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

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1. 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 supports the success of import liberalisation policy in the United States of America (USA) in the 1940s, Japan in 1960s and the exports promotion achievements of Asian Tigers in the 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 a key ingredient in facilitating transfer of technology from developed to developing countries [Heokman and Javorcik (2006) and Harding and Javorcik (2012)].

Theoretical literature suggest that trade liberalisation enhances economic growth and development through the specialisation 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 hypothesised that nations gain from trade, and World production would grow when trading nations specialise according to the principles of comparative advantage. On the other hand, the Neo-classical Economists argued that countries will tend to specialise in those products that use abundant resources intensively in the production process. As a consequence, factors prices will tend to equalise 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 liberalisation would improve exports and economic growth [Sachs and

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[1]Trade liberalisation 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 liberalisation lead to increase specialisation, promote industrialisation and technological progress, increasing competition and improvement in the living standards of the population [Cruz (2008)].

Warner (1995); Khan, *et al*. (1995); Iqbal and Zahid (1998); Edwards (1993; 1998), Frankel and Romer (1999); Ravallion (2001); Qadir, *et al*. (2000); 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), among others].[2]

The standard partial equilibrium trade theory emphasises that trade liberalisation 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 emphasise 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 fosters 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 elimination of trade barriers and increase in the volume of trade leads to a reduction in the income gaps between trading nations.

Free trade is critical ingredient for sustainable growth and productivity, jobs creation and higher wage rate is 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, industrialisation 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 industrialisation [Pakistan (2011)].[3]

Pakistan has experienced a continuous trade and investment liberalisation 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, rationalisation of tariffs structure, elimination of the SROs, improving export promotion and market information programmes, establishment of exports promotion zones (EPZs), liberalisation 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 [Pakistan (2011)].

Although researchers gradually agreed that trade is good for economic growth, but quantitive analysis have shown different picture with respect to the trade-growth relationship. There are three big reasons of mixed empirical results [Yen (2009)]. First, disagreement over the choice of trade liberalisation indicators, whether it is actual trade [Leamer (1980)] or tariffs and non-tariff berries [Sachs and Warner (1995)]. Second,

[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.

choices of explanatory variables for economic growth are different in countries carry out trade liberalisation measures. Third, more sophisticated methodology is needed to investigate the linkages between trade and growth, rather than single-equation methodology. Salvator (1983), Rashid (1995) and Wacziarg (2001) identified various channels through which trade liberalisation affects economic growth.

Given the paramount importance of trade liberalisation in economic growth process, it is necessary to understand the transmission channels through which liberalisation affects industrial productivity, private industrial investment, exports, imports and hence economic growth in Pakistan. Previous studies in Pakistan *inter alia* 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 as explanatory variable along with exports in the production function. Omission of import variable from the production function would result in spurious conclusions regarding the export-led growth hypothesis because imports of capital goods are used as inputs for exports and domestic productivity [Riezman, *et al*. (1996)]. Furthermore, liberalisation of trade also affects industrial productivity through investment, exports and imports channels. To the best of our knowledge no study is available that focused on the transmission channels through which trade liberalisation affects economic growth, industrial productivity, private industrial investment, exports and imports in Pakistan.

The present study tries to fill up this gap by developing a simultaneous equations model to determine how trade liberalisation affect industrial productivity, domestic investment, exports and hence economic growth in Pakistan over the period 1972–2011. Besides, the present study develops a composite trade liberalisation index following Wacziarg (2001) and then estimates 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 liberalisation 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 liberalisation policy into industrial productivity into its different components.

The rest of the paper is organised as follows: Section 2 briefly overviews the trade liberalisation 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 liberalisation 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 mixture of inward-and-outward-looking trade policy for nearly four decades. High tariff rates, non-tariff barriers, exchange controls and other administrative controls are the main features of Pakistan's policy. The objective of this policy regime was to promote import-substitution industrialisation 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, learning lessons from successful trade strategies by developed countries inspired many developing countries including Pakistan to adopt outward-oriented trade policies [Balassa (1989) and 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. Globalisation and World Trade Organisation (WTO) regime has enabled developing countries to reap benefits of specialisation, 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 of Pakistan has improved steadily (Table 1).

Pakistan has introduced a series of measures including rationalisation of tariff structure and removal of quantitive restrictions to liberalise trade and investment regime. To this end, 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 reduced 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.

