, except when it comes to investment in non-wovens, where the investment level of OEU firms is significantly higher than that of AUS firms, suggesting that non-woven firms with good EU demand shocks are in a position to take advantage of EU preferences obtainable at low or no costs of meeting *ROOs* and hence, choose to invest there.

Finally, there are proportionately more OEU firms in non-wovens than in wovens. This suggests that the market environment the two industries are facing could be different due to the different trade policy regime and the relevant ROOs.

Overall, non-woven firms seem to behave very differently both in terms of their sales to the US and to the EU. Although the EU is the favored export destination for Bangladeshi firms as a whole, it is less so for firms making woven garments. While only 58% of the sampled firms exported at least 5% of their output to the US, 76% of these made woven garments. On the other hand, while 88% of the sampled firms export at least 5% of their output to the EU, about 65% of these made woven garments. Despite this, only 68% of all firms exporting woven garments were US exporters, while 88% exported to the EU confirming a EU bias even among woven firms. This differential EU bias can be explained by the differences in trade policy and *ROOs* in the two destinations described in Section II, which make the EU by far the most preferred first market for Bangladeshi firms, especially for non-woven firms.

IV The Model

There has been an explosion of interest in heterogeneous firm models in trade in the last few years.[24] However, till recently, there were few theoretical models, at least general equilibrium ones, where firm heterogeneity played a major role. Quite recently, Melitz (2003), Bernard, Eaton, Jensen and Kortum (2003), and Eaton and Kortum (2002) provided two quite different approaches to incorporating firm heterogeneity in a reasonably simple and meaningful way into such models.[25]

The assumptions made in the model below are based on the differential *ROOs* and trade policies in the US and EU described earlier. We will use a simple partial equilibrium setting based on the setup in Melitz (2003). This will serve as the basis for the intuition behind the results. We first set up the demand side. Then we explain how firms behave in the presence of *ROOs* and provide the intuition behind our results on the equilibrium effects of *ROOs*. Finally, we describe how to incorporate demand shocks into our model.

A Utility

Utility is given by

$$U = (N)^{1-\beta} (Q)^{\beta}, \tag{1}$$

where Q can be thought of as the services produced by consuming $q(\omega)$ of each of a continuum of varieties indexed by ω. N is a numeraire good, which is freely traded and takes a unit of effective labor to produce. Let the sub-utility function take the CES form so that

$$Q = \left[\int_{\omega} q(\omega)^{\rho} d\omega \right]^{\frac{1}{\rho}}, \tag{2}$$

where $\sigma = \frac{1}{1-\rho} > 1$ is the elasticity of substitution. The cost of a util defines the price index

$$P = \left[\int_{\omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}, \tag{3}$$

[24] See Tybout (2002) for a very nice survey of much of the empirical work.

[25] See Bernard, Redding, and Schott (2007) for an extension of Melitz (2003) to a Heckscher Ohlin setting.

which is the price of the service given the varieties produced. The demand for each variety is then:

$$q(\omega) = \left[\frac{P}{p(\omega)}\right]^{\sigma} Q. \tag{4}$$

B Pricing and Equilibrium

Q and P are taken as given by each firm since there is a continuum of firms. Firms differ in their productivity level ϕ and, as a result, in a unit labor requirement of $\frac{1}{\phi}$. With wages set at unity, such a firm has a cost of $\frac{1}{\phi}$. A firm draws ϕ independently from the density function $g(\phi)$ after paying an entry fee of f_e. To produce in any given period, it must pay a fixed cost f. Once ϕ is realized, it stays with the firm forever as long as it does not die. Profits are zero if a firm exits. To sum up, each firm first pays the entry fee, gets a draw of productivity, then decides whether to stay in or not, and if it stays in, decides which markets to serve and how.

As each variety is symmetric, and a firm is a monopolist over its variety, price depends only on the productivity draw, not the variety per se, so profit maximization results in

$$p(\phi) = \frac{1}{\rho\phi}. \tag{5}$$

Then per-period revenue and profits are

$$r(\phi, .) = p(\phi)q(\phi) = \left(\frac{P}{p(\phi)}\right)^{\sigma-1} PQ \quad \text{and} \quad \pi(\phi, .) = \frac{r(\phi, .)}{\sigma} - f, \tag{6}$$

where $PQ \equiv E$ $(= \beta I$, where I is total income) is aggregate expenditure on all differentiated goods. Since $\sigma > 1$, firms with ϕ close to zero, whose price goes to infinity, get close to zero in variable profits. Note that output share and revenue share depend inversely on price relative to average price of goods produced. Moreover, as profits rise with ϕ due to the envelope theorem, and since firms pay f to produce, as well as a marginal cost, low productivity firms will exit so that only firms with $\phi > \phi^*$ stay in, where ϕ^* is defined from $\pi(\phi^*, .) = 0$. As a result, ex-post, ϕ is distributed as $M\mu(\phi)$, if a mass of M firms is in the market and gets realizations according to $\mu(\phi)$, where $\mu(\phi) = \frac{g(\phi)}{1-G(\phi^*)}$ for $\phi \geq \phi^*$ and 0 otherwise.

Firms are assumed to die at a constant rate δ, independent of age. A mass M_e of firms enters in each period and they draw their ϕ from the same distribution, $g(.)$. Then in steady state, the mass of successful entrants is exactly equal to the mass of firms that die, or

$$(1 - G(\phi^*)) M_e = \delta M. \tag{7}$$

Thus, if we know M and ϕ^*, we know M_e, and, as will become apparent, all the endogenous variables in the model. Note that M can be determined from the ex-ante condition that entry will occur till expected profits from entering are zero.

Using equations (3) and (5) and the fact that the cutoff level is ϕ^* gives

$$P = \left[M \int_{\phi^*} \left(\frac{1}{\rho\phi} \right)^{1-\sigma} \frac{g(\phi)}{1 - G(\phi^*)} d\phi \right]^{\frac{1}{1-\sigma}} \equiv p(\tilde{\phi}(\phi^*)) M^{\frac{1}{1-\sigma}}. \tag{8}$$

The price index, P, depends on the cutoff level, ϕ^*, which defines the representative firm $\tilde{\phi}(\phi^*)$, and the mass of firms, M. It is easy to verify that $P(\phi^*, M)$ falls with ϕ^*, as higher ϕ^* makes firms more productive on average, reducing the average price charged. Similarly, a rise in M reduces $P(\phi^*, M)$ as consumers like variety. This completes the description of the closed economy equilibrium.

C Trade and Trade Policy

Next we turn to how trade and trade policy can be incorporated into our model. Trade makes the choices open to a Bangladeshi firm more complex as firms have additional choices: to export or not, to invoke preferences or not if these are available, and which markets to export to? Fortunately, since marginal costs are constant, decisions in each market are independent.

Assume a firm must pay f_x each period to export to any given market. In addition, exporters face transport costs of the iceberg form of $\tau > 1$ and an ad valorem tariff $\kappa^i \geq 0$ set by country i. It proves convenient to work with the tariff in terms of the consumer price denoted by $t^i = \kappa^i / \left(1 + \kappa^i\right) \in [0, 1]$, so that an exporter from any country j to country i, who charges consumers price p, receives $\left(1 - t^i\right) p$ per unit. Such a firm chooses p to maximize

$$(1 - t^i) \left[\left(\frac{P}{p} \right)^{\sigma - 1} PQ - \frac{\tau}{\phi(1 - t^i)} \left(\frac{P}{p} \right)^{\sigma} Q \right].$$

This is equivalent to choosing p to maximize the term in the square brackets, which is the profits of a domestic firm in i with productivity $\frac{\phi(1-t^i)}{\tau}$. Hence, the price chosen will be the profit maximizing price of such a firm. As a result, the price set by a Bangladeshi firm with productivity ϕ exporting to market i, which has transport costs of τ and tariff t^i, is the same as the price set by a domestic firm in i with productivity $\frac{\phi(1-t^i)}{\tau}$, $p(\phi,\tau,t^i) = p(\frac{\phi(1-t^i)}{\tau}) = \frac{1}{1-t^i}\frac{\tau}{\rho\phi}$. The revenues (and profits) of such a firm are the same as those of a domestic firm in i with a productivity $\left(1-t^i\right)^{\frac{1}{\rho}}\frac{\phi}{\tau}$.[26]

Since there are fixed costs, which can be more easily covered by more productive firms with larger sales, all firms with productivity above a threshold ϕ_x^* will find it worth exporting and all firms with productivity above ϕ^* will produce for the domestic market. We assume that the cutoff for exports will exceed that for domestic production, so that only the more productive firms will be exporters. This requires fixed costs of exporting be large relative to those of producing domestically.

C.1 Incorporating Preferences and Quotas

How can *ROOs* be incorporated? Let the superscript $i = B, U, E$ denote the level of the variable in Bangladesh, the US, and the EU, respectively. If the Bangladeshi firm meets *ROOs* in country i, its cost of production for the export market is $\left(\frac{\theta^i}{\phi}\right)$ per unit, where $\theta^i > 1$ to reflect the cost of meeting *ROOs* in country i, $i = U, E$. In addition, in the EU it faces zero tariffs, while in the US there are no such preferences given, but as there are quotas, meeting *ROOs* is a necessary condition for all Bangladeshi exporters. From these considerations alone, the revenue, and hence variable profits, of a firm in Bangladesh with draw ϕ that chooses to export to the US and meet *ROOs* is that of a firm situated in the US with draw $\left(1-t^U\right)^{\frac{1}{\rho}}\frac{\phi}{\tau\theta^U}$. Moreover, there are fixed documentation costs of d. The variable profits earned by a Bangladeshi firm exporting to the EU and meeting *ROOs* are, thus, given by $\frac{r(\frac{\phi}{\tau\theta^E},P^E,E^E)}{\sigma}$.[27] Note that for any firm to choose to meet *ROOs*, $\left(1-t^E\right)^{\frac{1}{\rho}}\left(\theta^E\right)^{-1}$ must be more than unity.[28]

However, for a firm exporting to the US, in addition to the *ROOs* that need to be met to obtain origin and access the quota (which raises production costs), the quota license price has to be paid. Since a quota license acts like a specific tariff, we need to see how to incorporate a specific tariff into the model. If a firm faced a specific tariff, s, it would price as if its costs were $\frac{1}{\phi}+s$, and hence,

[26] To see this, note that $r_x^{ji}(\phi) = \left(1-t^i\right)E^i\left(P^i\left(1-t^i\right)(\tau)^{-1}\rho\phi\right)^{\sigma-1} = E^i\left(P^i\left(1-t^i\right)^{\frac{1}{\rho}}(\tau)^{-1}\rho\phi\right)^{\sigma-1}$.

[27] Note that the revenue and profit functions take the same *form* at home or abroad for an exporter or for a domestic firm. All that needs to change to pin down the context is the level of the arguments.

