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The impact of globalization on total factor productivity of the manufacturing sector in Pakistan

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***Abstract*—This main focus of this paper is to assess the effect of globalization on total factor productivity (TFP) performance of the Pakistan's manufacturing sector. The study was inspired because of the requirement to analyze the effect of globalization on the TFP estimates of the manufacturing sector. In this paper, the overall effect on globalization is construed by considering the variables that represent globalization of economy. These encompass capital intensity, foreign investment, high technology content in sector, labor force, value added (output) by sector, openness of the economy and the sector contribution to GDP growth. This study utilizes data from Federal Bureau of Statistics (FBS), Economic Surveys (ES), State Bank of Pakistan (SBP), Census of Manufacturing Industries (CMI) and Asian Productivity Organization (APO) which cover the period from 1990 to 2013. The data is analyzed using descriptive statistics, Philips Peron unit root test and panel regression models on SPSS and EViews. The findings show that the capital intensity, value added (output) and openness of economy are significant variables when considering their descriptive statistics and positively contribute to the TFP of the Pakistan's manufacturing sector. Alternatively, high technology content agreements and foreign direct investment are not significant as per statistical analysis. Together these two factors do not constitute as much to the positive impact of TFP in the manufacturing sector.**

Keywords—total factor productivity; globalization; manufacturing sector.

I. INTRODUCTION

Globalization is a compulsory part of development strategies among developing countries. It is widely acknowledged as a factor which accelerates growth and result in more revenue which improve technological capability. Globalization requires investment in R&D with effective backward and forward linkage to be successful. Effect of globalization is closely affiliated with foreign direct investment and this effect also have impact on total factor productivity (TFP).

Economy of South Asia is the focus area for most of renowned economist because it is one of the emerging markets in Asia. South Asia contributes 6.87 % share to global Gross Domestic Product (GDP) today which has reduced from 7.41% since 2003. It shows the effect of stagnant economic conditions in the region relative to world. One of the three major economically strong countries in South Asia are India, Pakistan and Bangladesh. India and Pakistan contribute 80 % to this region GDP with India contributing major chunk of it [1]. Up to 1990, India adopted controlled economic development strategy, import-substituting and inward oriented policy which resulted in meager growth for last four decades but after 1990, they introduced domestic reforms, floating of exchange rate, trade liberalization and opening to foreign direct investment which has influence the TFP of India. In context of Pakistan, efforts for economy integration towards the globalization characteristics, such as removal of barrier tariffs against imports, facilitating firms to access global market for export, inflows and outflows of capital reserves, and increase in high end technology content agreements, remain somewhat stagnant for last 20 years and the realization is creeping to open up the economy to bring foreign direct investment by facilitating the foreign companies to invest in economic development activities. From the period of 1973 to 1998, GDP annual average growth rate has remained somewhat stable up to 4%. As contrast to India and Bangladesh, Pakistan economy has performed very sluggishly after 1990 except 2003 to 2007 period when macroeconomic reforms were introduced as shown in Fig. 1 [2].

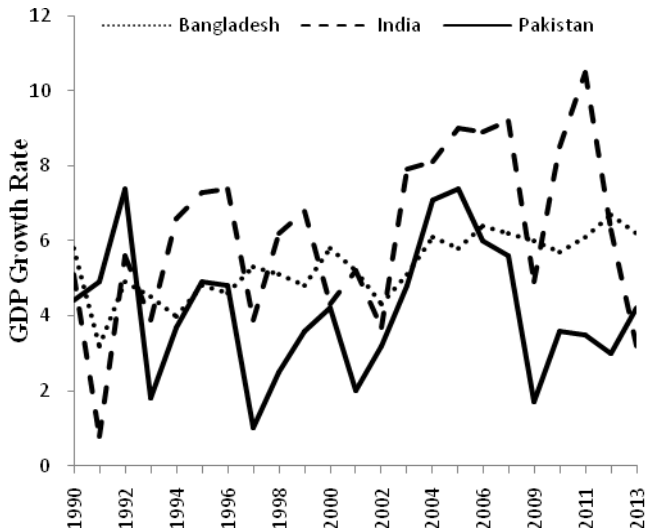

Fig. 1. Comparison of GDP growth rate in South Asian countries.