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[4]
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	13.9	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.

[4]We would like to thank Ms Naila Jabeen PhD Scholar, Pakistan Institute of Development Economics, Islamabad for providing data on tariff revenues.

These measures have brought down effective rate of protection, eliminate the anti-export bias and promote competitive and efficient industry environment [Khan and Qayyum (2006)]. A number of laws were promulgated to bring the trade regime in line with WTO regulations.[5] However, 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. Table 1 depicts the outcomes of the liberalisation policy.

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 prices, adverse effects of unprecedented floods of 2010 and low productivity of manufacturing sector [Amjad, *et al*. (2011)]. Despite the liberalisation measures, trade to GDP ratio in 2010 was approximately the same as a decade earlier. Quality of poor governance and poor 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 ineffectiveness [Pakistan (2011)]. Import dependence ratio which was 15.71 percent in 2001 increased to 23.28 percent in 2008, and then followed declining trends and 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 sad picture of external sector performance calls to revisit the trade liberalisation programme, further rationalise tariff structures and eliminate regulatory duties.

3. TRANSMISSION CHANNEL MODEL OF TRADE AND DEVELOPMENT

Taking lead from Wacziarg (2001) we formulate macroeconometric model of trade and development and identify various potential channels such as, industrial sector private investment, exports and imports that could affect industrial productivity in Pakistan. These channels can be grouped into three broad categories viz. private industrial 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 specialisation). 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 economic growth rate is entered as dependent variable. Technology transmission channels that includes export of manufacturing goods and import capital goods and trade liberalisation 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 start with the assumption that Pakistan's 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}):

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

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

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:

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

The model expressed in Equation (2) is incapable to explain the effects of structural changes on industrialisation and development (Salvatore, 1983). Lewis (1954) argued that in the process of industrialisation, labour (L_t) and capital (K_t) migrated from low productivity sector (agriculture sector) to high productivity sector (modern industrial sector). This mobility of factors depends on the pace of industrialisation which can be taken as proxy for the rate of past investment. Assume that 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 liberalisation. Theoretical literature also recognised that exports contribute to greater economic growth through generating favourable externalities, allowing economies of scale to accrue, alleviating foreign exchange constraints and fostering competitive pressures [Sprout and Weaver (1993)]. Production of manufactured exports (MX_t) and primary exports (PX_t) introduces greater competition; equipped the economy with latest technological advances and leads to higher rate of savings and investments. Capital goods imports (CM_t) and agriculture productivity (Y_t^{Agr}) are another important determinants of industrial growth. Capital goods imports are an important source of technology transfer; enhance competition and reduce constraints in terms of intermediate inputs. Agriculture value added is also included in the specification because agriculture sector is backbone of developing economies. Rapid agriculture growth has been associated with industrialisation and leads to industrial productivity and economic growth. Besides, shortages of energy, particularly natural gas shortages to manufacturing sector ($INDGAS_t$) and inflation rate ($INFL_t$) are likely to influence manufacturing productivity [Zerfu (2002) and Khan and Din (2011)].

It is assumed that technical efficiency of production depends largely on the trade reforms and can have significant impact on production function. To capture the effects of trade liberalisation we have included trade liberalisation index (LIB_t) in the specification. Now the industrial production function takes the following form:

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

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

3.1. Transmission Channel 1: Private Industrial Investment

The private industrial investment is one of the important channels through which liberalisation 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 saving and foreign exchange is 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 addition to the rate of capital formation because technological progress is embodied into new capital. Following Chenery and Eckstein (1970) and Salvatore (1983) domestic savings can be specified as a function of real income (Y_t) and real exports (X_t):

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

In Equation (4) real income reflects a country's state of development and expected to have a favourable impact on the saving rate [Rashid (1995)]. Export performance is expected to affect the saving rate positively. A higher ratio of exports relative to GDP can be expected to lead to a higher level of private (public) savings because trade taxes are the major sources of government revenue. Since imports are generally restricted by government restrictive policies and act as constraint on the domestic investment. Thus, import of investment goods has been included in the private industrial investment function as proxy for foreign capital. Based on the above arguments, private industrial investment can be specified as:

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

It can be argued that primary exports and manufactured exports also play an important role in determining the private 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 private industrial investment. Increases in inflation rate generate macroeconomic uncertainty which eventually produces adverse impact on private industrial investment. Further, public investment in industrial sector (GI_t^{IND}) which concentrates mostly on infrastructure development exerts significant influence on the 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) now can be rewritten as:

