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Assessing Impact of Quota Elimination on Factor Productivity Growth of Textile Sector of Pakistan

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Abstract
Export of textile sector of Pakistan is also dependent on the trade policy of importing countries, particularly European Union and USA, as these countries have been major importer of textile goods of Pakistan. This study is unique in the way that it contributes in existing literature by estimating factor productivity growth of textile sector in the perspective of pre quota and post quota elimination situation, as this has been ignored in past. We explored that textile sector of Pakistan did not get benefit of quota elimination and productivity remained almost stagnant over the period. We suggest penetrating textile export in unrestricted markets apart from European Union and USA and closure of sick units and outdated technology.

Key Words: *Quota elimination, Total factor productivity growth, Import penetration, Multi-Fiber Arrangements*

JEL codes: F140, F130, F51, F15, L67

1. Introduction

Many developing countries started adopting liberalized trade polices during late 1970s and early 1980s. Pakistan is one of the developing countries, who initiated liberalized trade policy in the same period. Trade liberalization not only increases capital formation through enterprises, but the efficiency of the industries as well (winter, 2000). Developing nations may achieve economic growth through trade liberalization but it is benefited when it alleviates poverty. Indeed it is litigious that what type of the trade policy may yield positive spill over for poor people. We found diverse literature in endogenous growth theories focusing different assortment of models in which liberalization can either decrease or increase economic growth (Romer, 1990; Grossman and Helpman, 1990; Rivera-Batiz and Romer, 1991a,b; Matsuyama, 1992).

Total factor productivity is one of the major sources of economic growth. The productivity of manufacturing and non-manufacturing sector contributes in overall economic growth of a country. For example in Singapore, productivity of industrial and services sector contributed in economic growth and for Australia and America agricultural sector contributed prominently in economic growth. In Pakistan after agricultural sector, textile and clothing sector are pre dominant sectors in export of Pakistan. The performance of textile and clothing sector of Pakistan remained volatile. After phasing out of Multi-Fiber Arrangements (MFA) increase in the exports of textile and clothing products was expected, but the outcomes were different. Export is considered one of the major determinants of total factor productivity growth of manufacturing

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sector. Therefore objective of this study is to explore the impact of quota abolition on export which ultimately leads to factor productivity growth. On contrary, Rodrick (1992) believes import liberalization policy slows down the productivity growth by reducing domestic sales.

Table 1 shows present picture of Pakistan's textile and clothing export share in the world trade.

Table 1 Export of Textile and Clothing (US $ billions)

	2000	2004	2005	2006	2007	2008	2009
World Textile	157.3	195.5	202.7	220.4	240.4	250.2	211.0
World Clothing	197.7	260.6	276.8	309.1	345.8	361.9	316.0
Total	**355.0**	**456.1**	**479.5**	**529.5**	**586.2**	**613.1**	**527.1**
Pakistan Textile	4.5	6.1	7.1	7.5	7.4	7.2	6.5
Pakistan Clothing	2.1	3.0	3.6	3.9	3.8	3.9	3.0
Total	**6.7**	**9.1**	**10.7**	**11.4**	**11.2**	**11.1**	**9.5**
%age of World Trade	1.88	2.01	2.23	2.15	1.91	1.81	1.80

Source: WTO (2010)

Despite increase in prices of textile goods, export demand of textile products increased from EU and US. Pakistan's textile produces high quality yarn and exports instead of using for high value added products like garments and fabric. Japan, Hong Kong, and South Korea are major importer of this good quality Yarn of Pakistan's textile sector. It has been observed that demand for textile and clothing products has increased in developed countries but the production has been shifting to developing nations. The noticeable part is that trade in clothing than textile increased more rapidly during last two decades. Trade in clothing increased to 222%, while trade in textile increased by 173%, during 1985 and 1995. Further during the same period the share of textile sector trade was US $ 153 billion in the total world trade of US$311 billion. (Government of Pakistan, 2010).

Developing countries reluctantly agreed to participate in these arrangements because they were scared of the alternative restrictions. These arrangements followed by successive Multi-Fibre Agreements (MFA) further restricted exports of textile and clothing products. Later, developed countries lifted import quotas for developing nations and restricted their exports of textile and clothing products by other kind of measures such as tariff. MFA had four phases with over 40 participants and covered 80 percent of world textile and clothing exports. It is generally believed that the MFA reduced the volume of textile and clothing exports of developing nations. Textile and clothing sector of developing countries was vulnerable to the imposition of MFA quotas. In response of these quotas restrictions, developing countries like Pakistan, China, India, Indonesia, and Egypt put restrictions on the imports from these developed countries for the balance of payment purposes. The elimination of MFA was planned in 1995 with the entry of WTO. The elimination proceeded in four phases; therefore trade liberalization or quota free policy actually starts from the year 1995.

All 140 members of World Trade Organization (WTO) were signatory of ATC and they decided to free the world trade of textile and clothing from all kinds of trade restrictions, which will be applicable from January 1, 2005. The objective of the GATT was to promote free trade and avoid non-discriminatory actions of the member countries. ATC was formulated with the view of emphasizing on liberalizing trade on the products like made-up textile and clothing, fabrics, yarn etc. This liberalized process enhanced the quotas until completely eliminated. This process was consisted of four stages which are shown in the table 2. Among other objectives of ATC were to provide safeguard against any damages to producers of textile and clothing products during four stages of elimination phases. The TMB (Textile Monitoring Body) was also set up to implement on rules and regulation formulated by ATC during transitional phases of quotas elimination. The detail of this transitional period for the removal of quota is given in the table 2. According to which importing industrial countries will increase import volume gradually in four phases till the abolition of complete quota for exporting countries.

