

## **The Impact of Productivity on Foreign Direct Investment in Pakistan: A Structural VAR Analysis**

### **Abstract**

This paper investigates the role of labor productivity in attracting foreign direct investment in Pakistan for the period of 1980 to 2015. The aim of this research study is to examine the contagion effects of productivity variations on FDI flows in Pakistan using SVAR modeling. The results of impulse response function confirm that productivity is a long-term phenomenon in attracting foreign direct investment. It is also found that FDI flows into Pakistan react to consumption changes in the long run. The results of variance decomposition suggest that the productivity of Pakistan is the most dominant factor in predicting forecast error variance of foreign direct investment in Pakistan. Pakistani productivity shocks are stronger as compare to Chinese productivity shocks in explaining variation in FDI. These findings lead to accept the hypothesis that an increase in productivity of Pakistan attracts FDI. The real effective exchange rate behaves negatively to FDI flows in the long run, reflecting that locally produced goods are more expensive. It is recommended that, all the economic policies that increase countries' productivity and consumption growth in the long run are caused to attract FDI. The findings of this research study also recommend sound policy implications for policy makers to make strategic decisions in the context of China-Pak Economic Corridor (CPEC).

### **1. Introduction**

Foreign direct investment (FDI) is one of the most significant aspects of developing economies because of its stable nature. It is not only flow of capital from one country to another, but also promotes countries' infrastructures. Moreover, FDI inflow is considered an engine of competition, entrepreneurial and managerial skills and driver of technological diffusion, which enable the economies to improve the productivity and capital accumulation (Borensztein, De Gregorio, Lee, 1998; Bengoa and Sanchez-Robles, 2003; De Mello, 1999; Romer, 1993).

The Pakistani Economy has been becoming more integrated by means of FDI inflows for the last few decades. According to Pakistan Economic Survey (2014-15), FDI inflows increased at a growth rate of 10.2 percent in July-April, 2015 and reached at \$2,057.3 million against USD 1866.3 million in the same period of FY 2014. FDI inflows kept fluctuating as % of GDP from 1980 to 2015, peaked at 3.67% in 2007. However, the international investment shrank by 37% owing to the world financial crisis; Pakistan also went through a decline in FDI flows and reached at 3.2% of GDP in 2008 followed by a continuous decline till 2012 then started increasing. The major FDI inflows are from China, the United State of America, the United Arab Emirates, the United Kingdom and Italy.

Theoretically, a country will transfer a macroeconomic shock to its trading partners by means of its capacity to have an effect upon terms of trade or relative prices. The capacity can be explained with the help of different factors, which include the relative size in the worldwide trade, its relative size of the host economy, and its productivity change in relation to the other economies, the type of a shock and whether it is permanent or temporary and the way of price determination of goods and services, which can be traded. Likewise, the occurrence of shocks in the foreign economies (of trading partners) affects FDI inflows, as result, stepping in the host country's ability to attract cross-border capital flows.

To the best of my knowledge, no study has been conducted to analyse the impact of labour productivity on FDI inflows in Pakistan so far. The first attempt is being made to investigate the impact of productivity on FDI flows in Pakistan. This article inquires into three new macroeconomic variables that appear significant in attracting investment flows into Pakistan. First, an upward movement in Pakistani productivity growth, thereby, Pakistan would attract more FDI with the objective to have a better yield on the capital being invested. Second, the magnitude and size of the aggregate demand increase owing to increase in productivity of Pakistan. Third, a decrease in FDI inflows to Pakistan as result of Chinese productivity increases.

Thus, the study examines the magnitude and size of changes in productivity growth of both Pakistan and China that affect FDI flows into Pakistan, where labour productivity is employed for the measurement of productivity. SVAR (structural vector auto-regression) methodology will be used to capture the contagion effects of productivity shocks on FDI flows. In addition, contagion effects of two other variables on FDI flows will also be analyzed such as aggregate demand of domestic economy and to measure the competitiveness, the effective real exchange rate will be taken. The paper is organized as follows: literature review is presented in section 2. Section 3 consists of data description and the structural VAR methodology. Section 4 presents the discussion of results. Section 5 concludes.

