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Foreign Direct Investment Inflows and Labor Productivity in Pakistan: A Sector-Wise Panel Cointegration Analysis

Ayesha Serfraz[1]

[1]*Doctoral Student at University of Hamburg, Germany. Assistant Professor at University of the Punjab, Lahore, Pakistan*
Email: ayesha.serfraz@live.com Tel: +92-300-4426557

Abstract

This study empirically analyzes the effects of sector-wise FDI inflows on respective sector-wise labor productivity for a panel of seven major sectors of Pakistan's economy covering time period of 1997-2016. For empirical analysis, sector-wise FDI inflows has been used as an independent variable while sector-wise labor productivity is a dependent variable. Initial tests conclude that LSDV fixed effects model is the most appropriate test for the data being used for empirical analysis. Further tests confirm the existence of a long-run Cointegration between these two variables. Wald test shows that a uni-directional short-run causality exists, running from sector-wise labor productivity to sector-wise FDI inflows. Pair-wise Granger-Causality test further shows that the effects of FDI inflows are not limited to one sector, rather there is an evidence of spillover effect from one sector to an-other. All empirical tests conclude that sector-wise FDI inflows positively affect sector-wise labor productivity in case of Pakistan.

Keywords: Sector-wise FDI inflows, Sectors-wise labor productivity, Panel cointegration, Spillovers, Pakistan.
JEL Classification: F21, J01, C10.

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Contents

1. Introduction

It is generally accepted by researchers that foreign direct investment (FDI) inflows cause positive impact on recipient country by way of boosting economic growth through transfer of better technology, knowledge and skills, training, education opportunities and many more. Further as added by Kurtishi-Kastrati (2013) FDI inflows lead to capacity building of labor and entrepreneurs. In addition, it leads to an improvement in social conditions. Johnson (2005) adds that FDI helps in growth of international trade by flow of goods and capital from one part of the world to the other part. This invariably takes place through MNCs and thus FDI has become an important factor in the process of globalization. Regarding labor productivity, particularly in developing economies, recent debates have resulted in different answers. In some countries FDI inflows do increase labor productivity by providing more technical know- how especially in case of MNCs which are responsible for providing better training, resulting in an increase in wages and that in turn raises standard of living and thus causes an enhancement in labor productivity. This relationship has been discussed theoretically and tested empirically in the recent paper by the same author i.e., Serfraz (2017). On the other hand, labor productivity may fall due to replacement of labor by capital in the form of high technology, especially in case of labor abundant countries, since absorptive capacity of labor serves as a hurdle. MNCs cause wage differentials by hiring the already better trained labor and refining their skills by providing higher training. Also education plays a very important role in increasing labor productivity. Although role of MNCs results in unequal distribution of income and misallocation of resources, but the afore-mentioned advantages cannot be ignored. The extent of productivity growth caused by FDI varies from country to country. Therefore it would be incorrect to claim that FDI inflows do not increase productivity at all. It does increase productivity and growth but not at a uniform level. Pakistan has also benefitted from FDI inflows and presently, it is attracting higher amount of FDI due to liberalization policies. The advantages have been observed in the form of technology transfer, increase in labor productivity, reducing saving-investment gap etc. If the research is narrowed down to analyze the impact of FDI inflows on individual sectors rather than economy as a whole, many studies have argued that FDI inflows benefit individual sectors though not every sector equally. It may be due to the biasedness of foreign investors caused by ease of doing business in a particular sector as compared to the other. Mostly industrial and services sectors attract more FDI inflows as compared to other sectors like agriculture because these two sectors hire more educated and skilled people viz a viz labor force employed in agriculture sector. Consequently it becomes easy for foreign investors to train the already skilled labor.

Overall economic growth of any country is a measure of its level of development but sectoral growth cannot be ignored since sectors of any country are its building blocks and play a vital role in increasing economic growth.

According to Pakistan Bureau of Statistics[1], the three main sectors of Pakistan's economy are agriculture, industry and services. But these sectors are further divided into sub-sectors like food, mining, trade, transport, construction etc. Majority of discussion related to sectors is confined to these three main sectors. Moreover the relationship between sector-wise FDI inflows with reference to growth of respective sectors does not focus on sector-wise labor productivity. Regarding growth, it has been established in literature that sector-wise FDI inflows increase sector-wise growth especially related to industrial sector.

Pakistan needs to introduce more investment friendly policies, particularly for foreign investors, to increase FDI since more FDI inflows will not only increase the growth of individual sectors but also the overall growth of economy. Many authors (detailed discussion available in literature review) have suggested the same for other developing countries. At the same time, there are controversies related to the impact of FDI inflows on various sectors. There is a lot of discussion about sector-wise FDI inflows and economic growth but not much has been discussed about sector specific labor productivity. Whether, sector-wise FDI inflows increase respective sector-wise labor productivity or not, this is the main innovative point of the present study and is actually an addition to the present knowledge on the subject. This paper is an extension of the previous research carried out by the same author, i.e. Serfraz (2017) in which an empirical analysis has been conducted to analyze short run and long run causality between FDI inflows and labor productivity in Pakistan. Now the main focus is to find out the relationship between sector-wise FDI inflows and related labor productivity for seven major sectors of Pakistan's economy.

A panel of seven sectors has been taken along-with sector specific labor productivity to empirically analyze the relationship. Sector-wise FDI inflows and sector-wise labor productivity data has been used.

Panel unit root tests have been applied. Since panel data tests can be applied as fixed effects, random effects or pooled LSDV model, the empirical part first proves that which test and static panel data model is suitable for the data being used to carry out empirical analysis. After getting confirmed results about type of static panel data model, panel Cointegration tests have been conducted. Therefore, this study does not directly jump to the type of model to be used, but all initial tests have been presented in empirical section and conclusion is drawn on the basis of results. Also empirical section throws light on characteristics of panel data models and as to what are their advantages and disadvantages.

The seven sectors used in this study are:-

1- Agriculture
2- Manufacturing and mining
3- Construction
4- Electricity and gas distribution
5- Transport
6- Trade
7- Others (financing, real estate, business services, extra territorial and other public and private services).

[1] http://www.pbs.gov.pk/content/what-are-major-sectors-economy-pakistan

For this purpose the data from 1997-2016 has been used. Data prior to 1997 has not been estimated, therefore this puts a limitation on the study.

For each sector, FDI inflows have been estimated along-with the labor specific to the sector. The details of data are also mentioned in coming chapters of the paper.

This paper is divided into four main sections. Section 1 explains the introduction and objective of study. Section 2 throws light on literature review with sub-sections dealing with available literature, both national and international studies, relating to the topic under discussion. Also, it highlights the gaps in existing body of knowledge and contribution made by present study. Detailed empirical analysis has been presented in section 3 with sub-sections explaining different steps, empirical tests and their interpretations. Last section concludes the study along-with policy recommendations.

1.1. Contribution and Objective of the Study

After establishing a positive relationship between FDI inflows and labor productivity in case of Pakistan in the previous paper (Serfraz, 2017) this study, instead of analyzing FDI's impact on the growth of different sectors of Pakistan's economy, aims at examining the sector-wise FDI inflow and its effect on respective sector-wise labor productivity in Pakistan. For this purpose, seven major sectors have been taken along-with the data of labor force hired in those particular sectors.

Whereas majority of the studies have concentrated on the relationship between sector-wise FDI inflows and growth, the unique contribution of this study in the existing literature is that it analyzes the relationship between each sector's FDI inflows and its corresponding impact on labor productivity. Furthermore, this study is one of the very few studies which has investigated the relationship between FDI and respective labor productivity of 'seven' major sectors of Pakistan's economy for empirical analysis instead of empirically analyzing 'growth' of two or three sectors. The reason behind taking these seven sectors and not more, is due to the limitation on availability of data. Those sectors have been included for which data is available for all the years (1997-2016).

2. Literature Review

Literature review is divided into three sections. Section 1 deals with the relevant literature on the topic available in international studies. Also the established relationships of individual sectors will be discussed in detail since the available literature has used different sectors for analyzing the relationship. In section 2, studies related to Pakistan will be analyzed. Section 3 sums up the literature explaining the gaps which will be filled by the present study.

2.1. International Studies

Maathai and Sahoo (2008) carried out an empirical analysis to examine the effects of FDI inflows to nine major sectors of India using panel Cointegration approach covering time period from 1991-92 to 2004-05. Their empirical findings suggested a positive impact of FDI inflows on output, labor productivity and exports on drugs and pharmaceuticals sectors. In case of transport and metallurgical sectors, FDI inflows and labor productivity revealed a positive Cointegration whereas FDI inflows did not show a positive impact on labor-intensive sectors like transport and chemicals due to backwardness of labor. Their overall conclusion showed a negative impact on labor productivity and an increase in FDI inflows did not reveal any positive impact on Indian economy at the sectoral level both in terms of output and labor productivity.

Dürnel (2012) empirically investigated the effects of FDI inflows on ten individual sectors of Turkish economy. Using panel Cointegration and Granger-Causality test for the time period of 2000-2009, the study concluded that FDI inflows seemed to benefit growth rate mostly in the Manufacturing, Electricity, Gas and Water, Wholesale and Retail Trade sectors. The essential findings of the study suggested that Foreign Direct Investment contributed towards overall growth rate of Turkish economy. The results indicated that though all the sectors were not benefitting from FDI inflows equally but, it was found that FDI inflows increased labor productivity which resulted in an increase in sectoral growth at different levels and to various extents.

