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Differing Impact of Liberalisation: The Case of Vertically Integrated Clothing Firms

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This paper compares the productivity and other characteristics of vertically integrated and non-integrated firms to investigate whether efficiency gains associated with a given liberalisation episode vary across firms, depending on their organisation. A theoretical setting of vertical integration in the textile and clothing industry is developed, to reveal that trade expansion triggers a change in the relative factor cost of these two types of firms, and consequently, a change in product range produced by them. The results are further backed by using a sample of clothing firms in Pakistan for the years 1992-2010 to analyse the effect of the phasing out of U.S. textile and clothing quotas on firm-level efficiency. The empirical findings illustrate that an increase in the level of quotas brings about a significant growth in the mean productivity of vertically integrated clothing firms. The diminishing efficiency of non-integrated firms points to the lack of ability of these firms to benefit from tighter quality control, timely revision of production policies and guarantee of supplies.

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1. INTRODUCTION

Do efficiency gains associated with a given liberalisation episode vary across firms depending on their organisation? There are a large number of both theoretical as well as empirical studies which attempt to measure the effect of a greater exposure to international markets on firm and industry productivities. In the context of trade liberalisation and its impact on firm efficiency, what has still remained a relatively understudied subject is the diverging outcome of a given liberalisation regime on different types of firms. If a certain trade policy change creates contrasting outcomes across different groups of firms, empirical methodologies based on aggregated data or assuming homogeneity in the effect of a liberalising episode are highly likely to produce ineffectual results. In this paper, we strive to tackle this weakness in the existing literature. In particular, we compare the productivity of vertically integrated and non-integrated firms within a country, allowing both types of firms to engage in international trade, and analyse how trade liberalisation affects the efficiency of these firms differently.

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By making use of detailed data, available for an industry which usually comprises of both vertically integrated and non-integrated companies, we analyse the experience of clothing firms in Pakistan under the U.S. Textile and Clothing (T&C) quotas and the subsequent end of the Multi-Fibre Arrangement (MFA). Our paper utilises data on the amount of quotas under the MFA and the succeeding Agreement on Textile and Clothing (ATC), along with the company-level data set of a representative sample of T&C companies in Pakistan, and thus, provides an excellent context of trade liberalisation in a developing country, which heavily relies on the export of textile products.

Vertical integration is the configuration of production under which one business unit carries on sequential stages in processing/distribution of a manufactured good which is sold by other firms without additional processing [Blois (1972)]. In line with the Transaction Cost Economics (TCE) theory, founded by Williamson (1975), internal organisation of a firm needs to be designed in such a way so as to improve incentives and control agency costs. The literature has identified a range of factors associated with integration [Acemoglu, *et al.* (2005)]. Firms integrate vertically to erect entry barriers, maintain product quality, assist investments in specialised assets and develop coordination [Williamson (1975)]. Companies often vertically integrate to ensure that the supply of key inputs is readily available. Most of these companies often produce more inputs than they need and sell the remainder [Hortaçsu and Syverson (2012)]. Managerial oversight, customer contacts and marketing know-how are just some of the many benefits enjoyed by vertically integrated firms.

The advantages must be weighed against disadvantages, which usually consist of disparities between productive capacities at different stages of production, lack of specialisation and lack of direct competitive pressure on costs of products [Blois (1972)]. Nevertheless, there is modest micro-level evidence on productivity-integration relationship and on how production differs in vertically integrated firms compared to non-integrated firms. There is an even lesser evidence on the impact of trade liberalisation on productivity of vertically integrated firms. There is a growing literature on international specialisation of production and its impact on firm efficiency. Expansion of international specialisation and disintegration of production has been an important characteristic of the international economy [Antràs and Helpman (2004)].[1] However, the focus of this literature has been on productivity gains associated with disintegration of production across different countries.

In this paper, we analyse the effect of trade liberalisation on the productivity of firms exporting T&C products. The way we define liberalisation in this paper is by a gradual lifting of trade quotas on the exports of textile and clothing products from developing to developed countries, characterised by the MFA. The MFA enforced restrictions on T & C exporters, and the Uruguay Round (1994) ended the MFA by signing the ATC. ATC commenced the practice of integrating T&C products into General Agreement on Tariffs and Trade (GATT) and World Trade Organisation (WTO). Integration occurred across four phases. In Phase I, countries were to incorporate products, representing 16 percent of their 1990 import volumes. At the start of Phases II and III on January 1st, 1998 and January 1st, 2002, respectively, further 17 and 18

[1]Hummels, *et al.* (2001) demonstrate that international trade has grown faster in components than in final goods.

percent of 1990 export volumes were integrated. Lastly, on January 1st, 2005, Phase IV of the ATC integrated the outstanding 49 percent of export volumes, with all quotas abolished. Other than removing quotas, the ATC enhanced developing countries' access to the developed countries, by speeding up quota growth over the four phases through the "growth-on-growth" provision [Brambilla, *et al.* (2007)]. Expiration of these quotas was expected to bring about considerable reallocation of production and exports across countries, including Pakistan, for which the T&C sector is an imperative industry. Although there are a number of studies which investigate the efficiency of vertically integrated firms relative to non-integrated firms, none of these in particular consider the influence of trade liberalisation caused by phasing out of quotas on firm-level efficiency of these two types of firms. We explain how trade liberalisation generates a greater incentive for vertical integration in the production of clothing goods.

The most important contribution of this study is the theoretical setup, created to generate the differential outcomes for the two types of firms. The theoretical background to vertical integration in clothing industry shows that liberalisation causes a change in relative factor cost of the two types of firms, and therefore, a change in product range produced by each of them. Liberalisation in home country results in an increase in product range, produced by vertically integrated firms. Moreover, the theory is further substantiated by the empirical models used in the following sections. The empirical findings demonstrate that an upsurge in the level of quotas generates a significant decrease in mean productivity of clothing firms that are not vertically integrated. This is in contrast to the conventional wisdom, according to which the T&C industry of Pakistan would perform much better in the quota free regime, given that it was apparently constrained by the MFA quotas. The result is also intriguing because it corroborates the argument in favour of vertical integration of production, at least in the T&C industry.

The paper is organised as follows: In Section 2, we concisely go over the recent literature on vertical integration of production and the influence of trade on firms. Section 3 provides a theoretical background to vertical integration in T&C industry. We will then illustrate our methodology. Empirical results are presented in Section 5 while Section 6 concludes.

2. LITERATURE REVIEW

In order to motivate the diverse outcomes in terms of distinct firm performance as a result of liberalisation, it would be appropriate to review the literature on integration choices of firms. Acemoglu, *et al.* (2005) obtain cross-country correlations between vertical integration and financial development, contracting costs and entry barriers. When credit markets are imperfect and when there is lack of financial development, there are more likely to be larger firms in a country [Kumar, *et al.* (1999)]. These firms are prone to produce some of their own inputs. Therefore, improved financial institutions and credit markets may perhaps be associated with not as much of vertical integration [Acemoglu, *et al.* (2005)].

Babe (1981) makes productivity comparisons of integrated and non-integrated Canadian telephone companies, in order to determine the net effect of vertical integration on efficiency of telephone operations. Vertical integration results in lower costs to telephone operations in the form of reduced contracting and selling costs. Conversely, vertical integration brings about inefficiency on the part of telephone companies, owing to the possibility that desirable technology available only from unaffiliated suppliers may be foreclosed. Atalay, Hortaçsu, and Syverson (2013) point towards an alternative explanation for vertical ownership, namely that it promotes efficient intra-firm transfers of intangible inputs.

Hortaçsu and Syverson (2007) use a rich plant-level data set of cement and ready-mixed concrete producers to reflect on the reasons and results of vertical integration, with particular regard to its effects on market power. Contrasting total factor productivity (TFP) changes among formerly non-integrated plants shows that plants that become integrated, witness approximately 10 percent faster productivity growth. Hortaçsu and Syverson (2009) make use of the Longitudinal Business Database to study the productivity of plants in vertically structured firms. They discover that vertically integrated plants have higher productivity levels than their non-integrated industry cohorts.