## 1.2 Theories Explaining Foreign Direct Investment Fluctuations

At the beginning, the industrial organizational theory provided the basis for modelling of international investment, where companies' cross-border investment decisions contingent upon national factors including structure of the markets and cost advantages. For instance, Vernon (1966) asserts the product life-cycle theory, which explains that at the beginning technology-intensive investments are gradually channelized to other economies which are less capital-intensive. Second factor, which has been foregrounded as shaping FDI contains in imperfect intermediation.

Foreign direct investment become more attractive owing to technology leadership which includes design, market power, patents, trademarks and makes in comparison of the licensing of intellectual property because of transmitting competitive advantages, increasing the quality of workforce. Globalisation through FDI would take an advantage and also minimize the transaction costs related to the imperfection of intermediary markets (Hymer, 1960; Buckley and Casson, 1981; Buckley and Ghauri, 1999; Wang, 1990).

Dunning (2001) amalgamated this view of competitive advantage with the OLI (Ownership, Location and Internalization) theory. OLI theory explains the behaviour of firm that the firm's decision regarding to overseas investment is a function of holding competitive advantages consist of both intangible assets including trademark, product quality, design, etc. and tangible assets, which contains patents.

The originative work of Cushman (1985) actuated the macroeconomic theories. This work came out of two new factors, such as country risk and the real exchange rate affecting FDI decisions. Cushman's theory appears as combination of macroeconomic thoughts and microeconomic principles. This theory is established on optimization in which firm design both domestic and foreign investment opportunities alternatively. Specifically, throughout different specifications of the model, the factors affecting FDI decisions, such as the exchange rate, relative input prices, which includes the long-term real exchange rate, domestic and international market size, the handiness of the resources needed for different investment opportunities and country risk.

A theory presented by Cushman (1985) was extended by Froot and Stein (1991). In addition to the real exchange rate, partial equilibrium model developed by Froot and Stein (1991) regarded as one of the determinants of FDI flows factors which included trade barriers, decline in relative asset-price caused by the foreign exchange rate depreciation, tax incentive structures and investments made through industry-specific growth in other countries. Along the same line of reasoning, the emphasis of the theory gradually directed from microeconomic and entrepreneurial aspects to macroeconomic principles in which the role played by different policy variables including trade barriers, taxes and exchange rates in FDI decisions is highlighted.

The validity of the theory presented by Froot and Stein (1991) is confirmed by empirical estimations across industries, showing the effect of various macro-level factors on FDI flows. This leads to draw a conclusion that the real exchange rate appears as one of the decisive determinants of FDI flows. This finding is also supported by the research study conducted by Goldberg and Kolstad (1995).

## 2. Literature Review

On the basis of different investment theories, the literature focuses on the role played by various macroeconomic variables in FDI decision making. As an example, De Mooij and Ederveen (2003) and Davies (2004) highlight the impact of taxes on cross-border investments. Their findings indicate that this effect appears elastic and significant. Different research studies highlight another element, which is the quality of institutions, particularly, when measured from the point of view of corruption. For instance, various corruption indices are negatively related to FDI inflows as found by Wei (2002).

Bloningen et al. (2005) examine the impact of different barriers to trade on FDI inflows. Broadly speaking, it is found that the substantial effective tariffs confronted by firms, ultimately encouraged FDI inflows. Such tariffs appear as a protective barrier, which bestow a privilege upon domestic production. Encouraging such a strategy is acknowledged as “tariff jumping”. A pioneer time series empirical analysis is done by Melo and Rodrigues (1998) on the determinants of FDI inflows in Brazil from 1970 to 1985. The findings suggest that FDI inflows are discouraged by the unstableness of macroeconomic policies and government investments. On the other hand, economic growth is recognised as a pull factor for FDI flow.

