Modelling Trade, Investment, Growth and Liberalization: Case Study of Pakistan

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Abstract

This study models the transmission channels through which trade liberalization policy indirectly affects industrial productivity and economic growth in Pakistan over the period 1972-2011. To measure the international trade reform policy, an index for trade liberalization policy is constructed and employing channel analysis to quantify the direct and indirect impact of liberalization policy on the industrial productivity in Pakistan. Results suggest that liberalization policy promotes industrial productivity and economic growth through its favourable effects on private sector industrial investment, manufactured exports and imports of capital goods. The contributions of direct channel of trade liberalization to industrial productivity is 30.49 percent, while the indirect contributions of trade liberalization through its impacts on private industrial investment, manufactured exports and capital goods imports are 31.71 percent, 18.9 percent and 18.9 percent respectively. The overall impact of liberalization is o.164 percent which implies that a one percent increase in liberalization index increases industrial productivity by 0.164 percent. The impact of trade liberalization policy on manufactured goods exports and capital goods imports is 0.18 and 0.17 percent respectively, which implies that increase in technological capability of exports and imports occupies 17-18 percent of the overall channels impact.

Key Words: Trade, Industrial Productivity, Trade Liberalization Index, Pakistan.

Introduction

The role of trade in economic development as an engine of economic growth has been at the centre of hot policy debates over the past four decades. History seems to support the success of import liberalization in the United States of America (USA) in 1940s and Japan in 1960s as well as the exports promotion achievements of Asian Tigers in 1970s and 1980s (Yen, 2009).[1] There is no doubt that increased movement of goods and services across international borders over the past few decades has helped developing countries to achieve faster and sustainable growth. Many researchers argued that free trade has been a key ingredient in this process by facilitating transfer of technology from developed countries to developing countries (Heokman and Javorcik, 2006 and Harding and Javoricik, 2012).

The theoretical literature suggest that trade liberalization enhances economic growth and development through specialization and technological developments. The theoretical link between international trade and economic development can be traced back to the earlier writings of Classical economists (Adam Smith and David Ricardo) and neoclassical economists (Heckscher and Ohlin) in the early part of nineteenth century. The classical economists hypothesized that all countries gain from trade and World production would grow when countries specialize according to the principles of comparative advantage. On the other hand, the neo-classical economists argued that countries will tend to specialize in those products that use abundant resources intensively in the production process. As a consequence, factors prices will tend to equalize across trading nations if production technologies remain identical throughout the world (Stolper-Samuelson approach). They further claimed that trade stimulate economic growth through production, consumption and saving linkages. The proponents of free trade believed that trade liberalization would improve exports and economic growth (Sachs and Warner, 1995; Khan *et al*., 1995; Iqbal and Zahid, 1998; Edwards, 1993; 1998, Frankel and Romer, 1999; Ravallion, 2001; Qadir *et al*., 2000;

[1] Trade liberalization may be defined as set of measures which includes elimination of government distortions, dismantling quantitative restrictions on imports, reducing import tariffs, making currency convertible for current account transactions, eliminating bureaucratic red tape and other impediments to foreign direct investment and improving customs procedures (Rodrik, 2006). The outcomes of trade liberalization lead to increase specialization, promote industrialization and technological progress, increasing competition and improvement in the living standards of the population (Cruz, 2008).

Dollar and Kray, 2002; Greenaway *et al*., 1997, Kemal *et al*., 2002; Berg and Krueger, 2003; Yanikkaya, 2003; Din *et al*., 2003; Mamoon and Murshed, 2006; Khan and Qayyum, 2006; Qayyum and Khan, 2008 , Miller and Mukti, 2000; and Sachs and Howard, 1996).[2]

The standard partial equilibrium trade theory emphasizes that trade liberalization can play an important role in boosting exports and economic growth through technology transfer and diffusion of knowledge among countries (Golder and Kumari, 2003; Husted and Melvin, 2001, Laird, 1997, Grossman and Helpman, 1991, among others). The new trade theories also emphasize the role of economies of scale associated with international trade which further gains in efficiency (Helpman and Krugman, 1985). The main conclusion emerges from the static theories of trade is that liberal and free trade foster economic growth, welfare and reduces poverty. The main transmission channels leading to this outcome are growth, productivity, investment and price stability. Ben-David (1996) argued that the elimination of trade barriers and increases in the volume of trade lead to a reduction in the income gaps between trading nations.

Free trade is critical ingredient for sustainable growth and productivity, creation of jobs, raises wages associated to higher private industrial investment (Balassa, 1978, Keesing, 1967, 1979, Krueger, 1988, Bhagwati and Srinivasan, 1978 and Khalid and Teck-Cheng, 1997). Openness creates international competitive environment through the elimination of government trading monopolies. It allows reaching new markets through trade and investment treaties, easy access to international financial markets and brings with other benefits such as, knowledge, technology and managerial capacity, creates business environment, etc. Trade become the paramount engine of growth, industrialization and development, and is considered to be the third among the most important factors contributing to growth following improvements in infrastructure quality, economic governance and promote industrialization (GOP, 2011).[3]

Pakistan has experienced a continuous trade and investment liberalization throughout the 1990s and process of reforms is still going on. These reforms include reduction in government intervention, removal of import quota, import surcharges and regulatory duties, rationalization of tariffs structure, elimination of the SROs, improving export

[2] Detailed discussions of empirical literature and references can be seen in Qayyum and Khan (2009) and Jaffari (2006).

[3] Framework for Economic Growth Pakistan: May 2011, Planning Commission, Government of Pakistan.

promotion and market information programmes, establishment of exports promotion zones (EPZs), liberalization of exchange rates and investment regimes and opening up investment regime, among others. Despite these measures, Pakistan's export growth rates were still modest by international standards (GOP, 2011).

Although researchers gradually agreed that trade is good for economic growth, but quantitive analysis have shown different picture on the link between trade liberalization and economic growth. There are three big reasons of mixed empirical results (Yen, 2009). First, disagreement over the choice of trade liberalization indicators, whether it is actual trade (Leamer, 1980) or tariffs and non-tariff berries (Sachs and Warner, 1995). Second, choices of explanatory variables for economic growth are different in countries carry out trade liberalization measures. Third, more sophisticated methodology is needed to investigate the linkages between trade and development, rather than single-equation methodology. Salvator (1983), Rashid (1995) and Wacziarg (2001) identified various channels through which liberalization policy affects economic growth.