Table 2. Transitional Stages of Quota Abolition

Phases	Integration (based on 1990 volume)	Growth Rate of Residual Quotas (based on previously agreed MFA growth rates of quotas)
Stage 1 (January 1, 1995)	16 percent	16 percent higher growth than initially
Stage 2 (January1, 1998)	Further 17 percent (total 33 percent)	Increase by 25 percent
Stage 3 (January 1, 2002)	Further 18 percent (total 51 percent)	Increase by 27 percent
End of the 10 year transition period (January 1, 2005)	Remaining 49 percent (total 100 percent)	

Source: Francois, McDonald, and Nordstrom (1995).

Our study aims at finding total factor productivity growth of textile sector in the context of quota elimination and exploring those other determinants responsible for low productivity growth of this sector. This part in the existing literature of textile sector has been ignored. We can find hardly a few studies relating to textile productivity growth of Pakistan but no study focused on quota scenarios. This study specifically contributes in present literature relating to textile sector of Pakistan in broader perspective of assessing impact of quota elimination on productivity growth.

For this purpose study first estimated productivity for two periods i.e. pre quota elimination and post quota elimination period. Comparing the results our study found no significant change in factor productivity growth. Moreover to see the extent of impact of quota elimination on factor productivity and to explore other determinants that may affect factor productivity growth of textile sector, a time series data was taken from various domestic and international sources. Later, by applying Auto-Regressive Distributed Lag (ARDL) technique to cointegration, other important determinants of factor productivity growth were explored. We first constructed a model on the basis of theoretical consideration and later model specification tests were used.

Remaining sections of this paper is constructed as: section (2) follows literature review, section (3) provides theoretical discussion of productivity estimation, section (4) data and methodology, section (5) shows empirical results and section (6) provides conclusion.

2. Literature Review

What have been the key determinants of economic growth in Pakistan is still debatable but no one can deny the contribution of TFP growth in economic growth of any country and so the Pakistan. Many empirical and theoretical studies have focused on the role of TFP growth for the long-run growth (Solow, 1956). Different approaches in the past literature are found to measure TFP such as Kendrick approach of arithmetic measure (1961), Solow residual approach or growth accounting, Tornquist index a frontier approach (Tornquist, 1936, Theil 1967), Malmquist index (1953) of technical and efficiency changes etc.

In Solow residual approach residual value decreases when independent variables of inputs increases. In this approach inputs are used in quantitative numbers not in qualitative. For example when instead of taking only capital and labor inputs, additional variable of educational attainment is used as qualitative input then residual decreases (Denison 1962; Otani & Villanueva 1990). Therefore to capture qualitative characteristics of inputs other approaches may be used to measure total factor productivity such as (Tornquist, 1936, Theil 1967, Malmquist index, 1953; Caves et al., 1982a,b) and distance function by (Fare et al. 1994). Productivity is reflected from many ways, Bhatia (1990) argues that higher efficiency of the same level of inputs produces high level of output and eventually reduces cost of production. Bhatia (1990) concluded that demographic changes and poor technology are the causes of low productivity in India as compared to developed nations such as United States and United Kingdom. Technological improvement is an important factor of efficiency enhancement, when it is properly absorbed with other inputs. Katz (1969) found the role of technological advancement and labor productivity growth through residual approach of TFP for the period 1946-1961.

The results of this study significantly supported the contribution of capital. The studies of Elias (1978), Krueger and Tuncer (1982a, 1982b), Kim and Park (1985) and Nishimizu and Robinson (1982) directly captured the effects of a trade regime on the growth of total factor productivity of developing economies. Empirical finding of these studies supported the evidence. Maisom and Arshad (1992) indicated mixed results of TFP growth in the manufacturing sector of Malaysia. This study used the data of manufacturing survey of industries owned and operated by domestic producers and foreign owned firms operated in Malaysia. The data covering the period from 1973 to 1989 showed that TFP growth for overall economy increased every year but in manufacturing sector it remained small. On the other hand foreign owned firms had larger TFP growth as compared to firms owned by domestic producers. This larger TFP growth of foregin firms is due to reaping benefit from technological advancement in Malaysa by these firms. Fare, Grosskopf, and Lee (1995) analyzed productivity through decomposition of Malmquist Index into technical efficiency change and technical change for Taiwanese manufacturing industries over the period of 1978-89. This study suggested that technical change is the cause of TFP growth in long run. On average trade liberalization effect on TFP was higher than pre liberalization period.

Satish and Kunal (2002) studied the effects of trade liberalization on the total factor productivity growth in manufacturing industries of India by using panel study of 30 industries over the period of 1973-88. India has focused on slow and steady liberalization policy and remained different across different industrial sector. This study used growth accounting methodology and Tornquist index to calculate factor productivity of manufacturing sector in intermediate and capital goods. The study revealed that trade liberalization policy of intermediate goods had statistically significant impact on productivity growth of this sector. Baier et al (2002) found the contribution of the growth of human and physical capital in TFP growth for 145 countries. According to the results of this study TFP growth is not so important because it only contributes 25 percent output per worker growth for United States and Western countries. The economic prosperity of developed countries may be achieved due to total factor productivity growth of all sectors (Prescott, 1997).

Unel,s (2003) estimated average annual TFP growth of manufacturing sector of India for the period from 1979-80 to 1990-91 and found 1.8 percent factor productivity growth on the annual average in manufacturing sector and 2.5 percent annual average factor productivity growth between the period from 1991-92 to 1997-98. Indian manufacturing industries also experienced faster TFP growth in the post reform period as compared to pre reforms (TSL, 2003).

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Young (1995) found that the long run economic growth in Singapore was due to intensive use of the inputs instead of their productivity. An average annual growth of TFP remained only 0.2 percent during 1966 to 1990 and manufacturing sector of Singapore just experienced 1-percent growth. Senhadji (1999) concluded that there is an ample literature on determinants of growth in individual and cross-country studies but very few studies explored the determinants of TFP growth. However some studies partially focused on finding determinants of TFP growth. Pasha et al. (2002) found determinants of TFP growth of some sectors and for the economy of Pakistan and results indicated that primary and secondary education is one of the major determinants of productivity growth. Bjuerk and Durevall (2000) estimated total factor productivity growth of manufacturing sector of Zimbabwe for the period from 1991 to 1995 after implementation of structural adjustment program.