A panel study conducted by Nonnemberg and Mendonca (2004) of 33 countries on FDI determinants from 1985 to 2000. The macroeconomic variables such as GDP growth, trade openness, country risk, lagged GDP growth and energy consumption appeared significant while inflation rate and years of formal education remained insignificant. A study by Mattos et al. (2005) examined the real exchange rate along with aforementioned macroeconomic variables using a VAR model from 1980-2000. The result indicated that GDP growth and the real exchange rate attracted FDI inflows positively. An empirical by-sector analysis on FDI inflows is conducted by Amal (2005) in Brazil. The findings indicate that the growth rate of industrial production, rate of return on industrial production, relative wage rate, and the rate of return on previous investments attract FDI.

An analysis conducted by Amal et al. (2010) in the case of Latin America. The dynamic model used in this study included both macroeconomic and institutional variables, where economic freedom and political risk remained significant attracters of FDI flows. GDP also affected FDI inflows positively. The results of the study suggested that investment decisions are subjected by the absolute size of an economy. The exchange rate has a negative effect on FDI inflows, which lead to draw a conclusion that exchange rate fluctuations do affect international investments. Azam and Khattak (2009) examined different macroeconomic factors effecting FDI from 1971-2005 in Pakistan. It is found that market size and trade balance appeared significant.

Shahzad and Kaid Al-Swidi (2013) find significant macroeconomic variables affecting FDI flows of Pakistan such as GDP, imports and exports, balance of payment along with political stability. Hunjra et al. (2013) examine the impact of GDP growth rate, inflation, exchange rate, interest rate on FDI flows into Pakistan. The findings indicate that GDP growth and interest rate affect FDI flows significantly and inflation rate and exchange rate appear insignificant. A recent study conducted by Dias et al. (2014) complements the previous empirical studies. This study investigates the role of some new macroeconomic variables such as productivity and consumption in attracting FDI in the long run from 1992 to 2011 Brazil, employing SVAR model (structural VAR). The findings suggested that both productivity and consumption attract FDI inflows.

### 3. Data Description and Methodology

**3.1 Data:** In this study, annual data from 1980 to 2015 is used. The variables under investigation are as follows:

- Foreign Direct Investment (LFDI): An updated series of FDI flows into Pakistan in USD is extracted from World Development Indicators (WDI) of World Bank.
- Labour Productivity in Pakistan (LPP): Labour productivity computed as nominal GDP in USD is divided by the total employment in both rural and urban areas during the respective year, using data from WDI and Pakistan economic surveys.
- Labour Productivity in China (LPC): Labour productivity of China calculated as nominal GDP in USD is divided by the total employment of respective year using data from WDI and OECD economic and statistical surveys.
- Aggregate consumption (LC): Data on final consumption expenditure is retrieved from World Development Indicators (WDI) of World Bank.
- Effective Real Exchange Rate (LER): Data on real effective exchange rate is also collected from World Development Indicators (WDI) of World Bank.

### 3.2 Econometric Methodology

#### 3.2.1 Unit Root Tests (Stationarity Test)

Stationary time series means a time series data having constant mean and correlation function over the period of time. Stationarity test is presented by Engel and Granger (1987) i.e. an Augmented Dickey-Fuller (ADF) test is used to check the stationarity of different indicators.

##### 3.2.1.1 The Augmented Dickey Fuller Test

When the error term is correlated, ADF test is used in order to check stationarity. Following equation is estimated:

$$\Delta Y_t = \beta_1 + \beta_2 t + \alpha_0 Y_{t-1} + \alpha_1 \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t$$

Here  $\alpha$  and  $\beta$  are parameters,  $\Delta$  is the first difference operator, time trend is shown by  $t$ ,  $\varepsilon$  represents the error term and  $m$  indicates the lag length. The null hypothesis consists of non-stationarity that a non-stationary series can be rejected if  $\alpha_0$  is statistically significant.