In the context of textile industry, an incredibly valuable and applicable study that compares the performance of firms under various management conditions is that by Braguinsky, *et al*. (2015). Using the Japanese cotton spinning industry data, they analyse ties between productivity, profitability and ownership as clear mechanisms to spur the industry's growth. Although the principal objective of their study is to quantify the result of acquisitions and management turnover; numerous findings generated in the paper offer strong empirical support to the ones we display in the present study, for example, the influence on profitability.

Lots of developing countries have initiated programs of trade liberalisation. Hay (2001) investigates effects of the 1990 Brazilian trade liberalisation on the market share, profit and productivity of 318 manufacturing firms. A production function for the period 1986-94 shows sizeable TFP gains in the period up to 1994. The effect of trade liberalisation on the productivity of Pakistani firms is best examined by Liaqat (2013). The study measures productivity, using a technique that deviates from the assumptions of perfect competition and constant returns to scale, and employs numerous specifications using input and output tariff data to compute efficiency. The results imply that not only there is a rise in competition following trade liberalisation but also a reduction in the returns to scale for most industries. Likewise, there is no strong evidence of an improvement in productivity after trade reforms were introduced in the manufacturing sectors of Pakistan.

The effect of quota phase-outs in the form of the end of MFA on firm-level efficiency has recently been analysed by Liaqat (2014). The study uses a sample of textile and clothing companies to display that MFA expiration leads not only to an increase in the average productivity of textile producing firms but a significant reduction in the mean productivity of clothing producers. Liaqat (2014) offers a number of explanations for this outcome, such as, a change in the input and product mix, entry by non-exporters in the clothing sector and sectoral differences in quality ladders, and draws some crucial policy lessons from this study. Despite its remarkable results, Liaqat (2014) makes no distinction between the clothing firms, producing their own inputs as opposed to the ones buying raw materials from other textile companies. In fact, the vertically integrated clothing firms are referred to as *clothing* firms alone, regardless of their production of

T&C industry intermediate goods. As shown in the theoretical and empirical models below, this is a very strong assumption and may produce potentially distorted estimates. In that respect, the current study goes one step further in underscoring the heterogeneity within the textile and clothing firms by distinguishing between vertically integrated and non-integrated clothing firms.

Therefore, none of the contemporary papers considers the effect of trade liberalisation caused by phasing out of quotas on firm-level efficiency of the two types of firms. This paper is the first one to emphasise the variation in the effect of MFA termination, across firms depending on their organisation.

3. THEORETICAL BACKGROUND

Subsequent to the above analysis, it would be useful to compare productivity of clothing producers that buy their raw materials (either from domestic producers or from abroad), and productivity of vertically integrated clothing producers that manufacture their own yarn and fabric. In this section, we describe how trade liberalisation generates an incentive for vertical integration in the T&C industry. We follow the model by Yi (2003). Trade liberalisation triggers a change in relative factor cost of the two types of firms, and consequently, a change in product range produced by each of them. We consider two special cases of free-trade equilibrium which generate complete specialisation in the production of all goods.

Consider three types of firms having the following production functions:

$$y_1^i(z) = A_1^i(z)\, k_1^i(z)^{\alpha}\, l_1^i(z)^{1-\alpha}, \quad \ldots \quad (1)$$

$$y_2^i(z) = x_1^i(z)^{\theta}\left[A_2^i(z)\, k_2^i(z)^{\alpha}\, l_2^i(z)^{1-\alpha}\right]^{1-\theta}, \quad \ldots \quad (2)$$

$$y_3^i(z) = A_3^i(z)\, k_3^i(z)^{\gamma}\, l_3^i(z)^{1-\gamma}, \quad \ldots \quad (3)$$

where $i = H$ or F (H denoting home production and F denoting foreign production), and $z \epsilon [0,1]$ indicates product z produced by the firm. $A_f^i(z)$ is the TFP of firm f in the production of good z in country i, and $l_f^i(z)$ and $k_f^i(z)$ are labour and capital used by firm f in producing output $y_f^i(z)$. The first type of firm produces raw materials purchased by the second type, i.e. $y_1^i(z) = x_1^i(z)$, where $x_1^i(z)$ is firm 2's use of output produced by firm 1. The second type of firm combines input produced by the first type, labour and capital in a nested Cobb-Douglas production function. In our case, it suggests that the first type produces textile products and the second type buys textile products from type one firm and uses them to produce the final good, for example, ready-made garments. The third type of firm also produces the final good but, unlike the second type of firm, produces its own raw materials.

Firms and Technology

Let us only consider the home industry. Firms maximise profits taking prices as given. The profit maximisation problem for type 1 firm is given by:

$$\text{Max}\,\{p_1(z)y_1(z) - wl_1(z) - rk_1(z)\}\ \text{w.r.t.}\ k_1 \text{ and } l_1,$$

and that for type 2 firm:

$$\text{Max}\,\{p_2(z)y_2(z) - p_1(z)x_1(z) - wl_2(z) - rk_2(z)\}\ \text{w.r.t.}\ x_1, k_2 \text{ and } l_2,$$

if the firm buys only domestically produced raw materials from type one firms. $p_1(z)$ is the world price of textile raw materials, $p_2(z)$ is price of the final good, and w and r are the wage and rental rates. If firm 2 buys imported raw materials, profit maximisation problem is given by:

$$\text{Max}\,\{p_2(z)y_2(z) - p_1(z)\,(1+\tau)x_1(z) - wl_2(z) - rk_2(z)\}\ \text{w.r.t.}\ x_1, k_2 \text{ and } l_2,$$

where τ is a measure of trade liberalisation, for example, tariff rate or price of quota license. Since firms 2 and 3 both produce the same final good, the market price for their output will be identical ($p_2(z) = p_3(z)$). Therefore, profit maximisation problem for type 3 firm is given by:

$$\text{Max}\,\{p_2(z)y_3(z) - wl_3(z) - rk_3(z)\}\ \text{w.r.t.}\ k_3 \text{ and } l_3.$$

Households

The utility maximisation problem of households is specified as:

$$\text{Max}\ \sum_{t=0}^{\infty}\beta^t \ln(C_t^i),$$

$$\text{w.r.t.}\ \ P_t^iC_t^i + P_t^i\left[K_{t+1}^i - (1-\delta)K_t^i\right] = w_t^iL_t^i + r_t^iK_t^i + T_t^i \equiv P_t^iY_t^i,$$

$$K_{t+1}^i = (1-\delta)K_t^i + I_t^i,\ \ \forall\, t \geq 1,$$

where P_t^i and Y_t^i are the price and output of the final good in country i at time t. C_t^i is consumption, K_t^i and L_t^i are total capital and labour, I_t^i is investment, and T_t^i is the lump-sum transfer of quota license revenue, expressed in terms of the home final good. Households own the capital and rent it to firms period by period.

Market Clearing

The market clearing condition for good 1 (textile – raw material) is:

$$y_1(z) = y_1^H(z) + y_1^F(z) = x_1^H(z) + x_1^F(z),$$

and market clearing condition for good 2 (apparel – finished good) is:

$$y_2(z) + y_3(z) = y_2^H(z) + y_2^F(z) + y_3^H(z) + y_3^F(z),$$
$$y_{2t}(z) + y_{3t}(z) = C_t^i + \left[K_{t+1}^i - (1-\delta)K_t^i\right] = Y_t^i,\ \ \forall\, t \geq 1 \text{ and } i = H, F.$$

This is because both firms 2 and 3 provide an identical finished good to the market. Market clearing conditions for labour and capital markets, respectively, are given by:

$$L^i = \int_0^1 l_1^i(z)dz + \int_0^1 l_2^i(z)dz + \int_0^1 l_3^i(z)dz,$$

$$K^i = \int_0^1 k_1^i(z)dz + \int_0^1 k_2^i(z)dz + \int_0^1 k_3^i(z)dz.$$

Let the textile raw materials (good 1) be the numeraire, i.e. $p_{1t}(z) = 1$, and $p_{2t}(z) = P_t(z)$.