Given the paramount importance of trade liberalization in economic development, it is necessary to understand the transmission channels through which liberalization affects industrial productivity, domestic private industrial investment, exports, imports and hence economic growth in Pakistan. Previous studies in Pakistan, *inter alia* by, Khan *et al*. (1995), Iqbal and Zahid (1998), Din *et al*. (2003), Mamoon and Murshed (2006), Khan and Qayyum (2007), Qayyum and Khan (2008), among other, either estimated export function or tested Granger/Toda-Yamamoto causality between trade and real GDP and fail to incorporate imports along with exports in production function. Omitting the import variable would result in spurious conclusions regarding the export-led growth hypothesis because capital goods imports are inputs for exports and domestic productivity (Riezman et al. 1996). Furthermore, liberalization of trade also affects productivity through investment, exports and imports channels. To the best of our knowledge no study has focused on the transmission channels through which trade liberalization affect economic growth, industrial productivity, industrial investment, exports and imports.

The present study tries to fill up this gap by developing a simultaneous equations model to determine how trade liberalization affect industrial productivity, domestic investment, exports and hence economic growth in Pakistan over the period 1972-2011. Furthermore, following Wacziarg (2001) the present study develops a composite trade liberalization index and then estimate simultaneous equations model using ordinary

least squares methodology. It is worth mentioning here that application of Wacziarg (2001) approach for time series data is more superior to other approaches because it separately analyses partial channels to evaluate the impact of economic reforms initiated in 1990s to Pakistan's economy, of which liberalization of trade and investment regimes is the most fundamental innovation in external sector. The Wacziarg (2001) approach allows us to decompose the total effect of liberalization policy into industrial productivity into its different components.

The rest of the paper is organized as follows: Section 2 briefly overviews the trade liberalization policy so far carried out in Pakistan. Transmission channels model of trade and development is specified in section 3. Section 4 presents data sources. Construction of liberalization policy index is also discussed in this section. Empirical results are interpreted in section 5, while concluding remarks are given in the final section.

2. Overview of Trade Policy in Pakistan

Pakistan has pursued a mixed inward-oriented/outward-oriented trade policy for nearly four decades. High tariff rates, various types of non-tariff barriers, exchange controls and other administrative controls are the main features of this policy. The objective of this policy regime was to promote import-substitution industrialization and to protect infant industries from external competition. This policy has generated anti-export bias, inefficiencies and promoted rent seeking attitudes (Qayyum and Khan, 2009). However, the lessons from successful trade strategies forced many developing countries including Pakistan to adopt outward oriented policies (Balassa, 1989, Michaely et al. 1991). Benefits of outward-orientation policies inspired Pakistan and other Asian countries to open up their economies for trade and investment in the early 1990s. Globalization and World Trade Organization (WTO) regime has enabled developing countries to reap benefits of specialization, obviate the constraints of small size of markets and enhance the capacity of absorbing spillovers of knowledge creation in different parts of the world (RIS, 2004 and Qayyum and Khan, 2009). Due to outward orientation policies the growth performance has improved steadily (Table 1).

Trade reform includes a series of measures including rationalization of tariff structure and removal of quantitive restrictions. Maximum tariff rate on imports which was 225 percent in 1986-87 has come down to 25 percent in 2005 (Hussain, 2005 and Khan and Qayyum, 2006). The average tariff rate which was 66 percent in 1990 was come down to 14.7 percent in 2009. Similarly the number of custom duty slabs was reduced from 13 in

1996-97 to 4, quantitive restrictions were lifted except for those relating to security, health, and public morals, religious and cultural related. All para-tariffs have been merged in to the statutory tariff regime and import duties on 4000 items were reduced.

These measures have brought down effective rate of protection, eliminate the anti-export bias and promote competitive and efficient industries (Khan and Qayyum, 2006). A number of laws were promulgated to bring the trade regime in line with WTO regulations.[4] Despite the substantial reduction of tariffs and non-tariffs barriers the growth in exports in 1990s was only 5.6 percent as compared to 14.97 percent in 1970s and 8.5 percent in the 1980s. The outcome of the liberalization policy is demonstrated in Table 1.

Table 1: Growth Rates of Exports, Imports, Share of Trade to GDP and Average Tariff

Year	GDP	Manufa-cturing Value-added	Exports	Imports	Trade as percentage of GDP	Import Dependence Ratio	Simple Average Tariff	Tariff revenue as percentage of imports[5]
1970s	4.8	5.5	6.07	8.35	23.22	14.84	-	-
1980s	6.5	8.2	14.97	18.78	31.38	20.02	-	26.79
1990s	4.6	4.8	8.52	4.54	34.75	22.37	71.37	28.49
2000s	4.8	7.0	5.61	3.22	35.33	19.14	46.58	19.99
2001	2.0	9.3	9.07	6.25	30.37	15.71	20.2	10.31
2002	3.1	4.5	2.32	-7.53	30.54	15.31	17.2	7.13
2003	4.7	6.9	19.14	20.13	32.85	16.13	16.8	9.14
2004	7.5	14.0	13.84	20.04	30.30	14.63	16.2	8.70
2005	9.0	15.5	16.8	39.6	35.25	19.56	14.61	7.64
2006	5.8	8.7	14.3	31.6	38.45	23.22	14.79	8.04
2007	6.8	8.3	4.4	8.0	35.54	21.34	14.9	7.14
2008	4.1	4.8	18.2	31.2	36.73	23.28	14	5.99
2009	1.7	-3.6	-6.4	-10.3	33.25	20.34	14.71	6.24
2010	3.8	5.5	2.9	-1.7	32.32	18.73	-	5.66
2011	3.0	3.1	29.3	14.5	27.83	15.93	-	5.41

Source: Khan and Qayyum (2006), Economic and Social Survey of Asia and the Pacific 2012 and World Bank-World Development Indicators 2012.

It can be seen from the Table 1 that since 2008 Pakistan's economy followed a very low growth trend. This could be due to the energy shortages, rising global commodity

[4] A number of laws were promulgated such as anti-dumping, countervailing measures and intellectual property rights.

[5] We would like to thank MS Naila Jabeen Ph.D scholar for providing data on tariff revenues.

prices, adverse effects of unprecedented floods of 2010 and low productivity of manufacturing sector (Amjad et al., 2011). Despite the liberalization measures, trade to GDP ratio in the 2010 was approximately the same a decade earlier. Quality of poor governance and management structures, dispersal of responsibilities among implementing agencies and absence of mechanism for monitoring and resolving policy issues could be the reasons of this trade policy failure (GOP, 2011). Import dependence ratio which was 15.71 percent in 2001 increased to 23.28 percent in 2008 and then followed declining trends and was reached to 16 percent in 2011. The simple tariff rate which was 20.2 percent in 2001, decreased to 14.71 percent in 2009. Similarly, tariff revenue over total imports was decreased after the enforcement of WTO agreement in 2001. This picture of external sector performance calls to revisit the trade liberalization programme, further rationalize tariff structures and eliminate regulatory duties.