##### 3.2.2 The Structural VAR Analysis

In this research study, structural vector auto regression (VAR) methodology is used to empirically analyze the impact of productivity changes both in Pakistan and China on the FDI inflow in Pakistan that is carried out by measuring the contagion effects of variation in productivity of both domestic (Pakistan) and foreign (China) on FDI inflow, in terms of structural shocks. These shocks indicate the unsystematic behavior different economic variables and their major interest is to find out impact on real

economic variables. Gottschalk (2001) has considered SVAR technique as the most popular technique in current time period. The structural VAR methodology is suitable to measure the dynamic response of estimated variables to different shocks as links between economic theory and the multiple time-series analysis. Structural VAR methodology uses economic theory to examine the relationship among the variables, and it reduces the problem attached with reduced form of VAR. System of simultaneous equations in the mathematical form can be expressed as:

$$By_t = \gamma_0 + A(L)y_{t-1} + M\varepsilon_t$$

Where  $y_t$  is a vector of endogenous variables,  $\gamma_0$  is constant,  $y_{t-1}$  is a vector of their lagged values,  $\varepsilon_t$  is a vector of disturbance terms of variables which reflect exogenous shocks,  $B$  is a square matrix of structural parameters,  $A(L)$  is the matrix of lag polynomials,  $M$  is the matrix that shows the response of endogenous variables to the structural shocks. The structural variables are not directly computable: the first step is to estimate reduced form VAR. To solve for reduced form structural VAR in two variable models can be written in matrix form as:

$$\begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

Or in vector form we can write it as  $BY_t = \Gamma_0 + \Gamma_1 Y_{t-1} + e_t$  Where  $\Gamma_0 = B^{-1} \gamma_0$ ,  $\Gamma_1 = B^{-1} A(L)$  and  $e_t = B^{-1} M \varepsilon_t$

Multiplication by  $B^{-1}$ , we obtain the standard VAR model. The error terms in structural VAR models are assumed to be uncorrelated in order to measure unexpected shocks (Zivot, 2000). In VAR methodology, the source of variation of  $y_t$  is random disturbances that is defined by  $e_t$  in reduced form usually known as a vector of innovations and this is considered as the only source of variation in  $y_t$  variables (Amisano and Giannini, 1997). This research study employs the SVAR technique by using long run restrictions generate impulse response function and variance decomposition. The SVAR analysis focuses on the response of endogenous variables due to shock to one of the endogenous variable. It also employs the direction of correlation between innovations and variables. Structural VAR model derived under certain theoretical restrictions in order to identify exogenous policy shocks. There are number of methods to get parameters in structural form equations from the parameters in the reduced form equation. A well known method is to orthogonalize reduced form disturbances defined by cholesky decomposition. Structural VAR is also defined by Bernanke (1986), Blanchard & Watson (1986) and Sims (1986) in which restrictions are applied only on contemporaneous structural parameters. These restrictions can be defined with respect to time i.e. short run restriction and long-run restrictions. Short run restrictions are interpretable easily if prior knowledge is available but that knowledge is hardly available (Khan, 2008) Blanchard and Quah (1989) SVAR approach used the long run restrictions to identify exogenous shocks and to check their effect on endogenous variables. The selection of restrictions depends on whether the shocks are permanent or temporary (Tashrifov, 2005).