Sabir and Ahmed (2003) have drawn similar conclusion that education has positive and significant impact on productivity as it was discussed in the study of Pasha et al. (2002) but with different determinants. Authors found that cotton yield, human capital, vintage capital, foreign remittances and development expenditure are determinants of TFP growth in Pakistan. Rodrik and Subramanian (2004) investigated the causes of productivity growth in India since 1980. They found that pre-trade reform environment in India is responsible for growth, instead of traditional post reforms such as improved agricultural performance, trade liberalization policies. Penelope (2005) attempted to extricate the effects of trade liberalization policy during 1980s on exports, imports and balance of payment in Mexico. According to the results of this study trade liberalization significantly affected the trade balance and the effects of North American Free Trade Area (NAFTA) remained negligible.

Burki and Khan (2005) found the impact of allocative efficiency on energy substitutability and allocation of resources for Pakistan's economy. This study was based on pooled time series data of large manufacturing sector of Pakistan for the period from 1969-70 to 1990-91. The results of this study indicated the evidence of allocative efficiency and high cost of production. Afzal (2006) calculated total factor productivity for large scale manufacturing sector with three different approaches. This study used classical approach to make comparison in the first place, simultaneous equation approach was used in second place and in the third stage autoregressive models were used to forecast productivity. The results of this research showed that labor, capital, gross national product affect productivity. Mahmood, et al. (2007) examined the efficiency of large scale manufacturing sector of Pakistan by using stochastic production frontier technique. This study covered two time periods 1995-96 and 2000-01 to estimate production frontier for 101 industries at 5 digits Pakistan Standard Industrial Classification (PSIC). The study showed the minor improvement in the efficiency of large scale manufacturing sector. This study further had given mixed results at disaggregated level, though, majority of industries gained from technical efficiency.

Yi, Wu, and Zeng (2008) investigated the impact of trade liberalization on imports, exports and trade balance for a large sample of developing countries. The study found strong evidence that trade liberalization increases imports and exports. However in contrast to the study of Santo-Paulino and Thirwall (2004) who found negative and robust impact of trade liberalization on the overall trade balance, this study had mixed evidence of a negative impact. The study applied two different measures of trade liberalizations and one of the measures provided evidence of worsened impact of trade liberalization but the evidence was not robust across different estimations and the estimated impact remained smaller than that of the study of (Santo-Paulino and Thirwall, 2004). Teweldemedhin and Van Schalkwyk (2009) studied implications of trade liberalization on agricultural sector growth of South Africa and concluded that country gained from trade liberalization policy. Study also emphasized on the formation of regional trading block as it promoted economic growth and reduced poverty in South Africa.

3. Model Specification, Data and Methodology

According to Debreu (1951) and Koopmans (1951) efficiency consists of two components i.e. technical efficiency which estimates optimum level of output from given inputs while allocative efficiency shows the optimal use of inputs from their given prices and combination of these two efficiencies is called economic efficiency. This study assumes constant return to scale that means equivalent measures of technical efficiency under input or output oriented measures. In the present study Data Envelopment Analysis (DEA) uses inputs and outputs data of textile sector for decision making unit. The DEA measure was initiated by Charnes, et el.(1978) that is based on frontier concept developed by Farell, (1957). This study uses the frontier methodology called DEA- Malmquist Index developed by Fare, et al. (1994) and Coelli, et al. (1998). In fact this idea was firstly given by a Swedish statistician Mamlquist in 1953. DEA- Malmquist index is appropriate methodology to measure factor productivity because of many reasons. For example, according to Mahadevan (2002) DEA methodology is superior to translog index because later neglects technical efficiency and only measures technical change, while TFP growth is composed of both technical change and technical efficiency. Secondly, it tells the sources of TFP growth that helps to policy makers to know the reasons of low TFP growth. Thirdly, in this non-parametric methodology we do not need to calculate production function because it provides best practice frontier. In parametric approach, a comprehensible functional form of a desired variable is required, while a non-parametric approach does not specify technological relationship.

Present study follows Malmquist index, that is a combination of technical and efficiency change and these two changes give total factor productivity change or growth. Fare, et al. (1994) put forward the distance function, which describes whether the TFP growth is due to catching up effect or due to technological effect with a given set of inputs. This function calculates the distance between potential level of output and given level of output. Here, potential level of output means the level that touches the boundary of frontier technology. According to Fare et al.(1994) Malmquist index of TFP change between time period t and t+1under constant return is defined as:

$$M_k^{t+1}(x_k^{t+1}, y_k^{t+1}, x_k^t, y_k^t) = \left[\frac{D_k^{t+1}(x_k^{t+1}, y_k^{t+1})}{D_k^t(x_k^t, y_k^t)}\right] \times \left[\frac{D_k^t(x_k^{t+1}, y_k^{t+1})}{D_k^{t+1}(x_k^{t+1}, y_k^{t+1})} \times \frac{D_k^t(x_k^t, y_k^t)}{D_k^{t+1}(x_k^t, y_k^t)}\right]^{1/2} \quad (1)$$