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

The impact of liberalisation policy (LIB_t) on private industrial investment is ambiguous. However, literature has identified two factors that could contribute to the fall in private industrial investment. First, some expenditure-switching policies 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, costly resource reallocation involved uncertainty. As a result, private investors may keep capital either abroad or in existing activities until the policy uncertainty will not be reversed. Evidence suggests that private investment could fall due 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 trade liberalisation influences industrial productivity. The learning effects of exports accumulate mostly in the manufacturing sector. 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 in 1990-91, which was increased to 18 and 69 percent respectively in 2010-11. This implies that trade liberalisation 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 and the world market conditions [Salvatore (1983)]. The level of industrialisation can be measured in terms of industrial productivity (Y_t^{IND}) which can 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 liberalisation policies. On the other hand, exports are expected to decrease with the increase in 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:

$$X_t^J = X(RPX_t, Y_t^W, CAP_t, LIB_t) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Where X_t^J represent exports of primary goods, semi-manufactured goods and manufactured goods.

3.3. Transmission Channel 3: Imports of Capital Goods

Finally in trade and industrialisation 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 trade liberalisation policy. Following Khan (1996), Paulino and Thirlwall (2004) and Khan and Din (2011) we specify import function in the following form:

$$M_t^Z = M(RPM_t, Y_t, REMIT_t, LIB_t) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Where M_t^Z represent merchandised and capital goods imports.

Theoretical literature suggest that real imports are positively related to domestic real income, remittances and trade liberalisation policy, whereas relative price of imports exert negative impact on imports.

The trade balance (TB_t) is defined as:

$$TB_t = (X_t - M_t) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

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 are 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 the recent literature that most of the macroeconomic time series displays a non-stationary behaviour. 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. If they are found to be stationary stationary then OLS parameters of treated as asymptotically efficient and super consistent. 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 utilises annual data for the period 1972-2012 for Pakistan. Data on GDP, industrial value added, agriculture value added, industrial labour force, private industrial investment proxied by gross fixed capital formation in private, government investment in industrial sector proxied by gross fixed capital formation in government sector are collected from various issues of Pakistan Economic Survey. These data are expressed at constant prices. Data on natural gas consumption, primary exports, manufactured exports, semi-manufactured exports, capital goods imports, nominal exchange rate, worker's remittances are also 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 utilisation variable is calculated as industrial value added minus industrial value added obtained after the use of HP-filter. Data on Liberalisation Policy Index (*LIB*) is constructed using principal component method. All variables are expressed in logarithmic form except for inflation rate.

4.2. Trade Liberalisation Index

Wacziarg and Welch (2008) claimed that tariff and non-tariff barriers restrict trade directly. Import liberalisation mostly depends 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 quantify the impact of trade liberalisation, it is necessary to obtain weights for liberalisation policy index with reference to tariff and non-tariff barriers. As pointed

[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)].

by Wacziarg (2001), Pakistan was signatory of World Trade Organisation (WTO) in 1995 but enforced liberalisation 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 liberalisation. However, changes in tariff rate are not comparable across time as the tariff base changed and 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 adopted free floating exchange rate regime in July 2000 and with the establishment of interbank foreign exchange market, black market is eliminated. Based on these information we have constructed a dummy variable (DUMBM) that takes value 1 for 1972-2000 and zero for 2001-2012. The liberalisation index (*LIB*) can be expressed in Equation (10):

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

Where ω_i is the weight of the component constructed using principal component method. The results are reported in Table 2.

Table 2

Eigenvectors of the Policy Variables

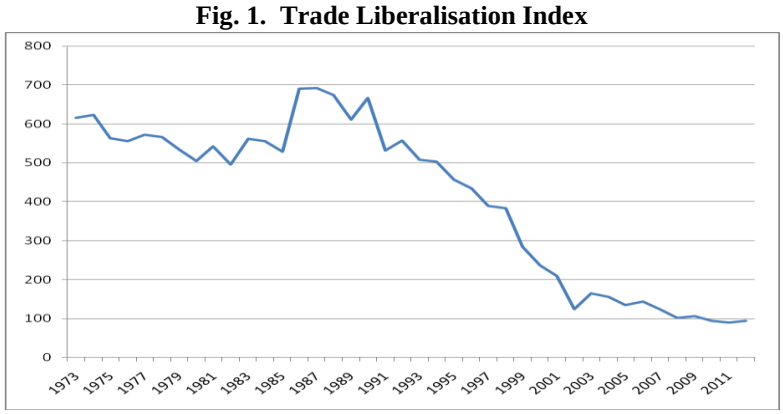
Variable	Eigenvectors PC1	PC2	PC3
ATR	0.564991	0.812806	0.141883
DUMBM	0.579945	–0.513522	0.632423
DUMWTO	–0.586898	0.275028	0.761519
Eigenvalues	**2.771218**	**0.172953**	**0.055828**