It is evident as discussed above that government policies play an important role in the growth of TFP as well as overall GDP growth. It is also acknowledge in one of the theory known as "new" or "endogenous" growth theory. Growth in TFP is closely linked with growth of GDP in every developing country as shown in trend of Fig. 1 and 2 [3].

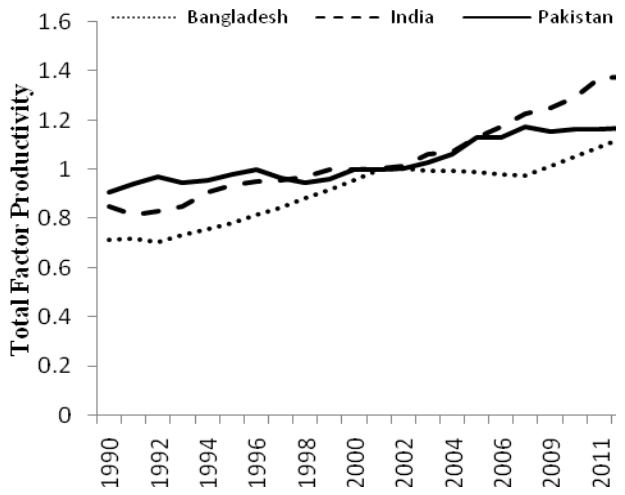

Fig. 2. Comparison of Total Factor Productivity in South Asian countries.

Economy of Pakistan is fairly relying on the growth of manufacturing sector and 25% contribution amounted to GDP is coming from this sector. Improvement in manufacturing sector will have much more percussion on GDP, export, import, human capital and energy planning. Meanwhile, manufacturing contribution has also followed same pattern as of GDP growth which showed that manufacturing sector contribution is closely correlated with GDP growth rate as shown in Fig. 3.

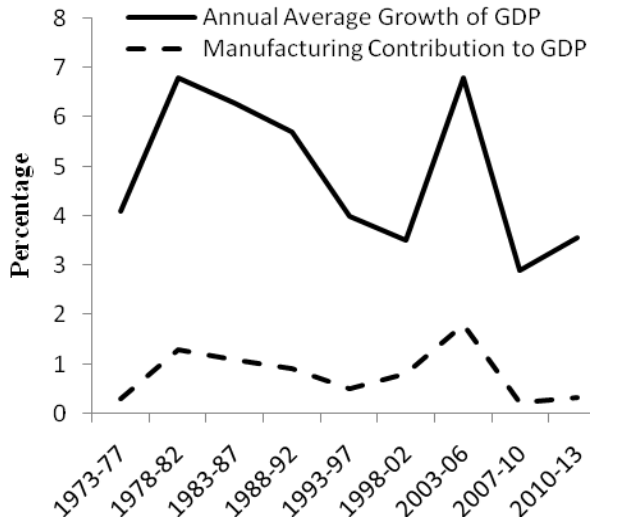

Fig. 3. Relation of Annual Average GDP growth rate and Manufacturing contribution (%)

To analyze the subject of globalization and the effect of globalization on TFP, the following variables are rigorously analyzed to highlight the effect of these variables on the economy. To avoid misrepresentations and dubious analyses, globalization itself is represented via variables; for example openness of the economy as share of exports and imports to GDP, the foreign direct investment inflows, capital intensity, human resource development in sector due to technology spillover and the percentage of high technology content agreements for export. In context to Pakistan economy, it is estimated that more globalization of economy will impact the under investigated variables that results in influence of TFP directly and indirectly, particularly in the manufacturing sector. All of the factors stated above would be expected to transform/affect the TFP of the manufacturing sector.

