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Terrorism and Manufacturing Productivity Growth in Pakistan

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Abstract: The study examines the impact of terrorism on manufacturing productivity growth in Pakistan covering the period of 1980-2014. Results of Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests illustrated that all the variables are I (1). Thus, study adopted Johansen Co-Integration approach and Error Correction Model to analyze long-run and short-run relationship. The results demonstrated the long-run dynamics among variables. Terrorism, oil price and real effective exchange rate negatively influence manufacturing productivity growth. Exports show positive association with manufacturing productivity growth.

Jel Classification: O14, H56, Q41
Key words: Manufacturing Productivity · Terrorism · Oil Price · Pakistan

INTRODUCTION

Terrorism is an old and global issue but captured much significance among researchers after 9/11/2001 attack on World Trade Centre in United States of America (USA). Taliban rulers of Afghanistan and their followers were directly blamed for terrorist movements in USA. Therefore, USA and North Atlantic Treaty Organization (NATO) assaulted Afghanistan on 7/10/2001[1]. The empirical studies of terrorism in context of economics also appeared after 9/11. The studies are mostly organized to explore the influence of terrorism on economic conditions [2].

The war and terrorism in Afghanistan also influenced Pakistan as a bordering country [1]. Terrorism has disturbed social structure, political frame work and economic performance of Pakistan. Pakistan has been suffering by terrorism from last three decades as a result of persistent Afghanistan wars. Along with these wars, various suicidal attacks and bomb blast resulted from different cultural and sectarian disputes of different groups are also creating terrorism in Pakistan [2]. Comparing the Pakistan terrorism statistics of last 35 years, it can be observed that numbers of attacks are increasing in each coming decade. During 1980's, 36 incidents of terrorist attacks were noted which were rose to 62 incidents in 1990's. In 2000's, the reported incidents show abrupt rise and go up to 457 in numbers. The attacks volume in 2011 dramatically climbed to 553, more than the total reported incidents of terrorism in 2000's. In 2012, these were hiked to 1035, almost double than those of 2011 (Figure 1).

Pakistan is experiencing infrastructure destructions, less economic opportunities and activities, disobedience of law and regulations and human rights and wastage of human lives which are rapid outcomes of terrorism. Moreover, it inflates the probability of risk and uncertainty which has made the investment and economic growth sluggish [2].

Manufacturing sector as one of the growth contributing sector also suffers from terrorism. The repeated attacks of terrorism have harmed the production and transaction units. According to Sheffi (2002) [3], the terrorist attack of 9/11 affected manufacturing sector by facing delays in raw material and manufacturing plants supply.

Manufacturing is the 3rd largest sector of Pakistan's economy, adding approximately 13.5 % of GDP (Figure 2). The sector provides 14.1 % of employment to total labor force. The fast growth of manufacturing sector is a key objective to win the target of economic development. The development via manufacturing sector can assist in achieving improved production, technological advancements, higher income and employment level, modernization and structural transformation [4]. Nearly all developed nations of today have structurally transformed their economy through manufacturing sector growth. The last decades of 18th centaury emerges

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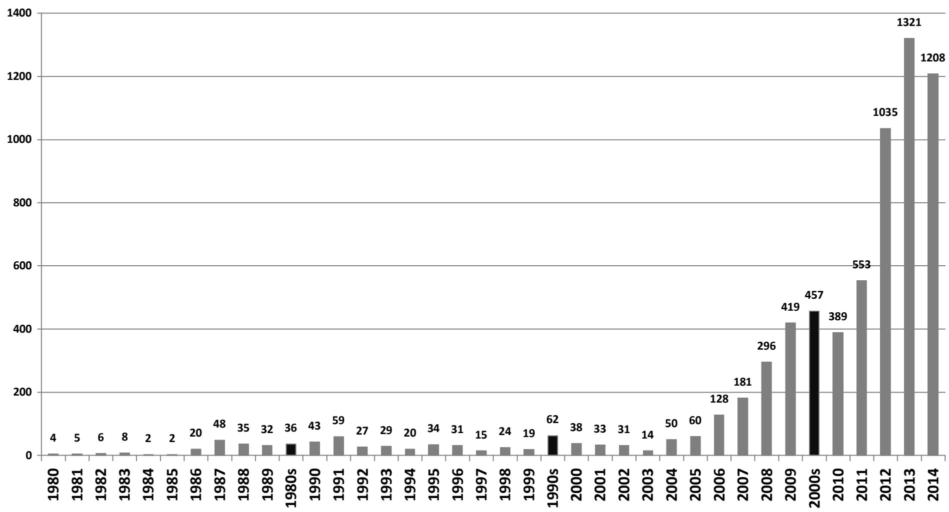

