

Impact of Sector-Specific FDI on Sector-Specific Labour Productivity in Pakistan

¹Haider Mahmood and A.R. Chaudhary

¹GC University, Lahore, Pakistan

²NCBA&E, Gulberg III, Lahore, Pakistan

Abstract: This study aims at finding the impact of sector-specific FDI on sector-specific labor productivity in Pakistan. The study uses the data of the primary, secondary and tertiary sectors and data is taken from 1972 to 2010 for analysis. The study uses ADF, PP and Zivot-Andrews unit root tests to check the unit root problem in time series and ARDL cointegration bound testing technique to find the long-run and short-run relationships for each sector separately. The results show that the long-run relationships exist in the labour productivity model of all sectors. The short-run relationship exists in case of the secondary sector labour productivity model. The short-run relationships do not exist in case of primary and tertiary sector labor productivity models. Sector-specific FDI has a positive and significant impact on labor productivity in case of all sectors. So, the study finds that FDI is helpful in raising labor productivity in all sectors in Pakistan.

Key words: FDI • Labour Productivity • Cointegration • Stationarity

INTRODUCTION

Impact of Foreign Direct Investment (FDI) on host country's labor productivity level depends on technology transfers and training of labor. Foreign firms working in developing countries usually possess superior technology and efficient technique of operation. So, these may enhance the competition amongst local firms and these are forced to adopt better technologies and operate their production process efficiently. Thus, foreign investment may increase labor productivity in these countries. Technology transfers also have positive externalities on local firms. Local firms may use better technology to compete foreign firms. Technology may also transfer to local firms if local investors buy intermediate goods from foreign firms. Foreign firms use the domestic labour that transfers their skills when they are employed by local firms or when they set their own business after leaving foreign firms. Local knowledge of labor may also raise with new inventions abroad Fosfuri *et al.* [1]. Blomstrom and Kokko [2] claimed that productivity of labour can rise through learning-by-watching effect. Foreign investors are superior in proprietary technology, so they may help in enhancing the marketing and managerial skills if these factors are transferred in subsidiary firms.

Literature Review: MacDougall [3] found that FDI had positive spillovers on the host countries through technology and production expansion. Streeten [4] suggested that the host country's welfare could increase by FDI through technology. Caves [5] claimed that FDI could increase welfare of the host country by introducing new technology, new skills, better marketing techniques and production techniques. He also claimed that FDI had main advantage of product differentiation in imperfect competition in the host country, which affected the Multi National Enterprises (MNEs) decision to invest in that country.

Buckley and Casson [6] claimed that MNEs invested in the host country due to market imperfection to gain monopoly advantage. MNEs developed and transferred the knowledge and skills in the host country and created benefit for both host and home countries. Buckley and Casson [7] stated that FDI could reduce the import of final goods and increase the import of capital goods, which could enhance productivity level in the host country. Magee [8] found a positive impact of FDI on technology transfers in the host country and further stated that the degree of transfers depended on trademark laws and patent system of the recipient country. Casson [9] claimed that MNEs could affect the economic and cultural environment of the recipient country and could also

become a source of technology transfer with better productivity.

Findlay [10] stated that FDI was the source of technology including capital and management. Technology depended on the host country's educational level, market structure and laws relating to licensing, patents and royalties. He also stated that the degree of technological change in backward regions of the host country depended on the level of foreign capital in such regions. Koizumi and Kopecky [11] explained that the transfer of technology depended on the share of foreign capital in the total capital stock of the host country. When FDI increased the foreign capital stock, the marginal product of capital would rise greater than the host country's rate of interest. Domestic capital accumulation increased up to the point where marginal product of capital equalized the rate of interest. There would also be capital intensity in the host country with this process.

Das [12] assumed that MNEs had superior technology and monopoly powers. Technology was transferred to the firms of host country when MNEs set up their firms. MNEs enjoyed monopoly power and higher profits while the profits of the domestic firms were not certain and depended on the elasticity of demand and supply of the domestically produced goods.

Wang and Blomstrom [13] explained that MNEs was the source of technology diffusion in the host country. It was an endogenous phenomenon showing how rapidly the local firms adapted the technology and bore their cost. The host country enjoyed the technology spillovers, because it enhanced international competitiveness, trade performance and economic growth. Dunning [14] stated that technology spillovers of MNEs to the host country depended on economic structure and institutional environment of that country. Moreover, it also depended whether MNEs set up a complete firm or entered in a joint venture. The spillover of FDI depended on the host country's market structure, policies, level of competition, the extent of ownership advantage, absorptive capacity of local firms, investment type, diffusion and accumulation of new knowledge and technology.

According to Hanson *et al.* [15], welfare effect of technology transfers depended on the nature of FDI. Production-oriented FDI had greater technical spillovers on the host country than that of distribution-oriented FDI, because production-oriented FDI had better linkage with the local firms. Pearce and Singh [16] stated that MNEs decentralized the innovation activities which helped in technological advancement in the host countries.