Bang *et al.* (2007) Carried out an empirical analysis to study the impact of FDI inflows on economic growth of China and Vietnam, using sectoral data of China from 1997-2004 and 1995-2003 for Vietnam. The results revealed that though FDI directly showed a significant and positive effect on economic growth as well as through its interaction with labor productivity in both countries, but, the impact was not evenly distributed across sectors. In both the countries, the industrial sector seemed to be the only sector to consistently benefit from FDI inflows as compared to other sectors.

According to Alam *et al.* (2008) Eastern European countries and Former Soviet union have observed high economic growth in recent years due to increased level of investment. According to the author, productivity growth is the most important factor for increasing overall economic growth. An increase in productivity leads to an increase in profits and consequent investment. Resultantly, wages grow upwards, leading to an increase in standard of living which enhances labor productivity. As a result, the sectors which receive higher investment also have more productive labor force. Author focuses on three main sectors of economy, i.e., agriculture, manufacturing and services. The allocation of resources to relevant sectors directly affects sector-wise productivity and the labor attached to that sector. Due to increase in investment in a particular sector leads to transfer of labor from less productive sector (agriculture) towards more productive sectors (manufacturing and services). At the same time, labor moving to more productive sectors also showed an increase in productivity relevant to that sector.

From this study it can be inferred that labor productivity cannot be determined in isolation, rather sectoral productivity and labor productivity are related and dependent on each other.

Same conclusion has been derived in a study conducted by Mallick (2015). Author carried out an empirical analysis for examining the structural changes and effects of globalization in the form of FDI inflows and economic integration, on labor productivity growth in BRICS countries using shift-share analysis, dynamic panel data method and input-output tables covering the time period of 1990-91 to 2011-12. The empirical findings suggested a high labor productivity growth in BRICS due to globalization and economic integration policies. FDI inflows

resulted in a two way causality, i.e., FDI inflows affect labor productivity and in turn labor productivity increases sectoral growth resulting in reallocation of labor towards more productive sectors. In addition, the results also suggested that due to FDI inflows, labor is shifting to non-agriculture sectors in case of India and China, and towards services sector in Brazil, Russia and South Africa.

Ilboudo (2014) tested the hypothesis that Solow Residual or TFP can be targeted to increase sectoral growth for mining sector of Chile. Highlighting the importance, author mentions that the mining sector of Chile is one of the most important sectors of Chilean economy and almost one-third of government income comes from copper exports. Using Cobb-Douglas production function, the study revealed a long run relationship between FDI inflows and labor productivity for mining sector of Chile.

Vu and Noy (2009) conducted an empirical study using sector-wise data for a group of six member countries of OECD. They analyzed the relationship between sector-specific impacts of FDI on growth in developed economies. Using cross-country regression, they found that the impact of FDI inflows may be positive or negative depending on direct impact on economy or through an increase in labor productivity. Also different results were obtained across countries and sectors. For some sectors, there was a positive relation and for others it was negative; real estate and financial sector showed a negative but significant effect. Only mining and quarrying showed positive and significant results. In the end, they suggested that FDI in certain sectors is more productive and has high labor productivity and the level of productivity differs across sectors.

Msuya (2007) examined the impact of FDI inflows on agricultural sector of Tanzania. The qualitative study by author suggests that the crops produced by small farmers organized in small holders set-ups attract more FDI as compared to others. Labor productivity depends on many macroeconomic variables including investment regulatory frameworks, policies that promote macroeconomic stability, and improved physical infrastructure. In addition author recommended that creation of 'strong bonds' between small holders and investors through more integration, would help in attracting more FDI inflows to agricultural sector but this should be extended to developing strong institutions in all sectors. This would lead to more FDI inflows which would further increase the productivity and reduction in poverty.

Moving on to industrial sector, Fillat and Woerz (2011) conducted an empirical analysis for examining the impact of FDI on output and productivity using industrial level data for a panel of 35 OECD, Asian and Eastern European countries. Their study concluded that FDI inflows lead to higher labor productivity and output in industrial sector of 'catching-up' or developing countries as compared to developed countries but the productivity differs across industries. Therefore such policies must be devised which can attract more FDI especially in those industries where labor is more productive as it would lead to a higher output.

Bijsterbosch and Kolasa (2010) carried out an empirical analysis for investigating the effect of FDI inflows on productivity by using industrial level data of Central and Eastern European countries. Their findings suggested that FDI leads to increase in productivity both at country and industrial sector level but it depends on area and absorptive capacity. If labor is more efficient and productive, the absorptive capacity results in more benefits from FDI inflows. They also found the evidence that level of labor productivity or human capital is positively associated with a larger impact of FDI though labor productivity levels have throughout remained depressed outside the euro area as compared to the euro area. In the year 2006, the output of industry was almost one-third of the euro area. The productivity level in services sector was almost half of the euro area while the pattern varied across the countries in the sector of construction.

Azeroual (2016) undertook an empirical analysis for examining the impacts of FDI inflows from France and Spain on the TFP of manufacturing sector of Morocco. Author used GMM system in dynamic panels for a subset of 22 branches of this sector between 1985 and 2012 and found that the impact varied depending on the source from which the FDI originated. The impact on TFP from French FDI was negative, and significant, in medium and high level technology industries while the impact of Spanish FDI was significantly positive. The negative impact of French FDI could be attributed to (i) productivity gap between Moroccan and French companies due to high difference in labor productivity and efficiency (ii) the investment rate and control on technology transfer in the hands of French investors. FDI from Spain seemed significant and positive on TFP though the positive impact was weak. French participation, being mostly concentrated in medium and high technology sectors, ranging between 30 percent of foreign ownership, and sometimes going above 70 percent in the case of automotive industry and transport equipment manufacturing.

Morrar and Gallouj (2016) in their empirical study examined the main factors which contribute to growth in services sector of Palestine. The results of panel data analysis suggested a positive and significant effect of FDI on the labor productivity growth while capital intensive service sectors exercised greater influence on labor productivity growth. Other public services like retail trade, the sale and repair of motor vehicles and land transport are on weaker growth trajectory. The political instability adds fuel to the fire by further affecting the productivity growth of services sector. The author recommends that government should concentrate on policies which create new jobs for those thousands who lost their jobs inside Israel along-with increasing productivity of its unskilled workers.

Alam *et al.* (2013) conducted an empirical analysis to examine the causality between economic growth, FDI inflows and labor productivity using a panel of 19 OECD member countries for the time period of 1980-2009. The results suggested the evidence of causality but after 1995, the policies favored in shifting FDI inflows towards manufacturing and services sectors where technological spillovers were high due to higher labor productivity in these sectors which resulted in both short run and long run causality.

Mallick (2013) argues that due to globalization, advancement in technology and factor of competition, the demand for productive labor is increasing since skilled and productive labor in every economic sector leads to an overall economic growth. For empirically analyzing this relationship, author conducted an analysis using panel estimation on data extracted from OECD and WDI covering time period from 1990-91 to 2011-12. The results of multiple regression also suggested that the indicators of globalization like FDI inflows and openness of economy have positive and significant impact on labor productivity both in individual sectors and economy as a whole.

Kirti and Prasad (2016) studied the impact of FDI inflows on Indian economy taking both sectoral analysis and combined effect together. The OLS estimation results revealed that FDI has both positive and negative effects on sectors and economy. They found that FDI leads to unemployment due to the use of capital intensive technology which replaces labor. Regarding sector-wise analysis, they suggested that if capital intensive technology is used in agricultural sector (most backward sector of economy), this will lead to an increase in output based on high labor productivity due to spillover effects from technology transfer. However, manufacturing and services sectors are attracting more FDI due to high labor productivity in the respective sectors.

Thangavelu *et al.* (2015) analyzed the impacts of trade on labor productivity of services sector for five ASEAN countries—Indonesia, Malaysia, the Philippines, Singapore, and Thailand. They used fixed effects and GMM estimators for the time period of 1990-2005. Four subsectors have been used for empirical analysis, i.e., (i) wholesale, retail, and hotel; (ii) transport, storage, and communications; (iii) finance, insurance, and real estate; and (iv) community, social, and personal sectors. The results show that the more exposure to exports leads to an increase in labor productivity in all these five countries. Furthermore, higher FDI inflows lead to increase in productivity and output of services sector which then provides inputs for manufacturing sector in the region. Therefore author suggests that such policies must be adopted which would lead to more openness and exposure to foreign investment for the advancement of services sector since it supports manufacturing sector as well. Their results also highlight that increase in labor productivity and mobility of skilled labor will lead to an increase in services sector to the overall growth of both domestic and regional economies.

Thuy (2007) investigated the effects of FDI inflows on industrial sector of Vietnam using industry level panel data for 29 industrial sectors during the periods of 1995-1999 and 2000-2002. The author also made an attempt to estimate the extent to which FDI inflows generate spillover effects on industrial sector. The empirical results revealed that FDI inflows lead to reduction in government budget deficit, increased exports and employment opportunities and have a positive impact on industrial growth and productivity. The results also indicate that FDI inflows lead to an increase in industrial labor productivity in the form of spillover effects.