A. Openness of economy

Openness of economy is linked with globalization which have positive consequence on TFP growth. Openness of economy is basically estimated in terms of ratio of export to import per annum. It is judged from import penetration ratio, tariff reforms and exchange rate [4]. Increase in import penetration results in enhancement of total trade and spillover effects which slow down the export for time being but bring technological improvement that accelerate the export after sometime. Meanwhile, high tariff barrier result in higher investment cost, costly import and affect TFP. The exchange rate of currency which is majorly dependent on foreign exchange reserves, also influence the component of export and import bills.

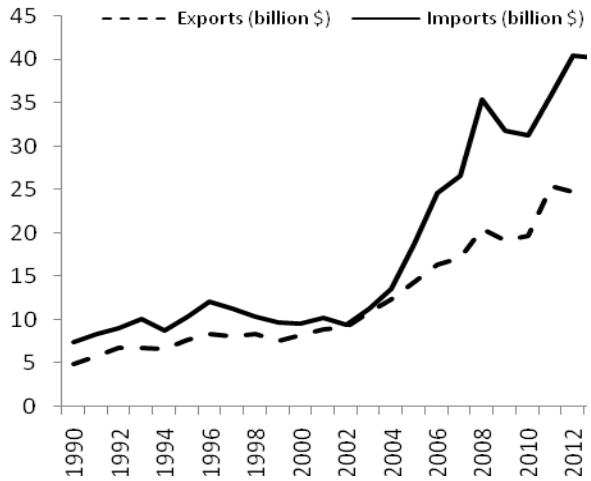

Fig. 4. Comparison of Exports and Imports of Pakistan

As shown in Fig. 4, imports are increasing rapidly since 2005 which shows the better tariff reforms due to need of requirement in service and energy sector. Up to 2005, balance of payment was hovering nearly neck to neck but after this period, TFP and total trade increased exceptionally in contrast to negative balance of trade. Meanwhile, same effect was illustrated by Hwang and Wang (2004) who encountered same phenomena in Japanese Manufacturing industries from period of 1973 to 1998 [5].

B. Human Capital

Human capital is closely linked with openness of level of openness of economy. In poor income countries, human capital effect shift from negative to positive effect when level of openness is improved [6]. In this way, this factor contributes positively to TFP otherwise it has counterproductive response in low income countries. As shown in Fig. 5, skilled human capital is constantly increasing but still it has no impact on export share which shows negative effect of openness in Pakistan after 2005. This trend give us the sign of disparities in country economic environment which had lead to low wages and unemployment.

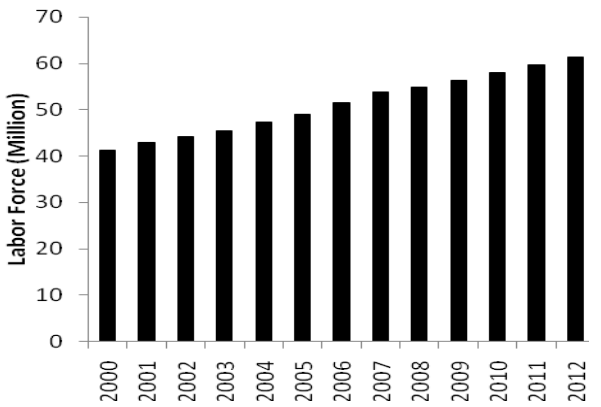

Fig. 5. Amount of Labor Force in Pakistan.

C. Labor Productivity

Labor Productivity is mainly characterized by factor such as investment, capital deepening and total trade. Labor productivity has positive implication on TFP and service sector is the major driving force in acceleration of labor productivity. In Pakistan, labor productivity is constantly increasing as shown in Fig. 6, which shows the effect of capital deepening and shift in TFP. As per Economic Survey of Pakistan (2011), it also shows that per capita income has doubled in last eight years that give evidence of capital deepening. Secondly, Labor productivity acceleration is accredited to growth in service sector which has 54% contribution to GDP [7].