Caves [17] used the data of Canadian and Australian manufacturing industries and found that FDI had positive impact on the labor productivity in Australia. However, in case of Canadian manufacturing industries, he did not find any significant relationship between FDI and productivity levels. Blomstrom and Persson [18] found a positive relationship between productivity level of domestic plants and industry's foreign employment share in Mexico. Chen [19] found a positive and significant relationship of industry's technical progress and of FDI in Hong Kong. Fairchild and Sosin [20] conducted a survey on domestic and foreign owned firms. They found a positive impact of FDI on technical activities and performance of manufacturing firms.

Blomstrom and Wolff [21] used the Mexican data and found that the higher level of FDI and its share in industrial production had a positive impact on the labour productivity in domestic firms. Pearce and Singh [22] suggested that Research and Development (R&D) activities in MNCs helped in fulfilling local demand and adjusted production process and technology according to local conditions. Haddad and Harrison [23] found the insignificant productivity spillovers of FDI on Moroccan manufacturing firms but the FDI in joint ventures benefited the productivity spillovers. Kokko [24] found a positive impact of FDI on labor productivity in domestic firms in Mexican manufacturing industry, but such relation did not exist in those industries which had large technology gaps.

Singh *et al.* [25] found in a survey that strategy of the most of foreign firms concentrated on R&D in UK, which could help in raising productivity level. Conyon *et al.* [26] found that FDI had a positive impact on labor productivity after foreign acquisition of the local firms in UK manufacturing firms. Gorg and Strobl [27] surveyed 12,812 manufacturing plants in Ireland. They found that MNEs benefited the domestic firms in high-tech industries, but low-tech industry did not get any benefit from FDI. Branstetter [28] investigated the Japanese investment in United States and found bi-directional knowledge spillovers.

Harris and Robinson [29] claimed that they did not find any positive spillovers of FDI on UK manufacturing plants, even productivity of these plants fell after foreign acquisition. Keller and Yeaple [30] used the data of 1115 US manufacturing firms to find the impact of FDI and imports on productivity spillovers. They found that both FDI and imports had positive impact on productivity spillovers and also found that FDI had greater impact than that of imports. Girma *et al.* [31] used 4,600 UK

manufacturing firms to find the impact of horizontal, backward and forward FDI on productivity spillovers. They found backward and forward productivity spillovers from MNEs to domestic firms. There was no productivity spillover through horizontal linkage.

Chakraborty and Nunnenkamp [32] found that the industry-specific FDI had significant and positive impact on secondary sector, insignificant and positive impact on primary sector and transitory effect on tertiary sector. Singh [33] found that MNEs invested significant amount in specialist technology in water industry, which improved the productivity in this industry. Suyanto *et al.* [34] found positive technological spillovers from FDI in Indonesia through changed technical and scale efficiencies. Whalley and Xin [35] found that labor productivity of the foreign investment enterprises were 20% higher than that of the domestic enterprises.

Methodology: To find the impact of sector-specific FDI on sector-specific labour productivity, the study focuses only on these two variables for primary, secondary and tertiary sectors. The study takes only sector-specific FDI as independent variable and sector-specific labor productivity as dependent variable. Model of labor productivity is as follows:

$$\text{PROD}_{jt} = f(\text{FDI}_{jt}) \quad (1)$$

Where,

PROD_{jt} = Productivity of labour at j sector and t time period

FDI_{jt} = Foreign Direct Investment at j sector and t time

At first, the study will check the stationarity of data by applying ADF and PP unit root test to check the order of integration of individual variable for each sector j. Then Zivot-Andrews unit root test will be applied to check stationarity with possible structural break in the time series. Augmented Dickey Fuller (ADF) unit root test developed by Dickey and Fuller [36] is as follows:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots + \gamma_m \Delta Y_{t-m} + u_t \quad (2)$$

The optimum lag length will be selected through Schwarz Bayesian Criterion (SBC) to remove serial correlation. The equation (2) will also be tested with intercept and time trend to ensure the trend stationary

behavior of time series if any. Second test is Phillips and Perron (PP) [37] unit root test which ignore the $\gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots + \gamma_m \Delta Y_{t-m}$ from ADF equation. As, PP test removes the serial correlation by giving ranks to the residuals. PP's equation is as follows:

$$\Delta Y_t = \alpha + \lambda T + \delta Y_{t-1} + u_t \quad (3)$$

PP test uses the modified statistic Z_t and Z_δ which are as follows:

$$Z_t = \left(\frac{\hat{\sigma}^2}{\hat{\pi}^2} \right)^{1/2} t_{\delta=0} - \frac{1}{2} \left(\frac{\hat{\pi}^2 - \hat{\sigma}^2}{\hat{\pi}^2} \right) \left(\frac{T \cdot SE(\hat{\delta})}{\hat{\sigma}^2} \right) \quad (4)$$

$$Z_\delta = T \hat{\delta} - \frac{1}{2} \frac{T^2 \cdot SE(\hat{\delta})}{\hat{\sigma}^2} (\hat{\pi}^2 - \hat{\sigma}^2) \quad (5)$$