Contessi and Weinberger (2009) in their study analyzed the empirical literature on the studies analyzing the relationship between FDI, productivity and growth. Their main emphasis was on studies that used aggregate data and focused on finding the answers of two questions: Is there evidence of a positive relationship between foreign direct investment and national growth? And does the output of the "multinational sectors" exhibit higher labor productivity? According to authors, the available literature provides ambiguous results but majority of studies have concluded that MNCs and FDI inflows lead to increase in labor productivity, wages and employment. These results are specifically true if compared with domestic firms who do not have enough resources to provide better opportunities to domestic labor, FDI not only increases labor productivity but also makes use of human capital by providing more employment opportunities and higher wage rate which leads to sectoral and overall economic growth.

This section of literature review has some important implications. First, all studies agree that FDI inflows and openness lead to increase in labor productivity and sectoral growth. Also an important point to highlight is that, not all sectors enjoy same level of benefits. In most of the studies, agricultural sector has been given less importance due to its backwardness and low return. Industrial and services sectors show better performance and attract more FDI because of higher return as well as availability of skilled and productive labor force working in these sectors. Basically there is a bi-directional causality. FDI leads to increase in sectoral productivity along-with the increase in labor productivity of respective sectors which in turn attracts more FDI inflows.

2.2. Studies Related to Pakistan

This section reviews studies relevant to Pakistan, including studies relating to Asian countries or a panel of such countries inclusive of Pakistan, though majority of the studies focus on impact of FDI inflows on sectoral growth rather than sectoral labor productivity.

Ullah *et al.* (2012) empirically analyzed the role of FDI inflows using data of agriculture and industrial sectors of Pakistan for the time period of 1979-2009. Services sector was also incorporated as an independent variable in the equations of agricultural and industrial sectors. The results of two stage least square (2SLS) suggested a negative impact on agriculture sector and a positive impact on industrial sector. Their results also suggested that an increase in growth rate of agriculture and industrial sector leads to a higher growth of services sector. Consequently employment increases which causes an inclination towards attaining more education. This facilitates availability of increased number of educated and skilled workers which leads to enhancement in labor productivity both at sectoral and macro level. As a result, economic growth picks up.

Khan and Khan (2011) are of the view that although Pakistan has great potential for attracting FDI inflows, but it has not been successful in attracting sufficient amounts due to ineffective institutional framework, poor law and order situation and low labor productivity. Their empirical analysis basically focuses on testing the impact of sector-wise FDI inflows on growth and output using data of Pakistan from 1981-2008. The panel Cointegration and Granger- Causality results suggested that although sectoral FDI inflow increases output and growth of three major sectors i.e., agriculture, industry and services but it is not satisfactory due to above mentioned factors.

Kasi and Zafar (2016) examined the productivity and spillover effects of FDI inflows in four member countries of SAARC including Bangladesh, India, Nepal and Pakistan for the period of 1990-2013. Authors used 3 main sectors for analysis, i.e., primary, manufacturing and services and applied Fully Modified Least Square technique. According to their results, although FDI inflows have positive and significant impact on productivity of all sectors but the effect varies across sectors. They found that maximum productivity effect of FDI is found in services sector through spillover effects where FDI plays an important role and increases labor productivity through technology, training and education.

Majority of studies argue that Pakistan has high potential for attracting FDI inflows but there are many factors which are acting as a hurdle and low labor productivity is one of the most important factors. This is applicable not only at sectoral level but as a whole, as Khan (2011) states,

'On the whole, Pakistan has a lot of potential to attract foreign investment. Although the rising trend of FDI in various sectors reflects the success of policy; however, FDI inflows are considerably hindered by institutional weakness, corruption, ineffective legal institutions, political uncertainty, poor laws, weak regulatory systems, deteriorating law and order situation, labour productivity and unsustainable international political relations.' (Page 20)

Sahoo (2006) carried out empirical analysis to examine the impact of FDI inflows and its determinants on growth of five South Asia countries including India, Pakistan, Bangladesh, Sri Lanka and Nepal. According to the author, since these countries have been following liberalization policies to attract FDI, all benefitted from FDI but Pakistan is at the bottom of the list. FDI inflows in South Asian countries is basically concentrated in manufacturing and services sectors. The panel Cointegration analysis suggested that market size, labor for growth, infrastructure index and trade openness are main determinants of FDI inflows in these countries. Regarding low benefits from FDI inflows to Pakistan, author points out that major reason is poor labor laws which result in low labor productivity even in those sectors which are attracting high FDI inflows. In addition, Pakistan has a 'decent' FDI policy but low labor productivity is acting as a hurdle in both attracting and benefitting from FDI inflows.

Suleman and Amin (2015) in their study examined the impact of sectoral FDI inflows on industrial growth of Pakistan. They used Cobb-Douglas production function for three sectors of Pakistan's economy including manufacturing, construction, mining and quarrying by using panel Cointegration analysis covering the time period of 1997-2011. Their empirical results suggested that sectoral FDI, capital and labor productivity affect industrial growth of Pakistan both positively and significantly. Authors recommended that such policies should be devised which provide better standard of living, reduce poverty and unemployment in order to increase labor productivity.

Regarding FDI inflows and TFP in Pakistan (Adnan *et al.*, 2017) used Johansen Cointegration analysis and found a positive and significant impact of FDI in Pakistan during long run time period. Domestic factor of production or labor is affected due to low productivity. Their findings suggest that labor needs more attention in the form of increase in education expenditure, better standard of living and high productive capacity.

Here authors started with TFP in Pakistan but ended up at labor productivity since its abundance and importance cannot be ignored.

Park and Shin (2012) studied services sector of 12 major Asian economies including Pakistan. Authors mainly focused on examining that whether services sector can become new engine of growth for developing Asia based on high labor productivity in services sector. Authors added that since services sector had already contributed to Asian economies in past, the panel Cointegration analysis suggested that services sector (as compared to other sectors) has future potential to increase GDP growth of these countries since FDI inflows to services sector is positively affecting the labor productivity of this sector, consequently employment opportunities are increasing. In addition, it was found that labor productivity in services sector is increasing at a high rate in Asian economies, and in case of Pakistan the performance of services sector is on higher trajectory due to which it has become the strongest sector of the economy since the labor productivity has direct and positive relationship with FDI inflows to this sector.

Slimane *et al.* (2013) empirically examined the direct and indirect impact of FDI inflows on food security for 63 developing economies including Pakistan. For empirical analysis, they used Cobb-Douglas agriculture production function and covered the time period from 1995-2009. Their empirical results did not suggest a direct significant effect of sectoral FDI on food security but a significant and positive indirect impact was found for FDI in agriculture and secondary sector through the growth of agriculture production but it did not show any impact on mining. Negative effects in tertiary sector were observed through FDI inflows. Their results also suggested that secondary sector benefitted through high employment and wage rate which increased labor productivity. Spillover effects were observed in agriculture food security and labor productivity through transfer of technology and knowledge spillovers.

Yusuf (2013) discussed whether Chinese FDI would accelerate Pakistan's growth and argued that Chinese FDI would have positive impacts if China began off-shoring more of its labor-intensive manufacturing activities, Pakistan's textile, leather, white goods and auto industries. Pakistan has been facing problems in benefitting from FDI inflows due to technological backwardness and low labor productivity. Although there is a high potential since it has large number of urban centers but poor investment policies and low factor productivity are main hindrances. Labor laws need to be implemented so that technological spillovers can be enjoyed in manufacturing and export producing sectors. Labor productivity in growth increasing sectors needs attention since Pakistan can gain more from FDI inflows if proper investment is made in modern sectors specially manufacturing and export producing industries.

This section of literature shows that undoubtedly policy makers and researchers have consensus that in general FDI inflows increase labor productivity. Moreover agriculture sector is the most backward sector compared to manufacturing and services sectors. Yet the discussion mainly concentrates on sector-wise FDI inflows and sectoral growth or overall growth instead of labor productivity of each sector.

The empirical part of this paper is aimed at concentrating on the impact of sector-wise FDI on respective sector-wise labor productivity.