Fig. 1: Number of Terrorism Attacks in Pakistan (Suicide + Non-Suicide)
Note: Global Terrorism Database, 2014 [7]

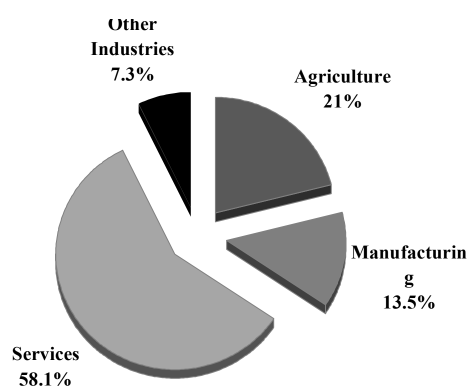

Fig. 2: Sectoral Shares in GDP
Source: Economic Survey of Pakistan, 2013-14 [4]

the manufacturing sector as a chief driver of economic growth [5]. Manufacturing dominates other economic sectors as it generates greatest multiplier effect. The economic development of developing economies extensively relies on patterns and potential of manufacturing sector [6].

The present study aims to provide empirical evidence of affect of terrorism on manufacturing productivity growth in Pakistan by using time series annual data for the period of 1980-2014.

MATERIALS AND METHODS

Data Collection: The study employed the time series data for the period of 1980-2014. The data series of terrorism was obtained from International Terrorism Database. Manufacturing Productivity growth data was derived from Pakistan Bureau of Statistics and data of oil price was found from Energy Information Administration. Whereas the data collection of exports and exchange rate was sourced from World Bank.

Model Formulation: The following model was formulated for estimation;

$$MGDP = \alpha_0 + \alpha_1\, TERR + \alpha_2\, OP + \alpha_3\, EX + \alpha_4\, EXP + e_t \quad (1)$$

Where, *MGDP*: real manufacturing gross domestic product, *TERR*: terrorism (A proxy of Number of Attacks), *OP*: real crude oil price, *EX*: real effective exchange rate, *EXP*: exports.

Augmented Dickey Fuller (ADF) Unit Root Test: Dickey and Fuller developed a new unit root test which was the extension of Dickey and Fuller test. It adds sufficient lagged lengths of explained variable to abolish serial correlation. There are three situations of ADF test.

$$\Delta V_t = \theta V_{t-1} + \sum \beta_i \Delta V_{t-1} + u_t \quad (2)$$

$$\Delta V_t = a_0 + \theta V_{t-1} + \sum \beta_i \Delta V_{t-1} + u_t \quad (3)$$

$$\Delta V_t = a_0 + \theta V_{t-1} + d_2 t + \sum \beta_i \Delta V_{t-1} + u_t \quad (4)$$

Equation (1) indicates ADF test of data series without trend and intercept. Equation (2) exhibits ADF test with trend only and Equation (3) presents the possibility if data series has both trend and intercept. The above three equations are differentiated by α_0 and d_2t. McKinnon (1991) critical values determine the existence or absence of unit root.

Phillips-Perron (PP) Unit Root Test: Dickey Fuller unit root tests assumes that error terms are not correlated and posses a constant variance. Phillip and Perron (1988) presented a new unit root test which is more flexible in terms of relaxing assumptions of constant variance and no-correlation of error terms.
Suppose AR(1) procedure;

$$\Delta V_{t-1} = a_0 + \beta V_{t-1} + u_t \tag{5}$$

PP unit root test is the generalization of ADF unit root test. It simply corrects the t-values of V's parameters. The acceptance and rejection of null hypothesis of no unit root depends upon McKinnon (1991) critical values.