Definition of Equilibrium

An equilibrium is a sequence of goods and factor prices, $\{p_{1t}(z), p_{2t}(z), P_t^i, w_t^i$ and $r_t^i\}$, and quantities $\{k_{1t}^i(z), k_{2t}^i(z), k_{3t}^i(z), l_{1t}^i(z), l_{2t}^i(z), l_{3t}^i(z), y_{1t}^i(z), y_{2t}^i(z), y_{3t}^i(z), x_{1t}^i(z)$, and $Y_t^i\}$ $\forall\, t \geq 1, z \in [0,1]$ for $i = H, F$ such that the first order conditions of firm's and household's maximisation problems given above, as well as market clearing conditions, are satisfied.

For the sake of simplicity, let us remove the time subscript. The profit maximisation problem of first type of firm can be written as:

$$\text{Max}\,\{A_1(\tau,\varphi)k_1^{\alpha}\, l_1^{1-\alpha} - wl_1 - rk_1\}\ \text{w.r.t.}\ k_1 \text{ and } l_1.$$

The productivity, $A_1(z)$, is a function of τ plus all other factors that influence firm productivity, denoted by φ. Productivity is affected by a number of factors, such as, worker skills, energy outages, off-balance sheet transaction costs, corruption, security and infrastructure. The profit maximisation problem for type 2 firm is:

$$\text{Max}\,\{p\big(x_1{}^{\theta}[A_2\,(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{1-\theta}\big) - x_1 - wl_2 - rk_2\}\ \text{w.r.t.}\ x_1, k_2 \text{ and } l_2,$$

if the firm buys only domestically produced raw materials. Alternatively, if the firm buys imported raw materials, profit maximisation is given by:

$$\text{Max}\,\{p\big(x_1{}^{\theta}[A_2\,(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{1-\theta}\big) - (1+\tau)x_1 - wl_2 - rk_2\}\ \text{w.r.t.}\ x_1, k_2 \text{ and } l_2.$$

Similarly, we obtain the profit maximisation problem for type 3 firm. We can derive an expression for relative productivity, $\frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)}$, by using the first order conditions for type 2 and type 3 firms (see Appendix 1):

$$A(z) \equiv \frac{A_3(z)}{A_2(z)} \equiv \frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)} \cong \frac{(1+\tau)(1-\alpha)}{p(z)(1-\gamma)} \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (4)$$

Hence, relative productivity is a function of τ as well as all other factors that affect firm productivity. Let us consider two different cases as examples of free-trade equilibrium which generate complete specialisation in the production of all goods. Trade liberalisation in the form of a reduction in price of quota license causes a reduction in relative factor cost of firm 2 compared to firm 3. In other words, the relative factor cost of firm 3 will go up. This is shown in Figure 1. The vertical axis measures relative productivity and relative factor cost of firm 3 relative to firm 2. On the horizontal axis, with no loss of generality, the [0, 1] continuum can be arranged so that it is diminishing in productivity of firm 3 relative to firm 2 in the home country; $z = 0$ is the good in which firm 3's productivity (relative to that of firm 2) is the highest. The "cutoff" z_3 defines the pattern of production. The arbitrage condition that determines the cutoff separating production between firms 2 and 3 can be found by equating relative factor cost to relative productivity. The condition essentially says that vertically integrated firm (i.e. firm 3) produces and exports up to the point where its cost advantage (disadvantage) relative to non-integrated firm (i.e. firm 2) equals its productivity disadvantage (advantage). An upward shift in relative factor cost line will lead to a reduction product range, produced by firm 3 and an increase in product range produced by firm 2, if there is no change in relative productivity of the two firms. However, there might be other factors φ which will affect relative productivity. As a result, the relative productivity function may shift up or down. Figure 1 shows what happens if relative productivity function, *A(z),* shifts up. In this case, there is an increase in product range produced by firm 3 since the cut-off goes up from z_3 to z_3''.

Hence, what happens to the product range would depend on not just the tariff change but also on all other factors affecting relative productivity of firms. In Figure 2, relative productivity function shifts in the downward direction. A reduction in relative productivity of firm 3 for all values of z, as well as a rise in relative factor cost (compared to firm 2) will result in an enormous reduction in product range of finished goods produced by firm 3. In Figure 3, the y-axis denotes relative factor costs (home/foreign) and relative productivities for firm 2 (home/foreign) and for firm 3 (home/foreign). On the horizontal axis, the continuum is arranged so that it is diminishing in home country's comparative advantage in goods produced by firm 3. Let us also assume that comparative advantage ordering of firm 2 productivity at home is the same as it is for firm 3. The cut-offs z_2 and z_3 now define the pattern of production. The middle region of the continuum engenders the need for vertical integration. In this region, firm 3 in home country produces the finished good and exports it to the foreign country. Trade affects the pattern of specialisation because it changes the cost of imported inputs. The range of vertical integration, or goods produced by firm 3, goes up as a result of a reduction in τ. This is accompanied by an increase in product range produced by firm 2. Thus, trade liberalisation in home country results in an increase in product range produced by vertically integrated firms as well as an increase in country-wide product range produced.

4. EMPIRICAL METHODOLOGY

Before we begin to explain the methodology, it would be motivating to explore how different these firms are in terms of key firm characteristics, such as output, number of physical inputs used, net profit, etc. This is imperative because if the two types of firms are not significantly different from each other with respect to these characteristics, then the difference in our estimation results could be the upshot of other factors, not directly measurable in the data. To investigate how different these firms are in terms of firm characteristics, we run the following regression:

$$y_{ijt} = \beta_0 + \beta_1 \mathrm{VI}_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}, \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where VI is an indicator variable denoting a vertically integrated firm, and y_{ijt} are the different firm characteristics of firm i in year t in industry j at six-digit level, such as, measures of productivity used, fixed assets, size of the firm, capital intensity, net profit, etc. The coefficient β_1 reports the difference across integrated and non-integrated clothing producers. δ_t and δ_j are time and industry fixed effects, respectively, and ε_{jt} is the error term. Robust standard errors are corrected for clustering at the firm level. Since we are interested in estimating change in productivity after the end of MFA, our main objective is to test if the *change* in these dependent and independent variables is significant, and whether or not it is related to vertical structure of the firm per se. Therefore, we replace y_{ijt} in Equation (5) by Δy_{ijt} :

$$\Delta y_{ijt} = \beta_0 + \beta_1 \mathrm{VI}_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Lastly, we run the same regressions but after controlling for firm's sales:

$$y_{ijt} = \beta_0 + \beta_1 \mathrm{VI}_{ijt} + \beta_2 \log(sales)_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}, \quad \ldots \quad \ldots \quad (7)$$

$$\Delta y_{ijt} = \beta_0 + \beta_1 \mathrm{VI}_{ijt} + \beta_2 \log(sales)_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}. \quad \ldots \quad \ldots \quad (8)$$

We use structural techniques introduced by Olley and Pakes (1996), and Levinsohn and Petrin (2003) to find a measure of productivity for the firms in our sample. There are quite a few ways of measuring productivity change in response to a change in policy. The key econometric issue in the estimation of production functions is the likelihood that some of these inputs are unobserved, and if the observed inputs are chosen as a function of these unobserved inputs, then there is a possible endogeneity problem [Ackerberg, Caves, and Frazer (2015)]. Another source of endogeneity is sample selection bias; firms often exit the market when productivity drops below a specific threshold. Therefore, we do not rely on the OLS estimates of the observed inputs coefficients and instead use the methods introduced by Olley and Pakes (1996) (OP), and Levinsohn and Petrin (2003) (LP) in the dynamic panel data literature. The OP methodology allows for the error term to have two components, a white noise component and a time-varying productivity shock.[2] Profit maximisation generates an investment demand function that is determined by two state variables, capital and productivity. If the investment demand function is monotonically increasing in productivity, it is feasible to invert the investment function and get an expression for productivity as a function of capital and investment [Pakes (1994)].