[28] Otherwise, $r(\frac{\phi}{\tau\theta^E},P^E,E^E) < r(\left(1-t^E\right)^{1/\rho}\frac{\phi}{\tau},P^E,E^E)$ for any level of ϕ, and no exporter will invoke *ROOs*.

price and profits would be as if its productivity was the inverse of its cost or $\frac{\phi}{1+\phi s}$. Thus:

$$\pi\left(\phi, P, E, s\right) = \pi\left(\frac{\phi}{(1+\phi s)}, P, E\right).$$

As ϕ rises, so does $\frac{\phi}{(1+\phi s)}$, but at a decreasing rate as $\frac{\phi}{(1+\phi s)}$ is concave in ϕ. Note that s acts differently from t: as it is a dollar amount, it raises the cost of high productivity firms by a greater percentage than that of low productivity ones. As a result, profits increase more slowly with ϕ than under an ad-valorem tariff as depicted in Figures 3 and 4.[29]

We now use these insights to develop the payoffs of a Bangladeshi firm given P and E.

C.2 Bangladeshi Firms Choices

Bangladeshi firms have several options to choose from in terms of serving each of three potential markets in our model, and a firm serves a market if it makes positive profits from doing so.

When it comes to a domestic market, firms can produce or not. Thus, from this market they get $\max\left(0, \frac{1}{\sigma}r(\phi, P^B, E^B) - f\right)$. As to exporting to the EU, they can choose not to do so, export under EBA and meet *ROOs*, or not invoke preferences and pay the MFN tariff. Let $(1-t)^{\frac{1}{\rho}} \equiv \lambda^{-1}$. Thus, from this market they get $\max\left(0, \frac{1}{\sigma}r\left(\frac{\phi}{\lambda^E \tau}, P^E, E^E\right) - f_x, \frac{1}{\sigma}r\left(\frac{\phi}{\tau\theta^E}, P^E, E^E\right) - f_x - d\right)$.

When it comes to serving the US market, firms have no choice but to meet *ROOs* as there are quotas. They also need to pay for a quota license. Thus, from the US market they get $\max\left(0, \frac{1}{\sigma}r\left(\frac{\phi}{(\lambda^U\tau\theta^U + s\phi)}, P^U, E^U\right) - f_x - d\right)$, where s is the equilibrium price of a quota license for exporting to the US from Bangladesh. Note that $\frac{\phi}{(\lambda^U\tau\theta^U + s\phi)}$ is increasing and concave in ϕ, and it falls as t^U, θ^U, τ or s rise, i.e., trade policy gets more restrictive or trade costs rise, so that profits fall and become flatter at any ϕ. Thus, more restrictive trade policy makes profits shift down and become flatter, given P^U and E^U.

Hence, the overall profits of a Bangladeshi firm are the sum of its profits from the three markets:

$$\begin{aligned}
\Pi^B(\phi) \quad &= \quad \max\left(0, \frac{1}{\sigma}r(\phi, P^B, E^B) - f\right) \\
&+ \max\left(0, \frac{1}{\sigma}r\left(\frac{\phi}{\lambda^E \tau}, P^E, E^E\right) - f_x, \frac{1}{\sigma}r\left(\frac{\phi}{\tau\theta^E}, P^E, E^E\right) - f_x - d\right) \\
&+ \max\left(0, \frac{1}{\sigma}r\left(\frac{\phi}{\lambda^U\tau\theta^U + s\phi}, P^U, E^U\right) - f_x - d\right). \qquad (9)
\end{aligned}$$

[29] As $\pi_{xr}^{BU}(.)$ is increasing in ϕ, the intersection of $\pi_d^B(.)$ and $\pi_{xr}^{BU}(.) + \pi_d^B(.)$ is unique.

A firm serves a market if its profit from doing so is positive. Hence, there are three kinds of cutoffs: the domestic cutoff, ϕ^{*i}, below which firms do not serve the domestic market i, the export cutoff to market j, ϕ_x^{*ij}, below which firms choose not to export to country j, and ϕ_{xr}^{*ij}, above which exporters choose to invoke preferences offered by country j. Let $\pi_d^B(\phi)$ be the total profits from serving the Bangladeshi domestic market alone or the first line of equation (9). Let $\pi_x^{ij}(\phi)$ and $\pi_{xr}^{ij}(\phi)$ denote the profits from also exporting from country i to country j $(i, j = B, E, U)$ without invoking preferences and with invoking preferences, respectively. Thus, the second and third lines of equation (9) are $\max\left(0, \pi_x^{BE}(\phi), \pi_{xr}^{BE}(\phi)\right)$ and $\max\left(0, \pi_{xr}^{BU}(\phi)\right)$.[30] We will assume below, as is done in this literature, that f_x is large enough that only the more productive firms export and that similarly, d is large enough that only the more productive exporters choose to meet $ROOs$.

Thus, the following must hold for any levels of E^i and P^i as depicted in Figures 3 and 4:

$(1a)$ $\pi_d^B(\phi)$ must be flatter than $\pi_d^B(\phi)+\pi_x^{Bi}(\phi)$ (as both functions are increasing) and the latter expression has a higher intercept as f is always less than $f + f_x$.

$(1b)$ $\phi_x^{*Bi} > \phi^{*B}$. This follows from f_x being large enough.

$(2a)$ $\pi_d^B(\phi) + \pi_x^{Bi}(\phi)$ is flatter than $\pi_d^B(\phi) + \pi_{xr}^{Bi}(\phi)$, and has a higher intercept. The former is ensured by $\left(1 - t^E\right)^{\frac{1}{\rho}} \left(\theta^E\right)^{-1} > 1$, which is needed for $ROOs$ to be worth invoking. The latter is ensured by $f + f_x$ always being less than $f + f_x + d$.

$(2b)$ $\phi_{xr}^{*Bi} > \phi_x^{*Bi}$. Given $ROOs$ are worth invoking, this boils down to d being large enough.

We can make some further comparisons, but these are more subtle. First, note that ceteris paribus, an increase in the aggregate price index in a country, or an increase in its expenditure, makes profits as a function of ϕ steeper. A more restrictive trade policy, i.e., a rise in transport costs (τ), a dilution of preferences (a rise in θ so preferences are more costly to obtain) or a more restrictive quota (an increase in s), makes the profit function flatter.

Since the aggregate price index is endogenous, to proceed further, we need to understand how differences in trade policy should be expected to affect the price index, and thus, the various cutoff levels (the ϕ^*'s) we are interested in. If the price index falls as trade policy becomes more restrictive, then the price index in the US will be below that in the EU. In this event, both the more restrictive trade policy and the lower price index will make profits in the US flatter than in the EU.

That more restrictive trade policy leads to a lower, rather than higher aggregate price index seems counter-intuitive, but is exactly what is predicted in these heterogeneous firm models. Melitz and Ottaviano (2008) show that a more protectionist stance increases the market potential of a

[30] Note that r stands for $ROOs$ and x for exports. Exporting to the US without meeting $ROOs$ is not an option.

country and results in more firms locating there, more varieties competing with each other, and hence, a lower price index. Some evidence that this occurs can be found in Chen et al. (2009) who show that for EU countries, trade openness seems to exert a competitive effect in the short run, with prices and markups falling. However, consistent with the predictions in Melitz and Ottaviano (2008), these effects diminish, and may even be reversed, in the longer run as more protected economies attract entry.

Invoking this result of Melitz and Ottaviano yields that profits from exporting to the US are lower than those from exporting to the EU and this makes the export cutoffs of Bangladeshi firms for the US higher than those for the EU. Moreover, this gap between the export cutoffs in the US and the EU will be larger (as the difference in slopes will be greater) the larger the difference in the trade policy stances. Thus, the difference in the export cutoffs for Bangladeshi firms exporting to the US and EU in non-wovens will be magnified relative to that in wovens, and as a result, we expect to see a greater fraction of firms selling only to the EU in non-wovens.

We construct Figures 3 and 4 to reflect these differences in trade policy stances in the two industries.[31] Both greater protection and a lower price index in the US work in the same direction: namely, to flatten the profit curves of a Bangladeshi firm from selling in the US relative to those from selling in the EU. Thus, we also know that (as P is lower in the US):

(3) $\pi_d^B(\phi) + \pi_{xr}^{BU}(\phi)$ is flatter than $\pi_d^B(\phi) + \pi_{xr}^{BE}(\phi)$ and has the same vertical intercept.

In the woven industry, see Figure 3, there are fewer advantages of selling in the EU relative to selling in the US. Meeting *ROOs* does not give as much of a benefit because they are costly to meet in wovens. Hence, the line for exporting and obtaining preferences to the *EU* starts out below that for exporting without meeting *ROOs*, but is not much steeper. It is also not much steeper than the line for exporting to the US (where *ROOs* must be met but are less onerous). As a result, few firms choose to export to the EU and meet the *ROOs*, i.e., ϕ_{xr}^{*BE}, where firms are indifferent between exporting to the *EU* with and without *ROOs*, is quite high. It is also significantly larger than ϕ_{xr}^{*BU}, where firms are indifferent between exporting under *ROOs* to the *US* and not doing so at all.

Figure 4 depicts the situation for non-woven garments. As preferences can be obtained cheaply in the EU, $\pi_d^B(\phi) + \pi_{xr}^{BE}(\phi)$ is much steeper than $\pi_d^B(\phi) + \pi_x^{BE}(\phi)$ though the former has a lower intercept. Hence, ϕ_{xr}^{*BE} is close to ϕ_x^{*BE} so that most Bangladeshi firms will meet *ROOs* and invoke

[31] Note that even though in these figures $\pi_d^B(\phi) + \pi_{xr}^{BU}(\phi)$ is concave due to quotas, it intersects the line $\pi_d^B(\phi)$ only once, since the equation $\pi_{xr}^{BU}(\phi) = 0$ has a unique solution.

preferences. A higher tariff, binding quotas, and an induced lower aggregate prices in the US flatten the profit line $\pi_{xr}^{BU}(\phi)$, raising ϕ_{xr}^{*BU} so that it may even lie above ϕ_{xr}^{*BE} as depicted.

C.3 Adding Demand Shocks

It is worth noting that the model as it stands predicts that if the US is a tougher market than the EU (since trade policy is more restrictive and the price index is lower), there should be no firms who export only to the US. However, there are a small number of firms of this kind in our data.[32] This can be incorporated into the model by allowing firms to also differ in terms of market specific demand shocks. A positive demand shock in a market will, other things constant, increase profits in that market. Consequently, in Figures 3 and 4, for example, a more positive US demand shock will raise profits and reduce the productivity level needed to export to the US. The cutoff productivity for exporting to the US will, thus, depend on the demand shock obtained by the firm. A firm with a given productivity but a particularly favorable US market demand shock along with an unfavorable EU market demand shock might, thus, choose to sell to the US and not the EU.