3. Transmission Channel Model of Trade and Development

Taking lead from Wacziarg (2001) this study tries to explain the linkages between industrial productivity and trade liberalization policy through various potential channels such as industrial sector private investment, exports and imports in the case of Pakistan. These channels can be grouped into three broad channels viz. industrial sector private investment channel that measure size and quality effects on industrial productivity (i.e. by increase in inflow of capital goods and by increasing return to scale due to specialization). Yen (2009) argued that size effect of investment on growth can be directly measured by the capital variable and the quality effect is measured by total factor productivity (TFP) in growth equation in which dependent variable is growth rate. Technology transmission channels that includes export of manufactured goods and import capital goods and trade liberalization channel that enhance growth through the creation of incentives for governments to increase economic efficiency and growth through the removal of market distortions and trade impediments.

We assume that economy consists of industrial and non-industrial sectors. Aggregate real output (Y_t) is decomposed into the industrial output (Y_t^{IND}) and non-industrial output (Y_t^{NIND}):

$$Y_t = Y_t^{IND} + Y_t^{NIND} \quad (1)$$

Industrial output includes small scale and large scale industries, constructions, electricity and gas subsectors. Non-industrial output is taken as exogenous and calculated by subtracting industrial sector value-added from overall GDP. In industrial

sector capital stock (K_t^{IND}) and labour (L_t^{IND}) are the key factors of production. The production function for industrial sector is specified as:

$$Y_t^{IND} = Y^{IND}(K_t^{IND}, L_t^{IND}) \qquad (2)$$

The model expressed in equation (2) is incapable to explain the effects of structural changes on industrialization and development (Salvatore, 1983). Lewis (1954) argued that in the process of industrial development, labour (L_t) and capital (K_t) migrated from agriculture sector where productivity is low to modern industrial sector where productivity of factors is relatively high. This mobility of factors from traditional sector to modern sectors depends on the pace of industrialization which can be taken as proxy for the rate of past investment. Increasing productivity of industries may consider as preconditions for further growth of infrastructure and skilled labour which are the key ingredients of industrial development and hence economic growth (Salvatore, 1983 and Rashid, 1995).

Besides labour and capital, it is assumed that total factor productivity (TFP) can be affected by trade liberalization. It is theorized in economic literature that exports contribute to greater economic growth through various mechanism, such as generating beneficial externalities, allowing economies of scale to accrue, alleviating foreign exchange constraints and fostering competitive pressures (Sprout and Weaver, 1993). Production of manufacturing exports (MX_t) and primary exports (PX_t) introduces greater competition; keep the economy abreast of the latest technological advances and leads to higher rate of savings and investments. Import of capital goods (CM_t) and agriculture productivity (Y_t^{Agr}) are another important determinants of industrial growth. Import of capital goods is an important means for technology transfer; enhances competition and reduces constraints in the form of intermediate inputs. Agriculture value added is also included in the specification because in developing countries agriculture is considered as backbone of the economy. Rapid agriculture growth has been associated with industrialization and leads to industrial productivity and economic growth. Besides, shortages of energy shortages particularly of natural gas shortages to manufacturing sector ($INDGAS_t$) and inflation rate ($INFL_t$) are likely to influence manufacturing sector productivity (Zerfu, 2002 and Khan and Din, 2011).

Furthermore, the technical efficiency of production depends largely on the economic reforms and can have an impact on production function. To capture the effects of

economic liberalization we included liberalization policy index (LIB_t) in the specification. Now the industrial production function takes the following form:

$$Y_t^{IND} = Y^{IND}(K_t^{IND}, L_t^{IND}, IX_t, PX_t, CM_t, Y_t^{Agr}, INDGAS_t, INFL_t, LIB_t) \qquad (3)$$

All the right hand side variables are expected to influence manufacturing sector production positively except for inflation rate ($INFL_t$).

3.1 Transmission Channel 1: Industrial Sector Physical Investment

The industrial sector physical investment is one of the important channels through which liberalization affect industrial productivity and economic growth. The standard literature points out that rate of investment (I_t) is determined by domestic saving rate (S_t) and foreign capital inflows (K_t^f). Many developing countries including Pakistan have been facing the problem of capital shortage. Low levels of domestic savings and foreign exchange act as one of the big constraint on the level of domestic investment (Salvatore, 1983). Although foreign capital inflows often leads to a fall in domestic savings, however, domestic savings can make a positive net contribution to the rate of capital formation because technological progress is also embodied into new capital. Following Chenery and Eckstein (1970) and Salvatore (1983) domestic savings can be expressed as function of real income (Y_t) and real exports (X_t):

$$S_t = S(Y_t, X_t) \qquad (4)$$

The real income variable reflects a country's state of development and expected to have a favourable influence on the saving rate (Rashid, 1995). Export performance is expected to affect the saving rate positively. A higher ratio of exports to GDP can also be expected to lead to a higher level of private and public savings because trade taxes are major sources of government revenue. Since imports are generally restricted by government restrictive policies and they can act as a constraint on the domestic investment. Thus, import of investment goods has been included in the industrial investment function as proxy for foreign capital. Now manufacturing sector investment can be specified in the following form:

$$I_t^{IND} = I^{IND}(Y_t^{IND}, X_t, CM_t, LIB_t) \qquad (5)$$

It can be argued that primary exports and manufactured exports also play very important role in determining industrial investment. Therefore, we extend equation (5)

by incorporating primary goods exports and manufactured goods exports. Furthermore, inflation rate is also treated as one of the important determinant of industrial investment. Increases in inflation rate generate macroeconomic uncertainty which eventually produces negative impact on industrial investment. Further, public investment in industrial sector (GI_t^{IND}) which concentrates mostly on infrastructure exerts an important influence on private industrial investment. By incorporating primary goods export (PX_t), manufactured goods export (PX_t), inflation rate ($INFL_t$) and government investment in industrial sector equation (5) can be rewritten as:

$$I_t^{IND} = I^{IND}(Y_t^{IND}, PX_t, MX_t, CM_t, GI_t^{IND}, INFL_t, LIB_t) \qquad (6)$$

The impact of liberalization policy (LIB_t) on industrial investment is uncertain. However, there are two factors that could contribute to the fall in private industrial investment. First, some expenditure-switching policies that accompany the reform package could result in an increase in the relative price of imported capital goods due to the devaluation in the real exchange rate. Second, with costly resource reallocation involved, many uncertain private investors may opt to keep capital either abroad or in existing activities until the subjective probability that the reforms and adjustment programs will not be reversed is high enough for them to commit to new investments. Therefore, there is evidence to show that private investment could fall owning to the lack of credibility of overambitious reforms in an unsettled macroeconomic environment (Faini and de Melo, 1990).