In the actual data, however, investment is often very lumpy. This may not be in line with the strict monotonicity assumption regarding investment. Also, OP procedure can cause an efficiency loss in a data with zero investment. Instead of using an investment demand equation, LP uses an intermediate input demand function. Given that the intermediate input demands normally exhibit a lesser tendency to have zeros, the strict monotonicity condition is expected to hold in the LP methodology. Figure 4 shows mean productivity of the two types of firms computed, using three different productivity measures. We notice that over the entire sample period, vertically integrated clothing producers are much more productive than the non-integrated clothing producers, if productivity is computed using Levinsohn and Petrin (LP), and Olley and Pakes (OP) productivity measures. Whereas the average productivity of vertically-integrated clothing firms exhibits an upward trend, we do not see an analogous pattern for non-integrated clothing firms. Instead, the average productivity of non-integrated clothing firms remains roughly at the same level as at the start of the period.

Figure 4 also illustrates mean productivity computed from parametric estimation of production functions of the two types of firms. Although estimation of production function coefficients may yield biased estimates of productivity, we do observe an upward trend in average productivity of vertically integrated clothing firms. This is again not true for non-integrated firms. The variation in productivity is subsequently regressed on the level of quotas:

[2]It is derived from dynamic optimisation of firms, whereby it is assumed that unobserved productivity follows a first order Markov process and capital is accumulated by means of a deterministic dynamic investment process.

$$\Delta tfp_{ijt} = \beta_0 + \beta_1 \Delta \log(AdjQuota)_{jt} + \beta_2 \text{VI} \times \Delta \log(AdjQuota)_{jt} + X_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}, \quad \ldots \quad (9)$$

where $\log(AdjQuota)_{jt}$ is the logarithm of post-MFA level of quotas of product j at time t. X_{ijt} includes other control variables: size, age and capital intensity of the firm, whether or not the firm is ISO Certified, dummy variables for the city in which the firm is located and whether or not the firm is multinational, and herfindahl index of the industry. We expect β_1 to be positive if an increase in the level of quotas leads to an increase in mean productivity of non-integrated clothing firms. Also, a negative β_2 would signify that gain in productivity of vertically integrated firms is less than that in productivity of non-integrated firms (if β_1 is positive and $|\beta_1| > |\beta_2|$), or there is a significant reduction in mean productivity of vertically integrated firms (if β_1 is positive and $|\beta_1| < |\beta_2|$). Industry and year fixed effects are included in all specifications. Equation (9) is run separately for the different measures of productivity used.

In addition, to test if our results differ for more capital intensive vertically integrated firms or firms that are bigger in size, we run analogous regressions including interaction terms, i.e. interaction of VI with size and capital intensity of the firm:

$$\Delta tfp_{ijt} = \beta_0 + \beta_1 \Delta \log(AdjQuota)_{jt} + \beta_2 \text{VI} + \beta_3 \text{VI} \times \Delta \log(l)_{ijt-1} + X_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}, \quad \ldots \quad (10)$$

$$\Delta tfp_{ijt} = \beta_0 + \beta_1 \Delta \log(AdjQuota)_{jt} + \beta_2 \text{VI} + \beta_3 \text{VI} \times \Delta \log(k/l)_{ijt-1} + X_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}. \quad \ldots \quad (11)$$

Let us look at few other key variables. Vertically integrated firms produce, on average, a slightly higher output than non-integrated producers. There is an upward trend in the output of vertically integrated firms but we do not notice a comparable trend for non-integrated firms. As far as labour, raw materials and other factors are concerned, we do not observe much difference between the two types of firms. To test whether or not vertically integrated clothing firms fared better than non-integrated firms in terms of other key measures of performance, such as output and net profit, we replace productivity by firms' output and net profit in Equation (9):

$$\Delta \log(output)_{ijt} = \beta_0 + \beta_1 \Delta \log(AdjQuota)_{jt} + \beta_2 \text{VI} \times \Delta \log(AdjQuota)_{jt} + X_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}, \quad \ldots \quad (12)$$

$$\Delta \log(net\ profit)_{ijt} = \beta_0 + \beta_1 \Delta \log(AdjQuota)_{jt} + \beta_2 \text{VI} \times \Delta \log(AdjQuota)_{jt} + X_{ijt} + \delta_t + \delta_j + \varepsilon_{ijt}. \quad \ldots \quad (13)$$

Control variables now also include fixed assets, raw materials and trade costs. Following Bernard, *et al.* (2006), we define industry level variable trade costs ($Cost_{jt}$) for six-digit NAICS industry j in year t as the sum of ad valorem duty and ad valorem freight and insurance rates.

Data

This paper uses balance sheet data collected in the form of a survey. The Balance Sheet Data of Pakistani Listed and Non-Listed Companies (BSDPC) is a survey of a representative sample of 90 clothing companies in Pakistan for the years 1992-93 to 2002-2003.[3] The surveys are conducted by the Centre for Management and Economic Research (CMER) and they encompass a wide range of topics. The dataset covers almost all large and medium-sized formal manufacturing enterprises. However, coverage of the industrial sector is not complete since the informal enterprises are excluded and small formal firms are under-represented. The core survey is organised into four parts: Balance Sheet, Profit and Loss Account, Cash Flow Statement and Accounts Section. For each company and year, we observe the sales revenue, input use, investment, wage bill and all other costs, as well as industry codes and firm identity codes that allow us to track establishments over time. To estimate Equation (9) using the panel of firms, we need data on real output, capital stock, labour, raw materials and their respective shares in real output. Nominal output deflated by sectoral price deflators gives the real output.[4] Real labour was found by deflating total wage bill by the industry wage rate.[5] Materials were also deflated using two-digit sectoral price deflators. Real capital stock was calculated by deflating net fixed assets by sectoral investment deflators. Table 1 provides summary statistics for the balance sheet data used. This paper tracks a single country through time, eliminating obscuring country-specific effects. There is a notable variation in trade regimes between sample years which gives the analysis a laboratory-like flavor.

We utilise the data initially used by Brambilla, *et al.* (2007) that traces U.S. trading partners' performance under the quota regimes determined by MFA and the succeeding ATC. The database is assembled from U.S. trading partners' Expired Performance Reports, which were used by the U.S. Office of Textile and Apparel (OTEXA) to supervise trading partners' fulfillment with the MFA/ATC quotas. Provided by Ron Foote of the U.S. Census Bureau, they record imports, base quotas and quota adjustments by OTEXA category and year for all countries with which the U.S. negotiated a bilateral quota arrangement.[6] The data on trade costs is taken from Bernard, *et al.* (2006) which provides data on free-on-board customs value of imports, ad valorem duty and ad valorem freight and insurance rates for the underlying four-digit product-level US import data. Obtained directly from product-level trade data collected at the border, these trade costs take account of information about both trade policy and transportation costs, and they vary across industries and time. The next section discusses estimation results.

[3]The data compiled by CMER only covers the period 1992 to 2003. We updated the dataset to add seven more years of data on sales revenue, input use, investment, etc. The paper, therefore, uses data from 1992 to 2010. This was done in order to compute firms' productivity during the final phase of MFA expiration as well, since we know that the initial phases of the ATC were not very severe for producers in developed countries; the U.S. postponed removal of quotas on sensitive products until Phase III.

[4]The Economic Survey of Pakistan, which is published annually by the Federal Bureau of Statistics, Pakistan, provides industry price indices for output and intermediate inputs, which are used as deflators.

[5]Real labour is taken to be the total number of employees, and not the number of hours worked, since hourly wage rate is not known. Many firms list the number of employees directly so there is no need to deflate the wage bill by the industry wage rate.

[6]Base quota is the initially negotiated quota level decided at the beginning of an agreement term. Adjusted base quotas indicate the use of "flexibilities," which allowed countries to go over their base quota in a particular period by borrowing unexploited base quota, across categories within a year and across years within a category, up to a specified percentage of the receiving category.