We incorporate demand shocks by allowing randomness in the utility function in each market. For each market i, the utility function is still given by (1), but now we define Q^i as

$$Q^i = \left[\int_{\omega} \int_{z} \left(z^i(\omega) q^i(\omega) \right)^{\rho} dz d\omega \right]^{\frac{1}{\rho}}, \tag{10}$$

where $q^i(\omega)$ is a quantity of variety ω consumed, and $z^i(\omega)$ is a random demand shock specific to this variety in market i. The result of the utility maximization subject to the budget constraint leads to the following demand function for each variety:

$$q^i(\omega) = z^i(\omega)^{\sigma-1} Q^i \left(\frac{P^i}{p^i(\omega)} \right)^{\sigma}, \text{ where} \tag{11}$$

$$P^i = \left[\int_{\omega} \int_{z} \left(\frac{p^i(\omega)}{z^i(\omega)} \right)^{1-\sigma} dz d\omega \right]^{\frac{1}{1-\sigma}}, \tag{12}$$

is a redefined aggregate price index. In other words, a stochastic component $z^i(\omega)$ is a demand shifter for each variety ω, given $p^i(\omega)$, P^i, and Q^i. To simplify the notation, denote $z^{\sigma-1}$ by v. Then the demand for each variety is $q^i(\omega) = v^i Q^i \left(\frac{P^i}{p^i(\omega)} \right)^{\sigma}$.

[32] One cannot dismiss them as random error, as they tend to be quite large in size, especially in non-wovens.

As before, Q^i and P^i are taken as given by each firm, since there is a continuum of them. The timing of the game is as follows. In stage 1, firms pay an entry fee of f_e, and draw their productivity level ϕ from the density function $g(\phi)$. Once ϕ is realized, it stays with the firm forever as long as it does not die. It is also common across all the markets the firm serves. After observing its ϕ, each firm decides whether to enter each particular market. If its productivity is high enough to enter this market, it pays a fixed cost of f_m and draws a demand shocks v^i specific to this firm from the distribution $H(v)$. We assume that each shock v^i is i.i.d. and comes from the cumulative distribution $H(v)$, which is the same across countries and firms. Based on ϕ and ν^i, a firm decides how much to sell in this market, which entails a further fixed cost of production, f. In other words, a firm's decision on whether to sell in a market depends on the realization of firm specific productivity, ϕ, which is common among the markets the firm is selling, as well as the market specific demand shock, v^i, in each market. In addition, these two realizations affect a firm's decision about which option to use to sell in the market (e.g., to invoke *ROOs* or not). As shown in Kee and Krishna (2008), given that the demand shock enters the demand function (11) multiplicatively, it will not affect the price of each variety, and price depends only on the productivity draw.

To summarize, we have 3 stages of a firm's decision making in the model: In the first stage, firms decide whether to pay the fixed costs of finding out their productivity. If it is worth it, they pay f_e, enter and get a productivity draw ϕ. In the second stage, knowing ϕ, they decide whether to spend f_m to enter each market and get a firm specific demand shock v^i there. In the third stage, they decide whether to operate in this market, and if it is profitable, they pay the fixed cost of production, f, and start selling there.

As usual, the model can be solved backwards. In the third stage, for firms with productivity ϕ, which enter market i, we can define a demand shock cutoff, $v^{*i}(\phi)$, such that only firms, which receive a demand shock $v^i > v^{*i}(\phi)$, can cover the fixed costs of selling in this market and earn non-negative profits $\pi\left(\phi, v^i, P^i\right) > 0$. For any productivity level, ϕ, the equilibrium demand shock cutoff, $v^{*i}(\phi)$, solves the following zero-profit condition:

$$\pi\left(\phi, v^{*i}(\phi), P^i\right) = \frac{r\left(\phi, v^{*i}(\phi), P^i\right)}{\sigma} - f = 0. \tag{13}$$

Then in the second stage, firms, which know only their productivity ϕ, compare the expected profits from entering market i and getting a demand shock draw with the fixed costs of doing so,

f_m. These profits are

$$\begin{aligned}\tilde{\pi}\left(\phi, P^i\right) &= \Pr\left(v^i > v^{*i}\left(\phi\right)\right) * E\left[\pi\left(\phi, v^i, P^i\right) \mid v^i > v^{*i}\left(\phi\right)\right] \\ &= \left[1 - H\left(v^{*i}\left(\phi\right)\right)\right] E\left[\pi\left(\phi, v^i, P^i\right) \mid v^i > v^{*i}\left(\phi\right)\right].\end{aligned}$$

Thus, for each market i, we can define a productivity cutoff ϕ^{*i} as the productivity of a marginal firm making zero expected profits:

$$\tilde{\pi}\left(\phi^{*i}, P^i\right) = \frac{r\left(\phi^{*i}, v^{*i}\left(\phi^{*i}\right), P^i\right)}{\sigma} - f_m = 0. \tag{14}$$

In a partial equilibrium, given P^i and Q^i, equations (13) and (14) completely solve for two unknowns, $v^{*i}\left(\phi^{*i}\right)$ and ϕ^{*i}, as functions of P^i, Q^i, and the fixed costs, f and f_m.

Finally, in the first stage, firms decide to enter and get a productivity draw ϕ until the present value of their expected profits from selling in all markets is equalized to the entry costs:

$$\sum_i \Pr\left(\phi > \phi^{*i}\right) E\left(\frac{\tilde{\pi}\left(\phi, P^i\right)}{\delta} \mid \phi > \phi^{*i}\right) = f_e,$$

with δ being the exogenous death rate of firms, which is used as a discount factor for the future profits. This gives the mass of firms that enter and allows us to solve for the endogenous variables P^i and Q^i. This completes the description of the equilibrium.

The differences in trade policies described above can be incorporated into the model with demand shocks the same way as before. The only difference is that instead of productivity cutoffs, now we have demand shock cutoffs at any given productivity level in stage 3. This is defined as $v^{*i}\left(\phi\right)$ in (13), which is a downward sloping loci for each of the market. Only firms above the locus will serve a market (provided that their productivity is also above the entry cutoff in stage 2). Easier trade policy such as that of the EU in the non-woven sector, causes the locus to be closer to the origin and thus allows the less productive firms to be in the market at any given demand shock level. Moreover, ROOs are still more profitable to meet for firms with higher productivity at a given demand shock level. Thus, the introduction of demand shocks does not change our predictions for the productivity cutoffs, given demand shocks.

D Predictions

The predictions of our model can be summarized as the following.

Prediction 1 (Sorting across markets):

(a) Conditioning on demand shocks, as the US is the tougher market, the productivity cutoff for Bangladeshi firms exporting to the US should exceed that for exporting to the EU. Hence, within an industry, we should see firms sort across markets on the basis of their productivity, namely, more productive firms should export to the US and EU, while less productive ones should export only to the EU.

(b) This sorting should be more evident in non-wovens, where the trade policy stance of the US and EU differs by more.

Thus, between industries, we look for evidence consistent with the fact that, given demand shocks, cutoff productivities should differ more in non-wovens. As a result of this prediction, the proportion of firms that export to the US should be smaller than that of firms who export to the EU in both wovens and non-wovens, but especially in non-wovens, where the trade policies in the US and EU are further apart. This is supported by the evidence in Table 1. Firms that export to the EU include both OEU firms and AUS firms, while firms that export to the US include AUS firms and OUS firms.

Prediction 2 (Sorting by mode of market access):

(a) Among firms exporting to the EU, the more productive firms choose to meet ROOs, conditioning on demand shocks.

(b) This should be especially so in wovens, where *ROOs* are costly to meet, so that only the most productive firms find it worthwhile to meet them.

We expect to see the fraction of firms who sell to the EU and invoke *ROOs* being higher in non-wovens. By matching the customs data set and the firm survey we find that while 58 percent of the firms in non-wovens who sell to the EU invoke *ROOs*, only 40 percent do so in wovens.

Adding demand shocks also provides additional predictions which can be verified in the data.

Prediction 3 (Demand Shocks versus Productivity):

Demand shocks play a greater role in determining the markets firms serve when productivity cutoffs are close. Similarly, productivity plays a greater role in determining the markets firms serve when demand shocks are controlled for. This implies that the sorting of firms across markets, described in Prediction 1, should be stronger when demand shocks are controlled for.

An implication of Prediction 3 is that when export productivity cutoffs are similar across markets there are likely to be more OUS firms. This follows from demand shocks being the force that creates OUS firms and their playing more of a role in determining the markets served when productivity cutoffs are close. This is consistent with the fact that 3 percent of firms in non-wovens are OUS firms compared to 10 percent in wovens. Moreover, as large favorable US demand shocks will be required to create OUS firms in non-wovens, such firms should be larger in size in wovens than in non-wovens despite being less likely. These facts are documented in Kee and Krishna (2008).

To test the predictions of the model more formally, we now turn to estimating firm productivity.

V Results

A Productivity Estimation

We assume that the following Cobb Douglas production function holds *separately* for woven and non-woven industries (industry subscripts are omitted):

$$Y_{jt} = \phi_{jt} L_{jt}^{\alpha_L} M_{jt}^{\alpha_M} K_{jt}^{\alpha_K}, \tag{15}$$

where j and t are the indices for firm and year, respectively, and Y_{jt}, L_{jt}, M_{jt}, and K_{jt} are the output, labor, materials, and capital of firm j in year t. Output and material input are obtained by deflating total sales and material cost using firm specific price indices, which are constructed using detailed price information from the firm survey.[33] The total factor productivity (TFP) of firm j in year t is ϕ_{jt}. We assume that, in logs, ϕ_{jt} can be decomposed linearly into the following:

$$\ln \phi_{jt} \equiv \omega_{jt} + \alpha_t + \alpha_A a_{jt} + \eta_{jt}, \tag{16}$$

where ω_{jt} is observable to a firm at the beginning of each period before variable input choices are made, but not to researchers. The year specific productivity, α_t, captures the effect of time and others factors that are common to all firms during a year (within an industry) and $\alpha_A a_{jt}$ is the effect of (log of) age on productivity. The last term, η_{jt}, is the truly unobserved classical error term. Taking log of (15) and using (16) , we have

$$y_{jt} = \alpha_t + \alpha_A a_{jt} + \alpha_L l_{jt} + \alpha_M m_{jt} + \alpha_K k_{jt} + \omega_{jt} + \eta_{jt}, \tag{17}$$

where all lower case letters are in logs. In logs, output is linearly related to the two variable inputs, labor and materials, as well as the fixed input, capital stock. Given that ω_{jt} is observable to the

[33] Details are in the Appendix.

firms (but not to the researchers) before the variable input choices are made, it would tend to be positively correlated with l_{jt} and m_{jt}, which would cause the least squares estimates of α_L and α_M to be biased upward. However, ω_{jt} and m_{jt} could be negatively correlated. For example, if more productive firms could manage to use less material to produce, the least squares estimate of α_M could be biased downwards. In addition, if larger, older firms tend to stay in business despite low productivity, while younger, smaller firms tend to quit more easily, such endogenous exit decisions on the part of firms would bias the least squares estimates of the α_A and α_K downwards.