Some important figures related to country-wise and sector-wise FDI inflows to Pakistan have been shown in following tables:-

Table-1. Country Wise FDI Inflows ($ Million)

Country	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17 (Jul-May)
USA	1,309.3	869.9	468.3	238.1	227.7	227.1	212.1	208.9	40.5	40.8
UK	460.2	263.4	294.6	207.1	205.8	633.0	157.0	169.6	138.4	54.2
U.A.E	589.2	178.1	242.7	284.2	36.6	22.5	(47.1)	218.8	138.6	51.2
Japan	131.2	74.3	26.8	3.2	29.7	30.1	30.1	71.1	35.2	42.0
Hong Kong	339.8	156.1	9.9	125.6	80.3	242.6	228.5	136.2	119.5	10.1
Switzerland	169.3	227.3	170.6	110.5	127.1	149.0	209.8	3.2	53.4	15.9
Saudi Arabia	46.2	(92.3)	(133.8)	6.5	(79.9)	3.2	(40.1)	(64.8)	24.0	1.9
Germany	69.6	76.9	53.0	21.2	27.2	5.5	(5.7)	(20.3)	(11.6)	(6.1)
Korea (South)	1.2	2.3	2.3	7.7	25.4	25.8	24.4	14.3	(2.3)	7.3
Norway	274.9	101.1	0.4	(48.0)	(275.0)	(258.4)	(21.6)	2.7	172.5	(12.6)
China	13.7	(101.4)	(3.6)	47.4	126.1	90.6	695.8	256.8	626.2	878.8
Others	2,005.2	1,964.2	1,019.6	631.3	289.7	285.5	255.4	(73.6)	566.8	944.5
Total including Pvt. Proceeds	5,409.8	3,719.9	2,150.8	1,634.8	820.7	1,456.5	1,698.6	922.9	1,901.2	2,028.0
Privatisation Proceeds	133.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FDI Excluding Pvt. Proceeds	5,276.6	3,719.9	2,150.8	1,634.8	820.7	1,456.5	1,698.6	922.9	1,901.2	2,028.0

Source: *Board of Investment, Pakistan http://boi.gov.pk/ForeignInvestmentinPakistan.aspx*
22.6% increase in Net FDI in July-May, 2016-17 as compared to July-May, 2015-16.
Note: Pakistan's Fiscal Year runs from 1st July till 30th June. The figures in brackets are in negative.

Table-2. Sector Wise FDI Inflows ($ Million)

Sectors	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17 (Jul May)
Oil & Gas	634.8	775.0	740.6	512.2	629.4	559.6	502.0	299.0	248.9	135.6
Financial Business	1,864.9	707.4	163.0	310.1	64.4	314.2	192.8	256.4	289.0	62.8
Textiles	30.1	36.9	27.8	25.3	29.8	10.0	(0.2)	43.9	20.0	14.1
Trade	175.9	166.6	117.0	53.0	25.3	5.7	(3.2)	50.0	26.8	28.1
Construction	89.0	93.4	101.6	61.1	72.1	46.0	28.8	53.5	36.8	418.2
Power	70.3	130.6	(120.6)	155.8	(84.9)	28.4	71.4	219.3	751.3	548.0
Chemicals	79.3	74.3	112.1	30.5	96.3	71.6	94.9	55.3	88.5	10.6
Transport	74.2	93.2	132.0	104.6	18.7	44.1	2.7	6.2	70.1	38.1
Communication (IT&Telecom)	1,626.8	879.1	291.0	(34.1)	(312.6)	(385.7)	434.2	45.1	236.8	20.0
Others	764.5	763.4	586.3	416.3	282.2	765.5	375.2	105.8)	133.0	752.5
Total including Pvt. Proceeds	5,409.8	3,719.9	2,150.8	1,634.8	820.7	1,456.5	1,698.6	922.9	1901.2	2,028.0
Privatisation Proceeds	133.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FDI Excluding Pvt. Proceeds	5,276.6	3,719.9	2,150.8	1,634.8	820.7	1,456.5	1,698.6	922.9	1901.2	2,028.0

Source: Board of Investment, Pakistan http://boi.gov.pk/ForeignInvestmentinPakistan.aspx
22.6% increase in Net FDI in July-May, 2016-17 as compared to July-May, 2015-16.
Note: Pakistan's Fiscal Year runs from 1st July till 30th June. The figures in brackets are in negative.

2.3. Summary of Literature Review and Gaps to be filled by Present Study

Numerous studies (national and international) have been discussed in literature review. The international literature has thrown light on the relationship between sector-wise FDI inflows and sector-wise labor productivity concluding that sector-wise FDI inflows do increase sector-wise labor productivity especially in case of manufacturing and services sectors. Generally they are in the form of technology transfer, innovation, R & D and increase in labor productivity but agriculture and related sectors show either no impact or negative because of backwardness and low labor productivity. In case of Pakistan, most of the studies have emphasized on 'growth' instead of labor productivity. Moreover, the literature has also given a hint that spillovers may exist, i.e., FDI inflows to one sector may lead to an increase in labor productivity in one or more sectors like in case of developing economies such as Pakistan, agricultural output affects industrial output or productivity providing inputs for industrial sector (textile sector is the main sector which is affected by agricultural output).

This study aims to fill the gap by empirically analyzing the impact of sector-wise FDI inflows on sector-wise labor productivity. It also tests the spillover effects empirically through Granger- Causality test.

3. Empirical Analysis

The empirical part is divided into three sections. Section 1 deals with data details, empirical model and hypothesis. Section 2 shows result of unit root tests. Section 3 is a detailed analysis of panel data models. All panel data models have been applied in order to know that which static panel model suits best to the data being used for this study. The purpose of detailed analysis is to substantiate the relevance of the model applicable for empirical analysis rather than jumping directly to the empirical model itself. Also, the empirical rationale is shown as to which test is pragmatic and what assumptions it holds. In the end, section 4 shows pair-wise Granger-Causality test to see the spillover effects from one sector to another. Section 5 provides a complete interpretation of empirical results.

SECTION- 1

1.1) Data Details and Sources

- Data for FDI inflows has been extracted from World Development Indicators (WDI), World Bank. UNIT= Current BOP US Dollars

- Data for Sector-wise FDI inflows has been taken from Handbook of Statistics on Pakistan, Chapters 1-2, State Bank of Pakistan and Pakistan Economic Survey (Various issues).

UNIT=Percentage

- Data for sector-wise FDI inflows has been constructed by carrying out various steps. It is represented as value added per hour for each sector. Data for total labor force is taken from WDI. Distribution of employed persons of 10 years and above by major industries has been taken from Pakistan Economic Survey 2014-15 and 2015-16 (chapter 12).

UNITS = Value added per hour (Million Dollars)

- Data for sector-wise FDI inflows has been taken from Board of Investment (BOI), Pakistan.

UNITS = Million Dollars

Following abbreviations have been used for presenting data

FDI	=FDI Inflows
LPROD	=Labor Productivity
AGRI	=Agriculture
MANUF	= Manufacturing
CONST	= Construction
E & G	= Electricity and Gas
TRANS	= Transport
TRADE	= Trade
OTHERS	= Others

Following abbreviations have been used for presenting empirical tests

LLU = Levin, Lin & Chu.
IPS = Im, Pearon & Shin.
LSDV = Least Square Dummy Variable.

1.2) Model and Hypothesis

Model: Sector-wise FDI inflows increase Sector-wise LPROD

Hypothesis: *Relationship between Sector-wise FDI Inflows and Sector-wise LPROD*

For this purpose panel models have been applied using seven sectors and their respective labor productivity of Pakistan covering time period of 1997-2016. In all cases LPROD is the dependent variable and INFLOW is the independent variable since the aim is to check whether FDI inflows to each sector increase respective labor productivity or not.

1.3) Empirical Equation:-

$$yit = f(xit) + \mathcal{E}\ it$$

Where $\mathcal{E}\ it$ = error term

(To check robustness of results, the model has also been tested other way round)

In case of Wald test and Granger-Causality test, variables get automatically inter-changed to check bi-directional causality. Also, Granger-Causality test has been applied to empirically check the spillover effects.

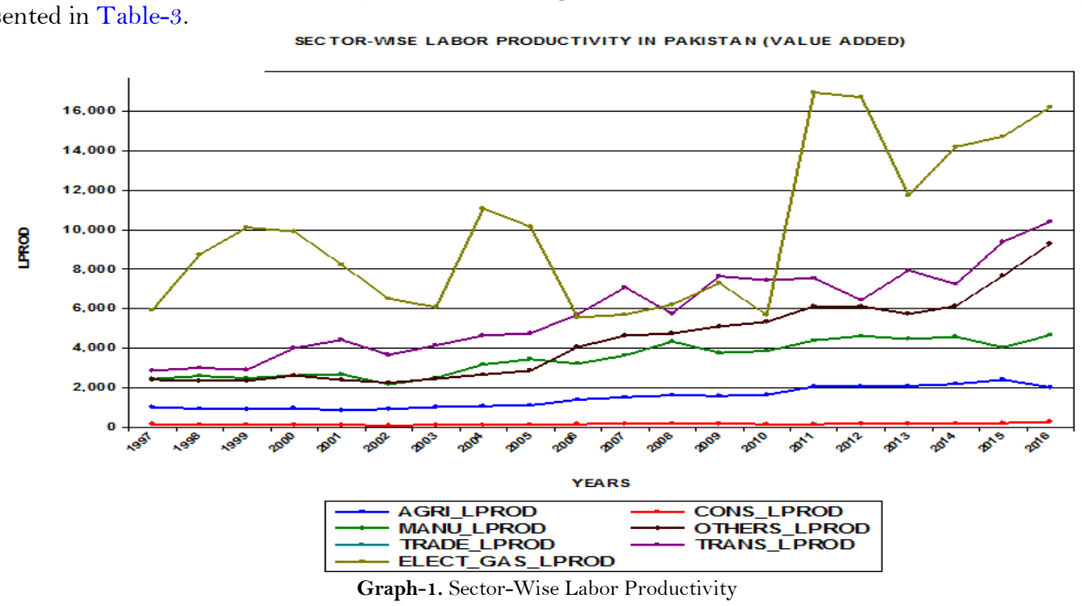
The empirical section does not directly jump to panel model, rather all initial steps have been conducted and presented to confirm the reliability of the model for panel data.