### 3.2.2.1 Specification of SVAR Model and Identification of Restrictions

For empirical investigation, the SVAR model has been constructed for the FDI flows into Pakistan. This SVAR methodology is composed of a system of simultaneous equations that depict a relation among FDI inflows and macroeconomic indicators under the standard Cholesky decomposition of VAR residuals. LFDI, LPP, LPC, LC, LER is the initial ordering of both FDI and macroeconomic indicators. Foreign direct investment (LFDI) is ordered ahead of all variables because this research paper

analyses the formation of different variables in attracting foreign direct investment in Pakistan along with the underlying hypothesis is that both Pakistani and China's labor productivity indicators cause and effect the foreign direct investment of Pakistan. The structural model of this study can be expressed in mathematical form as:

$$LFDI = \beta_{10} + \beta_{12}LPP + \beta_{13}LPC + \beta_{14}LC + \beta_{15}LER + \alpha_{11}LFDI_{t-1} + \alpha_{12}LPP_{t-1} + \alpha_{13}LPC_{t-1} + \alpha_{14}LC_{t-1} + \alpha_{15}LER_{t-1} + \mu_t^{LFDI}$$

$$LPP = \beta_{20} + \beta_{11}LFDI + \beta_{13}LPC + \beta_{14}LC + \beta_{15}LER + \alpha_{11}LFDI_{t-1} + \alpha_{12}LPP_{t-1} + \alpha_{13}LPC_{t-1} + \alpha_{14}LC_{t-1} + \alpha_{15}LER_{t-1} + \mu_t^{LPP}$$

$$LPC = \beta_{30} + \beta_{11}LFDI + \beta_{12}LPP + \beta_{14}LC + \beta_{15}LER + \alpha_{11}LFDI_{t-1} + \alpha_{12}LPP_{t-1} + \alpha_{13}LPC_{t-1} + \alpha_{14}LC_{t-1} + \alpha_{15}LER_{t-1} + \mu_t^{LPC}$$

$$LC = \beta_{40} + \beta_{11}LFDI + \beta_{12}LPP + \beta_{13}LPC + \beta_{15}LER + \alpha_{11}LFDI_{t-1} + \alpha_{12}LPP_{t-1} + \alpha_{13}LPC_{t-1} + \alpha_{14}LC_{t-1} + \alpha_{15}LER_{t-1} + \alpha_{16}ER_{t-1} + \mu_t^{LC}$$

$$LER = \beta_{50} + \beta_{11}LFDI + \beta_{12}LPP + \beta_{13}LPC + \beta_{14}LC + \alpha_{11}LFDI_{t-1} + \alpha_{12}LPP_{t-1} + \alpha_{13}LPC_{t-1} + \alpha_{14}LC_{t-1} + \alpha_{15}LER_{t-1} + \mu_t^{LER}$$

Representation of SVAR model in 5X5 matrixes with identification restriction will be as:

$$\begin{bmatrix} \mu^{LFDL} \\ \mu^{LPP} \\ \mu^{LPC} \\ \mu^{LC} \\ \mu^{LER} \end{bmatrix} \sim \text{i.i.d} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \beta_{21} & 1 & 0 & 0 & 0 \\ \beta_{31} & \beta_{32} & 1 & 0 & 0 \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & 0 \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & 1 \end{bmatrix}$$

In order to apply the long run restrictions generally lower triangular matrix is considered. Where in system of equations LFDI, LPP, LPC, LC and LER are endogenous variables.  $\mu_t^{LFDI}$ ,  $\mu_t^{LPP}$ ,  $\mu_t^{LPC}$ ,  $\mu_t^{LC}$ ,  $\mu_t^{LER}$  are uncorrelated and depicted as structural innovations. The system of equations can be expressed in matrix form as:

$$\begin{bmatrix} 1 & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & 1 & \beta_{23} & \beta_{24} & \beta_{25} \\ \beta_{31} & \beta_{32} & 1 & \beta_{34} & \beta_{35} \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & \beta_{45} \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & 1 \end{bmatrix} \begin{bmatrix} LFDI \\ LPP \\ LPC \\ LC \\ LER \end{bmatrix} = \begin{bmatrix} 1 & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & 1 & \beta_{23} & \beta_{24} & \beta_{25} \\ \beta_{31} & \beta_{32} & 1 & \beta_{34} & \beta_{35} \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & \beta_{45} \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & 1 \end{bmatrix} \begin{bmatrix} LFDI_{t-1} \\ LPP_{t-1} \\ LPC_{t-1} \\ LC_{t-1} \\ LER_{t-1} \end{bmatrix} + \begin{bmatrix} \mu^{LFDL} \\ \mu^{LPP} \\ \mu^{LPC} \\ \mu^{LC} \\ \mu^{LER} \end{bmatrix}$$