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).

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

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

Fig. 1. Trade Liberalisation Index



It is evident from Figure 1 that Pakistan has experienced continuous liberalisation measures throughout 1990s and the process of reforms is still going on, which can be easily observable from the negative trend of trade liberalisation index. Downward trend of trade liberalisation index indicates relaxing the 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. Since we have small data at hand with only 32 annual observations which constraint us to report only parsimonious equations.[7] Before estimation of individual equations of, we have started with Augmented Dickey Filler (ADF) unit root 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 diagnostics 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 are reported in below:

5.1. Industrial Productivity

The industrial value-added is positively and significantly explained by the private industrial investment, industrial labour force, capital goods imports, manufactured exports, agricultural value added and trade liberalisation. Only inflation rate and natural gas consumption exerts negative effects on industrial productivity.

$$\begin{aligned}
Y_t^{IND} &= 0.14 I_t^{IND} + 0.41 L_t^{IND} + 0.18 CM_{t-2} + 0.17 MX_t + 0.60 Y_t^{Agr} - 0.01 GAS_{t-1}^{IND} - 0.003 INF_t \\
&\quad (3.34)^* \quad (3.45)^* \quad (5.13)^* \quad (2.38)^* \quad (15.00)^* \quad (-0.26) \quad (-1.90)^{**} \\
&\quad + 0.05 LIB \\
&\quad (2.08)^{**} \\
&RSS = 0.04 \qquad \sigma = 0.50 \qquad \overline{R}^2 = 0.99 \qquad ADF = -5.27^* \\
&NormalityTest = 2.06[0.257] \qquad LM(F)-Test = 0.07[0.790] \\
&ARCH(F)Test = 2.16[0.153] \qquad Hetero(F)Test = 0.48[0.855] \qquad \ldots \qquad (12) \\
&RESET(F)-Test = 0.68[0.418]
\end{aligned}$$

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

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

As evident from the Equation (12) that besides labour and investment, trade related variables such as capital goods import (*CM*) and manufactured goods export (*MX*) carries positive signs. The result reveals that capital goods import and manufactured goods export contributes 0.18 percent and 0.17 percent to industrial productivity as the capital goods import and manufactured goods export increases by 1 percent. This result is consistent with the views of Golder and Kumari (2003) who argued that 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 liberalisation enhanced productivity of Indian industry in the post-reform period [Golder and Kumari (2003)]. Furthermore, the positive association between manufactured exports and industrial productivity and between capital goods import and industrial productivity verifies the Ricardo's comparative advantage theory and Heckscher-Ohlin's factor abundance theory. Herzer, *et al*. (2006) finds an evidence of productivity enhancing effects of manufactured exports and productivity limiting effects of primary exports in the case of Chile.

Agricultural value added is positively associated to industrial productivity with 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 agriculture sector [Mazumdar (2005)]. Rashid (1995) and Sastry, *et al.* (2003) finds similar results for India. This suggests that agriculture productivity is an important determinant of industrial productivity. Khan and Din (2011) also find an evidence of positive correlation between agro-based raw materials and industrial productivity.

One year lagged natural gas consumption of industrial sector exerts negative but insignificant effects on industrial productivity. This result could be possible because industrial sector uses only 25.3 percent natural gas and utilises 27 percent electricity and 5.9 percent petroleum in energy mix. 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 performance in recent years. Similarly, macroeconomic uncertainty produces negative influence on industrial productivity. This implies that increases in inflation rate influences industrial productivity through cost-push channels.