3.2 Transmission Channel 2: Manufactured Exports Function

Manufactured exports can be treated as another important channel through which liberalization policy influences industrial productivity and economic growth. The learning effects of exports accumulate mostly on manufacturing industries. In Pakistan the share of primary exports in total exports and the share of manufactured exports in total exports was 16 percent and 52 percent respectively which was increased to 18 and 69 percent respectively in 2010-11. This implies that liberalization policy has increased technological capability in Pakistan's industrial sector because the share of manufactured exports has increased since 1990-91.

To specify the exports function, it can be postulated that exports are generally depends on relative competitive position of the nation as well as on conditions on the world market (Salvatore, 1983). The level of industrialization can be measured in terms of

industrial sector productivity (Y_t^{IND}) can also be expected to affect the range and quality of exports. Theoretical literature suggest that exports are expected to increase with the world income (Y_t^W), industrial productive capacity (CAP_t) and trade liberalization policy, while exports are expected to decrease with the increase in the price of exports relative to domestic price level (RPX_t). Following Goldar (1989), Paulino and Thirlwall (2004), Lopez (2004) and Khan and Din (2011) exports function can be specified as:

$$X_t = X(RPX_t, Y_t^W, CAP_t, \ LIB_t) \qquad (7)$$

For the empirical analysis we have also estimate exports function for primary goods, semi-manufactured goods and manufactured goods.

3.3 Transmission Channel 3: Imports of Capital Goods

Finally in trade and industrialization model, imports should be treated as endogenous and are generally determine by relative price of imports (RPM_t), domestic real income (Y_t), real value of worker's remittances ($REMIT$) and liberalization policy. Following Khan (1996), Paulino and Thirlwall (2004) and Khan and Din (2011) we specify import function in the following form:

$$M_t = M(RPM_t, Y_t, REMIT_t, \ LIB_t) \qquad (8)$$

Theoretical literature suggest that real imports are positively related to domestic real income, remittances and liberalization policy, whereas relative price of imports exert negative impact on imports. For the empirical analysis we have also estimate imports function of capital goods.

The trade balance is defined as:

$$TB_t = (X_t - M_t) \qquad (9)$$

4. Data and Methodology

The applicability of the estimation methodology has been often seen in the light of data availability. Due to the short time span, structural break and data with low frequency, the number of feasible estimation methods is limited. Therefore, we have employed a single-equation based cointegration method advanced by Engle and Granger (1987) to determine the long-run relationship between the variables entered in equations (3-8). It is well documented in recent literature that most of the macroeconomic time series

displays a non-stationary behavior. If two or more series are non-stationary at their levels then ordinary least squares (OLS) method gives spurious results even though the estimated coefficient is highly significant (Khan and Din, 2011). Engle and Granger (1987) suggest the estimation of cointegration relationship in the first stage with static OLS method. The resulted residuals are then tested for stationarity. Although multivariate cointegration method due to Johansen (1991) is superior to that of Engle and Granger method, however, multivariate cointegration method requires high frequency data, but we are dealing with limited number of observations (32 observations), which makes possible to apply Engle-Granger cointegration method to investigate long-run relationship.

4.1 Data Issues

The present study utilizes annual data for the period 1972-2012 for Pakistan. Data on GDP at constant prices, industrial value added at constant prices, agriculture value added at constant prices, industrial sector labour force, private investment in industrial sector proxied by gross fixed capital formation in private sector at constant prices, government investment in industrial sector proxied by gross fixed capital formation in government sector at constant prices, natural gas consumption, primary exports, manufactured exports, semi-manufactured exports, capital goods imports, nominal exchange rate, worker's remittances are taken from Pakistan Economic Survey (Various issues) and undated from State bank of Pakistan's database. Data on merchandised exports, merchandised imports, exports price proxied by the unit value of exports (2000=100), imports price proxied unit value of imports (2000=100), whole sale price index (2000=100), consumer price index (2000=100), foreign output proxied by United States GDP, United States consumer price index (2000=100) and taken from International Monetary Fund's International Financial Statistics (IFS)-CD-ROM and updated from various monthly IFS bulletins. Data on capacity utilization variable is calculated as industrial value added minus industrial value added obtained after the use of HP-filter. Data on financial liberalization policy is constructed using following strategy. Data on liberalization policy index is constructed using principal component method. All variables are expressed in logarithmic form except for inflation rate.

4.2 Trade Liberalization Index

Wacziarg and Welch (2008) claimed that tariff and non-tariff barriers directly restrict trade. Import liberalization depends mostly on the extent of restriction caused by the tariffs and non-tariff barriers (Yen, 2009). Similarly black market premium on exchange

rate could be considered as trade restriction.[6] Lowering of tariffs and non-tariff barriers produces a significant impact on imports. In order to conduct quantitive analysis of the impact of liberalization it is necessary to construct liberalization policy index and its weights for tariff and non-tariff barriers. As pointed by Wacziarg (2001), Pakistan was signatory of World Trade Organization (WTO) in 1995 but enforced liberalization measures in 2001. Therefore a time dummy (DUMWTO) for non-tariff barriers removal was assigned value 1 for 2001 to 2012 and zero for the previous period (1972-2000). The tariff rate is another measure of trade liberalization. However, changes in tariff rate and incomparable across time as the tariff base changed, widening the total tariff lines (Yen, 2009). Therefore, we have used average tariff rate (ATR) proxied by import tax revenue over total imports. The third indicator is the existence of black market. Pakistan opted free floating exchange rate regime in July 2000 and with the establishment of interbank foreign exchange market eliminated black market. We have constructed a dummy variable (DUMBM) that takes value 1 for 1972-2000-2012 and zero for 2001-2012. The liberalization policy index (LIB) can be expressed in equation (10):

$$LIB = \omega_1 ATR_t + \omega_2 DUMBM + \omega_3 DUMWTO \qquad (10)$$

Where ω_i is the weight of the component constructed using principal component method. The results are reported in Table 1.