To address such input endogeneity and selectivity bias, Olley and Pakes (1996) (OP) derive a 3-step procedure to obtain consistent estimates of the $\alpha's$. In their model, firms choose to exit or not once they know their productivity. If they do not exit, they decide on how much to invest and make other output and input decisions. Productivity, ω_{jt}, is assumed to be the only unobserved state variable in each year t. It follows a common exogenous Markov process, which, jointly with the fixed input, k_{jt}, and its age, determines the exit decision and investment demand, i_{jt}, of the firms in each period. They consider the Markov perfect Nash equilibrium, so firm's expectations match the realization of future productivity. Then a polynomial function of i_{jt}, k_{jt}, and (the log of) age, a_{jt}, can be used to proxy for the unobserved productivity, ω_{jt}. This is possible because, given k_{jt} and a_{jt}, i_{jt} is increasing with ω_{jt}, which makes the investment function invertible. The assumption that investment is monotonically increasing with the unobserved productivity is crucial, since without it invertibility is not ensured. Furthermore, to control for the exit decision, they estimate a Probit regression to obtain the survival probability and use it to control for selection bias.

In our current data set, it is likely that (in addition to the unobserved productivity) firm's investment and exporting decisions also depend on market specific demand shocks that vary across firms. As pointed out in Kee and Krishna (2008), the fact that in non-wovens there exist OUS firms who are fewer in number, but larger in market share, is one such piece of evidence. Without accounting for such demand shocks, investment may not be monotonic in productivity, which would invalidate the use of the standard approach described above.

To accommodate these facts, we modify OP along the lines suggested by Ackerberg, Benkard, Berry and Pakes (2007). Basically, what we do is extend OP from a scalar setup to a vector one. Instead of having each firm observe its productivity alone before making its output, sales, and investment decisions, we have them observe firm specific demand shocks in the US and the EU, which together with their productivity would determine their actions, including their investment decisions and export shares in the US and EU. If this vector function is invertible, we can obtain productivity as a function of investment and export shares rather than just investment as in OP.

We assume that at the beginning of each period, each firm observes its productivity, ω_{jt}, and its demand shocks, μ_{jt}^{E} and μ_{jt}^{U}, for the EU and US markets respectively. These follow independent exogenous first order Markov processes,

$$p\left(\omega_{jt+1}|\left\{\omega_{j\tau}\right\}_{\tau=0}^{t},J_{jt}\right)=p\left(\omega_{jt+1}|\omega_{jt}\right),\quad\text{and}\tag{18}$$

$$p\left(\mu_{jt+1}^{i}|\left\{\mu_{j\tau}^{i}\right\}_{\tau=0}^{t},J_{jt}\right)=p\left(\mu_{jt+1}^{i}|\mu_{jt}^{i}\right),i=E,U,\tag{19}$$

where J_{jt} is the information set of firm j in year t. Having observed ω_{jt}, μ_{jt}^{E}, and μ_{jt}^{U} (which are not observed by the researcher) and formed its perception of the future distributions, firm j has the following decisions to make: to exit the market or not. If not, how much to invest (and produce), and how much to export to each market to maximize the present discounted value of current and future profits governed by the Bellman equation

$$\begin{aligned}&V\left(k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U},\Delta_{t}\right)\\=\;&\max\left\{\begin{array}{l}\Phi\left(k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U},\Delta_{t}\right),\\ \max_{i_{jt},x_{jt}^{E},x_{jt}^{U}}\left\{\Pi\left(k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U},\Delta_{t}\right)-c\left(i_{jt},\Delta_{t}\right)\right.\\ \left.+\beta E\left[V\left(k_{jt+1},a_{jt+1},\omega_{jt+1},\mu_{jt+1}^{E},\mu_{jt+1}^{U},\Delta_{t+1}\right)|k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U},\Delta_{t},i_{jt}\right]\right\}\end{array}\right\},\end{aligned}$$

where $\Pi\left(k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U},\Delta_{t}\right)$ and $c\left(i_{jt},x_{jt}^{E},x_{jt}^{U},\Delta_{t}\right)$ represent the per period profit and investment and export costs, which depend on Δ_t, the economic environment in year t that is common across all firms. The sell off value of the firm is $\Phi\left(k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U},\Delta_{t}\right)$ and the firm will exit if the present discounted value of current and future profits of continuing is less than Φ.

Thus, the vector of firm specific shocks $(\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U})$ determines the vector of investment and export shares $(i_{jt},x_{jt}^{E},x_{jt}^{U})$ for this firm.

$$\begin{pmatrix}i_{jt}\\x_{jt}^{E}\\x_{jt}^{U}\end{pmatrix}=\Upsilon_{t}\left(k_{jt},a_{jt},\omega_{jt},\mu_{jt}^{E},\mu_{jt}^{U}\right).\tag{20}$$

Assume $\Upsilon_t(.)$ is a bijection in $\left(\omega_{jt}, \mu^E_{jt}, \mu^U_{jt}\right)$ conditional on (k_{jt}, a_{jt}).[34] Then it can be inverted as

$$\omega_{jt} = \Upsilon_t^{-1}\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right) = h_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right). \tag{21}$$

In other words, we can proxy for unobserved firm productivity using a polynomial function, $h_t(.)$. Hence, our first stage estimation involves using a polynomial function $h_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right)$ to control for ω_{jt} in order to estimate the α coefficients on the variable inputs, l_{jt} and m_{jt}, which are chosen after $\left(\omega_{jt}, \mu^E_{jt}, \mu^U_{jt}\right)$ are observed.

$$\begin{aligned} y_{jt} &= \alpha_t + \alpha_L l_{jt} + \alpha_M m_{jt} + \alpha_K k_{jt} + \alpha_A a_{jt} + h_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right) + \eta_{jt} \\ &= \alpha_L l_{jt} + \alpha_M m_{jt} + \nu_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right) + \eta_{jt}, \end{aligned} \tag{22}$$

where $\nu_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right) = \alpha_t + \alpha_K k_{jt} + \alpha_A a_{jt} + h_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right)$ combines α_t, $\alpha_K k_{jt}$ and $\alpha_A a_{jt}$ with $h_t(.)$, and $h_t(.)$ is assumed to be common across all firms in an industry but may vary over time. In our three stage nonlinear estimation procedure we allow all the polynomial functions to be specific to the pre-EBA period, 1999-2000, and the post-EBA period, 2001-2003. This helps control for differences in the market environment due to changes in trade policy that may influence investment decisions. Provided that $h_t(.)$ is successful in controlling for ω_{jt}, the least squares estimates for α_L and α_M, $\hat{\alpha}_L$ and $\hat{\alpha}_M$, are consistent.

To estimate α_K and α_A, we need to control for the propensity to exit, since exit is endogenous and is affected by size and age of firms. For each firm i, in order to maximize the present discounted value of current and future profits, the optimal exit rule having observed $\left(\omega_{jt}, \mu^E_{jt}, \mu^U_{jt}\right)$ is

$$\chi_{jt} = \begin{cases} 1 \text{ (continue)} \\ 0 \text{ (exit)} \end{cases} \text{if } \omega_{jt} \gtreqless \bar{\omega}_t\left(k_{jt}, a_{jt}, \mu^E_{jt}, \mu^U_{jt}\right), \tag{23}$$

where $\bar{\omega}_t$ is the cutoff productivity for exporting.

Thus, the probability that firm j survives in year $t+1$ given the information set in year t, J_t, is

$$\begin{aligned} \Pr\left(\chi_{jt+1} = 1 | J_t\right) &= \Pr\left(\omega_{jt+1} > \bar{\omega}_{t+1}\left(k_{jt+1}, a_{jt+1}, \mu^E_{jt+1}, \mu^U_{jt+1}\right) | J_t\right) \\ &= \tilde{\varphi}_t\left(\omega_{jt}, \bar{\omega}_{t+1}\left(k_{jt+1}, a_{jt+1}, \mu^E_{jt+1}, \mu^U_{jt+1}\right)\right) = \tilde{\tilde{\varphi}}_t\left(\omega_{jt}, k_{jt+1}, a_{jt+1}, \mu^E_{jt}, \mu^U_{jt}\right) \\ &= \varphi_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right) = \mathbf{P}_{jt+1}, \end{aligned} \tag{24}$$

[34] As there are other markets, the US and EU export shares need not add up to unity allowing invertibility.

where the first equality holds because of the exit rule (23) , the second and third equalities hold due to the assumption of the exogenous Markov process of ω_{jt}, μ^E_{jt} and μ^U_{jt}, and the last equality holds because the tri-variate policy function $\left(i_{jt}, x^E_{jt}, x^U_{jt}\right) = \Upsilon_t\left(k_{jt}, a_{jt}, \omega_{jt}, \mu^E_{jt}, \mu^U_{jt}\right)$ is a bijection in $\left(\omega_{jt}, \mu^E_{jt}, \mu^U_{jt}\right)$ conditional on (k_{jt}, a_{jt}) , and k_{jt+1} and a_{jt+1} can be inferred from k_{jt}, i_{jt} and a_{jt}, from,

$$K_{jt+1} = K_{jt}(1-\delta) + I_{jt}, \text{ and } A_{jt+1} = A_{jt} + 1. \tag{25}$$

In other words, in the second stage, we can estimate the survival probability in $t+1$ non-parametrically using a period specific polynomial function of $\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right)$ in a probit regression. This would allow factors like the existence of the EBA to affect exit decisions. We denote the estimated survival probability in $t+1$ as $\hat{\mathbf{P}}_{jt+1}$.