5. ESTIMATION RESULTS

5.1. Difference between Integrated and Non-integrated Clothing Producers

Let us first examine the differences between these two types of firms in terms of output, capital stock, labour, intermediate inputs, capital intensity and net profit. This can be seen by looking at the firm-level relationship between these variables and integration status of a firm by regressing each variable on an indicator for firm's vertical integration status (denoted by VI = 1 if a clothing firm is vertically integrated; VI = 0 otherwise), and a series of industry-year fixed effects. Consequently, the vertical integration dummy coefficient captures mean difference across integrated and non-integrated producers in the same industry and time period. This specification is helpful because it compares producers facing identical industry-level demand and supply conditions [Hortaçsu and Syverson (2006)].

The results are shown in Tables 2 and 3. They report differences in key dependent and independent variables across integrated and non-integrated clothing producers. The reported coefficients are for the indicator variable. On average, vertically integrated producers have higher sales, capital stock, labour and capital intensity than non-integrated firms but a lower level of raw materials and net profit. On the contrary, none of these results are statistically significant. On the other hand, coefficients for productivity measures (both OP as well as LP) are positive and significant in both tables. Although the coefficient for parametric estimate of productivity is positive but not significant, as shown in Table 2, it is positive and significant when the *change* in productivity is regressed on VI (look at column (3) in Table 2). We include firm's sales as a control variable to prove the robustness of these results. The growth in productivity for vertically integrated firms is higher on average than non-integrated firms having equally sized sales, and the coefficients are statistically significant.

5.2. Production Function Estimates—Levinsohn and Petrin

Table 4 reports production function estimation results for vertically integrated and non-integrated clothing firms using LP productivity measure. These estimates are employed to calculate measured TFP of a plant. The change in firm productivity is thenceforth regressed on the change in quotas for both types of firms (i.e. firm 2 and firm 3 in the model above), allowing for time and industry fixed effects. This procedure is then repeated using OP as well as parametric estimate of productivity. The results are illustrated in Table 5.

5.3. Productivity and Vertical Integration

Table 5 exhibits the effect of elimination of quota on productivity of clothing firms. A rise in the level of quotas brings about a drop in the productivity of non-integrated clothing firms. This can be deduced from the negative coefficient of adjusted quota base in almost all specifications shown in Table 5. On the other hand, the coefficient for interaction term, i.e. the interaction of VI dummy with adjusted level of quota is positive and statistically significant: the magnitude of change in productivity for vertically integrated clothing producers is positive and bigger than non-integrated clothing firms, as there is an increase in adjusted level of quotas.

These results persist even when other methodologies are used to compute productivity, such as, running the same regression using OP semi-parametric productivity measure and parametric estimation of productivity.[7] This shows that a trade liberalisation episode causes not just a significant change in productivity of these firms, but also that the results immensely differ for the two types of firms. Vertically integrated firms, equipped with latest machinery, supply most of the higher-quality market segments. An increase in adjusted level of quotas causes their productivity to go up. Quotas weaken the motivation to advance technologically in order to capture market share because market shares are predetermined, and thus, hinder productivity growth.

Let us analyse the implications of these results in terms of the model described above. Figure 1 shows what happens if relative productivity function, *A(z),* shifts up. In this case, there is an increase in product range produced by firm 3 since the cut-off goes up from z_3 to z_3''. Trade liberalisation in the form of a reduction in price of quota license will cause a reduction in relative factor cost of firm 2 compared to firm 3. If other factors, which affect relative productivity, cause relative productivity function to shift up, then the product range produced by vertically integrated clothing producers rises.

We now concisely look at other control variables. For all specifications shown in the table, the coefficient of size is positive and statistically significant. Although capital intensity does not have a significant impact on productivity of clothing producers, nevertheless higher capital intensity is associated with higher productivity level. Furthermore, older firms are more productive on average. The coefficient for multinational dummy takes both positive and negative values and is never significant. The sign of herfindahl index coefficient is negative but generally insignificant. Alternatively, ISO Certification does affect firm efficiency significantly, when using OLS to compute productivity. We have taken into account the fact that some firms are located in more developed areas and that there may be differences in infrastructural facilities in different parts of the country by controlling for regional fixed effects.

Table 6 demonstrates the effect of abolition of quotas across phases. Although a majority of the results described above stand across individual phases as well, some of the findings differ across phases and for the two types of firms. One reason is that there is a significant decline in the number of observations. A rise in quotas brings about a decrease in productivity of clothing firms that are not vertically integrated. This is true for all phases under LP but only for Phase IV under OP. In Phases I, II and III, the sign of the coefficient for level of quotas under OP is positive but insignificant. On the other hand, productivity of vertically integrated firms actually goes up as there is growth in adjusted level of quotas in all four phases, and the coefficients are statistically significant; we observe that the magnitude of change is positive for vertically integrated producers of clothing products.[8]

[7]The OP and OLS results are not reported in the paper but can be made available on request.

[8]The coefficients for firm characteristics are not reported in the table since most of these turned out to be insignificant due to a small number of observations across phases. The sign of herfindahl index coefficient is negative and significant in the specification for Phases I and II. This means that higher concentration in the industry leads to lower productivity of firms. One would normally expect that a greater degree of concentration in an industry leads to greater market power for firms in that industry and, hence, lower their productivity growth. This is the case here.

Table 7 displays the results we get by including the interaction of VI with firm's size and capital intensity as right hand side variables. Although there is no strong evidence of more capital intensive integrated firms to perform better than less capital intensive ones, we do observe that bigger vertically integrated firms, on average, outdo smaller integrated firms. The only case in which the coefficients of capital intensity turn out to be significant is when they are positive (see columns 5 and 7). Higher capital intensity is expected to raise efficiency of workers and other inputs in a capital-intensive textile sector, although the effect may be negligible in the clothing sector which is relatively more labour-intensive. Since the vertically integrated firms produce both, it is not surprising that the overall effect is ambiguous. Nonetheless, larger firms surpass smaller firms. This is an interesting result which points towards the benefits of economies of scale enjoyed by larger companies, housing the production of their raw materials along with the finished product. A vertically integrated firm which operates on a smaller scale forgoes the cost savings which may potentially arise as a result of expanding production, not only to serve its own needs but also to supply intermediate goods to the rest of the market.

5.4. Adjusted Quotas and Other Dependent Variables

To test whether or not vertically integrated clothing firms fared better than non-integrated firms, in terms of other key measures of performance, such as output and net profit; we replace productivity by firms' output and net profit in Equation (9). The results are depicted in Table 8. While the growth of quotas does lead to a higher output for integrated firms, the positive coefficient of the interaction term is not significant. This is not the case if we replace output on the left hand side by net profit: the impact on net profit of all clothing firms, both vertically integrated as well as non-integrated, is positive in all specifications used. Moreover, the coefficient of the interaction term (VI x Adjusted Quota) remains highly significant. This analysis makes the interpretation of estimation results, derived earlier, all the more fascinating. The key findings also support the results obtained by Braguinsky, *et al*. (2015), as discussed earlier. Non-integrated firms are often predicted to be much less profitable compared to their vertically integrated counterparts due to their obligation to maintain higher inventory levels and lower capacity utilisation. On the other hand, vertical integration substantially lowers the need to preserve greater inventories, and improves the ability to manage uncertainties in demand, resulting in higher and sustained profits. Thus, these differences merely reflect the management problems likely to arise under a non-integrated production setup. The challenge becomes more acute under growing pressures of rapid trade liberalisation.

6. CONCLUSION

Expansion of international specialisation and disintegration of production has been an important characteristic of the international economy. Although a variety of studies look into productivity gains, associated with disintegration of production across different countries; none of these in particular consider the effect of trade liberalisation on the efficiency of vertically integrated firms relative to non-integrated firms within a country. There is modest micro-level evidence on the productivity-integration relationship and on the way production differs in vertically integrated firms compared to the non-integrated firms. In this paper, we compare the productivity of these two types of firms, allowing both types of firms to engage in international trade, and analyse how a given liberalisation episode affects their productivity.