After testing the ADF and PP unit root test, Zivot and Andrews [38] test will be used to find that either with taking one unknown structural break, time series are stationary or not. If there is a problem of structural break in the data and we ignore it then the results of unit root tests are misleading. The equations for Zivot-Andrews unit root test are as follows:

$$\begin{aligned} \text{Model A: } \Delta Y_t &= \mu_1^A + \gamma_1^A t + \mu_2^A DU_t(\lambda) \\ &+ \alpha^A Y_{t-1} + \sum_{j=1}^k \beta_j \Delta Y_{t-j} + \varepsilon_t \end{aligned} \quad (6)$$

$$\begin{aligned} \text{Model B: } \Delta Y_t &= \mu_1^B + \gamma_1^B t + \gamma_2^B DT_t^*(\lambda) \\ &+ \alpha^B Y_{t-1} + \sum_{j=1}^{k-1} \beta_j \Delta Y_{t-j} + \varepsilon_t \end{aligned} \quad (7)$$

$$\begin{aligned} \text{Model C: } \Delta Y_t &= \mu_1^C + \gamma_1^C t + \mu_2^C DU_t(\lambda) + \\ &\gamma_2^C DT_t^*(\lambda) + \alpha^C Y_{t-1} + \sum_{j=1}^{k-1} \beta_j \Delta Y_{t-j} + \varepsilon_t \end{aligned} \quad (8)$$

Where $DU_t(\lambda)$ is 1 and $DT_t^*(\lambda) = t - T\lambda$ if $t > T\lambda$, 0 otherwise. $\lambda = T_B / T$, T_B is for a possible break point.

Model (A) allows for a structural break in the intercept of the time series, Model (B) allows for a structural break in the trend of the time series, while Model (C) allows structural break in both intercept and trend of time series. After testing for unit root problem, ARDL cointegration technique will be applied on the basis of selected lag

length for all sectors separately. ARDL is developed by Pesaran *et al.* [39]. The study uses the SBC to find the optimum lag length. To find the cointegration amongst sector-specific labour productivity and sector-specific FDI, ARDL model is as follows:

$$\Delta PROD_{jt} = \delta_{jc0} + \delta_{c1} PROD_{jt-1} + \delta_{c2} FDI_{jt-1} + \sum_{i=1}^p \beta_{c1i} \Delta PROD_{jt-i} + \sum_{i=0}^q \beta_{c2i} \Delta FDI_{jt-i} + \lambda_c D_{PRODj} + \varepsilon_{jct} \quad (9)$$

In equation (9), first difference of $PROD_{jt}$ is the dependent variable, the null hypothesis is ($H_0: \delta_{c1} = \delta_{c2} = 0$) and alternate hypothesis is ($\delta_{c1} \neq \delta_{c2} \neq 0$) which shows existence of long run relationship in the model, δ_{jc0} is a constant for each j sector and ε_{jct} is error term for respective j sector. D_{PRODj} is included in equation for possible structural break and to complete the information for each sector j separately. This is also shown as $F_{PRODj}(PROD_{jt}/FDI_{jt})$. If cointegration exists in any sector then long run and short run coefficients will be calculated for that sector. Error correction model to find the short run relationship is as follows:

$$\Delta PROD_{jt} = \gamma_{jc} + \sum_{i=1}^p \beta_{c1i} \Delta PROD_{jt-i} + \sum_{i=0}^q \beta_{c2i} \Delta FDI_{jt-i} + \phi_{jc} D_{PRODj} + \phi_{jc} ECT_{jt-1} + \zeta_{jct} \quad (10)$$

is showing the speed of adjustment from short run disequilibrium to long run equilibrium for each sector j . Afterwards, diagnostic tests will be used to check the normality, functional form, heteroscedasticity and serial correlation for each sector j . CUSUM and CUSUMsq statistics will be used to ensure the stability of parameters.

Data: Data on sector-specific labour productivity is generated by taking the contribution of primary, secondary and tertiary sectors in aggregate GDP and it divides each sector's contribution in GDP with labor force employed in that sectors. Data on aggregate GDP, employed labor force, percentage contribution on primary, secondary and tertiary sectors in GDP has been taken from World Bank [40] from the year 1972 to 2010. Data of FDI on primary, secondary and tertiary sector has been taken from State Bank of Pakistan [41].

Empirical Results: At first, the study checks for stationarity of variables. It uses the ADF and PP unit root tests to check the unit root problem. Results are given in the table below.