Table 1: Eigenvectors of the Policy Variables

	Eigenvectors		
Variable	PC1	PC2	PC3
ATR	0.564991	0.812806	0.141883
DUMBM	0.579945	-0.513522	0.632423
DUMWTO	-0.586898	0.275028	0.761519
Eigenvalues	**2.771218**	**0.172953**	**0.055828**

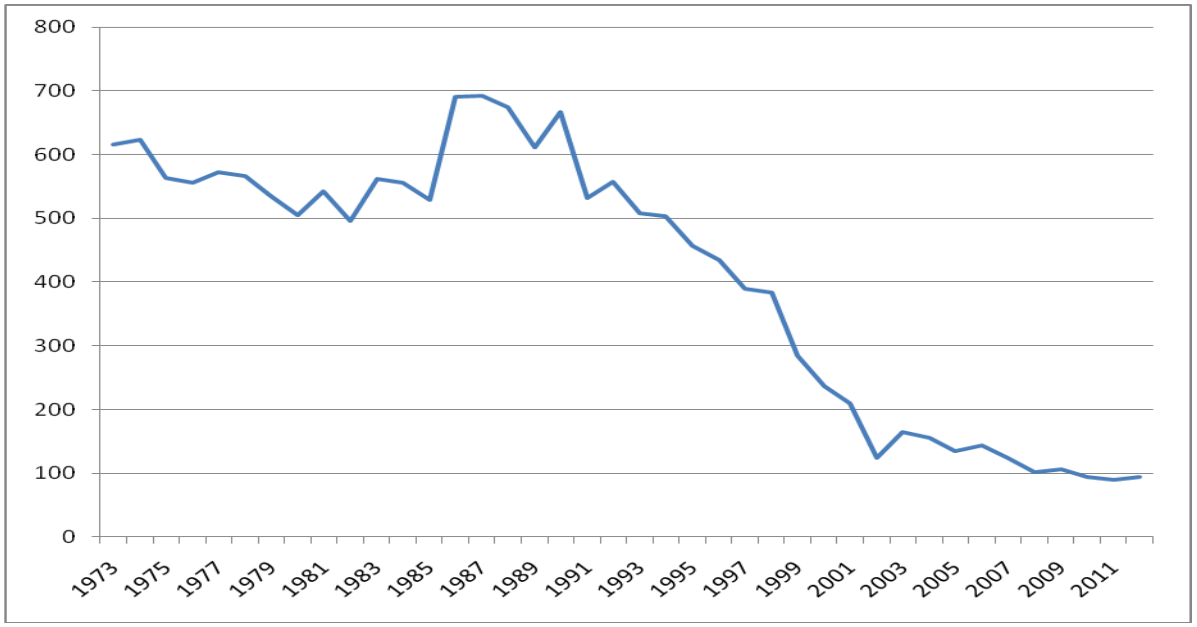
We select the first principal component because it covers 92 percent of the total variations and has a fixed value of ω_i with the weight based on the eigenvalue value to arrive at equation (11).

[6] For example, exports have purchase to foreign inputs using foreign currency obtained on the black market but remit their foreign exchange receipts from exports to the government at the official exchange rate, the black market exchange rate acts as trade restrictions (Wacziarg and Welch, 2008).

$$LIB = 0.2039ATR_t + 0.2093DUMBM - 0.2118DUMWTO \qquad (11)$$

Using the weights of variables ω_i from equation (11) and multiplying the corresponding variables, the index for trade liberalization policy is calculated. Figure 1 presents trade liberalization policy index from 1973.

Figure 1: Trade Liberalization Index



It is evident from Figure 1 that Pakistan has experienced continuous liberalization measures throughout 1990s and the process of reforms is still going on which can be easily observable from the negative trend of liberalization policy index. Downward trend of liberalization policy index indicates the relaxing of tariffs and non-tariff barriers since 1990.

5 Empirical Estimates of Structural Equations

The behavioural equations in the model have been estimated using OLS method. We have undertaken general-to-specific procedure to obtain more parsimonious results because we have a small sample at hand with annual frequency data of 32 years. This constraints us to report only parsimonious equations.[7] Before estimation of specific equations of the model, we have started with Augmented Dickey Filler (ADF) unit root

[7] We have used PcGets approach to select an appropriate model. For details of PcGets modeling approach, see Hendry and Krolzig (2004).

test to examine the time series properties of the data and the results are reported in Table 3 (Appendix 1). The results shows that all the series under consideration following I (1) processes. For each equation t-values of the estimated coefficients are given in parentheses. Residual sum of squares (RSS), standard deviation of dependent variables (σ) and the adjusted coefficient of multiple determination ($\overline{R}^2$) are listed below each equation. The *ADF* cointegration test performed on the residuals obtained from the estimated equations is reported below each equation.[8]

In addition, to access the appropriateness of the estimated equations, we have employ a battery of diagnostic tests such as, Jarque-Bera (JB) for normality, Langrange Multiplier (LM) for serial correlation, autoregressive conditional heteroscedasticity ($ARCH$) for heteroscedasticity, Remsay's *RESET* test for functional specification and *CUSUM* and *CUMSUMSQ* for structural stability of each equation. The more parsimonious results of each structural equation is reported in below:

1- Industrial Sector Productivity

The value added in the industrial sector is positively and significantly explained by the labour force engaged in industrial sector, real industrial investment, real import of capital goods, real manufacturing exports, agriculture sector value added and liberalization policy. Only the macroeconomic policy variable proxied by inflation rate and energy shortages proxied by real natural gas consumption produces a negatively and effects on industrial sector productivity.

$$\begin{aligned} Y_t^{IND} &= 0.14 I_t^{IND} + 0.41 L_t^{IND} + 0.18 CM_{t-2} + 0.17 MX_t + 0.60 Y_t^{Agr} - 0.01 GAS_{t-1}^{IND} - 0.003 INF_t \\ &\quad (3.34)* \quad (3.45)* \quad (5.13)* \quad (2.38)* \quad (15.00)* \quad (-0.26) \quad (-1.90)** \\ &\quad + 0.05 LIB \\ &\quad (2.08)** \end{aligned} \tag{12}$$

$$RSS = 0.04 \qquad \sigma = 0.50 \qquad \overline{R}^2 = 0.99 \qquad ADF = -5.27*$$

$$Normality\ Test = 2.06[0.257] \qquad LM\,(F) - Test = 0.07[0.790]$$

$$ARCH\,(F)\,Test = 2.16[0.153] \qquad Hetero\,(F)\,Test = 0.48[0.855]$$

$$TESET\,(F) - Test = 0.68[0.418]$$

[8] *, ** and *** indicate significant at 1%, 5% and 10% level.