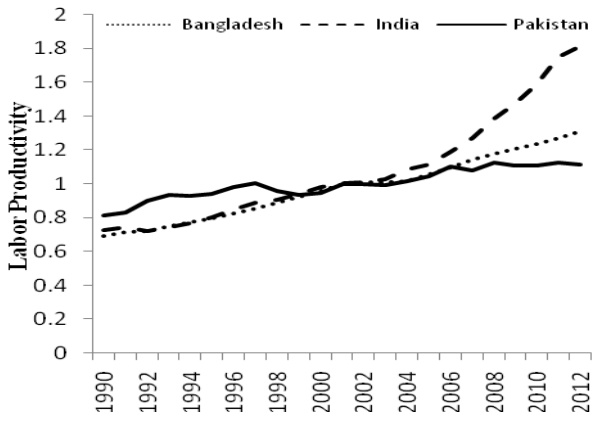

Fig. 6. Labor Productivity in South Asian Countries.

D. Foreign Direct Investment

In every emerging economy, FDI has a key role for transitioning the economy where a large gap exists between highly skilled work force and low technological level of equipment. The role of foreign and domestic owned firm are closely linked with FDI phenomena. High ratio of foreign owned firms create competitive atmosphere in local market which can have adverse effect also but to overcome this, foreign firms should be outward oriented with focus on export. One of the prime force contributed by these firms are that they improve productivity and have positive spillover effects on local firms in same sector. It is also stated by Jerome (2001) that outward oriented foreign firms contribute more to economy than inward ones. Meanwhile, domestic firms can interact with foreign owned forms for business purpose which results in labor turnover and faster adaptability to technology [8].

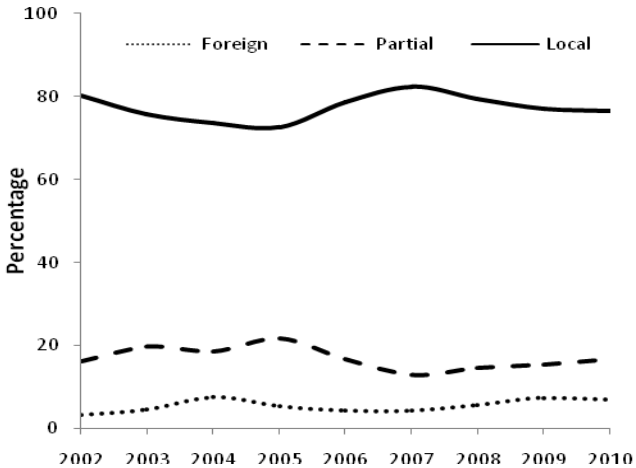

Fig. 7. Composition of LO, PFO, FFO in Pakistan.

As shown in Fig. 7, majority composition of firms are locally owned that is nearly equal to 80% while foreign owned firms only represent small portion up to 6%. This shows that the contribution to productivity is mostly coming from locally owned firms because of sharp reduction of foreign direct investment in recent years. This phenomena may be due to worsening law and order conditions & prevailing energy crisis in Pakistan. It also illustrates that significant portion of partial owned firms exist which give forward and backward linkages spillover. Fig. 8 provides the overall FDI inflows and FDI for manufacturing sector. It can be notice that overall FDI inflows and FDI for manufacturing shows similar trend pattern in Pakistan. The trend also show that when feasible and stable economic environment existed in the country than FDI inflows has increased significantly in that period. The trend also show that when feasible and stable economic environment existed in the country than FDI inflows has increased significantly in that period. In manufacturing sector, Petroleum segment has attracted maximum foreign direct investment in whole decade and textile segment being the biggest contributor in manufacturing sector got mediocre FDI. Meanwhile chemical, automotive, mechanical equipment and food processing are other potential FDI attracting segments of Pakistan's

manufacturing sector. Hassan et al. (2012) also stated that increase in FDI has positive gains on total productivity in manufacturing sector of Pakistan. It also further illustrated statistically that textile which is one of the major sector in Pakistan has least productivity due to absence of high technology content and tobacco sector that got minimal FDI for last decade shows highest productivity due to presence of fully foreign own firms in this sector [9]. It shows impact of high technology content and fully foreign owned firms (indirectly linked with FDI) in Pakistan's manufacturing sector.