According to (17) , the expected value of output net of the influence of labor and material in $t+1$, given the information set in t and survival in $t+1$, is

$$\begin{aligned}
E\left[y_{jt+1} - \alpha_L l_{jt+1} - \alpha_M m_{jt+1} | J_{jt}, \chi_{jt+1} = 1\right] &= \alpha_{t+1} + \alpha_A a_{jt+1} + \alpha_K k_{jt+1} + E\left[\omega_{jt+1} | J_{jt}, \chi_{jt+1} = 1\right] \\
&= \alpha_{t+1} + \alpha_A a_{jt+1} + \alpha_K k_{jt+1} + g\left(\omega_{jt}, \mathbf{P}_{jt+1}\right) \\
&= \alpha_{t+1} + \alpha_A a_{jt+1} + \alpha_K k_{jt+1} + g\left(\nu_t - \alpha_t - \alpha_K k_{jt} - \alpha_A a_{jt}, \mathbf{P}_{jt+1}\right),
\end{aligned} \tag{26}$$

where the first equality holds because a_{jt+1} and k_{jt+1} are known at t due to (25) . Given the assumption of a Markov process, ω_{jt+1} only depends on ω_{jt} and the probability of surviving in $t+1$, which is given in (24). Equation (26) suggests that we run the following nonlinear estimation in the third stage with $g\left(\nu_t - \alpha_t - \alpha_K k_{jt} - \alpha_A a_{jt}, \mathbf{P}_{jt+1}\right)$ being approximated by a polynomial function, to obtain α_t, α_A, and α_K,

$$\begin{aligned}
y_{jt+1} - \hat{\alpha}_L l_{jt+1} - \hat{\alpha}_M m_{jt+1} &= (\alpha_L - \hat{\alpha}_L) l_{jt+1} + (\alpha_M - \hat{\alpha}_M) m_{jt+1} + \alpha_{t+1} + \alpha_A a_{jt+1} + \alpha_K k_{jt+1} \\
&\quad + g\left(\hat{\nu}_t - \alpha_t - \alpha_K k_{jt} - \alpha_A a_{jt}, \hat{\mathbf{P}}_{jt+1}\right) + \zeta_{jt} + \eta_{jt},
\end{aligned} \tag{27}$$

where by construction, $E\left[\zeta_{jt} + \eta_{jt} | J_{jt}, \chi_{jt+1} = 1\right] = 0$, and $\hat{\alpha}_L$, $\hat{\alpha}_M$, and $\hat{\nu}_t$ are obtained from the first stage least squares regression and $\hat{\mathbf{P}}_{jt+1}$ is from the second stage probit regression. We also include l_{jt+1} and m_{jt+1} on the right hand side of (27) as over-identifying restriction tests on the validity of $\hat{\alpha}_L$ and $\hat{\alpha}_M$. If the polynomial function, $h_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right)$, is successful in controlling for ω_{jt}, and thus, $\hat{\alpha}_L$ and $\hat{\alpha}_M$ are consistent, then there should be no variation of

l_{jt+1} and m_{jt+1} left in (27) and the estimated coefficients should be zero.[35] Failing to reject null hypothesis that the estimated coefficients on l_{jt+1} and m_{jt+1} are insignificant also indicates that there are no systematic measurement errors in l_{jt} and m_{jt} that are correlated with firm productivity.

The results of the regressions are reported in Table 2. Columns (1) to (3) present the results for non-wovens, and (4) to (6) are for the woven industry.[36] The OLS estimations with no correction for endogeneity, selectivity, or year fixed effects are reported in (1) and (4). These estimates are quite strange, with the coefficient for capital actually being negative, though not significant. This is to be expected, as we know these estimates are likely to be biased.

Columns (2) and (5) report the first stage results of the extended OP procedure, where a 3rd order polynomial function of investment, capital, age, and export shares (which is allowed to differ pre and post EBA) is included as a control for the unobserved firm productivity, as well as the year fixed effects. For non-wovens, both the coefficients on labor and materials are now lower as expected, which suggests that the endogeneity issue was important. For wovens, while the coefficient on labor is lower, the coefficient on materials is now higher. The higher estimate for α_M suggests that material input is negatively correlated with productivity in wovens. This could be because high productivity firms tend to be able to save on costly domestic materials used in order to satisfy the *ROOs* requirement in the EU market under the EBA.

Given the estimates in Columns (2) and (5), Columns (3) and (6) show the third stage estimates with correction for selectivity bias to obtain the estimates for the coefficients on capital and age. Relative to the OLS estimates in Columns (1) and (4), the estimated coefficient on capital for non-wovens rises from 0.121 to 0.209, while for wovens, it rises from -0.013 to 0.208 and is now statistically significant. The coefficients on age, while positive, are not statistically significant in both industries.

Finally, coefficients on labor and material in Columns (3) and (6) are not statistically significant suggesting that $\hat{\nu}_t\left(k_{jt}, a_{jt}, i_{jt}, x^E_{jt}, x^U_{jt}\right)$ is sufficient to control for ω_{jt} and that there is no further correlation between these variable inputs and the unobserved productivity. This also indicates that there is no systematic measurement errors in labor and materials.[37]

[35] In fact, when we do not use x^E_{jt} and x^U_{jt} as controls for market specific demand shocks, μ^E_{jt} and μ^U_{jt}, one of overidentifying restriction tests is negative, implying that ω_{jt} cannot be proxied by the polynomial of i_{jt}, k_{jt}, and a_{jt}.

[36] We checked that on average, sweaters and knitwear look alike so that we are not doing violence to the data in pooling them.

[37] There may be a concern that labor and materials have measurement errors that are correlated with productivity. For example, material costs may be inflated more for the more productive firms in order to cheat on taxes, and more productive firms may hire better workers. In addition to the overidentifying restriction tests, here we also

Firm productivity is constructed based on the results presented in Columns (3) and (6) and forms the basis of our empirical exercise,[38]

$$\text{Non-Woven:} \qquad \ln \phi_{jt} = y_{jt} - 0.292 l_{jt} - 0.129 m_{jt} - 0.209 k_{jt}, \tag{28}$$

$$\text{Woven:} \qquad \ln \phi_{jt} = y_{jt} - 0.251 l_{jt} - 0.589 m_{jt} - 0.208 k_{jt}. \tag{29}$$

B Firm and Market Specific Demand Shocks

We use the estimated firm productivity from (28) and (29) to help us estimate firm specific demand shocks in the EU and the US markets, μ_{jt}^{E} and μ_{jt}^{U}. Our approach here is very similar to Eslava et al. (2004). The firm specific demand function in each market is the following,

$$q_{jt}^{i} = \mu_{jt}^{i} \left[\frac{p_{jt}^{i}}{P_{t}^{i}} \right]^{-\sigma^{i}} Q_{t}^{i}, \; i = E, U. \tag{30}$$

Here we allow the elasticity of substitution to be market specific.[39] Demand shock, μ_{jt}^{i}, is observable to the firm at the beginning of each period when production decisions are made. We have data on q_{jt}^{i} and p_{jt}^{i}. We proxy for P_{t}^{i} using a share weighted average of prices[40], and derive Q_{t}^{i} as the ratio of $P_{t}^{i} Q_{t}^{i}$ (or total exports to a market) and P_{t}^{i}. So, once we estimate σ^{i}, we can construct μ_{jt}^{i} from (30). Taking log on both sides of (30) and allowing for an industry-year specific dummy variable (which proxies for the product of Q_{t}^{i} and μ_{jt}^{i}), we have the following equation:

$$\ln q_{jt}^{i} = D_{t}^{i} - \sigma^{i} \ln \left(\frac{p_{jt}^{i}}{P_{t}^{i}} \right) + \varepsilon_{jt}^{i}. \tag{31}$$

Regressing $\ln q_{jt}^{i}$ on $\ln \left(\frac{p_{jt}^{i}}{P_{t}^{i}} \right)$ and D_{t}^{i} gives us an estimate of σ^{i}. To address the endogeneity of p_{jt}^{i}, we use the log of the estimated firm productivity, $\ln \phi_{jt}$, as an instrument. This is motivated by the optimal pricing rule of the firm, (5), as a firm charges a lower price if it is more productive. Also included as instruments are the log of capital and the firm's age. These two variables are

follow Griliches and Hausman (1986) to test for such errors in variable problem. This test result also shows that measurement errors are not relevant in the estimations.

[38] There may be a concern that non-wovens appear to have decreasing returns to scales, based on the point estimates of equation (28), $\hat{\alpha}_M + \hat{\alpha}_L + \hat{\alpha}_K = 0.73$. We tested for the null hypothesis of constant returns to scales, $H_0 : \alpha_M + \alpha_L + \alpha_K = 1$. Based on the bootstrapped standard error of 0.32, the t-statistic is -0.83, which is not statistically different from 0. Thus, the constant returns to scale hypothesis is not rejected. This result is available upon request.

[39] Constraining them to be the same does not change the results.

[40] Since $PQ = \sum p_{jt} q_{jt}$, $P = \sum p_{jt} \frac{q_{jt}}{Q}$, which suggests using an output share weighted construction to proxy for P.

the exogenous state variables in each period, which affect the input and output decisions of the firms. Equation (31) is fitted for each industry and each market and the results are presented in Table 3. All the σ^i are highly significant and are larger than one as required by theory.[41] With the estimated σ^i, we can construct μ^i_{jt}, using (30) for those observations with positive demand:

$$\mu^i_{jt} = \frac{q^i_{jt}}{Q^i_t}\left[\frac{p^i_{jt}}{P^i_t}\right]^{\sigma^i}, \; q^i_{jt} > 0. \tag{32}$$

Zero sales in a market for a firm mean that its demand shock for that market was too small for it to export there, given its productivity. For observations with zero demand, demand shocks are inferred by the following procedure suggested by the model. First, we group firms into 10 different decile intervals according to their productivity level within the same industry and year. We do so because the minimum shock needed to export to a market depends on its productivity. We then identify the minimum demand shocks (constructed according to (32) observed for exporter to a market in each decile). We then fill in for the missing demand shocks for firms not exporting to the market using a draw from a uniform distribution from the interval from zero to the minimal observed demand shock for exporters to that market in that decile. We further remove industry and year means from μ^i_{jt} to isolate shocks that are truly unique to firm j in each year.

Table 4 presents the sample averages of the estimated productivity and demand shocks by industry and firm type. In addition to OEU and AUS exporters defined earlier, we classify those firms that do not export to the EU, but export to the US, as only-US exporters (OUS). Here we can see some interesting patterns. Within non-wovens, OEU firms have the lowest TFP, follow by the AUS firms and then the OUS firms. However, the reverse ordering holds in wovens: OEU firms are more productive than AUS and OUS firms. This result highlights the importance of incorporating demand shocks in the model as a factor in determining the export destinations of the firms. The woven industry is the older one in Bangladesh. Older woven firms could have better contacts in the US, and hence, better demand shocks, and export there despite having lower TFP.

In both industries, EU demand shocks are larger for OEU firms than for AUS ones.[42] US demand shocks are larger for OUS than for AUS firms. OEU firms in non-wovens, on average,

[41] Note that these cannot be said to be "small" relative to usual estimates of import demand elasticities as we estimate firm level elasticities which captures the substitutability between this firms product and that of all other firms in the industry. They do not capture the response of a change in the industry price index on demand for the industry's product, which is what is usually estimated.

[42] By construction, OUS firms will have the lowest EU demand shocks.

have smaller positive EU demand shocks than do OEU firms in wovens. This is consistent with non-wovens being an easier market than wovens in the EU. Similarly, OUS firms in non-wovens have a higher US demand shock than do OUS firms in wovens consistent with the idea that it takes a really big positive demand shock to make a firm an OUS one in non-wovens as the EU is such an attractive market in this subindustry. We will test more formally the role of productivity and demand shocks in explaining exporter status below.

C Regression Analysis

C.1 Within Industry Analysis

Table 5 presents the results of probit regressions where we regress the export destinations of the firms on their productivity and its squares, controlling for year fixed effects, firm size, and age. Given that firm productivity is estimated with error, the bootstrapped standard errors are reported. The standard errors are also clustered by industry, year, location, and capacity of the firms in order to take into account any correlation among observations within the sampling clusters. In Columns (1) to (6) we run a variety of probits, without controlling for demand shocks. In Columns (7) to (12) we run them again, controlling for demand shocks.