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

5.2. Domestic Private Industrial Investment

The empirical literature on trade and investment suggests that the effects of liberalisation on economic growth are mediated by the rate of physical capital investment [Wacziarg and Welch (2003)]. Trade liberalisation 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 liberalisation on investment we have estimated the following regression:

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

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

Import of capital goods and other equipment exerts positive impact on industrial investment, whereas exports of primary goods and manufactured goods produce negative and positive influence on industrial 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 liberalisation policy and industrialisation. The coefficient of liberalisation policy variable is 0.37 which implies that trade liberalisation causes industrial investment by 0.37 percent.

Since trade liberalisation is considered to be the important channel of economic growth. To determine the effect of trade liberalisation on industrial productivity, we multiply coefficient on industrial investment in Equation (12) with coefficient of liberalisation in Equation (13). The effect of liberalisation on industrial productivity via industrial investment is estimated to be 0.055. This compares to the total effect of liberalisation on industrial productivity of 0.05 percent (Equation 12). Hence, this calculation reveals that investment channel accounts for about 17 percent of the effect of liberalisation on industrial productivity. These results imply that investment constitutes an important channel through which trade liberalisation influences industrial growth. Our results are consistent with earlier findings of Wacziarg and Welch (2008).

5.3. Merchandised Exports

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

(i) ***Merchandised Exports Function***

$$X_t = 0.76Y_t^W + 1.59CAP_t - 0.85RPX_t + 0.10REM_t + 0.21LIB_t$$
$$(26.30)^* \quad (2.40)^* \quad (-3.80)^* \quad (2.59)^* \quad (7.39)^*$$

$$\begin{aligned} &RSS = 0.13 \quad \sigma = 0.80 \quad \bar{R}^2 = 0.97 \quad ADF = -3.99^{**} \\ &NormalityTest = 0.84[0.656] \quad LM(F)-Test = 11.56[0.002] \\ &ARCH(F)Test = 1.21[0.279] \quad Hetero(F)Test = 0.81[0.655] \\ &RESET(F)-Test = 0.10[0.753] \end{aligned} \quad \ldots (14a)$$

(ii) ***Primary Exports Function***

$$PX_t = 0.30Y_t^W + 1.19CAP_t - 1.96RPX_t + 0.22REM_t + 0.35LIB_t$$
$$(5.98)^* \quad (1.09) \quad (-4.66)^* \quad (2.95)^* \quad (8.81)^*$$

$$\begin{aligned} &RSS = 0.26 \quad \sigma = 0.45 \quad \bar{R}^2 = 0.66 \quad ADF = -3.26^{***} \\ &NormalityTest = 1.72[0.419] \quad LM(F)-Test = 15.69[0.004] \\ &ARCH(F)Test = 2.72[0.107] \quad Hetero(F)Test = 0.99[0.494] \\ &RESET(F)-Test = 5.55[0.024] \end{aligned} \quad \ldots (14b)$$

(iii) ***Semi-Manufactured Exports Function***

$$SX_t = 0.73Y_t^W + 1.19CAP_t - 1.96RPX_t + 0.22REM_t + 0.35LIB_t$$
$$(5.98)^* \quad (1.09) \quad (-4.66)^* \quad (2.95)^* \quad (8.81)^*$$

$$\begin{aligned} &RSS = 0.26 \quad \sigma = 0.45 \quad \bar{R}^2 = 0.66 \quad ADF = -3.81^{**} \\ &NormalityTest = 1.72[0.419] \quad LM(F)-Test = 15.69[0.004] \\ &ARCH(F)Test = 2.72[0.107] \quad Hetero(F)Test = 0.99[0.494] \\ &RESET(F)-Test = 5.55[0.024] \end{aligned} \quad \ldots (14c)$$

(iv) ***Manufactured Exports Function***

$$MX_t = 0.74Y_t^W + 1.97CAP_t - 65RPX_t + 0.14REM_t + 0.18LIB_t$$
$$(26.58)^* \quad (2.89)^* \quad (-3.76)^* \quad (3.52)^* \quad (8.32)^*$$

$$\begin{aligned} &RSS = 0.13 \quad \sigma = 0.80 \quad \bar{R}^2 = 0.97 \quad ADF = -3.81^{**} \\ &NormalityTest = 1.27[0.531] \quad LM(F)-Test = 6.50[0.016] \\ &ARCH(F)Test = 1.53[0.024] \quad Hetero(F)Test = 0.88[0.588] \\ &RESET(F)-Test = 0.39[0.535] \end{aligned} \quad \ldots (14d)$$

Equation(s) 14a-14d predicts positive relationship between variant of exports and world income. This suggests that expansion of world markets for Pakistani products enable Pakistani firms to export more. The estimates of export demand elasticity with respect to world income varies from 0.30 to 0.76 which implies that Pakistani exports are sensitive to external demand.