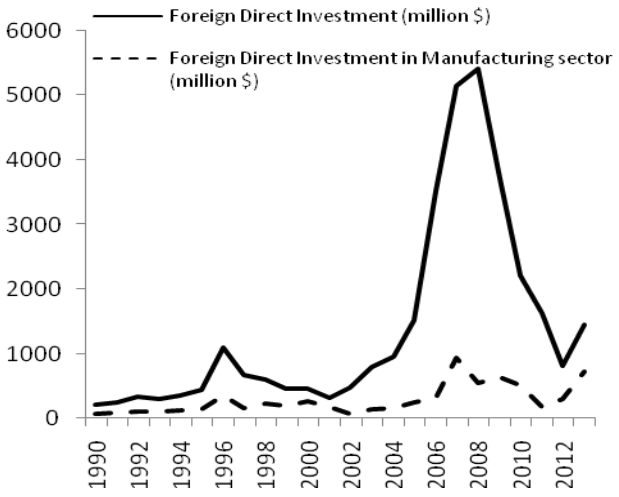

Fig. 8. Comparison of net FDI inflows relative to manufacturing sector of Pakistan.

II. Literature Review

Nelson and Phelps (1966) claimed that work force stock is the main factor to get maximum benefit from globalization [10]. Caves (1974) found out in Australian manufacturing sector that spillovers have significant and positive effects [11]. Findly (1978) studied the effect of technology development in foreign and local firms and found out that foreign owned firms inject capital which results in technology improvement of domestic owned firms [12].

Rhee and Belot (1989) illustrated that in developing countries like Mauritius and Bangladesh, entry of multinational firms has resulted in expansion and growth of domestic owned textile firms [13]. Urata and Yokota (1994) find out that trade liberalization results in TFP growth which is linked with openness of economy [14]. Coe and Helpman (1995) claimed that international trade and R&D capital are the driving force for country's productivity gains [15].

Diao, Rattso and Stokke (2005) found out that in Thailand, trade liberalization resulted in long and short term growth because it promoted foreign spillovers which have significant effect on trade expansion [16]. Pessoa (2005) utilized the data of 16 OECD countries to examine the impact of Foreign Direct Investment on TFP and result further showed that FDI is a source of technological change which has positive consequence on total factor productivity [17].

Kohpaiboon (2006) determined that technology capability and capital deepening factor is controlled by FDI which plays part in economic growth [18]. Lai, Peng and Bao (2006) proved that openness of economy and human capital development in the country drive the positive effect of globalization [19]. Murakami (2007) investigated the linkage of foreign owned firms in manufacturing sector of Japan and stated that in early stage, it has negative effect but in long term, it improves TFP growth due to spillover [20].

Herzer (2011) studied the connection of the outward foreign direct investment which has positive value on TFP in developing countries and FDI effect has more role in long term scenario [21]. Anwar and Nguyen (2011) found out that higher labor force in any industry get advantage from foreign direct investment because of backward linkage spillover [22]. Parviz (2011) investigated the impact of foreign direct investment and TFP in Canadian manufacturing sector but it showed neither any negative or positive significance [23]. Pangarkar and Jie (2011) illustrated that performance of emerging market is based on level of globalization and further stated that multi-factor productivity is improved due to globalization impact [24].