All tests are applied in EVIEWS 9.0.

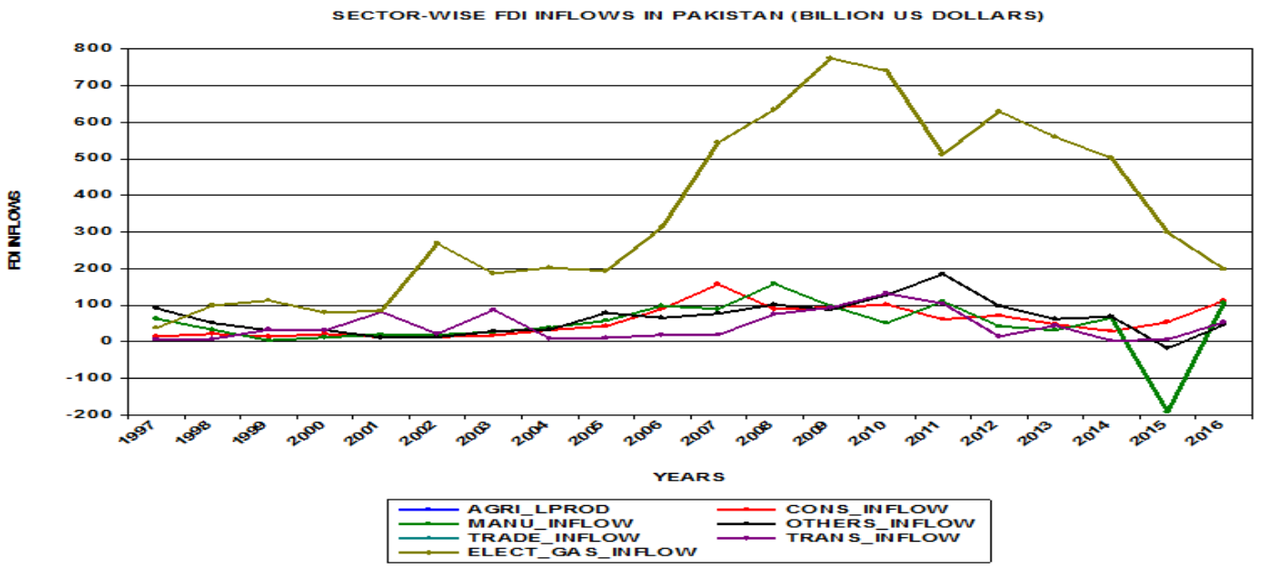
SECTION- 2

2.1) Panel Unit Root Tests

First step in any empirical study is to check the stationarity status of data. Depending on that, further tests are applied. Initially all series have been presented in graphical form and then results are presented in tabular form. For this purpose, two famous tests are applied for checking unit root, i.e. LLC and IPS. Results and interpretation are presented in Table-3.



Graph-1. Sector-Wise Labor Productivity



Graph-2. Sector-Wise FDI Inflows

Table-3. Panel Unit Root Tests

Method	Levin, Lin & Chu				Im, Pesaran and Shin (IPS)				Order of Integration
Variables	At Level		At First Difference		At Level		At First Difference		
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
LPROD	2.11491 (0.9828)	1.52993* (0.0630)	7.07647*** (0.0000)	5.74151*** (0.0000)	3.18318 (0.9999)	1.46509* (0.0714)	7.70225*** (0.0000)	6.25492*** (0.0000)	I(1)
INFLOW	1.34872 (0.0887)	0.1607 (0.5652)	4.42893*** (0.0000)	3.91451*** (0.0000)	2.31312* (0.0104)	-0.95487 (0.1698)	5.75636*** (0.0000)	4.77672*** (0.0000)	I(1)

Values in Parenthesis represent Probability values.
*significant at 10%
** Significant at 5%
*** Signiant at 1%

Levin *et al.* (2002) has a null hypothesis of unit root which assumes a common unit root whereas, Im *et al.* (2003) also has the same null hypothesis but this test assumes individual unit root process. According to both tests, series are co-integrated of order 1, i.e., they become stationary at first difference (taking all significance level) which is a necessary condition for Cointegration test.

Before applying panel Cointegration test, it is required to check that which kind of static panel data model is appropriate.

SECTION-3

3.1) Panel Data Models

Three basic panel data models have been applied one by one along-with interpretations.

(i) Pooled OLS

Table-4. Pooled OLS (empirical results)

Dependent Variable: LPROD **Method: Panel Least Squares** **Assumption: All sectors are same (no individuality)**				
Sample: 1997 2016 Periods included: 20 Cross-sections included: 7 Total panel (balanced) observations: 140				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	3102.485	327.0495	9.486287	0.0000
INFLOW	9.191757	1.698498	5.411699	**0.0000**
R-squared	0.175068	Mean dependent var		4083.403
Adjusted R-squared	0.169090	S.D. dependent var		3533.585
S.E. of regression	3221.013	Akaike info criterion		19.00696
Sum squared resid	1.43E+09	Schwarz criterion		19.04899
Log likelihood	-1328.487	Hannan-Quinn criter.		19.02404
F-statistic	29.28648	Durbin-Watson stat		0.335267
Prob(F-statistic)	**0.000000**	**DECISION: Inflow is significant but the assumption of no individuality cannot be accepted**		

Although results are significant, yet this test is not preferred since it pools all seven sectors and denies the individuality.

(ii) Pooled OLS Vs Fixed effects (F-test)

Now testing that which test is appropriate, fixed effect or pooled Regression Model? Also, is there any requirement for testing a model with heterogeneity? For this purpose, dummy variables are used to estimate fixed effect model. Since the panel consists of 7 sectors, 7dummy variables are created. The equation to be estimated is

LPROD=C(1)+C(2)*INFLOW+C(3)*D1+C(4)*D2+C(5)*D3 +C(6)*D4+C(7)*D5+C(8)*D6+C(9)*D7

Where LPROD (sector-wise labor productivity) is the dependent variable and INFLOW (sector-wise FDI inflow) is the independent variable.

C(1) is the co-efficient of constant

C(2) is the co-efficient of INFLOW

C(3), C(4), C(5), C(6), C(7), C(8) and C(9) are co-efficient of dummy1, dummy2, dummy3, dummy4, dummy5, dummy 6 and dummy7 respectively.

The null and alternative hypothesis of Panel Least Square model are:

Null: Pooled regression model is appropriate (all dummy variables are zero)

Alternative: Fixed effect model is more appropriate (all dummy variables are not zero)

To check whether all dummy variables are zero or not, Wald test is used.

Table-5. Results of Wald Test (F-statistic)

Wald Test:			
F-statistic based test			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	***32.31158***	(7, 131)	**0.0000**
Chi-square	226.1811	7	0.0000
Null Hypothesis: C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(3)		-8072.629	2159.858
C(4)		-5910.032	2175.133
C(5)		-9262.234	2077.298
C(6)		22.57162	2055.820
C(7)		-3533.529	2175.990
C(8)		-6024.004	2173.176
C(9)		-5055.283	2171.676

Since the Probability value is almost zero, null hypothesis is rejected and alternative is accepted, i.e., Fixed effect model is appropriate according to F-Statistic model.

(iii) Pooled Least-square Dummy variable Model

Table-6. Results of Pooled LSDV Model (Fixed Effect)

Dependent Variable: LPROD				
Method: Panel Least Squares				
Sample: 1997 2016				
Periods included: 20				
Cross-sections included: 7				
Total panel (balanced) observations: 140				
LPROD=C(1)+C(2)*INFLOW+C(3)*D1+C(4)*D2+C(5)*D3+C(6)*D4+C(7)				
***D5+C(8)*D6+C(9)*D7**				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	9317.984	2139.559	4.355097	0.0000
C(2)	**1.595601**	1.378895	1.157159	0.2493
C(3)	-8072.629	2159.858	-3.737574	0.0003
C(4)	-5910.032	2175.133	-2.717090	0.0075
C(5)	-9262.234	2077.298	-4.458790	0.0000
C(6)	22.57162	2055.820	0.010979	0.9913
C(7)	-3533.529	2175.990	-1.623872	0.1068
C(8)	-6024.004	2173.176	-2.771982	0.0064
C(9)	-5055.283	2171.676	-2.327826	0.0215
R-squared	0.697447	Mean dependent var		4083.403
Adjusted R-squared	0.678971	S.D. dependent var		3533.585
S.E. of regression	2002.109	Akaike info criterion		18.10392
Sum squared resid	5.25E+08	Schwarz criterion		18.29302
Log likelihood	-1258.274	Hannan-Quinn criter.		18.18076
F-statistic	37.74779	Durbin-Watson stat		0.551877
Prob(F-statistic)	0.000000			

Since LPROD is the dependent variable, the co-efficient of independent variable (INFLOW), which is C(2) must be same for fixed effect model estimation. The highlighted values in red show that in all tests the value of INFLOW co-efficient is same, which shows that it is fixed effect model.

(iv) Fixed Effects or Random effects

Now the question is that which test is **more appropriate? To find out, Hausman test is applied.**

Table-7. Results of Hausman Test

Correlated Random Effects - Hausman Test				
Test cross-section random effects				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random		4.017557	1	**0.0450**
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob
INFLOW	1.596216	2.007554	0.042115	0.0450

Prob. value is significant at 10 percent level, therefore it can be concluded that fixed effect Model is more appropriate.