Table (1) shows that $PROD_i$ is non-stationary in all sectors with both ADF and PP tests. FDI_i in the primary sector is stationary at level at 5% level of significance with intercept and with both intercept & trend with ADF and PP unit root tests. FDI_i in secondary sector is non-stationary with ADF and PP tests with intercept and with both intercept & trend except it is stationary at 1% level of significance with intercept & trend with PP test. FDI_i in tertiary sector is non-stationary with both ADF and PP tests.

Table (2) shows that $PROD_i$ in primary sector is non-stationary with significant break for the year 2000 in intercept, significant break in trend for the year 1998 and significant break in both intercept & trend for the year 1995. $PROD_i$ in secondary sector is non-stationary with significant break for the year 2000 in intercept, significant break for the year 1995 in trend and significant break for the year 2000 in both intercept & trend. EMP_i in tertiary sector is non-stationary with significant break for the year 1995 in intercept, significant break for the year 1981 in trend and significant break for the year 2003 in both intercept & trend. FDI_i in primary sector is stationary at 5% level of significance with

Table 1: Unit Root Tests at Level

| Sector | Variable | ADF | | PP | |
|-----------|----------|------------|------------|------------|-------------|
| | | C | C&T | C | C&T |
| Primary | $PROD_i$ | -1.322 (0) | -1.352 (0) | -1.322 (0) | -1.514 (1) |
| | FDI_i | -3.368*(1) | -3.315*(0) | -3.285*(1) | -3.239*(1) |
| Secondary | $PROD_i$ | -0.936 (0) | -1.998 (1) | -0.864 (1) | -2.002 (1) |
| | FDI_i | 0.441 (3) | -1.303 (3) | -3.155 (2) | -5.641**(1) |
| Tertiary | $PROD_i$ | -1.266 (3) | -2.164 (2) | -0.599 (9) | -1.878 (5) |
| | FDI_i | 1.983 (4) | 1.007 (4) | 1.038 (3) | 0.231 (4) |

Note: *, ** and *** show stationarity of variables at the 0.10, 0.05 and 0.01 level respectively. Brackets contain optimum lag length. C is intercept and C&T is intercept and trend.

Table 2: Unit Root Test: Zivot-Andrews

| Sector | Variable | K | Year of Break | α | t_a | Type of Model |
|-----------|-------------------|---|---------------|----------|--------|---------------|
| Primary | PROD _t | 2 | 2000 | -0.479 | -4.442 | A |
| | | 1 | 1998 | -0.589 | -4.274 | B |
| | | 1 | 1995 | -0.651 | -4.688 | C |
| | FDI _t | 3 | 1997 | -0.723* | -4.935 | A |
| | | 2 | 1990 | -0.812* | -4.560 | B |
| | | 3 | 1987 | -0.963* | -5.281 | C |
| Secondary | PROD _t | 2 | 2000 | -0.561 | -4.136 | A |
| | | 3 | 1995 | -0.479 | -3.141 | B |
| | | 2 | 2000 | -0.521 | -3.405 | C |
| | FDI _t | 2 | 1983 | -1.374* | -5.095 | A |
| | | 3 | 1991 | -1.578** | -5.771 | B |
| | | 3 | 1992 | -1.579** | -5.671 | C |
| Tertiary | PROD _t | 2 | 1995 | -0.413 | -2.973 | A |
| | | 1 | 1981 | -0.278 | -1.824 | B |
| | | 0 | 2003 | -0.206 | -1.857 | C |
| | FDI _t | 1 | 2003 | -0.182 | -1.405 | A |
| | | 0 | 2003 | -1.405** | -5.551 | B |
| | | 0 | 2003 | -2.388** | -9.182 | C |

Note: * and ** show stationarity of variables at the 0.05 and 0.01 level respectively.

Table 3" Unit Root Tests at First Difference

| Sector | Variable | ADF | | PP | |
|-----------|-------------------|-------------|-------------|--------------|--------------|
| | | C | C&T | C | C&T |
| Primary | PROD _t | -5.077**(1) | -5.041**(1) | -5.048**(2) | -5.005**(2) |
| | FDI _t | -8.374**(1) | -8.254**(1) | -10.387**(6) | -10.887**(7) |
| Secondary | PROD _t | -6.401**(1) | -6.311**(1) | -6.488**(5) | -6.339**(5) |
| | FDI _t | -3.236*(3) | -3.745**(3) | -5.804**(5) | -5.414**(4) |
| Tertiary | PROD _t | -4.132**(2) | -4.089**(2) | -6.693**(5) | -6.591**(5) |
| | FDI _t | -4.678**(4) | -5.503**(4) | -7.811**(4) | -8.463**(3) |

Note: * and ** show stationarity of variables at the 0.05 and 0.01 level respectively. Brackets contain optimum lag length.

significant break for the year 1997 in intercept, significant break for the year 1990 in trend and significant break for the year 1987 in both intercept & trend. FDI_t in secondary sector is stationary at 5% level of significance with significant break for the year 1983 in intercept. It is stationary at 1% level of significance with significant break for the year 1991 in trend and significant break for the year 1992 in both intercept & trend. FDI_t in tertiary sector is non-stationary with significant break for the year 2003 in intercept. It is stationary at 1% level of significance with significant break for the year 2003 in trend and in both intercept & trend. FDI_t in tertiary sector becomes stationary by considering significant structural break. It was not stationary with ADF and PP tests.