III. Design Methodology

The data source for the study is taken from Federal Bureau of Statistics (FBS), Economic Surveys (ES), State Bank of Pakistan (SBP), Census of Manufacturing Industries (CMI) and Asian Productivity Organization (APO). Basically a multivariate equation is used to examine the association amongst TFP performance and numerous self-regulating factors, namely; total value added, capital intensity, labor force in sector, high technology content, foreign direct investment, and the openness of the economy. To examine the measurement of total factor productivity in manufacturing sector of Pakistan, value added is consider as total net output in manufacturing sector. Labor data is taken from Labor Force Survey of Pakistan in terms of number of employees and wages per employee (inclusive of remuneration and earnings, gratuity, cash grants and overtime compensation). Capital stock in manufacturing sector is estimated by following identifiers:

$$K_t = K_{t-1} + I_t/P_t - d_t \quad (1)$$

K_t= the capital stock at time t.
K_{t-1} = the capital stock at previous year.
I_t= the gross fixed investment at time t.
P_t= the price index of year t based on 1990-1 prices.
I_t/P_t= the gross fixed investment at time t divided by the price index of year t.
D_t= depreciation based on K_{t-1}.

A. TFP Estimates

Approximation of TFP is calculated from the representation of the Cobb Douglas Production function with the postulation of continuous yield to scale.

$$Y = AK^{\alpha}L^{\beta} \quad (2)$$

Then calculation of the manufacturing function can be stated in log-linear formula as given below:

$$\ln Y = \ln A + \alpha \ln K + \beta \ln L + \mu \quad (3)$$

Wherever, Y is excess production, K is assets, L is labor, capital parameter is denoted by α, β denotes labor parameter and μ is an inaccuracy/error term.

B. Description of the Model

The association among TFP and self-governing factors in the multivariate equation can be specified as follow:

$$TFP_t = f\,(Y_t, K/L_t, EMP_t, HTC_t, SGDP_t, FDI_t, OPN_t, D_t) \quad (4)$$

For the econometric examination, equation (5) exhibits a combination of semi log-linear terms, where lowercase parameters are the $\log_n$ of the respective uppercase parameters. The experimental model for total factor productivity in the multivariate model can be stated as follow:

$$\ln TFP_t = \alpha + \beta_1 \ln Y_t + \beta_2 K/L_t + \beta_3 \ln EMP_t + \beta_4 HTC_t + \beta_5 SGDP_t + \beta_6 \ln FDI_t + \beta_7 OPN_t + D_t + \epsilon_t \quad (5)$$

$$t = 1, \ldots . t$$

TFP_t = signifies total factor productivity of sector.
Y_t = vector of value-added by sector.
K/L_t = capital intensity.
EMP_t = number of employment in sector.
HTC_t = percentage of high technology content for export in sector.
$SGDP_t$ = sector contribution to GDP growth (% point).
FDI_t = foreign direct investment in sector.
OPN_t = openness of the budget.
D_t = dummy time period and.
ϵ_t = an error term.

α and β are the vectors of parameters to be estimated. t is a time. D_t is a dummy variable of political stability in country, where 1 refers to the stable conditions and, 0 represents unstable conditions.

IV. Analysis

TABLE I shows the data of the variables that were used for this study. A positive increase of the value of variables is indicated by the table from 1990 to 2013 excluding the values of the variables of capital intensity and contribution to GDP by sector. It is not surprisingly that the capital intensity and contribution to GDP has fluctuated during those period in which the economic crunch occurred. The recovery of the economy is indicated after this era, while the remaining variables increase significantly from 2001 to 2007.

The descriptive statistics of the variables are given in TABLE II. TABLE V illustrates the outcomes of globalization variables and TFP of the manufacturing segment illustrating the three mathematical approximations which are; pooled least square model (PLS), fixed-effect model (FE) and random effect model (RE). Each of the above mentioned factors complied with the testing level of stationary projections. Unit root test (Philips Peron) illustrates that each of the factors mentioned are stationary at 1 percent of significance at the 1st order difference (see TABLE III).

For the selection of panel regression model, the particular study must validate some tests which will help us in selecting which particular mathematical model is appropriate for consideration of our study. The validation of the panel regression models are based on multi-colinearity and autocorrelation results. The multi-colinearity issue indicates the presence of the seamless or semi linear relationship amongst multiple or complete descriptive indicators of a mathematical model satisfying a regression equation besides it must be tested through association multiple pair correlation. The association between multiple observations represented in time dependent data can be described by autocorrelation problem.