DECISION: Both Hausman test and F-statistic suggest that Fixed Effect Model is appropriate.

3.2. Panel Cointegration Tests

Table-8. Results of Panel Cointegration test

Pedroni test with Individual intercepts

Pedroni Residual Cointegration Test					
Series: LPROD INFLOW					
Sample: 1997 2016					
Included observations: 140 Cross-sections included: 7					
Null Hypothesis (H_0): No Cointegration between variables.					
Alternative Hypothesis (H_1): Cointegration between Variable.					
Automatic lag length selection based on SIC with a max lag of 3					
Newey-West automatic bandwidth selection and Bartlett kernel					
Alternative hypothesis: common AR coefs. (within-dimension)					
				Weighted	
Test type		Statistic	Prob.	Statistic	Prob.
Panel v-Statistic		-0.590388	0.7225	-1.295781	0.9025
Panel rho-Statistic		0.542161	0.7061	1.556694	0.9402
Panel PP-Statistic		0.788221	0.7847	1.942475	0.9740
Panel ADF-Statistic		0.779412	0.7821	3.131847	0.9991
Alternative hypothesis: individual AR coefs. (between-dimension)					
Test Type	Test Type	Statistic	Prob.		
Group rho-Statistic		2.789980	0.9974		
Group PP-Statistic		3.911325	1.0000		
Group ADF-Statistic		4.684392	1.0000		
DECISION: Accept H_0 (No Cointegration)					

Pedroni Residual Cointegration Test					
Series: LPROD INFLOW					
Sample: 1997 2016					
Included observations: 140					
Cross-sections included: 7					
Null Hypothesis (H_0): No Cointegration between Variables. **Alternative Hypothesis (H_1): Cointegration between Variables.**					
Automatic lag length selection based on SIC with a max lag of 3					
Newey-West automatic bandwidth selection and Bartlett kernel					
Alternative hypothesis: common AR coefs. (within-dimension)					
				Weighted	
Test Type		Statistic	Prob.	Statistic	Prob.
Panel v-Statistic		0.266400	0.3950	2.707674	0.0034**
Panel rho-Statistic		-1.576706	0.0574*	-0.640072	0.2611
Panel PP-Statistic		-2.851450	0.0022**	-2.012096	0.0221*
Panel ADF-Statistic		-2.909437	0.0018**	-2.386335	0.0085**
Alternative hypothesis: individual AR coefs. (between-dimension)					
Test Type		Statistic	Prob.		
Group rho-Statistic		0.616731	0.7313		
Group PP-Statistic		-1.219229	0.1114		
Group ADF-Statistic		-1.810697	0.0351*		
DECISION: Accept H_1 (There is Cointegration)					

Pedroni test with Individual intercepts and trend (this is the heading of above table)

*significant at 10%
** Significant at 5%
*** Signiant at 1%

The results indicate that there is long run Cointegration between sector-wise labor productivity and sector-wise FDI inflows when test is carried out using both trend and intercept. Out of total 11 outcomes, 7 are significant, therefore, it is concluded that there is a strong evidence of Cointegration. For cross check, now applying Fisher Cointegration Test.

Table-9. Johansen Fisher Panel Cointegration Test

- ***Johansen Fisher Panel Cointegration Test (empirical results)***

Series: LPROD INFLOW				
Sample: 1997 2016				
Included observations: 140				
Trend assumption: Linear deterministic trend (restricted)				
Lags interval (in first differences): 1 1				
Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)				
Hypothesized	**Fisher Stat.***		**Fisher Stat.***	
No. of CE(s)	(from trace test)	**Prob.**	(from max-eigen test)	**Prob.**
None	25.46	0.0303	27.92	0.0146
At most 1	9.371	0.8066	9.371	0.8066
* Probabilities are computed using asymptotic Chi-square distribution.				
Individual cross section results				
	Trace Test		**Max-Eign Test**	
Cross Section	**Statistics**	**Prob.****	**Statistics**	**Prob.****
Hypothesis of no Cointegration				
Agri	23.2648	0.1020	15.9062	0.1493
manuf	17.3666	0.3881	14.6940	0.2108
const	21.7021	0.1515	16.9830	0.1080
e&g	27.6196	0.0300	24.4816	0.0083
trans	25.8957	0.0497	16.7830	0.1149
trade	14.5430	0.6126	7.7133	0.8463
others	15.4050	0.5410	13.1481	0.3162
Hypothesis of at most 1 cointegration relationship				
Agri	7.3587	0.3086	7.3587	0.3086
manuf	2.6726	0.9130	2.6726	0.9130
const	4.7191	0.6371	4.7191	0.6371
e&g	3.1380	0.8597	3.1380	0.8597
trans	9.1128	0.1735	9.1128	0.1735
trade	6.8297	0.3626	6.8297	0.3626
others	2.2569	0.9508	2.2569	0.9508

**MacKinnon (1990) p-values

Fisher test has a Null hypothesis that there is no co-integrated equation (the two variables are not co-integrated). In case of none, both trace test and max Eigen value test reject the null hypothesis. At the most one hypothesis has high probability values (more than 5%) for both trace co-integrated and max Eigen value test which leads to the conclusion that there is Cointegration between two variables (sector wise labor productivity and sector wise FDI inflows are)

3.3. Panel Vector Error Correction Model

Although the basic model deals with LPROD being a dependent variable but for robustness of test, separate VECM and system equation model are estimated taking INFLOW as a dependent variable.

Table-10. Results of Panel Vector Error Correction Model (VECM)

- when LPROD is dependent

Vector Error Correction Estimates		
Sample (adjusted): 2000 2016		
Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	**CointEq1**	
LPROD(-1)	1.000000	
INFLOW(-1)	-74.83640 (20.8250) **[-3.59359]**	
C	4203.830	
Error Correction:	**D(LPROD)**	**D(INFLOW)**
CointEq1	-0.039096 (0.01282) **[-3.05035]**	0.001254 (0.00110) **[1.14450]**
D(LPROD(-1))	-0.245484 (0.08641) **[-2.84080]**	-0.008062 (0.00739) **[-1.09094]**
D(LPROD(-2))	-0.355847 (0.08495) **[-4.18900]**	-0.005610 (0.00726) **[-0.77221]**
D(INFLOW(-1))	-3.756347 (1.44851) **[-2.59324]**	-0.471644 (0.12388) **[-3.80729]**
D(INFLOW(-2))	0.216792 (1.39912) **[0.15495]**	-0.307120 (0.11965) **[-2.56672]**

C	351.5799 (121.786) **[2.88687]**	12.99057 (10.4153) **[1.24726]**
R-squared	0.243475	0.210100
Adj. R-squared	0.210001	0.175149
Sum sq. resids	1.88E+08	1376352.
S.E. equation	1290.479	110.3635
F-statistic	7.273447	6.011222
Log likelihood	-1018.145	-725.5252
Akaike AIC	17.21252	12.29454
Schwarz SC	17.35264	12.43466
Mean dependent	231.6261	8.627731
S.D. dependent	1451.903	121.5172
Determinant resid covariance (dof adj.)		1.96E+10
Determinant resid covariance		1.76E+10
Log likelihood		-1741.524
Akaike information criterion		29.50460
Schwarz criterion		29.83155

The estimates of VECM also confirm a long run relationship between the variable under discussion. But the probability values are not available, for which system equation model is required. Since LPROD is the dependent variable, the first model is the main model of interest. VECM doesn't show probability values, therefore, construction of system equation model is required to get probability values.

Table-11. Results of System Equation Model

- Taking LPROD as dependent variable

Estimation Method: Panel Least Squares				
Sample: 2000 2016				
Included observations: 119				
Total system (balanced) observations 238				
Equation: D(LPROD) = C(1)*(LPROD(-1) - 74.8363953179*INFLOW(-1) + 4203.8300597) + C(2)*D(LPROD(-1)) + C(3)*D(LPROD(-2)) + C(4) *D(INFLOW(-1)) + C(5)*D(INFLOW(-2)) + C(6)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	**-0.039096**	0.012817	**-3.050354**	**0.0026****
C(2)	-0.245484	0.086414	-2.840799	**0.0049****
C(3)	-0.355847	0.084948	-4.188996	**0.0000****
C(4)	-3.756347	1.448514	-2.593242	**0.0101***
C(5)	0.216792	1.399120	0.154949	0.8770
C(6)	351.5799	121.7859	2.886868	**0.0043****
C(7)	0.001254	0.001096	1.144501	0.2536
C(8)	-0.008062	0.007390	-1.090941	0.2765
C(9)	-0.005610	0.007265	-0.772207	0.4408
C(10)	-0.471644	0.123879	-3.807294	**0.0002****
C(11)	-0.307120	0.119655	-2.566724	**0.0109****
C(12)	12.99057	10.41530	1.247258	0.2136
Determinant residual covariance	1.76E+10			
Observations: 119				
R-squared	0.243475	Mean dependent var		231.6261
Adjusted R-squared	0.210001	S.D. dependent var		1451.903
S.E. of regression	1290.479	Sum squared resid		1.88E+08
Durbin-Watson stat	2.162215			
Equation: D(INFLOW) = C(7)*(LPROD(-1) - 74.8363953179*INFLOW(-1) + 4203.8300597) + C(8)*D(LPROD(-1)) + C(9)*D(LPROD(-2)) + C(10) *D(INFLOW(-1)) + C(11)*D(INFLOW(-2)) + C(12)				
Observations: 119				
R-squared	0.210100	Mean dependent var		8.627731
Adjusted R-squared	0.175149	S.D. dependent var		121.5172
S.E. of regression	110.3635			
Durbin-Watson stat	1.828057	Sum squared resid		1376352.