Table (3) shows that PROD_t is stationary at 1% level of significance with both ADF and PP unit root tests in all sectors. FDI_t in primary sector is stationary at 1% level of significance in both ADF and PP tests. FDI_t in secondary sector is stationary at 1% level of significance in both ADF and PP tests except in ADF test with intercept at 5% level of significance. FDI_t in tertiary sector

is stationary at 1% level of significance in both ADF and PP tests.

There is evidence for mix order of integration I(0) and I(1) in all sectors. So, ARDL model is suitable to apply here. The study finds the optimum lag length for ARDL model by using SBC and then includes dummy variable D_{PROD} for each sector's model separately and using dummy variable is also helping to complete the information in the models. Optimum lag length is 1 for PROD_t and 0 for FDI_t in primary sector labour productivity model. The study selects the year 1995 for break period and put 0 from 1972 to 1991 and 1 afterward in D_{PROD}. Optimum lag length is 1 for PROD_t and 0 for FDI_t in secondary sector labour productivity model. The study selects the year 2000 for break period and puts 0 from 1972 to 2000 and 1 afterwards in D_{PROD}. Optimum lag length is 1 for PROD_t and 1 for FDI_t in tertiary sector labour productivity model. The study selects the year 2003 for break period and put 0 from 1972 to 2003 and 1 afterwards in D_{PROD}. The calculated F-statistic for selected ARDL models are given in table (4).

Table 4: ARDL Bound Test

| Sector | VARIABLES (when taken as a dependent) | F-Statistic (Calculated) | At 0.05 | | At 0.01 | |
|-----------|--|-----------------------------|---------|-------|---------|-------|
| | | | I(0) | I(1) | I(0) | I(1) |
| Primary | d(PROD _{it}) | 6.983** | 3.615 | 4.913 | 5.018 | 6.610 |
| Secondary | d(PROD _{it}) | 8.286** | 3.615 | 4.913 | 5.018 | 6.610 |
| Tertiary | d(PROD _{it}) | 8.925** | 3.615 | 4.913 | 5.018 | 6.610 |

** Means at 1%, 5% significant levels reject the null hypotheses of no cointegration

* Means at 5% significant level reject the null hypotheses of no cointegration

Table 5: Long Run Results: Dependent Variable is PROD_{it}

| Sector | Regressor | Parameter | S. E. | t-Statistic | P-value |
|-----------|-------------------|-------------------------|---------------------|-------------|---------|
| Primary | FDI _{it} | 3.51E ⁻³ * | 1.91E ⁻³ | 1.842 | 0.074 |
| | C | 605.169*** | 219.455 | 2.758 | 0.008 |
| | D _{PROD} | 192.231*** | 31.241 | 6.153 | 0.000 |
| Secondary | FDI _{it} | 5.78E ⁻⁶ *** | 1.85E ⁻⁶ | 3.129 | 0.004 |
| | C | 981.553*** | 49.697 | 19.751 | 0.000 |
| | D _{PROD} | 127.336 | 123.617 | 1.030 | 0.310 |
| Tertiary | FDI _{it} | 1.62E ⁻⁶ ** | 6.25E ⁻⁷ | 2.588 | 0.014 |
| | C | 1837.469*** | 655.341 | 2.803 | 0.007 |
| | D _{PROD} | 403.771*** | 111.844 | 3.610 | 0.001 |

Note: *, ** and *** show stationarity of variables at the 0.10, 0.05 and 0.01 level respectively.

Table 6: Error Correction Model: Dependent Variable is dPROD_{it}

| Sector | Regressor | Parameter | S. E. | t-Statistic | P-Value |
|-----------|--------------------|-------------------------|---------------------|-------------|---------|
| Primary | dFDI _{it} | 5.96E ⁻⁵ *** | 1.68E ⁻⁵ | 3.550 | 0.001 |
| | C | 4.162 | 7.278 | 0.572 | 0.571 |
| | D _{PROD} | 71.891 | 48.413 | 1.485 | 0.147 |
| | ECT _{t-1} | -0.169 | 0.111 | -1.528 | 0.136 |
| Secondary | dFDI _{it} | 5.14E ⁻⁶ | 5.26E ⁻⁶ | -0.978 | 0.335 |
| | C | 26.891** | 12.828 | 2.096 | 0.044 |
| | D _{PROD} | -67.935 | 76.935 | -0.879 | 0.385 |
| | ECT _{t-1} | -0.290* | 0.160 | -1.813 | 0.076 |
| Tertiary | dFDI _{it} | 4.61E ⁻⁸ * | 2.31E ⁻⁸ | 1.989 | 0.055 |
| | C | 49.582** | 21.462 | 2.345 | 0.025 |
| | D _{PROD} | -129.971 | 124.645 | -1.043 | 0.305 |
| | ECT _{t-1} | 0.0103 | 0.0109 | 0.947 | 0.351 |

Note: *, ** and *** show statistically significance of parameters at the 0.10, 0.05 and 0.01 level respectively.