According to the TABLE IV, the factors indicating variance inflation (VIF) have values which are smaller than the limit of 10; for pooled least squared (PLS) model, fixed effect (FE) model and random effect (RE) model, it is at 3.44, 6.95, and 5.23, respectively. This shows that all the descriptive factors are unrestricted after the multi-colinearity problem. These three models are not subjected to multi-colinearity which conform to presence of no correlation among regressors. However, the results of autocorrelation illustrate it's presence by approximation. For this issue, autoregressive model is used and problem was solved at AR(1).

Considering TABLE IV, the Wald test is used to determine which model is to consider between PLS and FE. The test indicates that the p-value is statistically significant at 1 percent , indicating that the FE model is prefered. To further differentiate between the Pooled Least Squares and Random Effects models, the LM test can be utilized. The LM test shows the presence of statistical significance at 1 percent which recommend the use of Random Effects model. As a final validation test, the Hausman test demonstrates that the FE model is designated for this study because of the elimination of null hypothesis for Random Effects model. Finally, after the analysis, the results indicate that the Fixed Effects model is suitable for this application, outcomes of which are summarized by the equation (see Table V):

$$\ln TFP_t = 1.74 + 0.420 \ln Y + 0.543 K/L + 0.23 \ln EMP_t + 0.009 HTC_t + 0.164 SGDP_t + 0.139 \ln FDI_t + 0.304 OPN_t - 0.11 D_t \quad (6)$$

From the outcome of the result, R^2 value is enumerated at 0.845. Elucidating that all descriptive factors explicate around 84.5 percent values of the manufacturing sector in terms of total factor productivity including all factors. The outcome illustrates the factors of output, capital intensity, employment, foreign direct investment, high technology content, contribution to GDP and openness of economy are statistically

TABLE I. SELECTED INDICATORS IDENTIFYING THE GROWTH RATE OF THE MANUFACTUING SECTOR

Indicators	1990	1995	2000	2005	2010	2013
Employment ('000 people)	3930	3400	4310	5960	7320	8030
Value Added (US$ Billion)	4.73	6.66	6.05	18.02	21.7	28.4
Capital Intensity	0.31	0.25	0.36	0.33	0.23	0.213
Foreign Direct Investment (US$ Billion)	0.071	0.145	0.274	0.251	0.524	0.727
High Technology Content (% of export)	0.071	0.041	0.387	1.38	1.685	1.78
Contribution to GDP growth (% point)	0.78	0.81	0.63	2.7	0.19	0.46
Export (US$ Billion)	4.92	7.75	8.19	14.4	19.63	24.79
Import (US$ Billion)	7.41	10.29	9.6	18.75	31.2	40.19
GDP (US$ Billion)	40.01	60.64	73.95	109.6	176.5	253.3

TABLE II. DESCRIPTIVE STATISTICS OF THE VARIABLES INVOLVED IN THE STUDY

Variables	N	Mean	Maximum	Minimum	Standard Deviation
TFP	96	2.31	3.9	1.62	0.511
EMP	96	5235000	8030000	3260000	1622700.38
Y	96	13.02	28.4	4.73	7.99
K/L	96	0.3	0.39	0.21	0.053
FDI	96	0.29	0.94	0.071	0.230
HTC	96	0.80	1.85	0.024	0.737
SGDP	96	0.79	2.7	-0.69	0.731
OPN	96	0.29	0.34	0.24	0.026
DSC	96	0.429	1.00	0.00	0.496