Where  $i = 1, 2, \dots, n$ . The first step in the calculation of structural VAR is to calculate reduced form of VAR. In reduced form of VAR model error terms are linear combinations of structural disturbances and having covariance matrix as  $E(\mu_{1t} \mu_{2t}) = \Sigma$ . Without imposing theoretical restrictions, structural VAR parameters cannot be identified. In order to calculate SVAR model long run restrictions have been applied in this study. The analysis of SVAR with long run restrictions put forwarded by Shapiro and Watson (1988), and Blanchard and Quah (1989). This technique become more popular, as long run restrictions are important because these are less controversial and also analyze short run dynamics without using further restrictions, most of economic models also defines the long term effects.

## 4. Discussion of Empirical Results

### 4.1 Unit Root Analysis

This section contains the empirical results and the analysis of these results. Results have been organized in tabulated form and provide overview about the response of foreign direct investment to different macroeconomic variables. The size of response has been measured with the help of SVAR to analyze the impact of productivity changes shocks. But before proceeding to SVAR, it is important to check the stationarity of the variables. In order to measure the unit root hypothesis ADF test has been used. The results of these tests are tabulated as:

**Table 1: Unit Root Analysis**

Variables	ADF				Remarks
	Level	Prob.	I <sup>st</sup> Diff.	Prob.	
LFDI	0.8798	0.8946	-4.9703	0.0000***	I(1)
LPP	3.0001	0.9989	-4.7177	0.0000***	I(1)
LPC	-0.0221	0.6677	-3.5493	0.05480**	I(1)
LC	5.3012	1.0000	-3.5185	0.0009***	I(1)
LER	-1.5929	0.1035*	-4.1275	0.0001***	I(0,1)

**Notes:** Rejection of the null hypothesis (the variable has unit root) at 1% level is indicated by three asterisk (\*\*\*) , or 5% level by two asterisk (\*\*) or, 10 % level by one asterisk (\*). All the variables are in log form.

The results indicate that all the variables are integrated at same order, if we take decision on the basis 5% level of significance. The results of ADF test show that variables like foreign direct investment (LFDI), labor productivity of Pakistan (LPP), labor productivity of China (LPC), consumption (LC) and real effective exchange rate (LER) are stationary at first difference.

### 4.2 The Structural Vector Autoregressive (SVAR) Analysis

Structural VAR method has been used to measure the structural shocks of productivity and consumption changes in attracting foreign direct investment. SVAR results are summarized as impulse response function (IRF) and variance decomposition. Impulse response function defines the time path of the variables in response to different shocks, while variance decomposition delineates the relative importance of different shocks by explaining the share of each shock in total variation in endogenous variables (khan, 2008). For the calculation of SVAR, it is important to select the appropriate lag length. For that number of lag selection criteria's are available like Schwarz Information Criteria, Akaike Information Criteria, LR test statistic, Hannan-Quinn (HQ) information criterion. On the basis of these criteria optimum lag length 5 has been selected.