As evident from the results reported by equation (12) suggest that besides labour and real investment proxied by gross fixed capital formation in industrial sector, trade related variables such as capital goods imports (CM) and manufactured goods exports (MX) carries positive signs. This reveals that capital goods imports and manufactured goods exports contributes 0.18 percent and 0.17 percent to industrial productivity as the capital goods imports and manufactured goods exports increases by 1 percent. This result is consistent with the views of Golder and Kumari (2003) that both exports and imports would make industrial sector more competitive, vibrant and efficient, and would enable industrial sector to achieve rapid growth. It is worth mentioning that import liberalization contributed to the better productivity performance of Indian industry in the post-reform period (Golder and Kumari, 2003). Furthermore, the positive association between real manufactured exports and real industrial productivity and between real value of capital goods imports and real industrial productivity verifies the Ricardo's comparative advantage theory and Heckscher-Ohlin's factor abundance theory. Herzer et al. (2006) also finds evidence of productivity enhancing effects of manufactured exports and productivity limiting effects of primary exports in the case of Chile.

Agriculture sector value added is positively associated to industrial productivity with almost 0.60 percent contribution. This result is not surprising in the case of Pakistan because Pakistan has been still agrarian economy and demands for industrial products depend on the performance of the agriculture sector (Mazumdar, 2005). Rashid (1995) and Sastry et al. (2003) also find similar results for the case of India. This suggests that agriculture productivity is an important determinant of industrial productivity. In case of Pakistan Khan and Din (2011) also find that there is positive correlation between agro-based raw materials and industrial productivity.

Industrial natural gas consumption lagged by one year also exerts negative effects on domestic industrial productivity with the estimated coefficient is -0.01, which implies that a 1 percent increases in natural gas demand by industrial sector reduces industrial productivity by 0.01 percent. However, the pass-through effect of natural gas demand is completed after one year. Although the coefficient of natural gas consumption is insignificant, but it provides very important information that shortage of energy particularly electricity and natural gas deteriorates industrial sector performance in recent years. Similarly, macroeconomic uncertainty proxied by inflation rate produces negative influence on industrial sector productivity. This implies that increases in inflation rate influences industrial productivity through cost-push channels.

Finally, the liberalization variable (LIB) is found to be positive and statistically significant, showing that liberalization measures and increased flexibility of firms through reduction of domestic constraints exerts positive and significant impact on productivity and growth. This result implies that domestic liberalization could lead positive growth of industrial sector.

2- Domestic Private Sector Industrial Investment

The empirical literature on trade and investment suggests that the effects of liberalization on economic growth are mediated by the rate of physical capital investment (Wacziarg and Welch, 2003). Trade liberalization shifts relative prices in the favour of exports sector, which increases the profits in the exports sector and hence induces domestic investment. Levine and Renelt (1992), Baldwin and Seghezza (1996) and Wacziarg (2001) have argued that investment rates are the main channels linking trade and growth. To investigate the effect of liberalization on investment we have estimated the following regression:

$$
\begin{aligned}
I_t^{IND} &= 0.41 Y_t^{IND} + 0.34 CM_t - 0.27 PX_t + 0.39 MX_t - 0.051 GI_t^{IND} - 0.01 INF_t + 0.37 LIB_t \\
&\quad (1.80)^{**} \quad (2.16)^{**} \quad (-2.45)^{*} \quad (1.48)^{***} \quad (-1.57)^{***} \quad (-1.18) \quad (3.99)^{*} \\
&RSS = 0.15 \qquad \sigma = 0.36 \qquad \overline{R}^2 = 0.84 \qquad ADF = -4.15^{*} \\
&Normality\,Test = 1.09[0.851] \qquad LM(F) - Test = 5.89[0.023] \\
&ARCH(F)Test = 0.03[0.865] \qquad Hetero(F)Test = 0.68[0.855] \\
&TESET(F) - Test = 3.64[0.069]
\end{aligned}
\tag{13}
$$

The results reported in equation (13) suggest that investment in industrial sector is positively related to industrial sector productivity. Industrial sector productivity can be often treated as size of industrial sector. Our results suggest that a 1 percent expansion of the size of industrial sector increases industrial sector investment by 0.41 percent. Furthermore, the positive association of industrial real income and industrial investment verifies the famous accelerated principle.

Import of capital goods and other equipment exerts positive impact on industrial sector investment, whereas exports of primary goods and manufactured goods produce negative and positive influence on industrial sector investment. The positive association between imports of capital goods and exports of manufactured goods suggest that trade play a significant role in determination of industrial investment. The negative

coefficient of exports of primary goods and raw materials suggest that exports of primary goods and raw materials create shortage of raw material for domestic industries which constraints industrial investment. Similarly positive coefficient of manufactured exports implies that a 1 percent increase in manufactured exports induces manufacturing investment by 0.39 percent. Inflation rate and government investment in industrial sector exerts negative influence in industrial investment. This result implies that macroeconomic uncertainty deteriorates industrial performance, while government investment in manufacturing sector crowds out industrial investment. The most striking result that we have obtained is the positive association between liberalization policy and industrialization. The coefficient of liberalization policy variable is 0.37 which implies that liberalization causes industrial physical investment by 0.37 percent. Since trade liberalization is considered to by the important channel of economic growth. To determine the effect of trade liberalization on industrial productivity, we multiply coefficient on industrial investment in equation (12) with coefficient of liberalization in equation (13). The effect of liberalization on industrial productivity via industrial investment is estimated to by 0.055. This compares to the total effect of liberalization on industrial productivity of 0.05 percent (equation 12). Hence by this calculation the investment channel accounts about 17 percent of the effect of liberalization on industrial productivity. These results reveal that investment constitutes an important channel through which trade liberalization influences industrial growth and hence economic growth. Our results are consistent with earlier findings of Wacziarg and Welch (2008).

3- Merchandized Exports

Theoretically exports are determined by world income, relative price of exports, exports potential, remittances and liberalization policy. Equation(s) (14a, 14b, 14c, 14d) reports the estimated results of merchandized export, primary goods exports, semi-manufactured exports and manufactured exports functions.