*Significant at 10%
**Significant at 5%,
*** Signiant at 1%

C(1) = Error Correction Term or speed of adjustment towards long run equilibrium

Since **C(1)** is negative and significant, it can be concluded that there is a long run causality running from independent variable (sector-wise FDI inflows) to dependent variable (sector-wise labor productivity). Or in simple words, an increase in sector specific FDI inflows leads to an increase in labor productivity working in that specific sector. This model explains long run causality which has already been established.

- When INFLOW is a dependent variable

Table-12. Results of Panel Vector Error Correction Model (VECM)

Vector Error Correction Estimates		
Sample (adjusted): 2000 2016		
Included observations: 119 after adjustments		
Standard errors in ( ) & **t-statistics in [ ]**		
Cointegrating Eq:	**CointEq1**	
INFLOW(-1)	1.000000	
	-0.013362	
	(0.01282)	
LPROD(-1)	**[-1.04245]**	
C	-56.17360	
Error Correction:	**D(INFLOW)**	**D(LPROD)**
	-0.093882	2.925767
	(0.08203)	(0.95916)
CointEq1	**[-1.14450]**	**[3.05035]**
	-0.471644	-3.756347
	(0.12388)	(1.44851)
D(INFLOW(-1))	**[-3.80729]**	**[-2.59324]**
	-0.307120	0.216792
	(0.11965)	(1.39912)
D(INFLOW(-2))	**[-2.56672]**	**[0.15495]**
	-0.008062	-0.245484
	(0.00739)	(0.08641)
D(LPROD(-1))	**[-1.09094]**	**[-2.84080]**
	-0.005610	-0.355847
	(0.00726)	(0.08495)
D(LPROD(-2))	**[-0.77221]**	**[-4.18900]**
	12.99057	351.5799
	(10.4153)	(121.786)
C	**[1.24726]**	**[2.88687]**
R-squared	0.210100	0.243475
Adj. R-squared	0.175149	0.210001
Sum sq. resids	1376352.	1.88E+08
S.E. equation	110.3635	1290.479
F-statistic	6.011222	7.273447
Log likelihood	-725.5252	-1018.145
Akaike AIC	12.29454	17.21252
Schwarz SC	12.43466	17.35264
Mean dependent	8.627731	231.6261
S.D. dependent	121.5172	1451.903
Determinant resid covariance (dof adj.)		1.96E+10
Determinant resid covariance		1.76E+10
Log likelihood		-1741.524
Akaike information criterion		29.50460
Schwarz criterion		29.83155

Again constructing system equation model for obtaining probability values.

Table-13. Results of System Equation Model

Estimation Method: Least Squares
Sample: 2000 2016
Included observations: 119
Total system (balanced) observations 238

Equation: D(INFLOW) = C(1)*(INFLOW(-1) - 0.0133624821954*LPROD(-1) - 56.1736043251) + C(2)*D(INFLOW(-1)) + C(3)*D(INFLOW(-2)) + C(4) *D(LPROD(-1)) + C(5)*D(LPROD(-2)) + C(6)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	**-0.093882**	0.082028	-1.144501	**0.2536**
C(2)	-0.471644	0.123879	-3.807294	**0.0002****
C(3)	-0.307120	0.119655	-2.566724	**0.0109***
C(4)	-0.008062	0.007390	-1.090941	0.2765
C(5)	-0.005610	0.007265	-0.772207	0.4408
C(6)	12.99057	10.41530	1.247258	0.2136
C(7)	2.925767	0.959157	3.050354	**0.0026****
C(8)	-3.756347	1.448514	-2.593242	**0.0101***
C(9)	0.216792	1.399120	0.154949	0.8770
C(10)	-0.245484	0.086414	-2.840799	**0.0049****
C(11)	-0.355847	0.084948	-4.188996	**0.0000*****
C(12)	351.5799	121.7859	2.886868	0.0043
Determinant residual covariance		1.76E+10		
Observations: 119				
R-squared	0.210100	Mean dependent var		8.627731
Adjusted R-squared	0.175149	S.D. dependent var		121.5172
S.E. of regression	110.3635	Sum squared resid		1376352.

Durbin-Watson stat	1.828057			
Equation: D(LPROD) = C(7)*(INFLOW(-1) - 0.0133624821954*LPROD(-1) - 56.1736043251) + C(8)*D(INFLOW(-1)) + C(9)*D(INFLOW(-2)) + C(10) *D(LPROD(-1)) + C(11)*D(LPROD(-2)) + C(12)				
Observations: 119				
R-squared	0.243475	Mean dependent var		231.6261
Adjusted R-squared	0.210001	S.D. dependent var		1451.903
S.E. of regression	1290.479	Sum squared resid		1.88E+08
Durbin-Watson stat	2.162215			

*Significant at 10%
**Significant at 5%,
*** Signiant at 1%

C(1) = Error Correction Term or speed of adjustment towards long run equilibrium

Since **C(1)** is negative though insignificant , it cannot be concluded that there is a long run causality running from dependent variable (sector-wise FDI inflows) to independent variable (sector-wise labor productivity). Therefore there is one way causality which is the main model i.e., sector –wise labor productivity is affected by sector-wise FDI inflows. Now checking short run causality through Wald Test.

3.4. Wald Test

- when LPROD is dependent

Table-14. Results of Panel Wald Test (estimating short-run causality)

C(4)= coefficient of inflow (-1)
C(5)= coefficient of inflow (-2)
Null Hypothesis states that C(4)=C(5)=0 which means that C(4) and C(5), jointly are zero.

Wald Test:			
Test Statistic	Value	df	**Probability**
Chi-square	9.551606	2	**0.0084**
Null Hypothesis: C(4)=C(5)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)			
		Value	Std. Err.
C(4)		-3.756347	1.448514
C(5)		0.216792	1.399120

Restrictions are linear in coefficients

Since the probability is less than 5 percent, Null hypothesis can be rejected. There exists a short run causality from independent variable (sector-wise FDI inflows) to dependent variable (sector-wise labor productivity)

- When INFLOW is a dependent variable

C(10)= coefficient of lPROD (-1)
C(11)= coefficient of LPROD (-2)
Null Hypothesis states that C(10)=C(11)=0 which means that C(10) and C(11), jointly are zero.

Table-15. Results of Panel Wald Test (estimating short-run causality)

Wald Test:			
Test Statistic	Value	df	**Probability**
Chi-square	21.79722	2	**0.0000**
Null Hypothesis: C(10)=C(11)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	**Value**	**Std. Err.**	
C(10)		-0.245484	0.086414
C(11)		-0.355847	0.084948

Restrictions are linear in coefficients

In this case too, as the probability is less than 5 percent, Null hypothesis can be rejected. There exists a short run causality from independent variable (sector-wise labor productivity) to dependent variable (sector-wise FDI-inflows).

The **overall conclusion** suggested by the empirical analysis proves that random effect or LSDV model is the most appropriate model for the data. Unit root tests suggest that all variables become stationary at first difference i.e., I (1). Pedroni and Fisher panel Cointegration models show that there exists a long run Cointegration between variables. The same is supported by VECM. System equation model shows that the independent variable has a long run causality on dependent variable, whereas, Wald test provides a strong evidence of short run causality between independent and dependent variables.

SECTION- 4

This section deals with an extended segment of empirical part based on spillover effects suggested in literature review. Some studies have suggested that there exists spillover effects in the form of one sector affecting the other; both in case of FDI inflows and labor productivity. For empirically testing spillover effects, pair-wise Granger-Causality test is applied. This part also adds further to the innovative contribution of the present study. Test has been carried out both at level and at first difference.