Table 4 shows that the F-value for all sectors is greater than upper bound values at 1% level of significance. So long run relationships exist in the models of all sectors.

Table (5) shows the results of long run estimates with selected ARDL models. The coefficient of FDI_{it} in primary sector is positive and significant at 10% level of significance. FDI_{it} has a positive and significant impact on PROD_{it} in primary sector. Intercept is positive and significant at 1% level of significance. Coefficient of D_{PROD} is positive and significant. So, intercept has changed after the year 1995. The results of secondary sector model show that the coefficient of FDI_{it} in secondary sector is positive and significant at 1% level of

significance. FDI_{it} has a positive and significant impact on PROD_{it} in secondary sector. Intercept (C) is positive and significant. The coefficient of D_{PROD} is positive but insignificant. The results of tertiary sector model show that the coefficient of FDI_{it} in tertiary sector is positive and significant at 5% level of significance. FDI_{it} has a positive and significant impact on PROD_{it} in tertiary sector. Intercept (C) is positive and significant at 1% level of significance. The coefficient of D_{PROD} is positive and significant. So, intercept has changed after the year 2003.

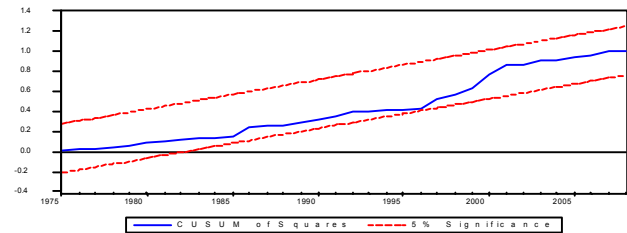
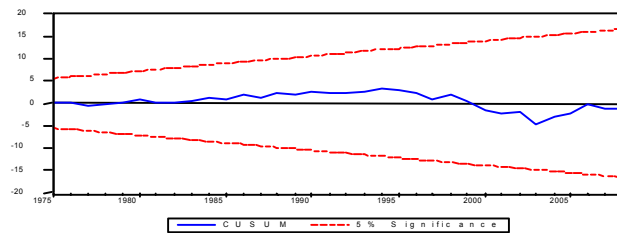
Table (6) shows the estimates of short run. Results of primary sector show that all coefficients are insignificant except dFDI_{t-1}. The coefficient of ECT_{t-1} is negative and insignificant. So, there is no short run relationship in

Table 7: Diagnostic Tests

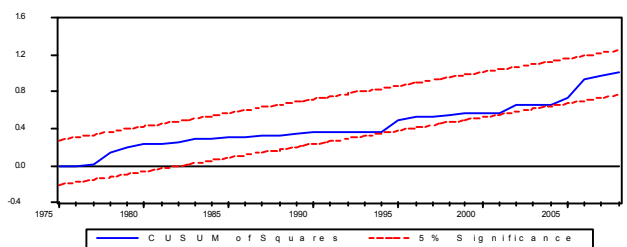
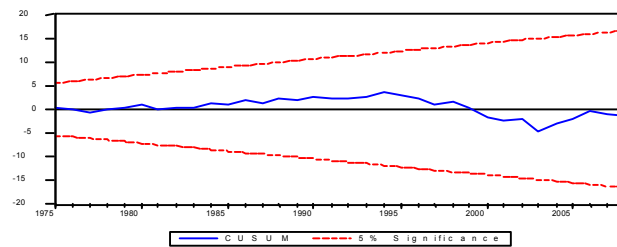
| Sector | Serial Correlation (χ^2) | Functional Form (χ^2) | Normality (χ^2) | Heteroscedasticity (χ^2) |
|-----------|---------------------------------|------------------------------|------------------------|---------------------------------|
| Primary | 0.004 (0.915) | 1.620 (0.203) | 0.541 (0.363) | 0.086 (0.770) |
| Secondary | 0.533 (0.466) | 2.160 (0.142) | 0.111 (0.946) | 2.105 (0.157) |
| Tertiary | 1.414 (0.234) | 1.263 (0.270) | 0.953 (0.493) | 1.146 (0.312) |