The equation 3.1 represents the product of a technical change index and index of technical efficiency change. Where M_k^{t+1} represents malmquist index at time t+1, x_k^{t+1} represents inputs at time t+1 of industry (k) i.e. textile and y_k^{t+1} represents output of industry k at time t+1, while $\left[\frac{D_k^{t+1}(x_k^{t+1}, y_k^{t+1})}{D_k^t(x_k^t, y_k^t)}\right]$ represents productivity efficiency or catching up effect in industry (k) between time t and t+1, and $\left[\frac{D_k^t(x_k^{t+1}, y_k^{t+1})}{D_k^{t+1}(x_k^{t+1}, y_k^{t+1})} \times \frac{D_k^t(x_k^t, y_k^t)}{D_k^{t+1}(x_k^t, y_k^t)}\right]^{1/2}$ represents technological change between time t and t+1. The efficiency change $\left[\frac{D_k^{t+1}(x_k^{t+1}, y_k^{t+1})}{D_k^t(x_k^t, y_k^t)}\right]$ is the ratio of two distance function between time t and t+1represents output oriented measures of technical efficiency. The value of this efficiency term may be greater, less or equal to one. A value greater than one indicates producer is moving closer to production frontier, equal to one indicates no change and less than one indicates moving away from frontier. While second term in square root represents technical change in production

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through technological improvements between time period t and t+1. It may also have values greater than, less than or equal to one, indicating technological best practice is improving, deteriorating or remaining unchanged respectively. These efficiency change and technical change indices helps us to investigate the determinants of TFP growth. Further, it helps policy makers to think rationally about decision making. From knowledge point of view it clears the understanding of policy makers about productivity growth drivers. Present study estimates factor productivity by using equation 1 to obtain the results for the overall time period in the context of pre and post quota..

In the following section the study aims to investigate whether quota abolition has any impact on TFP growth and what is the role of other factors in determining TFP growth of textile sector. To explore the relationship between TFP growth and other variables, model is specified as follow: As this study aims to calculate factor productivity growth with the given inputs along with export and import penetration in the context of assessing role of quota elimination, we developed following model.

The functional form of the model is given below:

$$FPG_t = f(TEXP_t, IMPEN_t, RA_t, K/L_t) \qquad (2)$$

Variables used for finding the impact pre and post quota reforms on total factor productivity growth of textile sector are as follow:

(TEXP) Textile export is taken in million rupees (RA) Raw material is taken in thousand kg including yarn, fiber to make cloth (K/L served technology variable) Capital in textile sector is in million rupees and Labor is used as annual average daily numbers of workers in textile sector. (IMPEN) Import penetration in million rupees. Import penetration captures the effect of trade restrictions and expressed as ratio of textile imports to domestic availability for textile industry. Domestic availability is calculated as production plus import minus export. Labor data shows annual average daily labor working in textile sector, while capital shows capital employed at stock exchange. Capital-labor ratio represents technology variable but conventionally it represents relative degree of mechanization. Time series data for all variables has been obtained from yearly publications of Pakistan Bureau of Statistics and All Pakistan Textile Mills Association, Comtrade and from the website of World Trade Organization (WTO).

Time series data may have the problem of stationarity, therefore study has checked unit root. Unit root problem can be identified through various tests such as Dickey-Fuller, Augmented Dickey Fuller and Philips Perron tests. But present study has chosen Ng-Perron, test. This test is considered better for small sample size (Ng and Perron, 2001). Later to find long run relationship through co-integration among variables several co-integration techniques are available such as Engle-Granger (1987), Johansen-Juselius (1990) etc. These techniques require the same order of integration of all variables, but these techniques provide contradictory results, particularly under different order of integration among variables.

Pesaran , Shin and Smith (2001) developed Autoregressive Distributive Lag (ARDL) bound testing technique to co-integration. This technique is also suitable for small sample than any other co-integration technique (Pesaran et al., 2001). ARDL also provides information about structural break in data and according to Pesaran and Shin (1999) lag orders in the ARDL model may correct the problems of residual serial correlation and endogenity in variables. In the view of Pesaran, Shin and Smith (2001) this technique is suitable to see long run relationship among macroeconomic variables after lag order selection for ARDL. In view of Alam and Quazi (2003)

ARDL is applicable even independent variables are endogenous. But, applicable only when we have mix order of integration among variables and fails when there is second I(2) order of integration.

Therefore study first estimates conditional lag order of variables in the model for ARDL. The representation of this order is shown in equation form as following:

$$\Delta FPGit_{it} = \beta_1 + \beta_{2t} + \beta_3 FPG_{it-1} + \beta_4 LTEXP_{it-1} + \beta_5 LRA_{it-1} + \beta_6 LIMPEN_{it-1} + \beta_7 LKL_{it-1} + \sum_{h=1}^{n} \Delta FPG_{it-h} + \sum_{j=2}^{n} \Delta LTEXP_{it-j} + \sum_{m=0}^{n} \Delta LRA_{it-m} + \sum_{p=2}^{n} \Delta LKL_{it-p} + \sum_{r=0}^{n} \Delta LIMPEN_{it-r} + e_{it} \quad (3)$$

The variables in the above equation are as follow:

FPG it = Factor productivity growth as dependent variable (FPG)

LTEXPit = Log of Textile export

LRAit = Log of Raw material

LIMPENit = Log of Import penetration

LK/Lit = Log of Capital labor ratio

After lag orders selection, study checks the relationship among variables through bounds test using Wald statistic. This provides us F-Statistic value which is to be compared with the critical values developed by Pesaran, Shin and Smith (2001) and Narayan (2005). If the calculated F-value falls within upper and lower bounds value then the result is inconclusive, if it exceeds the upper bound value then study rejects null hypothesis of no co-integration. If F-statistic value falls below the critical bounds values, we do not reject null hypothesis of no co-integration.

To capture the effect of liberalization, a dummy variable of export is used. This will investigate the change in the coefficient of export and its impact on factor productivity. The study also compares the results of before and after abolition of export quota. In the end to establish goodness of fit of ARDL model diagnostic test and Cumulative Sum of Recursive residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMsq) are conducted to see the stability and reliability in the model. For diagnostic tests, study examines functional form, serial correlation and heteroscedisticity related with model.

4. Results

The results of total factor productivity change and factor productivity growth for entire time period of 1972 to 2012 are given in table 3. Later tables 4 and 5 show the calculation of total factor productivity growth for two different periods, before quota abolition and after quota abolition.