(i) Merchandized Exports Function

$$X_t = 0.76Y_t^W + 1.59CAP_t - 0.85RPX_t + 0.10REM_t + 0.21LIB_t$$
$$(26.30)^* \quad (2.40)^* \quad (-3.80)^* \quad (2.59)^* \quad (7.39)^*$$
$$RSS = 0.13 \quad \sigma = 0.80 \quad \bar{R}^2 = 0.97 \quad ADF = -3.99^{**} \qquad (14a)$$
$$Normality\ Test = 0.84[0.656] \quad LM\,(F) - Test = 11.56[0.002]$$
$$ARCH\,(F)Test = 1.21[0.279] \quad Hetero\,(F)Test = 0.81[0.655]$$
$$TESET\,(F) - Test = 0.10[0.753]$$

(ii) Primary Exports Function

$$PX_t = 0.30Y_t^W + 1.19CAP_t - 1.96RPX_t + 0.22REM_t + 0.35LIB_t$$
$$(5.98)^* \quad (1.09) \quad (-4.66)^* \quad (2.95)^* \quad (8.81)^*$$
$$RSS = 0.26 \quad \sigma = 0.45 \quad \bar{R}^2 = 0.66 \quad ADF = -3.26^{***} \qquad (14b)$$
$$Normality\ Test = 1.72[0.419] \quad LM\,(F) - Test = 15.69[0.004]$$
$$ARCH\,(F)Test = 2.72[0.107] \quad Hetero\,(F)Test = 0.99[0.494]$$
$$TESET\,(F) - Test = 5.55[0.024]$$

(iii) Semi-Manufactured Exports Function

$$SX_t = 0.73Y_t^W + 1.19CAP_t - 1.96RPX_t + 0.22REM_t + 0.35LIB_t$$
$$(5.98)^* \quad (1.09) \quad (-4.66)^* \quad (2.95)^* \quad (8.81)^*$$
$$RSS = 0.26 \quad \sigma = 0.45 \quad \bar{R}^2 = 0.66 \quad ADF = -3.81^{**} \qquad (14c)$$
$$Normality\ Test = 1.72[0.419] \quad LM\,(F) - Test = 15.69[0.004]$$
$$ARCH\,(F)Test = 2.72[0.107] \quad Hetero\,(F)Test = 0.99[0.494]$$
$$TESET\,(F) - Test = 5.55[0.024]$$

(iv) Manufactured Exports Function

$$MX_t = 0.74Y_t^W + 1.97CAP_t - 65RPX_t + 0.14REM_t + 0.18LIB_t$$
$$(26.58)^* \quad (2.89)^* \quad (-3.76)^* \quad (3.52)^* \quad (8.32)^*$$
$$RSS = 0.13 \quad \sigma = 0.80 \quad \bar{R}^2 = 0.97 \quad ADF = -3.81^{**} \qquad (14d)$$
$$Normality\ Test = 1.27[0.531] \quad LM\,(F) - Test = 6.50[0.016]$$
$$ARCH\,(F)Test = 1.53[0.024] \quad Hetero\,(F)Test = 0.88[0.588]$$
$$TESET\,(F) - Test = 0.39[0.535]$$

It is evident from equation(s) 14a-14d that a positive relationship between variants of exports and world income suggest that an expansion in the world markets for Pakistani exports enables Pakistani firms to export more. The estimates of export demand elasticity varies from 0.30 to 0.76 which implies that Pakistani exports are sensitive to external demand.

Industrial productivity capacity (export potential) (CAP_t) which is proxied by industrial productivity gap exerts positive and significant effects on all variants of exports except for primary exports. This implies that an increase in productivity capacity of manufacturing industries stimulates semi-manufactured exports and manufactured exports, which eventually increases merchandized exports. Furthermore, this result suggests that domestic market condition strongly influence exports. Relative price of exports proxied by price of exports divided by whole sale price index produces negative effects on all types of exports with price elasticity ranges from 0.65 to 1.96. This result implies that an increase in price of exports relative to domestic price level discourages exports. The reason could be as exports price increases Pakistani exports becomes expansive in the world market. As results, foreign consumers reduce the demand for Pakistani products. Real value of remittances which is used as proxy for out-migration is another important determinant of exports. This result could be justified on the grounds that high percentage of remittances in Pakistan is spent on the purchasing land, construction and durable goods. This means that any increase in remittances is consider as an important source in building infrastructure for the export sector and provides the necessary cash reserves, allowing for continued growth and to achieve economies of scale in production (Kader et al., 1987).

Finally, liberalization policy exerts positive impact on exports in all cases. This result implies the lowering of trade barriers may have contributed positively to exports growth.

4- Merchandized Import Function

The merchandized import function is estimated as function of domestic income, ratio of imports price relative to domestic price foreign capital inflows proxied by real value of worker's remittances and liberalization policy. Equation (15a-15b) reports the estimates of merchandized imports and capital goods and equipments imports respectively.

(i) Merchandised Import Function

$$M_t = 0.40Y_t - 0.21RPX_t + 0.14REM_t + 0.27LIB_t$$
$$(17.82)^* \quad (-0.73) \quad (2.84)^* \quad (4.91)^*$$
$$RSS = 0.12 \quad \sigma = 0.48 \quad \overline{R}^2 = 0.92 \quad ADF = -3.17***$$
$$Normality\,Test = 1.77[0.413] \quad LM(F) - Test = 20.23[0.001]$$
$$ARCH(F)Test = 1.06[0.309] \quad Hetero(F)Test = 0.44[0.916]$$
$$TESET(F) - Test = 22.65[0.000]$$

(15a)

(ii) Capital Goods and Equipments Import Function

$$CM_t = 0.35Y_t - 0.39RPX_t + 0.17REM_t + 0.17LIB_t$$
$$(10.68)^* \quad (-1.54) \quad (3.33)^* \quad (3.40)^*$$
$$RSS = 0.19 \quad \sigma = 0.50 \quad \overline{R}^2 = 0.86 \quad ADF = -3.83** \qquad (15b)$$
$$Normality\,Test = 2.16[0.413] \quad LM(F) - Test = 25.97[0.001]$$
$$ARCH(F)Test = 9.75[0.004] \quad Hetero(F)Test = 1.36[0.245]$$
$$TESET(F) - Test = 22.17[0.145]$$

It can be seen from the resulted in equation(s) 15a-15b that domestic income, real value of remittances and liberalization policy exerts positive impact on real merchandized imports and capital goods imports, whereas relative price of imports produces negative but insignificant effect on both variants of imports. All variables enter in import function with expected signs and statistically significant, only the relative price of imports relative price of imports shows a statistically insignificant coefficient. Between the positive impact variables, domestic output (GDP) indicates highest and inelastic (0.40 for merchandised imports and 0.35 for capital imports), implying that a 1 percent increase in the GDP could lead to an increase in the merchandized imports and capital imports by 0.40 percent and 0.35 percent respectively. Foreign capital which is proxied by worker's remittances produces positive and significant effects on merchandized and capital goods imports. This result suggests that an increase in foreign capital could increase import demand by 0.14 percent (merchandized imports) and 0.176 percent (capital goods imports). The liberalization (LIB_t) produces positive and significant impact on both types of imports with reasonable coefficient. This implies that lowering

tariffs and other trade related impediments could lead to an increase in the imports and the contribution of liberalization with respect to capital goods imports is 0.17 out of 0.27 which is the elasticity of merchandized imports. The indirect effect of imports channel via capital goods imports on industrial productivity is equal to 0.031 percent, while the direct effect of capital goods imports on industrial productivity is equal to 0.18 percent (see equation 10). This suggest the besides exports imports also play very important role in enhancing industrial productivity.