The dependent variables of Columns (1) and (4) equal one if the firm only exports to the EU in non-wovens and wovens, respectively. Our model predicts that in non-wovens, productivity differences should play a greater role in determining whether firms are OEU or not, while in wovens, demand shocks should play a greater role. In non-wovens there should be large productivity differences in OEU and non OEU firms, given the demand shock, while in wovens they would be smaller. This is consistent with the estimates. An increase in the productivity of a firm significantly decreases the probability the firm is an OEU one, especially in non-wovens. An increase in the EU demand shock significantly increases the probability a firm is an OEU one and this is more so in wovens as is evident from Columns (7) and (10).

Similarly, in Columns (2) and (5) the dependent variable is one if the firm sells to both the EU and the US in non-wovens and wovens, respectively. It is not the reverse of what is done in Columns (1) and (4) as a non-OEU firm could be a firm that only exports to the US, or a firm that exports to a third market. Here we find that an increase in productivity increases the probability that the firm is an AUS firm in non-wovens but this is not significant, while this effect is significant and positive in wovens. The result in Column (2) may be due to the fact that we may have an omitted variable bias as demand shocks are not controlled for. The dependent variable in Columns (3) and (6) equals one if the firm only exports to the US (OUS-exporters). Again, we do not control for demand shocks. These two columns show that productivity is not important at all in determining which firms only export to the US when demand shocks are not controlled for.

In Columns (7) to (12), demand shocks are estimated from (32) as discussed. Note that as expected from our model, productivity differences play a greater role in determining whether firms are OEU or not in non-wovens than in wovens (-3.945 versus -.742), while EU demand shocks play a greater role in doing so in wovens (where productivity cutoffs are closer) relative to non-wovens (.569 versus .163)! In all cases, these demand shocks are extremely important in explaining export destinations of the firms. When a firm has a favorable demand shock in the US, the probability of the firm being an OEU one decreases significantly, while the probability of the firm being either an AUS or OUS increases significantly. Conversely, positive EU demand shocks increase the likelihood of a firm being an OEU or AUS exporter, but decrease the likelihood of being an OUS firm. More importantly, controlling for demand shocks significantly improves the explanatory power of productivity for firm exporter status, particularly for the AUS firms in non-wovens and OEU firms in wovens. Thus, the results of this table show that controlling for demand shocks, as the productivity of a firm increases, the likelihood that this firm only exports to the EU decreases, while the likelihood of this firm also exports to the US increases. These results are common across both woven and non-woven industries, but the marginal effects of productivity on export destination choices are larger for the non-wovens.

To test the hypothesis that AUS firms are more productive than OEU firms, we first regress firm productivity on an AUS/OEU firm dummy variable, which equals zero if it is an OEU firm and one if it is an AUS firm. These results are presented in Columns (1) and (2) of Table 6 for non-wovens and wovens, respectively. In non-wovens, the average productivity of an AUS firm is significantly higher than that of an OEU firm with point estimate equals to 0.22. However, in wovens, the productivity advantage of an AUS firm over that of an OEU firm is found to be negative and insignificant. These results are likely to be biased downwards given that we do not control for demand shocks, since firms with favorable demand shocks in the US will be able to export to the US despite low productivity draws. Columns (3) and (4) include demand shocks in the regression. As suspected, the estimated average productivity of an AUS firm increases in both industries.

Columns (5) and (6) further control for firm size, age, and the exposure to the EU and US market (export shares in these markets), in addition to market demand shocks. For non-wovens, the productivity advantage of AUS firms over OEU firms is now on average 33 percent (=exp(0.282)-1), while for wovens, it is 40 percent. Thus, we find evidence that controlling for demand shocks and other firm attributes, AUS firms are more productive than OEU firms in both industries.

Are firms that satisfy *ROOs* more productive than other firms in the same market when *ROOs* are binding? The information with regards to which firms meet *ROOs* is available in the customs data for 2004. By matching this data with that in the firm survey in 2003 using firm names, we isolated a subset of 46 OEU firms in wovens, of which 25 met *ROOs* in 2004. Column (7) compares the productivity of these firms to those OEU firms in wovens that do not meet *ROOs*, controlling for demand shocks, firm age, and size. The results show that the firms that invoke GSP preferences, and hence, must satisfy *ROOs* are on average 40 percent (=exp(0.338)-1) more productive than firms that did not meet *ROOs*.[43] Thus, the evidence supports the hypothesis that, when *ROOs* are binding as it is in the case of wovens, only the more productive firms choose to meet *ROOs*.

C.2 Between Industry Analysis

Our model predicts that, given that the cutoff productivities for the EU and the US markets are further apart for non-wovens, there should be proportionately more OEU firms in non-wovens for any given demand shock. Furthermore, controlling for demand shocks and other firm attributes, the productivity differences between OEU firms and other firms should be larger in non-wovens.

Table 7 performs the cross industry comparison using a difference-in-difference approach. In Column (1) we regress the AUS dummy on a woven industry fixed effect. The estimated coefficient is the additional proportion of AUS firms in wovens relative to that of non-wovens. Without any controls, the regression shows that the woven industry has 18 percent more AUS firms than the non-woven industry. Column (2) controls for demand shocks, together with firm size and age, but we still find that there are proportionately more AUS firms in wovens than in non-wovens. This finding is consistent with the theoretical prediction.

In Column (3) we regress the estimated firm TFP on a woven industry dummy, an OEU dummy, and the interaction term between the two. The results show that OEU firms are significantly less productive than other firms in non-wovens, but not necessarily so in wovens. Column (4) further controls for demand shocks and other firm attributes. The results are even stronger here. While OEU firms are less productive in general, the productivity difference is less in wovens than in non-

[43] Given that most firms meet ROOs in non-wovens, we cannot perform the same analysis there.

wovens. This result is consistent with the observation that while the trade policy regime in term of wovens is similar in both the EU and the US markets, it is considerably less restrictive for non-wovens in the EU market. Such between industry differences in the trade policy environment allow more inefficient OEU firms to operate in the EU market for non-wovens, causing the productivity differences between OEU firms and the other firms to be larger in non-wovens.

D Stochastic Dominance Tests

Can we say more about the productivity differential between AUS and OEU firms within the same industry? The analysis so far has focused on estimating average productivity differences but our theory suggests that the productivity distribution of AUS firms should first order stochastic dominate (FOSD) that of OEU firms within the same industry. Table 8 tests this hypothesis using a nonparametric test for first order stochastic dominance by Anderson (1996). This is a multiple comparison test based on the 10 decile intervals of the pooled distribution.

To control for demand shocks and other firm attributes, we first regress the AUS/OEU dummy variable in a probit regression by industry on the EU and US demand shocks, firm size and age, as well as year fixed effects. We compare the predicted status with the actual, and only keep the following two groups of firms:[44] those AUS firms that were predicted by demand shocks and other firm attributes to be OEU firms, and those OEU firms that were predicted to be AUS firms. If the model is correct, then the AUS firms we keep should be those with such a high productivity that they export to the US despite adverse US demand shocks. Similarly, the OEU firms we keep should be so unproductive that they remain OEU exporters despite having good demand shocks in the US. The AUS/OEU status of these two groups of firms is least likely to be driven by demand shocks or other firm attributes. There are 60 non-woven firms and 48 woven firms in these subsamples.

Table 8 compares the productivity distribution of OEU firms (distribution A) to that of the AUS firms (distribution B). Positive numbers in each decile interval imply that the cumulative distribution A lies above B, and vice versa. The result for non-wovens is shown in Column (1). Seven out of ten elements are positive, and two are statistically significant, which suggests that the productivity distribution of AUS firms FOSD that of OEU firms. Likewise for wovens in Column (2), where nine out of ten elements are positive and five are statistically significant. Results based on the bootstrapped bias-corrected confidence intervals are very similar. Overall the results based

[44] Cutoff probability is selected such that the proportion of predicted AUS firms is the same as the actual one.

on these multiple comparison tests support our theoretical model that conditioning on demand shocks the productivity distribution of AUS firms FOSD that of OEU firms in both industries.

VI Conclusion

Our findings are important for a number of reasons. First, our theoretical work is the first to introduce firm and market specific demand shocks as an additional dimension into heterogeneous firm models and to predict how firms would tend to sort themselves across markets in response to differences in trade policy, preferences, and the costs of obtaining these preferences. Second, we are also the first to test for these predictions in the data, by modifying the productivity estimation procedure to take into account the influence of firm-market specific demand shocks.

Third, our work shows how the apparently liberal preferences provided by developed countries may well be far less liberal than they seem. In the case of Bangladesh, such preferences may also have encouraged an industry (non-wovens), in which Bangladesh was not as competitive or does not have a natural comparative advantage. While preferences are in place, they shelter and tolerate inefficient firms, which otherwise may not have been able to compete head-to-head with firms from other countries. Once preference margins are removed, as it is the case with the MFA phase out, where quotas of other countries exporting to the EU were removed after 2006, intensified competition may force those inefficient firms from Bangladesh to leave the market. This is less likely for those firms exporting to the US with no preferences. Early evidence suggests that these firms are better able to survive in the US post MFA, which is consistent with their being better firms.

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A Appendix

A Firm Level Price Indexes

To estimate the firm's production function, we need to measure firm output and material input, which are constructed by deflating total values of sales and materials with output and material input price indexes, respectively. Due to the lack of data, industry level price indexes have long been used in the literature in place of firm price indexes. There are obvious problems in using them to deflate firm sales and material costs. For example, in our model more productive firms will charge a lower price. As such, using an industry price index, which reflects the average price level of all firms in the industry, to deflate sales of the more productive firms will underestimate the output level, and in turn, a firm's productivity. Furthermore, to the extent that differences in firm prices reflect differences in the quality of their products, quality differences across firms will be wiped out by using an industry price index. Similar issues arise for the input price index.

A unique strength of our data is the fact that we have data on prices at the firm level, which allows us to construct firm specific price index that are consistent across years and firms. Eslava, Haltiwanger, Kugler and Kugler (2004) construct a Tornqvist price index for each firm which is consistent within firms over time. The firm price index is a weighted average of unit value changes for each of the product the firm produces in each year, with weights that reflect the average share of the product in total sales of the firms in two consecutive years. However, by setting each firm price index equal to 1 in the base year, cross firm variation is ignored. This can hide firm heterogeneity in terms of product quality to the extent that the price level reflects quality.