TABLE III. UNIT ROOT TEST OF THE VARIABBLES AT LEVEL I(0) AND FIRST DIFFERENCE

Variables	Philips Peron Test Statistics			
	level I(0)		*First-Order Difference I(1)*	
	Continuous	*Continuous + trend*	*Continuous*	*Continuous + trend*
TFP	-2.39	-2.65	-9.22	-13.74
EMP	1.03	-3.09	-4.91	-5.34
Y	-0.26	-1.86	-4.99	-5.10
K/L	-1.47	-1.67	-5.16	-5.22
FDI	-1.89	-3.03	-5.63	-5.44
HTC	-0.63	-2.30	-5.63	-7.12
SGDP	-2.07	-2.03	-4.26	-4.55
OPN	-1.72	-1.82	-4.57	-4.46
DSC	-3.04	-3.25	-18.43	-21.46

Critical value for p = 0.01(Continuous) at level I(0) = -3.75
Critical value for p = 0.01 (Continuous + trend) at level I(0) = -4.41
Critical value for p = 0.01 (Continuous) at first-order difference I(1) = -3.76
Critical value for p = 0.01 (Continuous + trend) at first-order difference I(1) = -4.44

TABLE IV. RESULT OF PANEL REGRESSION MODELS

Tests	PLS Model	FE Model	RE Model
DW – Statistic	2.139	2.22	2.130
AR(1) test p-value	0.000	0.000	0.000
VIF	3.44	6.95	5.23

Wald test: F – Wald test 1%		Pooled vs Fixed reject H_0 (F critical > F table) (87.11) (2.70)	
LM test: χ^2 Test 1%	Pooled vs Random reject H_0 (χ^2 critical > χ^2 table) (103.89) (20.09)		
Hausman test χ^2 Test 1%			Random vs Fixed reject H_0 (χ^2 critical>χ^2 table) (127.42) (18.47)

TABLE V. RESULTS OF ANALYSIS

Dependent Variable : TFP	**PLS Model**	**FE Model**	**RE Model**
Independent Variable			
C	2.66	1.74	1.67
EMP	0.148	0.230	0.118
lnY	0.148	0.420	0.29
K/L	0.548	0.543	0.528
lnFDI	0.006	0.139	0.013
HTC	0.103	0.009	0.11
SGDP	0.067	0.164	0.083
OPN	0.34	0.304	0.019
DSC	-0.138	-0.11	-0.130
R Squared F-Statistic p-value	0.741 66.108 0.0000	0.8485 75.580 0.0000	0.6358 62.436 0.0000

the significant at 1 percent and 10 percent level. Output elasticity is 0.420 which reflect that 1 percent rise in output will cause the TFP of the manufacturing sector to increase nearly by 0.420 point. Moreover, the outcomes illustrate that 1 out of a hundred upsurge in capital intensity will cause the TFP of the manufacturing sector to rise by 0.543 point.

Alternatively, the factor of globalization like employment, FDI, high technology content and openness of economy illustrate positive association to TFP growth of Pakistan manufacturing sector. Rise of 1 percent in employment results in rise of TFP by 0.230 point. Foreign direct investment and high technology content is statistically significant at 10 percent resulting in rise of productivity by 0.139 and 0.009 point correspondingly. Openness of economy illustrates constructive factor of 0.304 indicating rise of one percent of value will result in productivity rise of 0.304 percent. Dummy variable influence is negative towards TFP of manufacturing sector after the year 2000.

V. CONCLUSIONS

From the outcomes as deliberated above, this study concludes that overall, globalization has influenced the TFP performance of the manufacturing sector. This is shown by the factors used in this study that characterize the pointers/substitutions of the globalization are attained significantly and positively contribute to the performance of TFP of the manufacturing sector. The capital intensity, openness of economy, value added by sector and human resource development are statistically significant and positively contribute to the TFP performance of the manufacturing sector. From the result, the amount of labor has augmented progressively for the manufacturing sector in the duration of the study, this shows that labor development contributes to the performance of TFP in this sector. Factors of FDI, high technology content agreements and sector contribution to GDP growth are inter-related with each other. This is for the reason that Pakistan government should provide motivation to foreign investor in terms of exports performance. In this case, the higher the exports of the multinational companies, the more incentive benefits to them.

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