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Table 3. Factor Productivity Change and Growth(1972-2012)

Years	Efficiency Change	Technical change	Pure Efficiency change	Scale Efficiency Change	Total Factor Productivity Change	Total Factor Productivity Growth
1972	nil	nil	nil	nil	Nil	……
1973	1.000	1.020	1.000	1.000	1.020	2
1974	1.000	1.090	1.000	1.000	1.090	9
1975	1.000	0.979	1.000	1.000	0.979	-2.1
1976	1.000	0.933	1.000	1.000	0.933	-6.7
1977	1.000	1.135	1.000	1.000	1.135	13.5
1978	1.000	0.971	1.000	1.000	0.971	-2.9
1979	1.000	1.107	1.000	1.000	1.107	10.7
1980	1.000	1.121	1.000	1.000	1.121	12.1
1981	1.000	1.165	1.000	1.000	1.165	16.5
1982	1.000	0.934	1.000	1.000	0.934	-6.6
1983	1.000	0.822	1.000	1.000	0.822	-17.8
1984	1.000	1.060	1.000	1.000	1.060	6
1985	1.000	0.965	1.000	1.000	0.965	-3.5
1986	1.000	1.087	1.000	1.000	1.087	8.7
1987	1.000	0.802	1.000	1.000	0.802	-19.8
1988	1.000	0.841	1.000	1.000	0.841	-15.9
1989	1.000	1.285	1.000	1.000	1.285	28.5
1990	1.000	0.947	1.000	1.000	0.947	-5.3
1991	1.000	0.820	1.000	1.000	0.820	-18
1992	1.000	0.510	1.000	1.000	0.510	15.9
1993	1.000	1.182	1.000	1.000	1.182	28.5
1994	1.000	0.737	1.000	1.000	0.737	-5.3
1995	1.000	1.493	1.000	1.000	1.493	-18
1996	1.000	1.095	1.000	1.000	1.095	-49
1997	1.000	1.029	1.000	1.000	1.029	18.2
1998	1.000	1.223	1.000	1.000	1.223	-26.2
1999	1.000	1.129	1.000	1.000	1.129	49.3
2000	1.000	0.928	1.000	1.000	0.928	9.5
2001	1.000	1.036	1.000	1.000	1.036	2.9
2002	1.000	1.029	1.000	1.000	1.029	-7.2
2003	1.000	0.870	1.000	1.000	0.870	3.6
2004	1.000	0.921	1.000	1.000	0.921	2.9
2005	1.000	1.026	1.000	1.000	1.026	-13
2006	1.000	1.074	1.000	1.000	1.074	-7.9
2007	1.000	0.887	1.000	1.000	0.887	2.6
2008	1.000	1.036	1.000	1.000	1.036	7.4
2009	1.000	0.998	1.000	1.000	0.998	-0.2
2010	1.000	1.004	1.000	1.000	1.004	-0.4
2011	1.000	0.921	1.000	1.000	0.921	7.9
2012	1.000	0.966	1.000	1.000	0.966	3.4
Mean	**1.000**	**0.979**	**1.000**	**1.000**	**0.979**	-

Source: Author's Calculation

In table 3 dark bottom line shows average factor productivity change of textile sector i.e. 0.979 from the period 1972 to 2012 which is due to technical change not efficiency change. The efficiency change remained constant over the entire period. This means there is no improvement in capability or managerial skill changes. The findings of this study are mixed when we compare it with the study of Rehman et al. (2008), who found the same value of TFP change in textile sector composite, for the period of 1998 to 2007.Their findings show that this change is due to technical efficiency change, while the present study reflects constant efficiency change as indicated from the average value which is equal to one. Technical efficiency equal to one is due to the product of pure efficiency change and scale efficiency change, which remained constant over time or equal to one. If scale efficiency is close to one, means that this sector is operating at optimum scale. Technical change in the present study is 0.979 on averages. This is very much similar to the study of Rahman et al. (2008) who found technical change is 0.984. The results of our study indicate that there is no technical efficiency improvement in textile sector and frontier did not shift. To analyze the factor productivity change and total factor productivity growth before elimination of MFA phases (i.e. quota elimination) study estimated the results and given in the table 4.

Table 4. TFP: Pre-Quota Elimination (1973-95)

Years	Efficiency Change	Technical Change	Pure Efficiency change	Scale Efficiency Change	Total Factor Productivity Change
1973	1.000	1.020	1.000	1.000	1.020
1974	1.000	1.090	1.000	1.000	1.090
1975	1.000	0.979	1.000	1.000	0.979
1976	1.000	0.933	1.000	1.000	0.933
1977	1.000	1.135	1.000	1.000	1.135
1978	1.000	0.971	1.000	1.000	0.971
1979	1.000	1.107	1.000	1.000	1.107
1980	1.000	1.121	1.000	1.000	1.121
1981	1.000	1.165	1.000	1.000	1.165
1982	1.000	0.934	1.000	1.000	0.934
1983	1.000	0.822	1.000	1.000	0.822
1984	1.000	1.060	1.000	1.000	1.060
1985	1.000	0.965	1.000	1.000	0.965
1986	1.000	1.087	1.000	1.000	1.087
1987	1.000	0.802	1.000	1.000	0.802
1988	1.000	0.841	1.000	1.000	0.841
1989	1.000	1.285	1.000	1.000	1.285
1990	1.000	0.947	1.000	1.000	0.947
1991	1.000	0.820	1.000	1.000	0.820
1992	1.000	0.510	1.000	1.000	0.510
1993	1.000	1.182	1.000	1.000	1.182
1994	1.000	0.737	1.000	1.000	0.737
1995	1.000	1.493	1.000	1.000	1.493
Mean	**1.000**	**0.979**	**1.000**	**1.000**	**0.979**