Table-16. Pair Wise Granger-Causality Test at Level

Direction Of Causality	F-Statistic	Prob.	Strength Of Causality
AGRI_LPROD → AGRI_INFLOW	6.80832	0.0095**	**Strong Causality**
CONS_LPROD →AGRI_INFLOW	16.9054	0.0002**	**Strong Causality**
ELECT_GAS_LPROD →AGRI_INFLOW	4.15488	0.0403*	Weak Causality
MANU_INFLOW →AGRI_INFLOW	4.03740	0.0433*	Weak Causality
MANU_LPROD →AGRI_INFLOW	5.91312	0.0149*	Weak Causality
OTHERS_INFLOW →AGRI_INFLOW	7.42717	0.0071**	**Strong Causality**
OTHERS_LPROD →AGRI_INFLOW	8.85650	.0037**	**Strong Causality**
TRADE_LPROD →AGRI_INFLOW	3.80538	0.0500*	Weak Causality
AGRI_INFLOW →TRADE_LPROD	3.14026	0.0772*	Weak Causality
TRANS_LPROD →AGRI_INFLOW	3.80538	0.0500*	Weak Causality
AGRI_INFLOW →TRANS_LPROD	3.14026	0.0772*	Weak Causality
AGRI_LPROD →CONS_INFLOW	2.84937	0.0942*	Weak Causality
AGRI_LPROD →CONS_LPROD	4.24308	0.0382*	Weak Causality
ELECT_GAS_INFLOW →AGRI_LPROD	2.96506	0.0869*	Weak Causality
MANU_INFLOW →AGRI_LPROD	3.59211	0.0573*	Weak Causality
AGRI_LPROD →MANU_INFLOW	2.85021	0.0941*	Weak Causality
MANU_LPROD →AGRI_LPROD	2.77625	0.0991*	Weak Causality
AGRI_LPROD →MANU_LPROD	4.10974	0.0414*	Weak Causality
OTHERS_INFLOW →AGRI_LPROD	7.18636	0.0079**	**Strong Causality**
TRADE_LPROD →AGRI_LPROD	4.11145	0.0413*	Weak Causality
TRANS_LPROD →AGRI_LPROD	4.11145	0.0413*	Weak Causality
CONS_INFLOW →CONS_LPROD	3.21053	0.0736*	Weak Causality
CONS_INFLOW →ELECT_GAS_INFLOW	7.52173	0.0068**	**Strong Causality**
CONS_INFLOW →MANU_INFLOW	3.23694	0.0723*	Weak Causality
CONS_INFLOW →MANU_LPROD	3.72899	0.0525*	Weak Causality
CONS_INFLOW →OTHERS_INFLOW	4.44847	0.0337*	Weak Causality
OTHERS_LPROD →CONS_INFLOW	9.90378	0.0024**	**Strong Causality**
MANU_INFLOW →CONS_LPROD	5.16748	0.0223*	Weak Causality
OTHERS_LPROD →CONS_LPROD	9.94203	0.0024**	Weak Causality
TRADE_LPROD →CONS_LPROD	11.9232	0.0011**	**Strong Causality**
TRANS_LPROD →CONS_LPROD	11.9232	0.0011**	**Strong Causality**
ELECT_GAS_INFLOW →ELECT_GAS_LPROD	9.45353	0.0029**	**Strong Causality**
MANU_INFLOW →ELECT_GAS_INFLOW	4.26847	0.0376*	Weak Causality
ELECT_GAS_INFLOW →TRADE_INFLOW	3.88697	0.0475*	Weak Causality
ELECT_GAS_INFLOW →TRANS_INFLOW	3.88697	0.0475*	Weak Causality
ELECT_GAS_LPROD →OTHERS_INFLOW	2.87770	0.0923*	Weak Causality
MANU_INFLOW →OTHERS_INFLOW	8.17106	0.0050**	**Strong Causality**
MANU_INFLOW →TRADE_INFLOW	3.31218	0.0688*	Weak Causality
OTHERS_LPROD →MANU_LPROD	4.75293	0.0282*	Weak Causality
TRADE_LPROD →MANU_LPROD	7.16874	0.0080**	**Strong Causality**
TRANS_LPROD →MANU_LPROD	7.16874	0.0080**	**Strong Causality**
OTHERS_INFLOW →OTHERS_LPROD	4.86832	0.0264*	Weak Causality
TRADE_INFLOW →TRADE_LPROD	3.45733	0.0625*	Weak Causality
TRADE_INFLOW →TRANS_LPROD	3.45733	0.0625*	Weak Causality
TRANS_INFLOW →TRADE_LPROD	3.45733	0.0625*	Weak Causality
TRANS_INFLOW →TRANS_LPROD	3.45733	0.0625*	Weak Causality

*Significant at 10%
**Significant at 5%,
*** Signiant at 1%

Test has been conducted using 2 Lags and 18 observations. Strong or weak causality is based on level of significance. 5% and 1% level represent strong causality where as 10% represents weak causality.

Table-17. Pair Wise Granger-Causality Test at First Difference

Direction of Causality	F-Statistic	Prob.	Strength of Causality
DCONS_LPROD →DAGRI_INFLOW	4.61474	0.0326*	Weak Causality
DELECT_GAS_LPROD →DAGRI_INFLOW	3.44244	0.0658*	Weak Causality
DAGRI_INFLOW →DMANU_LPROD	8.54178	0.0049**	**Strong Causality**
DOTHERS_INFLOW →DAGRI_INFLOW	9.27609	0.0037**	**Strong Causality**
DTRADE_INFLOW →DAGRI_INFLOW	3.14080	0.0800*	Weak Causality
DAGRI_INFLOW →DTRADE_LPORD	4.13372	0.0431*	Weak Causality
DTRANS_INFLOW →DAGRI_INFLOW	3.14080	0.0800*	Weak Causality
DAGRI_INFLOW →DTRANS_LPROD	4.13372	0.0431*	Weak Causality
DOTHERS_INFLOW →DAGRI_LPROD	4.29300	0.0392*	Weak Causality
DCONS_INFLOW →DMANU_INFLOW	7.53099	0.0076**	**Strong Causality**
DCONS_INFLOW →DMANU_LPROD	3.38722	0.0682*	Weak Causality
DOTHERS_LPROD →DCONS_INFLOW	8.40304	0.0052**	**Strong Causality**
DELECT_GAS →DCONS_LPROD	3.67455	0.0569*	Weak Causality
DMANU_INFLOW →DCONS_LPROD	4.27188	0.0397*	Weak Causality

DOTHERS_LPROD →DCONS_LPROD	4.13602	0.0430*	Weak Causality
DTRADE_LPORD →DCONS_LPROD	9.54526	0.0033**	**Strong Causality**
DTRANS_LPROD →DCONS_LPROD	9.545□6	0.0033**	**Strong Causality**
DELECT_GAS →DELECT_GAS_LPROD	3.56908	0.0608*	Weak Causality
DMANU_INFLOW →DELECT_GAS	3.61941	0.0589*	Weak Causality
DMANU_INFLOW →DELECT_GAS_LPROD	4.64914	0.0320*	Weak Causality
DMANU_LPROD →DELECT_GAS_LPROD	5.937□6	0.0161*	Weak Causality
DMANU_INFLOW →DOTHERS_INFLOW	2.93467	0.0917*	Weak Causality
DTRADE_LPORD →DMANU_LPROD	3.13544	0.0803*	Weak Causality
DTRANS_LPROD →DMANU_LPROD	3.13544	0.0803*	Weak Causality

*Significant at 10%
**Significant at 5%,
*** Signiant at 1%

Test has been conducted using 2 Lags and 18 observations
D represents Difference

Strong or weak causality is based on level of significance. 5% and 1% level represent strong causality where as 10% represents weak causality.

Granger-Causality test suggests existence of spillover effects both in case of labor productivity and FDI inflows.

4. Interpretation of Empirical Results

According to panel unit root tests, all series become stationary at first difference having same order of integration, i.e., I(1). Panel data models reveal that the most appropriate model is fixed effects models (LSDV). Same order of integration leads to application of Cointegration tests for checking long run relationship. For this purpose, Pedroni test and Johansen Fisher Panel Cointegration tests are applied. Evidence of Cointegration leads to application of Panel vector error correction model. For testing short-run relationship, Wald test is applied which shows that a uni-directional short-run causality exists running from sector-wise labor productivity to sector-wise FDI inflows. The pair-wise Granger-Causality test shows a broader picture, i.e., there exist spillover effects both in case of FDI inflows and labor productivity in all sectors, although in some cases, there is weak causality, yet it cannot be ignored.

5. Conclusion and Policy Recommendations

In this study, an empirical analysis has been carried out to analyze the relationship between sector-wise FDI inflows and respective sector-wise labor productivity in case of Pakistan. A panel of seven major sectors of economy has been made for which the results confirm that sector-wise FDI inflows increase respective sector-wise labor productivity. Moreover, the evidence of spillover effects from one sector to another have been found through Granger-Causality test.

Amongst the three sectors, agriculture is the most backward sector while industrial and services sectors (including their sub-sectors) attract more FDI inflows and consequently labor productivity of these sectors also increases on account of technology transfer, innovation and R & D. However in comparison to industrial and services sectors, agriculture sector, on account of its inherent weaknesses caused by continuous fragmentation of land holdings, non-adoption of modern technologies due to lack of resources as well as awareness, does not attract substantial FDI and consequently remains deprived of higher labor productivity despite this sector's contribution of more than 21 percent to national GDP and absorption of 44 percent of entire labor force (Pakistan Economic Survey, 2015-16) Not only this, 66 percent of Pakistan's exports and major portion of services sector (transport, wholesale, trading etc.) are directly related to agriculture sector. Textile is the largest industrial sector of Pakistan and it is dependent on the cotton crop grown in the country and further textile products like yarn, fabrics, bed sheets, towels and garments etc. are related with cotton. Therefore, the Pakistani leadership has to accept agriculture to be the growth engine for the economic development of Pakistan and prosperity of its people and to invest more, both internally as well as through international resources for not only increasing the average per acre yield but also to enhance the productivity of the labor employed in this sector. Pakistan has to transform its agriculture, presently at the subsistence level, to suit the requirements of market economy.

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