Industrial productive capacity (export potential) (CAP_t) proxied by industrial productivity gap exerts positive and significant effects on all variants of exports except

for primary exports. This implies that an expansion of productivity capacity of manufacturing industries stimulates semi-manufactured exports and manufactured exports, which eventually increases merchandised exports. This result suggests that domestic market conditions strongly influence exports. The export elasticities with respect to relative price of exports produce negative effects on all type of exports. The price elasticity of exports ranges from 0.65 to 1.96 which implies that an increase in price of exports relative to domestic price level discourages exports. The reason could be that as exports price increases Pakistani exports becomes more expansive in the world market. As results, foreign consumers reduce the demand for Pakistani products. These results are consistent with the earlier findings of Arize (1999) and Narayan (2004). Real value of remittances which is used as proxy for out-migration turns out to be 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. Any increase in remittances is consider as an important source in building infrastructure for the export sector and provides necessary cash reserves, allowing for continued growth and to achieve economies of scale in production [Kader, *et al*. (1987)].

Finally, liberalisation variable exerts positive impact on exports in all cases. This result implies the lowering of trade barriers may have positive effects on exports growth.

(v) ***Merchandised Import Function***

The merchandised import function is determined by domestic income, relative price of imports, foreign capital inflows proxied by worker's remittances and liberalisation policy. Equation (15a-15b) presents estimates of merchandised imports and capital goods and equipments imports respectively.

(vi) ***Merchandised Import Function***

$$M_t = 0.40Y_t - 0.21RPX_t + 0.14REM_t + 0.27LIB_t$$
$$(17.82)^* \quad (-0.73) \quad (2.84)^* \quad (4.91)^*$$

$$\begin{aligned} &RSS = 0.12 \quad \sigma = 0.48 \quad \bar{R}^2 = 0.92 \quad ADF = -3.17^{***} \\ &NormalityTest = 1.77[0.413] \quad LM(F)-Test = 20.23[0.001] \\ &ARCH(F)Test = 1.06[0.309] \quad Hetero(F)Test = 0.44[0.916] \\ &RESET(F)-Test = 22.65[0.000] \end{aligned} \quad \ldots \quad (15a)$$

(vii) ***Capital Goods and Equipments Import Function***

$$CM_t = 0.35Y_t - 0.39RPX_t + 0.17REM_t + 0.17LIB_t$$
$$(10.68)^* \quad (-1.54) \quad (3.33)^* \quad (3.40)^*$$

$$\begin{aligned} &RSS = 0.19 \quad \sigma = 0.50 \quad \bar{R}^2 = 0.86 \quad ADF = -3.83^{**} \\ &NormalityTest = 2.16[0.413] \quad LM(F)-Test = 25.97[0.001] \\ &ARCH(F)Test = 9.75[0.004] \quad Hetero(F)Test = 1.36[0.245] \\ &RESET(F)-Test = 22.17[0.145] \end{aligned} \quad \ldots \quad (15b)$$

Estimates reported in equation (15a-15b) reveals that domestic income, remittances and liberalisation policy exerts positive impact on merchandised 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 shows an insignificant effect. Income elasticity of merchandised and capital goods imports is inelastic (0.40 for merchandised imports and 0.35 for capital imports), implying that a 1 percent increase in real income could lead to an increase in the merchandised imports and capital imports by 0.40 percent and 0.35 percent respectively. Foreign capital produces significant positive effects on merchandised and capital goods imports. This result suggests that an increase in foreign capital could increases merchandised import demand by 0.14 percent and capital goods imports by 0.176 percent. The tariffs liberalisation variable (LIB_t) produces positive and significant impact on both variants of imports with reasonable coefficient. This means that lowering tariffs and other trade impediments could lead to an increase in imports with the contribution of liberalisation with respect to capital goods imports is 0.17 and 0.27 with reference to merchandised imports. The indirect effect of imports channel on industrial productivity through capital goods imports is equal to 0.031 percent, while the direct effect of capital goods imports on industrial productivity is equal to 0.18 percent (Equation 10). This suggest the besides export-led productivity growth, merchandised and imports of capital goods also play significant role in enhancing industrial productivity. However, trade liberalisation shows low impact on imports as compared to exports.