Source: Author's Calculation

The results of calculated total factor productivity before quota abolition are shown in table 4. This table depicts that before liberalization period or quota abolition factor productivity was 0.979 on averages. Again there was no change in technical efficiency as shown from its value equal to one over the period. While technical change on averages is also less than one (0.979) indicates, technology has deteriorated over the period of time. This is perhaps due to increase in input cost over the years that increased the prices of textile exports in competitive markets and reduced the returns. Therefore producers continued using obsolete technology. However, after the abolition of quota on exports it was expected to gain in exports and factor productivity of textile sector. Multi-Fiber Agreements (MFA) a system operated under multilateral frame work restricted exports of developing countries to developed nations. The basic objective of MFA was to protect the domestic industries of industrialized nations from the exports of developing countries of textiles. After the formation of World Trade Organization (WTO) in 1995, it was decided to eliminate MFA in four phases over the ten years transitional period. But major part of liberalization had to be completed by 2005. Keeping in view the beginning of abolition of quota phase from 1995, factor productivity of textile sector was measured and the results are given in table 5.

Table 5. TFP: After Quota Elimination (1995-2012)

Years	Efficiency Change	Technical Change	Pure Efficiency Change	Scale Efficiency Change	Total Factor Productivity Change
1995	-	-	-	-	-
1996	1.000	0.820	1.000	1.000	0.820
1997	1.000	0.510	1.000	1.000	0.510
1998	1.000	1.182	1.000	1.000	1.182
1999	1.000	0.737	1.000	1.000	0.737
2000	1.000	1.493	1.000	1.000	1.493
2001	1.000	1.095	1.000	1.000	1.095
2002	1.000	1.029	1.000	1.000	1.029
2003	1.000	1.223	1.000	1.000	1.223
2004	1.000	1.129	1.000	1.000	1.129
2005	1.000	0.928	1.000	1.000	0.928
2006	1.000	1.036	1.000	1.000	1.036
2007	1.000	1.029	1.000	1.000	1.029
2008	1.000	0.870	1.000	1.000	0.870
2009	1.000	0.921	1.000	1.000	0.921
2010	1.000	1.026	1.000	1.000	1.026
2011	1.000	0.978	1.000	1.000	0.978
2012	1.000	0.945	1.000	1.000	0.945
Mean	**1.000**	**0.941**	**1.000**	**1.000**	**0.941**

Source: Author's Calculation

Table 5 shows factor productivity change after liberalization, when quota gradually was eliminated. It is observed that even after liberalization factor productivity remained less than one. This indicates that there is no impact of trade liberalization on factor productivity of textile sector of Pakistan. We may draw the conclusion that textile sector of Pakistan has not been able to employ its resources fully and efficiently. This was perhaps due to quota imposed by developed nations that restricted the export market for developing countries such as Pakistan, India, and China. These countries could not increase their share of textile and clothing exports in developed countries. Moreover, some countries explored and approached to unrestricted markets, where due to competition, global prices of textile exports reduced. Some developing countries took the benefit and diverted their exports to unrestricted markets. Quota also reduced the efficiency, because of incentives given to the producers in the developed nations for processing fiber and textile into finished goods. Incentive like Generalized System of Preferences (GSP) plus status given to some developing nations remained beneficial for these countries. This outweighed the advantages of Pakistan's textile sector. On the other hand during quota elimination phases, particularly after complete abolition of quota in 2005, some countries had special preferential access to the market of industrialized nations particularly to the European Union, under the policy of Everything But Arms (EBA). High tariff restrictions on the textile exports also out weighted the benefit of abolition of quota for those developing countries who were not beneficiaries of GSP plus.

The empirical findings and results of the unit root methodology, long run coefficients, co-integration result, short run results and diagnostic tests are given below.

4.1 Results of N-g Perron Unit Root Test

In the first step results of unit root test are given below to check the order of integration among variables. As earlier mentioned, this study applies N-g Perron (2001) unit root test statistic due to its high power for small sample size.

Table 6. Unit Root Results

	N-g Perron at Level with constant			
Variables	**Mza**	**Mzt**	**MSB**	**MPT**
TFPg	-18.6424**	-3.05290	0.16376	1.31480
LTEXP	2.75863	3.03860	1.10149	111.927
LRA	2.12690	1.79486	0.84388	62.3768
LKL	1.03906	0.55004	0.52937	24.5237
LIMPEN	-18.7390***	-3.06074	0.16334	1.30825

Source: Authors calculation : **, shows at 5% significance level

According to table 6 variables of total factor productivity growth (TFPg), import penetration are stationary at level, while rest of the variables are not stationary and have unit root problem. In the above results we reject null hypothesis of unit root problem (non-stationary) if N-g Perron test statistic (MZa) is less than the critical values. Therefore, TFPg and IMPEN have calculated values less than table values and we reject the null hypothesis of a unit root problem in these two variables.

Table 7. Unit Root Results with 1st Difference

	N-g Perron at 1st difference with constant			
Variables	**Mza**	**Mzt**	**MSB**	**MPT**
TFPg	-13.1763***	-2.56672	0.19480	1.85948
LTEXP	-63.2904***	-5.61425	0.08871	0.41257
LRA	-17.1833***	-2.88167	0.16770	1.60626
LKL	-17.8070***	2.98214	0.16747	0.16747
LIMPEN	-27.6118***	-3.71563	0.13457	0.88730

Source: Authors calculation: *** shows 1%, level of significance

In table 7 all the variables are taken at 1st difference with constant. The results of N-g Perron unit root in this table show that all the variables are stationary at 1st difference at 1 percent level of significance. These unit root results of N-g perron test provide clear justification for the application of ADRL to co-integration, as some variables are stationary at level such as TFPg and IMPEN and all are stationary at 1st difference. In other words it has mix order of integration i.e. I(0) and I(1).

4.2 Results of Cointegration Test

The results of calculated F-statistic (Wald-Test) and critical bound test to indicate co-integration are presented in table 8. Table 8 represents the value of Wald statistic showing null hypothesis of no co-integration H0: $\beta 2= \beta 3= \beta 4= \beta 5=0$ among the variables against the alternative hypothesis of the existence of co-integration.