In our firm survey we have data on the value and quantity of the five main products for each firm in 2003. We can, thus, construct a weighted average unit value of products for each firm in 2003 with weights reflecting the share of each product in the total sales of the firm. This will be the firm product price level in 2003. The industry price level in 2003 is constructed by taking the firm sales weighted average of the firm price level. By dividing the firm price level by the industry price level, we obtain a cross sectional firm price index in 2003. Firms that have a price level higher than the industry price level will have a firm price index in 2003 exceeding unity. Conversely, firms that have a price level less than that of the industry in 2003 will have a firm price index below unity. In this manner, the cross sectional price index will capture firm heterogeneity in 2003. Finally, to extend the firm price index to the previous years, we rely on the information provided by the firms in the survey regarding the annual change in price of their main product. In this way, the constructed multi-year firm price index will be consistent within firms across years, as well as across firms within a year. A similar procedure is used to construct firm specific material price index.

We use these firm level product and material price indices to deflate total sales and material costs of the firms to obtain output and material inputs of the firms for the production function estimation. Note that, by construction, firms that have higher quality products (or more services per good), and thus, higher prices will have a higher firm price index. By deflating total sales using this firm price index, we obtain an output measurement that is quality free, i.e., is in terms of "effective units" of the good. Thus, our productivity estimates will not be contaminated by the quality of the firm's products. This is a known problem in the existing literature when an industry price index is used to deflate firm sales.

B Testing for Stochastic Dominance

We use a nonparametric test of stochastic dominance, developed in Anderson (1996), to test whether the productivity distributions of firms serving different markets in different industries are indeed statistically different as predicted by our model. Given that this is a relatively new technique, we will briefly describe the methodology, which is an extension of the Pearson goodness of fit test.

Let Φ be the rangespace of two productivity distributions A and B, with cumulative density functions $F_A(\phi)$ and $F_B(\phi)$. Distribution A first order stochastically dominates (FOSD) B iff

$$F_A(\phi) \leq F_B(\phi), \; F_A(\phi_i) \neq F_B(\phi_i), \text{ for some } i, \; \forall \phi \in \Phi. \tag{33}$$

That is, that the CDF of A does not exceed that of B. To test the hypothesis, first, the range of the two distributions is partitioned into J mutually exclusive and exhaustive intervals with respective relative frequency vectors p_A and p_B, where $p_i = \left(p_i^1, ..., p_i^J\right)$, and

$$p_i^j = F_i\left(\phi^j\right) - F_i\left(\phi^{j-1}\right) = \frac{x_i^j}{n_i}, \; i = A, B, \text{ and } j = 1, ..., J, \tag{34}$$

is the discrete empirical analogue of the probability density function, namely, the relative frequency in each interval, x_i^j, is the frequency of observations in sample i in interval j, and n_i is the size of sample i. Given that sum of all x_i^j must equal to n_i, vector $x_i = \left(x_i^1, ..., x_i^J\right)$ is distributed as a multinomial distribution with

$$E\left(x_i\right) = n_i p_i, \text{ and } Var\left(x_i\right) = \Omega_i = \left(\Omega_i^{jk}\right)_{J\times J} = \begin{cases} n_i p_i^j\left(1-p_i^j\right), \text{ if } j=k \\ -n_i p_i^j p_i^k, \text{ if } j\neq k \end{cases}. \tag{35}$$

By the multivariate central limit theorem, x_i being multinomial distributed implies that as n_i approaches ∞, x_i asymptotically follows a normal distribution, $x_i \sim N\left(n_i p_i, \Omega_i\right)$. This allows us to form test statistics based on $p_i = x_i/n_i$. Define I_f as the $J\times J$ cumulative sum matrix:[45]

$$I_f = \begin{bmatrix} 1 & 0 & 0 & \dots & 0 \\ 1 & 1 & 0 & \dots & 0 \\ 1 & 1 & 1 & \dots & 0 \\ \vdots & \vdots & \vdots & & \vdots \\ 1 & 1 & 1 & \dots & 1 \end{bmatrix}_{J\times J}. \tag{36}$$

The test that distribution A FOSD B boils down to:

$$H_0 : I_f\left(p^A - p^B\right) = 0 \text{ vs. } H_1 : I_f\left(p^A - p^B\right) < 0, \tag{37}$$

where under H_0, distributions A and B are statistically the same, whereas under H_1, distribution A statistically FOSD B. It is possible that the test does not support either H_0 or H_1, in which case, while distribution A is not the same as B, we could not say one distribution FOSD the other, which leads to the conclusion of indeterminacy in stochastic dominance.

Let $\upsilon = \left(p^A - p^B\right)$ and $\upsilon_f = I_f\upsilon$. Anderson (1996) shows that under H_0, υ and υ_f have well defined asymptotically normal distributions, and dividing each element of υ_f by its standard deviation permits multiple comparisons using the studentized maximum modulus distribution (Stoline and Ury, 1979), i.e., $\upsilon \sim N\left(0, m\Omega\right)$ and $\upsilon_f \sim N\left(0, I_f m\Omega I_f'\right)$, where $m = n^{-1}\left(n^A + n^B\right)/n^A n^B$,

$$n^{-1}\Omega = \begin{bmatrix} p_1\left(1-p_1\right) & -p_2p_1 & \dots & -p_Jp_1 \\ -p_2p_1 & p_2\left(1-p_2\right) & \dots & -p_Jp_2 \\ \vdots & & & \vdots \\ -p_Jp_1 & -p_Jp_2 & \dots & p_J\left(1-p_J\right) \end{bmatrix}, \quad \text{with } p_j = \frac{x_A^j + x_B^j}{n^A + n^B}, \tag{38}$$

[45] Pre-multiplying a vector representing the discrete empirical analogue of the probability density function by I_f gives the discrete empirical analogue of the cumulative density function.

and $PAT = \upsilon_f' \left(I_f m \Omega I_f' \right)^{-1} \upsilon_f$ is asymptotically distributed as $\chi^2_{(J-1)}$.

To implement the test, we separate the pooled sample into 10 intervals according to the deciles of the pooled distribution. Since the test is perfectly symmetric, distribution A FOSD distribution B (B FOSD A), if no element of υ_f is statistically greater (less) than 0 and at least one element of υ_f is statistically less (greater) than 0. In both cases, PAT needs to be statistically different from 0 to reject H_0. If at least one element of υ_f is statistically greater than 0 and another one is statistically less than 0, then stochastic dominance of distributions A and B is undetermined. We use this test coupled with the $\chi^2_{(J-1)}$ statistic to check the prediction of our model with data.

Table 1: Sample Averages: by industry and export destination

	All firms			Non-woven firms			Woven firms		
	All	OEU	AUS	All	OEU	AUS	All	OEU	AUS
sales	4066.6	2659.5	5083.3	3045.7	2782.0	3187.9	4542.4	2579.5	5679.5
export	4026.8	2608.4	5076.0	2940.8	2662.8	3181.2	4532.9	2572.9	5672.1
materials	2739.9	1801.6	3451.0	1948.2	1834.2	2060.3	3108.9	1780.3	3888.5
imported materials	2198.4	1270.4	2827.7	1282.7	1100.5	1366.7	2605.4	1366.9	3292.1
wage bill	441.2	304.2	542.2	421.8	372.0	459.1	450.3	259.8	568.4
employee	763.4	581.5	914.4	720.4	642.6	797.0	783.5	541.6	951.3
investment	104.0	92.7	111.8	151.8	188.4	117.6	81.7	30.2	110.0
capital	1332.4	738.0	1882.3	1067.1	1199.0	973.0	1456.0	436.8	2168.3
number of firms	292	101	163	99	44	41	193	57	122

Notes: Total number of observation is 1211.

All values are in thousands of US$, except for number of employees.

Table 2: Dependent variable: Log of output

	(1)	(2)	(3)	(4)	(5)	(6)
Industry	Non-woven	Non-woven	Non-woven	Woven	Woven	Woven
Dependent Variable	y_{jt}	y_{jt}	$y_{jt+1}-0.129m_{jt+1}-0.292l_{jt+1}$	y_{jt}	y_{jt}	$y_{jt+1}-0.589m_{jt+1}-0.251l_{jt+1}$
Materials	0.177***	0.129***	0.002	0.524***	0.589***	-0.009
	(0.051)	(0.047)	(0.044)	(0.044)	(0.043)	(0.029)
Labor	0.416***	0.292***	-0.022	0.396***	0.251***	-0.050
	(0.086)	(0.106)	(0.085)	(0.076)	(0.075)	(0.055)
Capital	0.121***		0.209***	-0.013		0.208***
	(0.048)		(0.064)	(0.032)		(0.071)
Age			0.161			0.026
			(0.265)			(0.118)
Endogeneity correction[1]	No	Yes	Yes	No	Yes	Yes
Selectivity correction[2]	No	No	Yes	No	No	Yes
Year fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	387	333	245	826	715	549

Notes: Heteroscedasticity corrected white robust standard errors in parentheses.

[1]A 2rd order polynomial function of age, capital, investment, export shares of EU and US are included.

[2]A 3rd order polynomial function of propensity to stay in business and the fitted output net of labor and capital are included.

Columns (2) and (5) are for observations with positive investments. Columns (3) and (6) lose one year of observations due to the lead variables.

Table 3: Dependent variable: Log of output

	Non-Woven		Woven	
	EU	US	EU	US
Relative price	-1.403***	-1.546***	-1.034***	-1.209***
	(0.109)	(0.237)	(0.084)	(0.096)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	341	171	723	563
Chi-squares	176.37	47.14	158.75	168.38

Notes: Bootstrapped standard errors are in parenthesis
and are clustered by industry, location and size.
** indicates the estimate is significant at 99% level.

Table 4: Average productivity and demand shocks estimates

	Non-Wovens			Wovens		
	OEU	AUS	OUS	OEU	AUS	OUS
Firm's productivity	8.341	8.561	9.959	2.071	2.046	1.938
EU demand shocks	0.419	0.403	-2.251	1.212	0.351	-3.061
US demand shocks	-0.865	1.105	2.953	-2.950	1.331	2.151

Source: Firm's productivity is constructed from (26) and (27).
Demand shocks are estimated from (28) and (29).