Johansen Co-Integration Procedure: Granger (1981) proposed the concept of co-integration and further developed by Engle and Granger (1987) by formulating Engle-Granger (EG) procedure of co-integration. The main shortcoming of this procedure was that it deals only with two variables. Johansen (1988) develops a new procedure of co-integration among more than two variables. Johansen procedure modified ECM (Error Correction Model) to VECM (Vector Error Correction Model).

Consider three endogenous data series, say, F, G and H. Let's give them matrix shape;

$$W_t = [F_t, G_t, H_t] \tag{6}$$

$$W_t = \alpha_1 W_{t-1} + \alpha_2 W_{t-2} + ... + \alpha_k W_{t-k} + \mu_t \tag{7}$$

With respect to VECM, Eq. (7) can be written as;

$$\Delta W_t = \gamma_1 \Delta W_{t-1} + \gamma_2 \Delta W_{t-2} + ... + \gamma_{k-1} \Delta W_{t-k-1} + \varphi W_{t-1} + \mu_t \tag{8}$$

Whereas,

$$\eta_i = (1 - \alpha_1 - \alpha_2 - ..... - \alpha_k)(i = 1, 2, ..., k-1) \tag{9}$$

and $\varphi = -(1 - \alpha_1 - \alpha_2 - ..... - \alpha_k)$ (10)

φ represents 3×3 matrix showing a real long-run association among $W_t = [F_t, G_t, H_t]$. The 'ϑ' in φ ϑ Ψ' indicates the convergence speed towards equilibrium and Ψ' denotes long-run coefficient matrix. The $\Psi' V_{t-1}$ depicts error correction term in two variable case. The equation in case of more than two variables is;

$$\begin{bmatrix} \Delta F_t \\ \Delta G_t \\ \Delta H_t \end{bmatrix} = \eta_1 \begin{bmatrix} \Delta F_{t-1} \\ \Delta G_{t-1} \\ \Delta H_{t-1} \end{bmatrix} + \varphi \begin{bmatrix} \Delta F_{t-1} \\ \Delta G_{t-1} \\ \Delta H_{t-1} \end{bmatrix} + \varepsilon_t \tag{12}$$

Or it can be said that;

$$\begin{bmatrix} \Delta F_t \\ \Delta G_t \\ \Delta H_t \end{bmatrix} = \eta_1 \begin{bmatrix} \Delta F_{t-1} \\ \Delta G_{t-1} \\ \Delta H_{t-1} \end{bmatrix} + \begin{bmatrix} \vartheta_{11}\vartheta_{12} \\ \vartheta_{21}\vartheta_{22} \\ \vartheta_{31}\vartheta_{32} \end{bmatrix} \begin{bmatrix} \Psi_{11}\Psi_{21}\Psi_{31} \\ \Psi_{12}\Psi_{22}\Psi_{32} \end{bmatrix} \begin{bmatrix} \Delta F_{t-1} \\ \Delta G_{t-1} \\ \Delta H_{t-1} \end{bmatrix} + \varepsilon_t \tag{13}$$

Now examine 1st equation part of error correction. The 1st row of 'φ'matrix is;

$$\varphi W_{t-1} = \left([\vartheta_{11}\Psi_{11} + \vartheta_{12}\Psi_{12}][\vartheta_{11}\Psi_{21} + \vartheta_{12}\Psi_{22}][\vartheta_{11}\Psi_{13} + \vartheta_{12}\Psi_{32}] \right) \begin{bmatrix} \Delta F_{t-1} \\ \Delta G_{t-1} \\ \Delta H_{t-1} \end{bmatrix} + \varepsilon_t \tag{14}$$

It can also be show as;

$$\varphi W_{t-1} = \vartheta_{11}\left(\Psi_{11} F_{t-1} + \Psi_{21} G_{t-1} + \Psi_{31} H_{t-1} \right) + \vartheta_{12}\left(\Psi_{12} F_{t-1} + \Psi_{22} G_{t-1} + \Psi_{32} H_{t-1} \right) \tag{15}$$

The equation represents two co-integrating vectors and ϑ_{11}, ϑ_{12} of their speed of adjustment[1].