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 merchandised exports and imports is –1.06, which implies that Marshal-Lerner conditions for a successful devaluation are satisfied.

5.4. Direct and Indirect Effects of Liberalisation on Industrial Productivity

The direct and indirect contributions of trade liberalisation with regard to channel equations can be reported in Table 3.

Table 3

Direct and Indirect Contributions of Trade Liberalisation

Channels	Impact	Contribution (in %)
Direct channel	0.05	30.49
Private industrial investment (I_t^{IND}) channel	0.052	31.71
Exports: Manufactured exports(MX_t) channel	0.031	18.9
Imports: Capital goods and equipments (CM_t) channel	0.031	18.9
Total effect of liberalisation on industrial productivity	0.164	100

It is evident from Table 3 that there is significant effect of liberalisation on industrial productivity through channels. The overall impact of trade liberalisation is 0.164 percent on industrial productivity in Pakistan. This provides an indication that private industrial investment (I_t^{IND}), manufactured exports (MX_t) and imports of capital goods (CM_t) are the key factors through which trade liberalisation affects industrial productivity and hence economic growth in Pakistan. It is worth mentioning here that technological capability accelerated through exports as results of diversifying trade partners after import liberalisation [Yen (2009)]. Import liberalisation enhances private industrial investment by providing cheaper capital goods and raw materials to domestic market and enables domestic traders to compete foreign products at international market. The indirect contribution of trade liberalisation to industrial productivity through private industrial investment is nearly 72 percent, followed by 20 percent contribution of manufactured exports and imports capital goods and equipments respectively.

Finally, our results provide a clear indication that for effectiveness of trade liberalisation policy and to reap the benefits of open door policy, there is a need to encourage private industrial investment and manage external sector of Pakistan's economy.

6. CONCLUSIONS AND IMPLICATIONS

This paper develops a macroeconometric model to examine the impact of trade liberalisation on industrial productivity, private industrial investment, variants of exports and imports in Pakistan over the period 1972–2012. Our finding supports the hypothesis that lowering tariffs and non-tariff barriers and adopting more open door policies leads to efficient utilisation of domestic resources which in turn, accelerates the pace of industrial productivity and economic growth. The relationship between industrial productivity, capital goods imports and manufactured goods exports seems highly significant, which verifies the hypothesis that trade is engine of economic growth. Besides exports and imports, domestic factors such as private industrial investment, industrial labour and agricultural productivity have highly significant impact on industrial productivity. Capital goods imports, semi-manufactured goods exports, manufactured goods exports and tariffs liberalisation promotes industrialisation significantly. Only primary goods exports influences industrialisation negatively.

Tariffs liberalisation contributes positively in enhancing exports and imports. Other factor such as, capacity utilisation, relative prices of exports and imports, world output, domestic absorption and home remittances appears as important determinants of exports and imports.

Furthermore, the contribution of private industrial investment, merchandised exports and capital goods imports to industrial productivity is 32 percent and 20 percent each respectively. In other words, private industrial investment contributes 32 percent while technology transmission group (i.e., exports and imports) contributes 40 percent to industrial productivity in Pakistan. In overall term, liberalisation contribution accounts for 0.164 percent which implies that a 1 percent increase in tariffs liberalisation instigates industrial productivity by 0.164 percent.

The above finding is a bit realistic for industrial success in Pakistan since economic reform policy aims at opening up international trade to facilitate private sector

in Pakistan. It is expected that imports liberalisation upgrades technological capability of industrial sector which in turn, industrial productivity and economic growth. If the country promotes manufactured exports and elevates technology transfer through imports, the impact of import liberalisation to economic growth will be enlarged [Yen (1999)]. Our result confirms the role of channels through which trade liberalisation influences industrial productivity. Therefore, there is need to import capital goods and technology-oriented products to make domestic industries more efficient, competitive and vibrant and accelerate 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 liberalisation affects industrial productivity and concentrates only on (i) a role of domestic factors, (b) role of external factors, and (c) impact of liberalisation on industrial output. In future, the study could be extended by taking in to account the disaggregate component of exports and imports

APPENDIX 1

Table 1

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 percent, 5 percent and 10 percent level. C and T represents constant and trend terms.

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