The relative price variable enters in import function with expected negative sign, but statistically insignificant in both cases. This result suggests that Pakistan's imports are insensitive with respect to imports price. This finding could be justified on the grounds that our imports are price inelastic which implies that an increase in imports produces on significant negative impacts on imports because of inelastic import demand. This result could be possible in the case of Pakistan because Pakistan imported machinery and other industrial equipments from the rest of the world which accounts for 93 percent of the total imports in 2011. The value of price elasticity of imports is consistent with the earlier findings of Khan (1996). The sum of the price elasticities of merchandized exports and imports is -1.06, which implies that Marshal-Lerner conditions for a successful devaluation are satisfied.

5.1 Direct and indirect Effects of Liberalization of Industrial Productivity

The direct contribution of trade liberalization and indirect contributions of trade liberalization through channel equations can be reported in below Table 2.

Table 2: Direct and Indirect Contributions of Liberalization Policy

Channels	Impact	Contribution (in %)
Direct channel	0.05	30.49
Industrial Sector Investment (I_t^{IND}) channel	0.052	31.71
Exports ((MX_t) manufactured exports) channel	0.031	18.9
Imports ((CM_t) Capital goods and equipments) Channel	0.031	18.9
Total effect of liberalization on industrial	0.164	100

productivity.		

It is evident from Table 2 that there is significant effect of liberalization on industrial productivity through channels. The overall impact is 0.146 percent to enhance industrial productivity in Pakistan. The impact of liberalization on industrial productivity proves that investment in manufacturing sector (I_t^{IND}), manufactured exports (MX_t) and capital goods imports (CM_t) are the major factors for liberalization process to boost industrial productivity and hence economic growth. It is worth mentioning here that technical capability accelerated through exports as results of diversifying trade partners after import liberalization (Yen, 2009). Import liberalization enhances manufacturing investment by providing cheaper capital goods and raw material to domestic market and enables domestic traders to compete foreign products at international market. The indirect contribution of liberalization in industrial productivity through physical investment in industrial sector is nearly 72 percent, followed by 20 percent contribution of manufactured exports and import of capital goods and equipments in industrial productivity respectively.

The results provide a clear indication that for effectiveness of development policy in Pakistan and to reap the benefits of open door policy, there is a need to encourage industrial sector investment and to manage external sector.

6 Conclusions and Implications

The main purpose of this study is to examine the impact of liberalization on industrial productivity, industrial sector investment, exports and imports in Pakistan over the period 1972-2012. The hypothesis that lowering tariffs and non-tariff barriers and adopting more outward orientation policies leads to a more efficient utilization of domestic resources which ultimately accelerates the pace of industrial productivity and hence economic growth is supported by the industrial sector's value added equation, where the liberalization policy index appeared in the equation positively and significantly.

The relationship between industrial productivity, capital goods imports and manufactured goods exports are highly significant in industrial productivity equation, which supports the hypothesis that trade is engine of economic growth. Besides exports and imports, domestic factors such as industrial sector investment, industrial labour and agriculture have a highly significant impact on industrial productivity. Import of

capital goods, exports of semi-manufactured, manufactured goods and liberalization policy influences industrialization positively and significantly. Only export of primary goods influences industrialization negatively.

Liberalization policy contributes positively in enhancing exports and imports. Other factor such as, capacity utilization, relative price of exports and imports, world out and domestic output and home remittances play an important role in enhancing exports and imports.

As far as the effect of investment, exports and imports channels on industrial productivity is concerned, the indirect contribution of liberalization to industrial output via industrial investment, merchandised exports and capital goods import is 32 percent and 20 percent respectively. Alternatively, industrial investment contributes 32 percent while technology transmission group (I.e. exports and imports) contributes 40 percent to industrial productivity. The overall liberalization contribution accounts for 0.164 which implies that a 1 percent increase in liberalization instigates industrial productivity by 0.164 percent.

This conclusion is a bit realistic for industrial success in Pakistan since the economic reform policy aims at opening up international trade to facilitate domestic private sector. When imports were liberalized, the productivity of the economy, particularly industrial productivity has been upgraded. If the country promotes manufactured exports and elevates technology transfer through imports, the impact of import liberalization to economic growth will be enlarged (Yen, 1999). The results of this study confirm the role of channels through which trade liberalization influences industrial productivity and hence economic growth. Pakistan needs imports to make industries more efficient and competitive and exports to earn foreign exchange. To increase the supply of exports there is need to expand export potential and reduce profit differential between producing for the home market and producing for the global market. Furthermore, there is need to use remittances for the development of infrastructure for exportable industries.

Although this study provides important information regarding the channels through which trade liberalization affects industrial productivity and concentrates only on the (i) role of domestic factors, (b) role of external factors, and (c) impact of liberalization on industrial output. In future, the study could be extended by taking in to account the disaggregate component of exports and imports

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APPENDIX 1

Table 3: Unit Root Test

Series	Specification	Lags	ADF-Levels	ADF-First Difference	Decision
Y_t^{IND}	C	1	-1.6903	-6.3321*	I (1)
Y_t^{AGR}	C	1	-0.9354	-5.2825*	I (1)
Y_t^{W}	C	1	-1.6059	-4.0809*	I (1)
I_t^{IND}	C	1	-2.8498	-2.9632***	I (1)
GI_t^{IND}	C	1	-1.5002	-4.3348*	I (1)
L_t^{IND}	C, T	1	-0.5304	-4.8611*	I (1)
M_t	C	1	-0.2879	-4.7767*	I (1)
CM_t	C	1	-1.8659	-4.7808*	I (1)
X_t	C	1	-0.0812	-3.8065*	I 1)
PX_t	C	1	-0.6314	-5.9756*	I (1)
MX_t	C	1	-1.0899	-4.4026*	I (1)
GAS_t^{IND}	C, T	1	-1.6861	-3.7607*	I (1)
RPX_t	C, T	1	-0.5451	-4.0284*	I (1)
RPM_t	C	1	-1.1583	-3.1412*	I (1)
$INFL_t$	C	1	-2.1159	-4.7491*	I (1)
CAP_t	C	1	-2.9243	-4.0214*	I (1)
REM_t	C	0	-1.7979	-2.9124***	I (1)
LIB_t	C, T	3	-2.4465	-7.4156*	I (1)

Note: *, **, *** indicates significant at the 1%, 5% and 10% level. C and T represents constant and trend terms.