RESULTS AND DISCUSSIONS

To avoid the possibility of spurious regression, two approaches of unit root are used; ADF and PP. The stationarity of data was tested by two models; firstly with intercept only and secondly with both trend and intercept. The results of both unit root tests with possibility of trend as well as with possibility of trend and intercept depicted that all variables are I (1). Therefore Johansen and Juselius (1990) co-integration approach and error correction model is applied for further analysis (Table 1).

The Pantula Principal suggested to choose the model with unrestricted intercept and no trend from 5 co-integration models. Trace statistics and Eigen accept the alternative hypothesis of existence of co-integration at 5 % because values of Trace and Eigen statistics exceed the critical values. The outcome illustrated the presence of one co-integrating vector among variables with respect to Trace and Eigen values (Table 2).

[1]The methodology is adopted from Ikram and Waqas (2014) [8].

Table 1: Unit Root Results

	ADF				PP			
	Intercept		Trend and Intercept		Intercept		Trend and Intercept	
Variables	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
MGDP	-2.433	-6.534***	-3.156	-6.654***	-2.384	-7.147***	-3.025	-7.697***
ER	-2.064	-4.824***	-0.259	-6.520***	-2.010	-4.885***	-0.304	-10.557***
TERR	-0.678	-5.692***	-2.078	-5.642***	-0.395	-7.445***	-2.074	-9.239***
OP	-1.333	-4.432***	-1.86	-5.501***	-1.337	-6.143***	-1.758	-7.487***
EXP	-1.715	-6.252***	-2.009	-6.366***	-1.805	-6.249***	-2.083	-6.377***

Note: *,** and * represents significance at 1%, 5% and 10% level respectively.

Table 2: Johansen Maximum Likelihood Test for Co-integration

Hypothesis	Trace Stat.	5 % Critical Value	Hypothesis	Eigen Stat.	5 % Critical Value
r = 1	73.9313	70.4900	r = 1	41.3062	33.6400
r = 2	32.6251	48.8800	r = 2	16.4963	27.4200
r = 3	16.1288	31.5400	r = 3	11.8961	21.1200
r = 4	4.2327	17.8600	r = 4	4.2071	14.8800
r = 5	.025556	8.0700	r = 5	.025556	8.0700

Table 3: ECM regression results

Variables	Coefficients	t-values
Intercept	4.469	1.742
ΔTERR	-0.050	-9.4998
ΔOP	-0.081	-2.049
ΔEXP	0.046	0.996
ΔEX	-4.21	-1.608
ΔECM(-1)	-0.163	-1.273

Note: ΔMGDP is dependant variable.

The next step is to explore the short-run relationship among variables. Error Correction term describes the convergence speed towards equilibrium. The term is negative as expected but not significant. The coefficients of terrorism influence manufacturing productivity growth negatively as terrorism generates uncertain business environment and leads to production losses by interrupting the new investment decisions and raw material supply and damaging infrastructure. Terrorism effected markets face high risk premiums, reducing investment inflows and increase in credit risk. Oil price also affects manufacturing productivity growth negatively as according to Riaz *et al*. 2016 [9], manufacturing sector instability mainly arises from oil price variation because oil is primary input of manufacturing. Oil inflation results in production losses due to high cost of production. Increase in exports increases the manufacturing productivity growth positively as exports generate high revenues and thus positively influence the production and investment decisions. The coefficient of real effective exchange rate shows negative relationship with manufacturing productivity growth. This result is in line with Ehinomen and Oladipo, 2012 [10]. (Table 3)

CONCLUSION

The study aims to investigate the impact of terrorism on manufacturing productivity growth in Pakistan for the period of 1980-2014. Results of Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests illustrated that all the variables are I(1). Thus, study adopted Johansen Co-Integration approach and Error Correction Model to analyze long-run and short-run relationship. The results demonstrated both long-run and short-run dynamics among variables. Terrorism, oil price and real effective exchange rate negatively influence manufacturing productivity growth. Exports show positive association with manufacturing productivity growth.

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