A theoretical background to vertical integration in clothing industry illustrates that trade liberalisation causes a change in relative factor cost of the two types of firms, and thus, a change in product range produced by each of them. The change in relative productivity of a vertically specialised firm to that of a non-vertically specialised firm depends, among other factors, on the change in price of the finished good as a result of trade liberalisation. We consider two special cases of free-trade equilibrium which generate complete specialisation in the production of all goods. This simple model shows that what happens to the product range produced by each type of firm depends on the change in relative factor cost and other factors affecting relative productivity of firms. Thus, a growth of trade in the home country results in an increase in the product range produced by the vertically integrated firms as well as a rise in country-wide product range produced. The theoretical findings of the paper are reinforced by a systematic empirical model by analysing the experience of clothing firms in Pakistan under the U.S. textile and clothing quotas and the subsequent end of MFA. This paper shows that a liberalisation episode may engender opposing changes in productivity of various firms even within the clothing industry. The empirical results show that vertical integration of production is linked with an improvement in productivity after trade reforms were introduced.

To sum up, there are a large number of conceivable reasons why these results hold. The most cited benefits to a firm through vertical integration are decreased marketing expenses, stability of operations, tighter quality control, timely revision of production policies, guarantee of supplies, improved inventory control, and the ability to charge lesser prices. Vertically integrated firms respond to competition by upgrading the quality of their clothing products. On the other hand, it is harder to upgrade quality overnight for non-integrated firms. Suppliers usually control new technology in the technologically advanced industries and internalising these technological capabilities through vertical integration, promises access to the knowledge required to build a portfolio of products based on highly developed technology [Afuah (2001)]. Textile quality, product standards, fabric finishing, styles, and patterns are other factors that shape competitiveness. The disparity in results across garment firms may, consequently, be related to the type of raw materials used by garment firms after the end of MFA. Nonetheless, we do not have that information in our data set. The weakening efficiency of non-integrated clothing firms indicates the incapacity of these firms to benefit from stability of operations and investment in specialised assets. Greater exposure to international markets is an opportunity for them to downsize their input usage which can help create a competitive edge over other clothing exporters.

Appendices

Appendix 1

Theoretical Background

From the first order conditions of type 2 firm, we get:

$$r = A_2(\tau,\varphi)(\alpha)\left(\frac{l_2}{k_2}\right)^{1-\alpha} \times px_1{}^{\theta}(1-\theta)[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{-\theta}, \quad \ldots \text{(A.1)}$$

$$w = A_2(\tau,\varphi)(1-\alpha)\left(\frac{k_2}{l_2}\right)^{\alpha} \times px_1{}^{\theta}(1-\theta)[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{-\theta}, \quad \ldots \text{(A.2)}$$

$$1 = p\theta x_1{}^{\theta-1}[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{1-\theta}, \quad \ldots \quad \ldots \quad \ldots \quad \ldots\text{(A.3a)}$$

or if the firm buys imported raw materials:

$$1 + \tau = p\theta x_1{}^{\theta-1}[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{1-\theta}. \quad \ldots \quad \ldots \quad \ldots \quad \ldots\text{(A.3b)}$$

From the first order conditions of type 3 firm, we obtain:

$$r = pA_3(\tau,\varphi)\gamma\left(\frac{l_3}{k_3}\right)^{1-\gamma}, \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \text{(A.4)}$$

$$w = pA_3(\tau,\varphi)(1-\gamma)\left(\frac{k_3}{l_3}\right)^{\gamma}. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \text{(A.5)}$$

We can find an expression for relative productivity, $\frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)}$, by using Eqs. (17) – (21):

$$w = pA_3(\tau,\varphi)(1-\gamma)\left(\frac{k_3}{l_3}\right)^{\gamma} = A_2(\tau,\varphi)(1-\alpha)\left(\frac{k_2}{l_2}\right)^{\alpha} \times px_1{}^{\theta}$$
$$(1-\theta)[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{-\theta},$$

$$r = pA_3(\tau,\varphi)\gamma\left(\frac{l_3}{k_3}\right)^{1-\gamma} = A_2(\tau,\varphi)(\alpha)\left(\frac{l_2}{k_2}\right)^{1-\alpha}$$
$$\times\, px_1{}^{\theta}(1-\theta)[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{-\theta},$$
$$1 + \tau = p\theta x_1{}^{\theta-1}[A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}]^{1-\theta}.$$

Let $\omega = \frac{x_1}{A_2(\tau,\varphi)k_2^{\alpha}\, l_2^{1-\alpha}}$ be the ratio of the intermediate inputs purchased from type 1 firm to the other inputs used by type 2 firm. Then the relative productivity can be written as:

$$\frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)} = \frac{(1-\theta)(1-\alpha)\,\omega^{\theta}}{(1-\gamma)}.$$

Using the above results, we get:

$$\omega = \omega^{\theta} \times \omega^{1-\theta} = \frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)} \times \frac{(1-\gamma)}{(1-\theta)(1-\alpha)} \times \frac{p\theta}{1+\tau},$$
$$\frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)} = \frac{\omega(1+\tau)(1-\theta)(1-\alpha)}{p\theta(1-\gamma)}.$$

In Equilibrium, ω can be approximated by $\frac{\theta}{1-\theta}$, the respective factor shares, i.e.

$$\omega = \frac{x_1}{A_2\,(\tau,\varphi) k_2^{\alpha}\, l_2^{1-\alpha}} \cong \frac{\theta}{1-\theta}\,.$$

Therefore,

$$\frac{A_3(\tau,\varphi)}{A_2(\tau,\varphi)} \cong \frac{(1+\tau)(1-\alpha)}{p(1-\gamma)},$$

$$A(z) \;\equiv \frac{A_3(z)}{A_2(z)} \cong \frac{(1+\tau)(1-\alpha)}{p(z)(1-\gamma)}\,.$$

Furthermore,

$$\frac{\partial A(\tau,\varphi)}{\partial \tau} = \left(\frac{1-\alpha}{1-\gamma}\right)\left[\frac{p(z) - (1+\tau)\frac{\partial P(z)}{\partial \tau}}{p^2(z)}\right] = \left(\frac{1-\alpha}{1-\gamma}\right)\left[\frac{1}{p(z)} - \frac{(1+\tau)}{p^2(z)}\cdot\frac{\partial P(z)}{\partial \tau}\right],$$

$$\frac{\partial A(\tau,\varphi)}{\partial \tau}\begin{cases} > 0 & \text{if } \frac{\partial P(z)}{\partial \tau} < \frac{p(z)}{1+\tau} \\ = 0 & \text{if } \frac{\partial P(z)}{\partial \tau} = \frac{p(z)}{1+\tau}\,. \\ < 0 & \text{if } \frac{\partial P(z)}{\partial \tau} > \frac{p(z)}{1+\tau} \end{cases} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \; \text{(A.6)}$$

The change in relative productivity of type 3 firm to type 2 firm depends, among other factors, on change in the price of finished good as a result of trade liberalisation.

Appendix 2

Tables and Figures

Fig. 1. Relative Factor Costs and Relative Productivities (Firm 3/Firm 2)

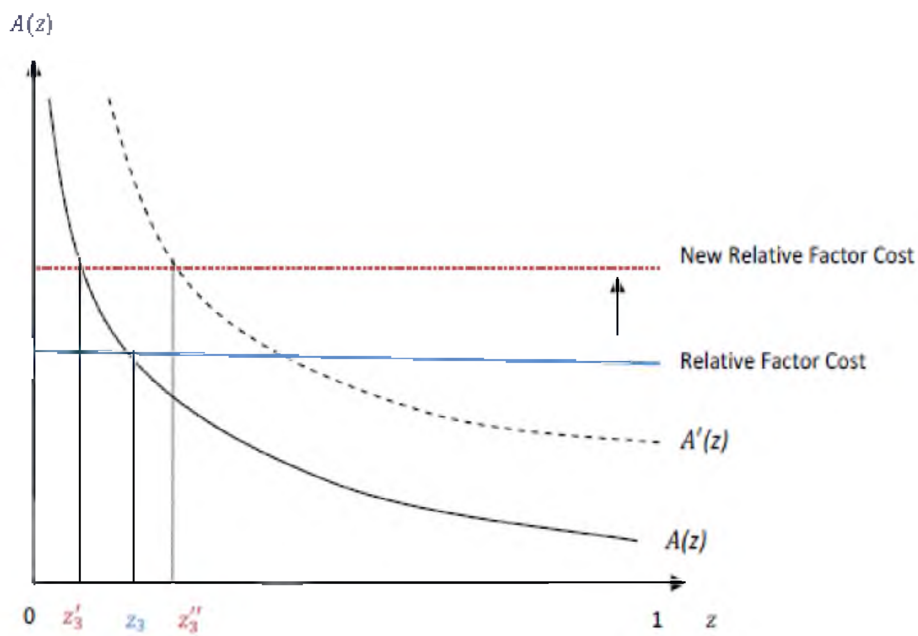


Fig. 2. Relative Factor Costs and Relative Productivities (Firm 3/Firm 2)