Note: Brackets contain p-values

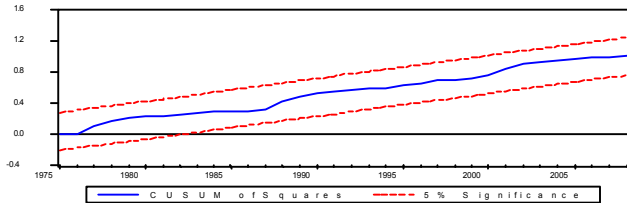
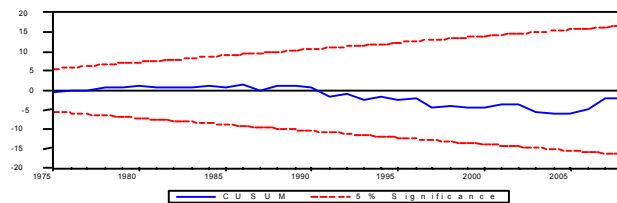
Primary Sector



Secondary Sector



Tertiary sector



the model of labour productivity of primary sector. Results of secondary sector show that the coefficients of all variables are insignificant except C. Coefficient of ECT_{t-1} is negative and significant at 10% level of significance. The short run relationship exists in secondary sector's labour productivity model and speed of adjustment is 29% in a year. The results of tertiary sector show that the coefficients of $dFDI_t$ and C are positive and significant. The coefficient of D_{PROD} is negative and insignificant. The coefficient of ECT_{t-1} is positive and insignificant. The short run relationship does not exist in tertiary sector's labour productivity model.

Results of Table (7) show that p-values of serial correlation, functional form, normality and heteroscedasticity are greater than 0.10 in case of all sector's models. So, there is no problem of serial

correlation, functional form, normality and heteroscedasticity in the models.

Figures are showing CUSUM and CUSUMsq tests for primary, secondary and tertiary sectors. Figures show that CUSUM and CUSUMsq do not exceed the critical boundaries at 5% level of significance in all sectors. So, the estimates calculated for these sectors are reliable and efficient.

CONCLUSIONS

To find the impact of sector-specific FDI on sector-specific labour productivity, the study uses sector-specific FDI as independent variables and sector-specific labor productivity as dependent variable. The study uses the data of primary, secondary and

tertiary sectors and data is taken from 1972 to 2010 for analysis. The study uses ARDL cointegration bound testing technique to find the long run and short run relations for each sector separately. The results show that the long run relationships exist in the labour productivity model of all sectors. The short run relationship exists in case of secondary sector's labour productivity model. The short run relationships do not exist in case of primary and tertiary sector's labor productivity models. Sector-specific FDI has positive and significant impact on labor productivity in case of all sectors. So, the study concludes that FDI is helpful in raising labor productivity in all sectors in Pakistan.

REFERENCES

1. Fosfuri, A., M. Motta and T. Ronde, 2001. Foreign Direct Investment and Spillovers through Workers' Mobility. *Journal of International Economics*, 53: 205-222.
2. Blomstrom, M. and A. Kokko, 1998. Multinational Corporations and Spillovers. *Journal of Economic Surveys*, 12(3): 247-277.
3. MacDougall, G.D.A., 1960. The Benefits and Costs of Private Investment from Abroad: A Theoretical Approach. *Economic Record*, 36: 13-35.
4. Streeten, P., 1969. New Approaches to Private Investment in Less Developed Countries. J.H. Dunning (ed.), *International Investment*. Penguin Books, Harmondsworth, pp: 436-452.
5. Caves, R.E., 1971. International Corporations: The Industrial Economics of Foreign Investment. *Economica*, 38: 1-27.
6. Buckley, P.J. and M. Casson, 1976. The Future of the Multinational Enterprise. Macmillan.
7. Buckley, P.J. and M. Casson, 1981. The Optimal Timing of Foreign Investment. *Economic Journal*, 91: 75-87.
8. Magee, S.P., 1977. Information and Multinational Corporations: An Appropriability Theory of Direct Foreign Investment. In: J. Bhagwati (ed). *The New International Economic Order*. MIT Press, Cambridge, MA, pp: 317-340.
9. Casson, M.C., 1987. The Firm and the Market: Studies in Multinational Enterprise and the Scope of the Firm. Blackwell and Cambridge, MA: MIT Press.
10. Findlay, R., 1978. Relative Backwardness, Direct Foreign Investment and the Transfer of Technology: A Simple Dynamic Model. *Quarterly Journal of Economics*, 92: 1-16.
11. Koizumi, T. and K.J. Kopecky, 1977. Economic Growth, Capital Movements and the International Transfer of Technical Knowledge. *Journal of International Economics*, 7: 45-65.
12. Das, S., 1987. Externalities and Technology Transfer through Multinational Corporations—A Theoretical Analysis. *Journal of International Economics*, 22: 171-182.
13. Wang, J.Y. and M. Blomstrom, 1992. Foreign Investment and Technology Transfer-A Simple Model. *European Economic Review*, 36: 137-155.
14. Dunning, J.H., 1993. MNEs, the Balance of Payments and the Structure of Trade. In: Dunning, J.H. (ed.). *Multinational Enterprises and the Global Economy*. Addison-Wesley. Wokingham, UK and Reading, MA.
15. Hanson, G.H. R.J. Mataloni and M.J. Slaughter, 2001. Expansion Strategies of U.S. Multinational Firms. NBER Working Paper No. 8433, National Bureau of Economic Research, Cambridge, MA.
16. Pearce, R.D. and S. Singh, 1991. *Globalising Research and Development*. Macmillan.
17. Caves, R.E., 1974. Multinational Firms, Competition and Productivity in Host-Country Markets. *Economica*, 41: 176-193.
18. Blomstrom, M. and H. Persson, 1983. Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from the Mexican Manufacturing Industry. *World Development*, 11: 493-501.
19. Chen, E.K.Y., 1983b. Multinational Corporations and Technology Diffusion in Hong Kong Manufacturing. *Applied Economics*, 15: 309-321.
20. Fairchild, L. and K. Sosin, 1986. Evaluating Differences in Technological Activity between Transnational and Domestic Firms in Latin America. *Journal of Development Studies*, 22: 697-708.
21. Blomstrom, M. and E.N. Wolff, 1989. Multinational Corporations and Productivity Convergence in Mexico. Working Paper No. 89-28, C.V. Starr Center for Applied Economics, New York University, New York.
22. Pearce, R.D. and S. Singh, 1991. *Globalising Research and Development*. Macmillan.
23. Haddad, M. and A. Harrison, 1993. Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco. *Journal of Development Economics*, 42: 51-74.