Table 8.Bound Testing Approach to Co-integration

ARDL(1,2,2,0,0) F-Statistic (Wald -Test) = 7.002959		
Level of Significance	**Lower Bound Value**	**Upper Bound Value**
5%	4.0117	5.2966
10%	3.3524	4.5456

Source: Author's calculation

The results in table 8 indicate calculated Wald statistic value 7.002959. This value is greater than Pesaran, Shin and Smith (2001) critical bound values that provides the evidence of co-integration among the variables. The lower bounds values at 5% and 10% level of significance are 4.0117 and 3.3524 respectively. While upper bounds values at 5% and 10% level of significance are 5.2966 and 4.5456 respectively. Thus present study confirms the long run relationship among total factor productivity growth of textile sector, capital-labor ratio, textile export, import penetration and raw material. After the establishment of ARDL co-integration through F-value the study discusses the long run elasticities of the variables taken in the model. These long run results are reliable, if co-integration is found in the model.

Table 9. Long-Run Relationship of ARDL to Co-integration

ARDL (1,2,2,0,0) based on R-BAR Squared Criterion Dependent Variable $TFPG_t$				
Variables	**Co-efficient**	**Standard Error**	**t-Statistic**	**p-Value**
$LTEXP_t$	0.01638*	0.00888	1.8613	.077
LKL_t	-4.9413**	2.6264	1.8813	.043
$LIMPEN_t$	-0.014836	0.16035	-.092526	.927
LRA_t	0.6840	0.1995	3.4293	.734
Constant	6.8477	7.3573	.93073	.361
Trend	-0.91380	1.0155	-.89982	.376

Note: **,*shows the rejection of null hypothesis at 5% and 10% level of significance respectively
Source: Author's calculation

Table 9 shows the estimated long run coefficients through ARDL model, when dependent variable is TFPGt. The results indicate that textile export plays modest but significant role in stimulating total factor productivity. The present result shows that 1percent increase in textile export increases factor productivity by 0.016 percent. Higher returns on textile exports encourage producers to invest in textile sector. It also helps investors to seek market for the exports of textile where producers do not face major threats from the big giant like China, India, and Bangladesh etc. Whereas if factor productivity growth i.e. on average less than one in estimation, which means, if factor productivity growth, on the average had increased or greater than one then export response could have been stronger. On the other hand, capital-labor ratio which serves as a technology variable indicates that with 1 percent increase in capital labor ratio, factor productivity declines by 4.94 percent. The reason behind this technology variable is that, textile sector of Pakistan uses obsolete or out-dated technology. Particularly weaving sector is comprised of smaller, inefficient and fragmented units. These units are inefficient and due to the use of those power looms which produce narrower width fabrics and use coarse counts of yarn do not yield better impact on productivity of textile products. More over after the year 2004-05 numbers of looms used in textile started declining and even imports of all sort of textile machinery declined after the year 2008 (APTMA, 2012). Therefore many producers used out-dated machinery. This may be of the reasons that diminishing return to scale in textile sector, which means increase in capital-labor ratio increases production with decreasing rate. Thus, factor productivity growth declines. Import penetration coefficient is showing negative but insignificant impact on factor productivity growth. This means textile sector is not threatened by imports because it is export oriented sector and textile sector imports play insignificant role. Raw material also has positive impact on factor productivity growth. On the average, one percent increase in raw material increases factor productivity by 0.684 percent.

In the second step of ARDL methodology, once long-run relationship is established, methodology allows us to estimate error correction model. The coefficient of error correction term explains the speed of adjustment to equilibrium after disequilibrium. The ARDL procedure assumes that variables in the model should be integrated at mixed order but if any variable is integrated at higher order then it is not valid procedure. Following the same lag length short run results are estimated. The results of error correction model are given in table 10.

Table 10. Error Correction Representation of ARDL Model

ARDL(1,2,20,0) based on R-BAR Squared Criterion Dependent Variable $TFPG_t$				
Variables	Co-efficient	Standard Error	t-Statistic	p-Value
$DLTEXP_t$	-.002659	0.002038	-1.3047	[.203]
$DLTEXP_t(-1)$	-.17999	0.16777	-1.0728	[.293]
$DLKL_t$	16.1728	20.6346	.78377	[.440]
DLKLt(-1)	68.0741*	24.5463	2.7733	[.010]
$DLIMPEN_t$	-.019691	.21259	-.092619	[.927]
$DLRA_t$	0.009078	.002661	3.4118	[.736]
DC_t	9.0885	9.7507	.93209	[.359]
DT	-1.2128	1.3620	-.89050	[.381]
ECT(-1)	-1.3272***	.17492	-7.5875	[.000]

Note: ***,*shows the rejection of null hypothesis at 1%, 5% and 10% level of significance respectively
Source: Author's calculation

Table 10 represents coefficients of differenced variables with their lagged values and model shows short run relationship among variables. Error Correction Term (ECT) coefficient is showing right negative sign and significant impact. Which means, time and speed of adjustment to equilibrium after disequilibrium in the short run. The speed of this adjustment can be verified from the ECT coefficient value of -1.3272. This indicates adjustment to short run equilibrium can be obtained approximately within 9.04 months i.e. (1*12/1.3272).

Table 11.Diagnostic Tests

	LM Version	**Probability**
Serial Correlation (χ^2)	0.022604	0.880
Functional Form (χ^2)	1.5398	0.215
Normality (χ^2)	1.7910	0.408
Hetroscedasticity (χ^2)	0.10774	0.743

Source: Author's calculation

Table 11 shows diagnostic tests such as serial correlation, functional form, hetroscedasticity and normality test. These tests are based on ARDL equations that take into account respective lags of the variables. Results indicate that p-values of all diagnostic tests are greater than 0.10. Thus, there is no problem of normality, serial correlation, hetroscedasticity and functional form in the model. In the next step to check the stability of coefficients of short-run and long- run period cumulative sum (CUSUM) and CUSUMsq cumulative sum of the squares are applied. Figures 1and 2, show cumulative sum (CUSUM) and CUSUMsq cumulative sum of the squares that represent stability of the long run and short run coefficients of the model graphically.