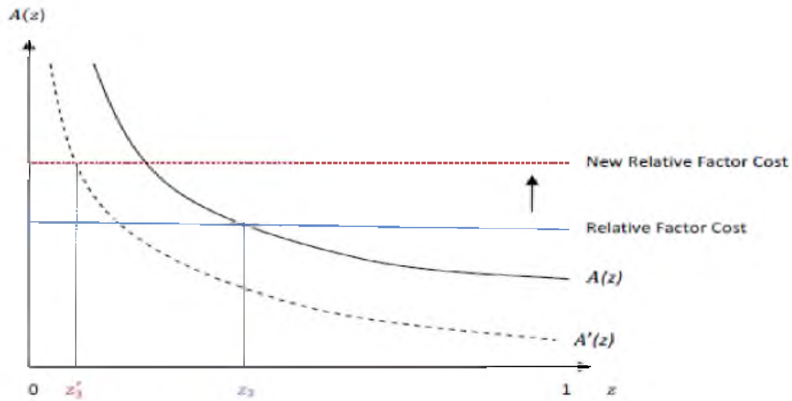


Fig. 3. Relative Factor Costs and Relative Productivities (Home/Foreign)

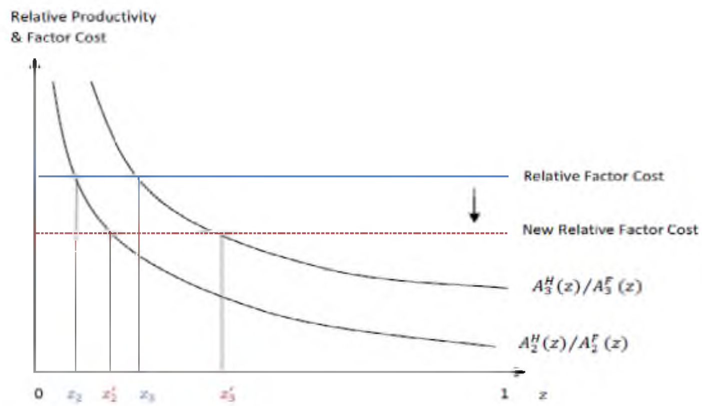
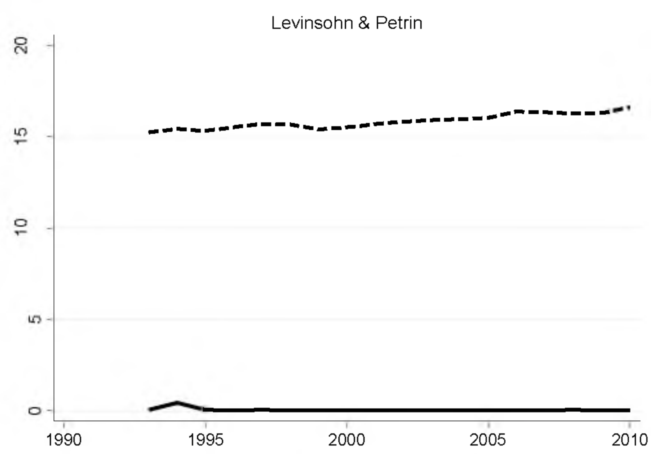
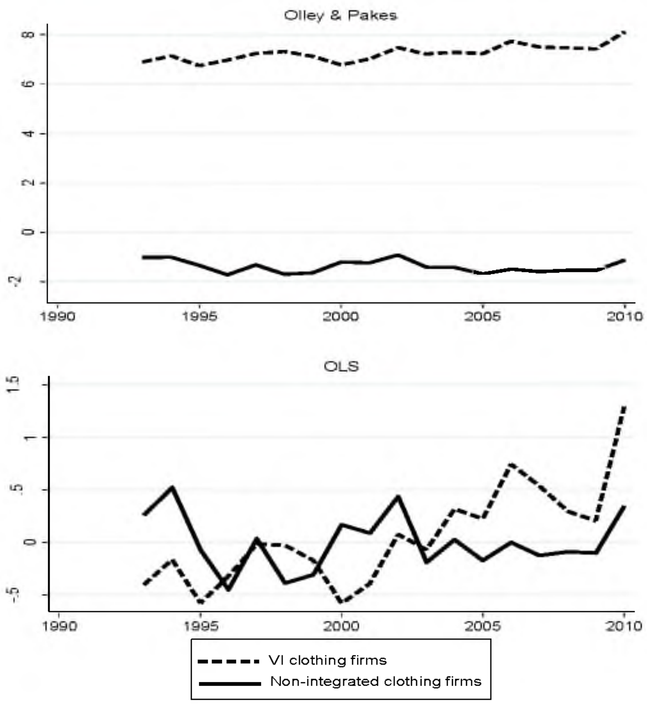


Fig. 4. Vertically Integrated and Non-integrated Clothing Firms Productivity





Source: Author's calculations based on Balance Sheet Data of Pakistani Listed and Non-Listed Companies.

Table 1

Summary Statistics

Variable	Observations	Mean	Standard Deviation
Log (Sales)	4717	19.25	3.73
Log (Fixed Assets)	4718	11.50	9.51
Log (Labour)	4718	16.36	1.93
Log (Raw Materials)	4718	18.71	3.58
Log (Net Profit)	4718	12.99	10.32
Log (Investment)	4813	4.01	7.22
Productivity (Levinsohn and Petrin)	4717	10.55	5.72
Productivity (Olley and Pakes)	4717	1.87	3.04
Productivity (OLS)	4717	-8.85e-10	1.88
Age	2895	23.78	16.10
Log (Age)	2846	2.97	0.82
Log (Capital to Labour ratio)	4407	0.73	0.58
Herfindahl Index	4813	0.82	0.62
ISO Certified	4606	0.67	0.47
Multinational	4606	0.10	0.30
Share of Foreign Ownership	4436	0.22	0.41
Exporting firm	4606	0.88	0.33
Importing firm	4606	0.42	0.49
Log (Cost of Imports)	2385	0.15	0.11
Log (Adjusted Base New)	3980	29.11	16.11
Log (Adjusted Base)	2499	16.73	1.13
Log (Imports)	1544	16.43	2.01
Average Fill Rate	2143	0.81	0.19

Source: Author's calculations based on Balance Sheet Data of Pakistani Listed and Non-Listed Companies.