24. Kokko, A., 1994. Technology, Market Characteristics and Spillovers. *Journal of Development Economics*, 43: 279-293.
25. Singh, S., M. Utten and M. Waterson, 1998. Strategic Behaviour of Incumbent Firms in the UK. *International Journal of Industrial Organisation*. 16: 229-251.
26. Conyon, M., S. Girma, S. Thompson and P. Wright, 1999. The Impact of Foreign Acquisition on Wages and Productivity in the UK. GLM Research Paper No. 99/8, University of Nottingham, UK: Centre for Research on Globalisation and Labor Markets, Nottingham.
27. Gorg, H. and E. Strobl, 2000. Multinational Companies, Technology Spillovers and Plant Survival: Evidence for Irish Manufacturing. EEG Working Paper No.8/2001. European Economy Group, Madrid.
28. Branstetter, L., 2000. Is Foreign Direct Investment a Channel of Knowledge Spillovers? Evidence from Japan's FDI in the United States. NBER Working Paper No. 8015, Cambridge, MA.
29. Harris, R. and C. Robinson, 2002. The Effect of Foreign Acquisitions on Total Factor Productivity: Plant-level Evidence from UK Manufacturing, 1987-1992. *Review of Economics and Statistics*, 84: 562-568.
30. Keller, W. and S.R. Yeaple, 2003. Multinational Enterprises, International Trade and Productivity Growth: Firm Level Evidence from the United States. NBER Working Paper No. 9504, National Bureau of Economic Research, Cambridge, MA.
31. Girma, S., H. Gorg and M. Pisu, 2004. The Role of Export and Foreign Linkages for FDI Productivity Spillovers. GEP Research Paper. University of Nottingham, Leverhulme Centre for Research on Globalisation and Economic Policy, Nottingham.
32. Chakraborty, C. and P. Nunnenkamp, 2006. Economic Reforms, Foreign Direct Investment and its Economic Effects in India. Kiel Working Paper No. 1272, The Kiel Institute for the World Economy, Duesternbrooker Weg 120, 24105 Kiel, Germany.
33. Singh, S., 2008. Water Industry. Background paper prepared for UNCTAD, Mimeo.
34. Suyanto, R., A. Salim and H. Bloch, 2009. Does Foreign Direct Investment Lead to Productivity Spillovers? Firm Level Evidence from Indonesia. *World Development*, 37(12): 1861-1876.
35. Whalley, J. and X. Xin, 2010. China's FDI and non-FDI Economies and the Sustainability of Future High Chinese Growth. *China Economic Review*, 21, 123-135.
36. Dickey, D. and W. Fuller, 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49: 1057-1072.
37. Phillips, P.C.B. and P. Perron, 1988. Testing for Unit Roots in Time Series Regression. *Biometrika*, 75: 335-346.
38. Zivot, E. and D.W.K. Andrews, 1992. Further Evidence on the Great Crash, the Oil-Price Shock and the Unit Root Hypothesis. *Journal of Business and Economic Statistics*, 10(3): 251-270.
39. Pesaran M.H., Y. Shin and R. Smith, 2001. Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, pp: 289-326.
40. World Bank, 2010. World Development Indicators. World Bank, Washington, DC.
41. State Bank of Pakistan, 2010. Foreign Liabilities & Assets and Investment in Pakistan. State Bank of Pakistan, Karachi, Pakistan.