Table 5: Probit Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Non-Woven			Woven			Non-Woven			Woven	
Dependent Variable	OEU	AUS	OUS	OEU	AUS	OUS	OEU	AUS	OUS	OEU	AUS	OUS
Log TFP	-2.047***	1.051	-0.326	-0.168*	0.277***	-0.087	-3.945***	1.945***	8.173	-0.742***	0.228**	-0.579**
	(0.785)	(0.684)	(4.651)	(0.093)	(0.099)	(0.147)	(1.090)	(0.676)	(5.323)	(0.113)	(0.073)	(0.286)
Log TFP squares	0.108**	-0.065*	0.055	0.025	-0.051***	-0.004	0.218***	-0.120***	-0.417	0.105***	-0.031**	0.014
	(0.044)	(0.038)	(0.234)	(0.024)	(0.015)	(0.026)	(0.061)	(0.037)	(0.280)	(0.021)	(0.015)	(0.078)
Log capital	0.042	-0.063	-0.202**	-0.175***	0.219***	-0.063	0.008	-0.143**	-0.010	-0.234***	0.019	-0.297***
	(0.054)	(0.054)	(0.093)	(0.031)	(0.031)	(0.047)	(0.060)	(0.058)	(0.140)	(0.041)	(0.044)	(0.084)
Age	-0.012	0.034***	-0.052	-0.022**	0.035***	0.001	-0.015	0.044***	-0.054	-0.017	0.023**	0.005
	(0.010)	(0.013)	(0.036)	(0.009)	(0.007)	(0.008)	(0.017)	(0.013)	(0.058)	(0.011)	(0.011)	(0.017)
EU demand shock							0.163***	0.156***	-1.157***	0.569***	0.157***	-0.865***
							(0.042)	(0.046)	(0.269)	(0.083)	(0.033)	(0.097)
US demand shock							-0.310***	0.375***	1.232***	-0.493***	0.322***	0.639***
							(0.051)	(0.042)	(0.320)	(0.041)	(0.040)	(0.083)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	382	382	382	826	826	826	382	382	382	826	826	826
Chi-squares	44.50	47.10	23.42	58.13	190.24	36.03	136.91	176.11	68.87	471.47	686.66	231.00
Mean of dependent variable	0.346	0.387	0.060	0.245	0.581	0.100	0.346	0.387	0.060	0.245	0.581	0.100

Notes: Bootstrapped standard errors that are clustered by industry, year, location and size are in parenthesis.
*, **, *** denote statistical significance at 90, 95 and 99 percent level.
OEU=1 if firm only sells to the EU; AUS=1 if firm sells to both the EU and the US; OUS=1 if firm only sells to the US.

Table 6: Dependent Variable: Log of TFP

	(1) Non-woven	(2) Woven	(3) Non-woven	(4) Woven	(5) Non-woven	(6) Woven	(7) Woven
AUS dummy	0.220*	-0.025	0.294*	0.259***	0.282**	0.340**	
(= 0 if OEU; =1 if AUS)	(0.131)	(0.076)	(0.177)	(0.081)	(0.116)	(0.241)	
EU demand shock			-0.016	-0.015	-0.026	0.219***	0.367***
			(0.064)	(0.024)	(0.112)	(0.035)	(0.064)
US demand shock			-0.036	-0.069***	0.034	-0.181***	-0.134*
			(0.064)	(0.016)	(0.072)	(0.023)	(0.080)
EU export share					1.674**	1.294***	
					(0.701)	(0.451)	
US export share					0.936	2.898***	
					(0.691)	(0.447)	
Log capital					-0.060	-0.187***	-0.304***
					(0.584)	(0.027)	(0.060)
Age					0.035***	0.011*	0.004
					(0.008)	(0.006)	(0.005)
Meeting ROOs							0.335**
							(0.168)
Year fixed effects	No	No	No	No	Yes	Yes	No
R-squared	0.0102	0.0001	0.0146	0.0213	0.1048	0.1898	0.3533
Observations	283	682	283	682	283	682	46

Notes: Bootstrapped standard errors in parentheses. Column (6) is for a subset of OEU exporters in 2003.
*, **, *** denote significance at 90, 95 and 99 percent level (bootstrap bias corrected for (5) and (6)).

Table 7: Between Industry Comparison

	(1)	(2)	(3)	(4)
Dependent variables	AUS dummy	AUS dummy	Log of TFP	Log of TFP
Woven industry dummy	0.183***	0.178***	-6.642***	-6.725***
	(0.041)	(0.032)	(0.066)	(0.067)
OEU dummy			-0.363***	-0.315**
			(0.110)	(0.128)
OEU dummy in Woven			0.372**	0.268**
			(0.132)	(0.137)
US demand shocks		-0.072***		-0.023
		(0.008)		(0.018)
EU demand shocks		0.118***		0.041***
		(0.003)		(0.015)
Firm size		-0.007		-0.122***
		(0.010)		(0.024)
Firm age		0.009***		0.027***
		(0.002)		(0.004)
R-squared	0.0306	0.4867	0.8981	0.9067
Observations	987	966	1208	1208

Notes: Dependent variables in Columns (1) and (2) equals 1 if AUS firms or 0 if OEU firms, in both industries
Dependent variables in (3) and (4) are firm TFP estimates from Table 6.
Robust standard errors in parentheses for all columns, clustered by industry, year, location and capacity.
*, **, *** denote significance at 90, 95 and 99 percent level.
Columns (2) and (4) control for year fixed effects in the regressions.

Table 8: First Order Stochastic Dominance Test of Productivity Distribution: AUS firms vs OEU firms

	(1)	(2)
	Non-Woven	Woven
Distribution A	OEU firms	OEU firms
Distribution B	AUS firms	AUS firms
Decile 1	1.386	1.789
Decile 2	1.127	3.778***
Decile 3	1.895	3.811***
Decile 4	2.335	3.247***
Decile 5	2.582*	3.201**
Decile 6	2.605*	1.171
Decile 7	1.895	1.270
Decile 8	0	2.619*
Decile 9	-1.808	1.789
Decile 10	0	0

Note: *, **, *** denote significance at 90, 95 and 99 confidence level, respectively.

Figure 1: Market Choice by Firms with Different Markets

Figure 2: Exporting and Productivity

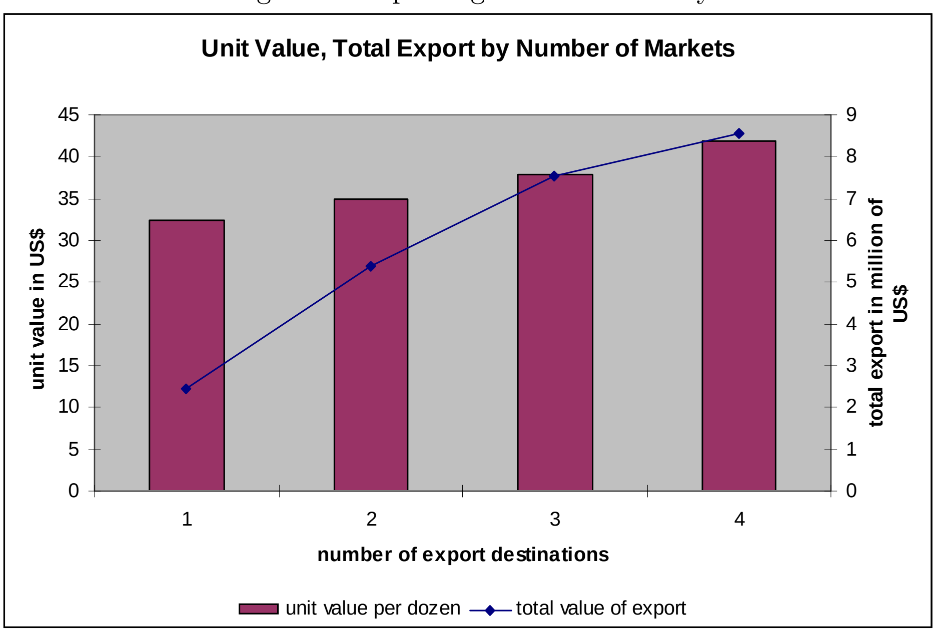

Figure 3: Woven Industry's Cutoffs

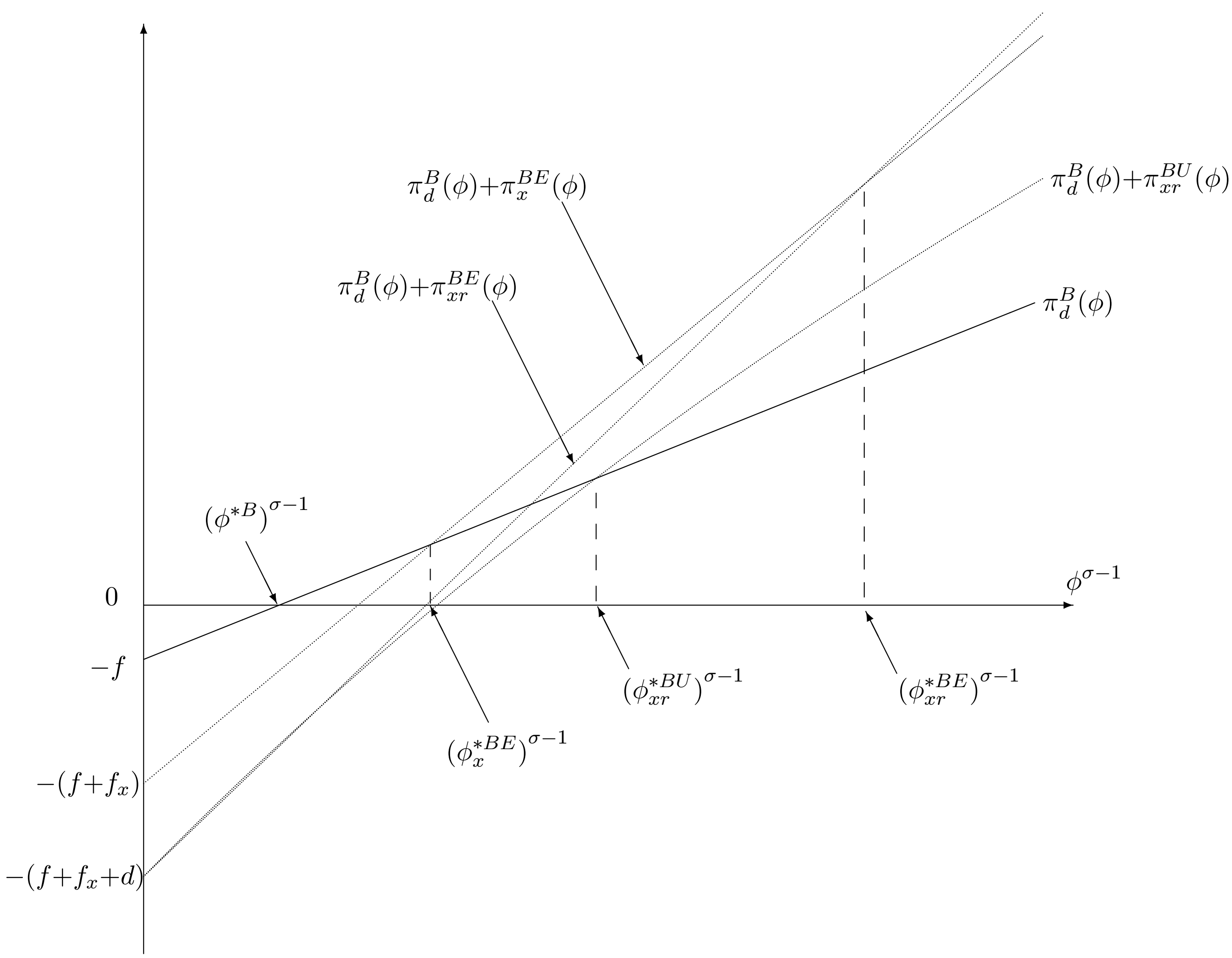

Figure 4: Non-Woven Industry's Cutoffs