Table 2

Differences between Integrated and Non-integrated Clothing Producers

Variables	LP	OP	OLS	Fixed Assets	Sales	Raw Materials	Net Profit	Size	Capital Intensity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VI	15.57***	8.591***	0.0688	2.154	0.00736	-0.505	-0.383	0.0520	0.120
	(0.280)	(0.553)	(0.438)	(1.979)	(1.160)	(1.041)	(2.210)	(0.253)	(0.119)
Constant	0.402**	-1.351***	0.299	2.631*	19.08***	18.40***	21.95***	16.25***	0.140*
	(0.191)	(0.453)	(0.418)	(1.386)	(0.870)	(0.671)	(1.558)	(0.365)	(0.0810)
No. of Observations	1255	1255	1255	1255	1255	1255	1255	1255	1254

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. Industry-year fixed effects are included in all specifications. Coefficients for the industry and year dummies are suppressed. The reported coefficients are those for an indicator variable, VI, denoting that a firm is vertically integrated. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

Table 3

Differences between Integrated and Non-integrated Clothing Producers—Controlling for Firm's Sales

Variables	Change in LP	Change in OP	Change in OLS	Change in LP	Change in OP	Change in OLS
	(1)	(2)	(3)	(4)	(5)	(6)
VI	0.759**	0.627*	0.602**	0.784**	0.582**	0.572
	(0.374)	(0.358)	(0.235)	(0.370)	(0.271)	(0.419)
Sales				0.154**	0.452***	0.377***
				(0.0788)	(0.0500)	(0.0601)
Constant	-0.403	-0.499	-0.259	-3.304**	-8.872***	-7.263***
	(0.518)	(0.565)	(0.506)	(1.571)	(1.068)	(1.259)
No. of Observations	1237	1237	1237	1237	1237	1237

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. Industry-year fixed effects are included in all specifications. Coefficients for the industry and year dummies are suppressed. The reported coefficients are those for an indicator variable, VI, denoting that a firm is vertically integrated. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

Table 4

Production Function Estimates for Vertically Integrated and Non-integrated Clothing Firms

	Vertically Integrated Clothing	Non-integrated Clothing
	(1)	(2)
Employment	0.169***	0.355***
	(0.0596)	(0.0362)
Fixed Assets	0.00113	0.00719
	(0.00716)	(0.0142)
Raw Materials	0.0553	0.999***
	(0.310)	(0.313)
No. of Observations	490	953

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

Table 5

Effect of Elimination of Quota-Restrictions on Productivity of Clothing Firms—Levinsohn and Petrin

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Adjusted Quota	-0.155**	-0.159**	-0.155**	-0.155**	-0.155*	-0.172*	-0.144	-0.154
	(0.0779)	(0.0803)	(0.0782)	(0.0782)	(0.0836)	(0.0952)	(0.124)	(0.136)
VI x AdjQuota	0.0261**	0.0273**	0.0269**	0.0269**	0.0271**	0.0297**	0.0266	0.0270
	(0.0119)	(0.0128)	(0.0127)	(0.0127)	(0.0125)	(0.0131)	(0.0182)	(0.0192)
Herfindahl Index		-0.0314	-0.0302	-0.0296	-0.0578	-0.0691	-0.0501	-0.0505
		(0.0557)	(0.0556)	(0.0556)	(0.0572)	(0.0577)	(0.0519)	(0.0527)
Multinational			0.601	0.695	0.682	0.682	1.839	0.390
			(0.599)	(0.647)	(0.654)	(0.646)	(1.753)	(0.661)
ISO Certified				-0.468	-0.506	-0.512	-0.979	-0.513
				(0.799)	(0.794)	(0.790)	(1.289)	(0.453)
K/L (Lagged)					0.136	0.171	0.171	0.176
					(0.131)	(0.137)	(0.176)	(0.183)
Size (Lagged)						0.0393*	0.0570**	0.0575**
						(0.0209)	(0.0249)	(0.0249)
Age							1.117*	1.103**
							(0.590)	(0.507)
Age^2							-0.279	-0.282*
							(0.228)	(0.166)
Constant	0	8.201**	0	0	0	8.658*	0	6.542
	(0)	(3.928)	(0)	(0)	(0)	(4.854)	(0)	(7.022)
City Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*No*
Industry/Time Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
No. of Observations	948	948	948	948	896	896	555	555

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. Coefficients for the industry and year dummies are suppressed. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

Table 6

Effect of Elimination of Quota-Restrictions on Productivity of Clothing Firms across Phases—Using Levinsohn and Petrin and Olley and Pakes Productivity Measures

Variable	Phase 1		Phase 2		Phase 3		Phase 4	
	LP	*OP*	*LP*	*OP*	*LP*	*OP*	*LP*	*OP*
Adjusted Quota	-0.104	0.275	-0.0474	0.470	-0.0435	0.278	-0.0302	-0.35***
	(0.0960)	(0.938)	(0.0596)	(0.364)	(0.160)	(0.231)	(0.0384)	(0.0545)
VI x AdjQuota	1.002***	0.480***	1.021***	0.519***	0.984***	0.617***	0.346***	0.189***
	(0.0221)	(0.0636)	(0.0269)	(0.0840)	(0.0355)	(0.0532)	(0.0100)	(0.0129)
Industry/Time Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
City Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
No. of Observations	107	107	160	160	66	66	192	192

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. Coefficients for the industry and year dummies are suppressed. The coefficients for firm characteristics are not reported. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

Table 7

Effect of Elimination of Quota-Restrictions on Productivity of Clothing Firms—Interaction of Vertically Integrated Indicator Variable (VI) with Firm's Size and Capital Intensity

	Interaction of VI with Firm's Size				Interaction of VI with Firm's Capital Intensity			
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Adjusted Quota	-0.0163	-0.0104	-0.00304	-0.105	0.0970	-0.0673	-0.0553	-0.203
	(0.0754)	(0.0780)	(0.0792)	(0.122)	(0.0677)	(0.102)	(0.0640)	(0.166)
VI	13.1***	13.2***	13.0***	13.1***	15.3***	14.3***	14.8***	14.3***
	(0.996)	(0.970)	(0.981)	(1.145)	(0.563)	(0.664)	(0.602)	(1.060)
Size (Lagged)	-0.0080	-0.0086	0.00505	-0.00410		0.059**	0.08***	0.0792*
	(0.0165)	(0.0165)	(0.0280)	(0.0456)		(0.0231)	(0.0282)	(0.0437)
VI x Size (Lagged)	0.108**	0.108**	0.118**	0.138**				
	(0.0476)	(0.0472)	(0.0469)	(0.0611)				
K/L (Lagged)			0.293	0.524	0.148**	0.0545	-0.178*	0.0452
			(0.209)	(0.383)	(0.0698)	(0.0559)	(0.0916)	(0.0732)
VI x K/L (Lagged)					0.0479	0.521	0.917**	0.817
					(0.292)	(0.399)	(0.432)	(0.549)
Industry Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
City Fixed Effects	*Yes*	*Yes*	*Yes*	*No*	*Yes*	*Yes*	*Yes*	*No*
No. of Observations	566	566	565	347	896	565	347	347

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. VI is an indicator variable denoting a vertically integrated clothing firm. The coefficients for firm characteristics are not reported, and coefficients for the industry and year dummies are suppressed. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

Table 8

Effect of Elimination of Quota-Restrictions on Net Profit and Output of Clothing Firms

	Net Profit			Output		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Raw Materials	0.319***	0.109*	0.127*	0.231***	0.0273	0.0559
	(0.0970)	(0.0592)	(0.0705)	(0.0721)	(0.0308)	(0.0360)
Employment	0.388***	0.162**	0.112	0.121***	0.107*	0.141**
	(0.0599)	(0.0667)	(0.0934)	(0.0359)	(0.0627)	(0.0582)
Fixed Assets	-0.933***	-0.686***	-0.822***	0.0221*	0.0943**	0.116**
	(0.0342)	(0.129)	(0.103)	(0.0122)	(0.0478)	(0.0543)
Adjusted Quota	-0.123	0.409	1.175***	-0.351	1.003**	1.048**
	(0.327)	(0.326)	(0.300)	(0.295)	(0.419)	(0.440)
VI x Adjusted Quota	0.0106	0.161***	0.235***	0.0204	0.0979	0.0335
	(0.0289)	(0.0497)	(0.0530)	(0.0277)	(0.0975)	(0.112)
Industry/Time Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
City Fixed Effects	*Yes*	*Yes*	*No*	*Yes*	*Yes*	*No*
No. of Observations	948	617	374	948	374	374

Notes: Robust standard errors corrected for clustering at the firm level in parentheses. The coefficients for firm characteristics are not reported, and coefficients for the industry and year dummies are suppressed. *** Significant at, or below, 1 percent. ** Significant at, or below, 5 percent. * Significant at, or below, 10 percent.

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