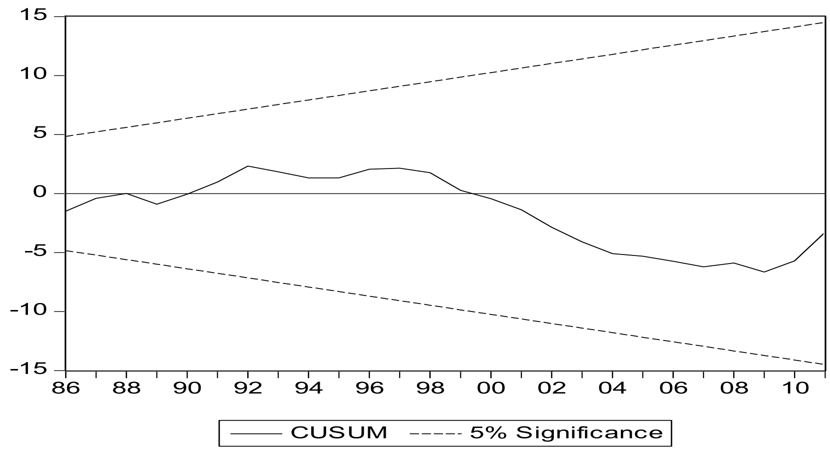

Figure 1. Plot of Cumulative Sum of Recursive Residual

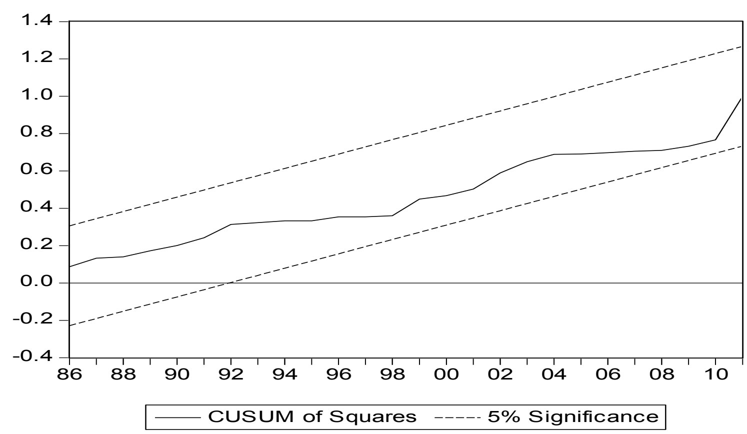

Figure 2. Plot of Cumulative Sum of Squares of Recursive Residuals

4.3 Impact of Quota Elimination on Factor Productivity Growth

To analyze the impact of quota abolition on factor productivity growth, this study generated dummy of export variable. The aim of this variable is to see whether quota abolition or liberalization contributes to increase factor productivity growth. This can be analyzed through the value of coefficient obtained from the model. The long run relationship results of quota abolition through ARDL to co-integration are presented in the table 12.

Table 12. Long-Run Relationship of ARDL to Co-integration (After Quota abolition)

ARDL (1,2,2,0,0) based on R-BAR Squared Criterion

Dependent Variable $TFPG_t$

Variables	Co-efficient	Standard Error	t-Statistic	p-Value
$LTEXP_t$	0.01211	0.09484	0.12768	0.214
LKL_t	-9.9702***	4.1329	-2.4123	0.008
$LDTEXP_t$	0.092*	0.0461	1.9956	0.055
$LIMPEN_t$	-0.017802	0.16358	-0.10883	0.914
LRA_t	0.00316	0.002379	1.3293	0.196
Constant	-3.9770	9.6435	-0.41198	0.684
Trend	-0.88971	1.0251	-0.86796	0.394

Note: **,*shows the rejection of null hypothesis at 5% and 10% level of significance respectively

The results obtained in table indicates that LTEXPt plays significant role in increasing total factor productivity growth but its coefficient after quota abolition to some extent increases i.e.(0.01211 + 0.092 = 0.1.0411). These result indicated by new coefficient that quota abolition increased productivity but not substantially. Therefore it accepts our established hypotheses that trade liberalization or quota abolition did not increase factor productivity of textile sector of Pakistan.

5. Conclusion and Policy Recommendation

From the above results and discussion, it can be concluded that on average for the entire period factor productivity growth did not increase, even after quota elimination period, when export quota was eliminated factor productivity growth could not substantially increase. While, to see the impact of export and quota elimination on factor productivity growth, ARDL to co-integration technique was applied and result found the existence of long run relationship among the variables. we also revealed that technical efficiency did not change because textile sector continued using poor technology and export plays its significant role in improving factor productivity, whereas textile sector of Pakistan did not get benefit of quota abolition. Textile sector failed to increase productivity and exports in the restricted markets like European Union and United States, because these markets continued other trade restrictions like tariff etc and given preferential status to some textile exporting countries.

Therefore this study suggests exploring other unrestricted markets like gulf countries where Pakistani products are demanded to large extent and to the rest of the world. Pakistan's textile producers should penetrate in these markets and benefit of quota abolition could be achieved. Raw material has significant impact on factor productivity, therefore its availability at low cost must be ensured. On the other hand capital-labor ratio that serves as technology variable decreases the rate of factor productivity growth due to the use of out-dated textile machinery and diminishing return to scale in textile sector of Pakistan. Therefore the study suggests improving technology in this sector and outdated machineries should not be operationalized. Moreover new techniques of production should be adopted and traditional methods of production must be halted.

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