#### 4.2.1 Impulse Response Function (IRF)

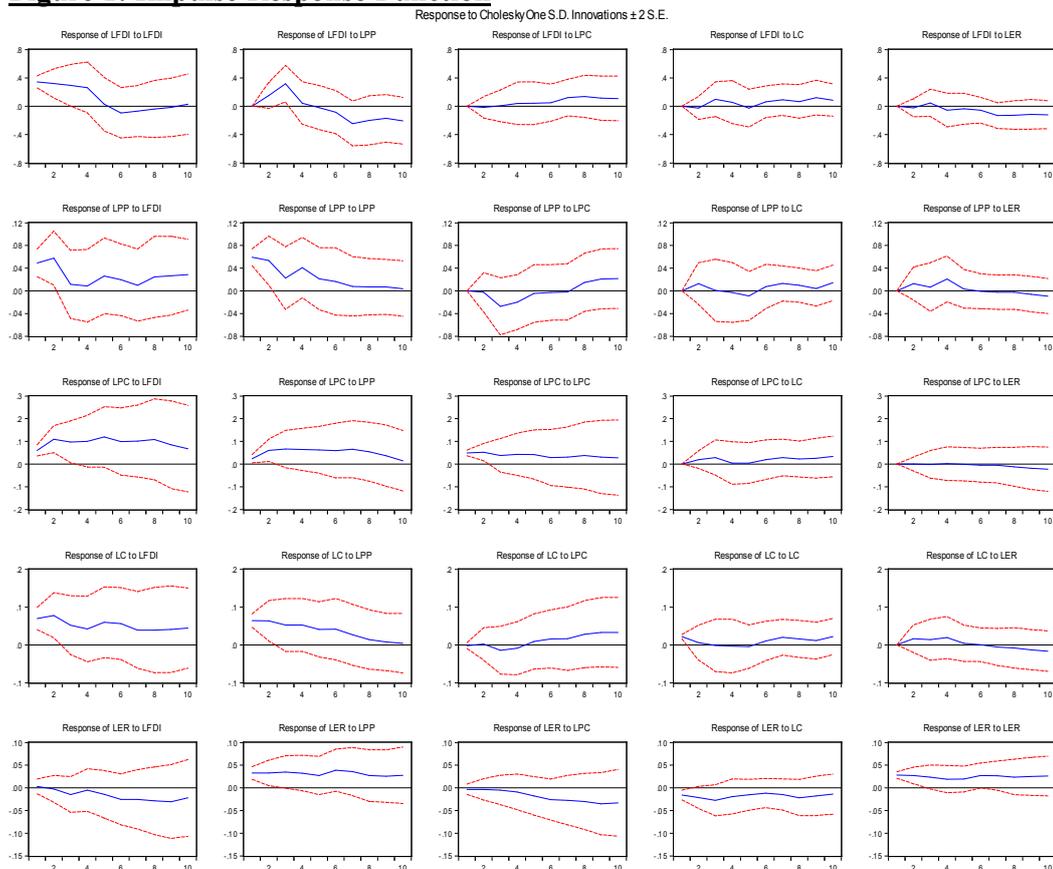
On the basis of optimal lag length selections, 5 lags are selected for the model under consideration. In Figure 1, short run mechanism has been defined by the impulse response function based on long-run restrictions. Results show the response function of FDI flows to macroeconomic variables, one unit shock to demand and productivity innovations. Initially, FDI remains positive for the four years due to its own shock, followed by a decrease in the FDI flows by 3 percentage point in fifth year. Then, there is a sharp decline in FDI around 5% percent for the next year then again started increasing. More or less the same response of LFDI to LPP is shown. Shock in productivity of Pakistan (LPP) attracts FDI in the long run till the 5-year. The impact

of productivity does not die out in the long run. However, the response of LFDI to LPC is remained close to zero line till 6-year indicating that Pakistani FDI inflows are independent of changes in Chinese productivity but positive afterwards. Empirically, this variation in FDI confirms a positive relationship between LPP and LFDI. However, positive relationship also finds between LPC and LFDI, by virtue of spillover effects of Chinese productivity. A noteworthy fact is that the contagion effects of productivity changes of both Pakistan and China on FDI are usually permanent and remains statistically significant in the long run.

Theoretically, there exists a positive relationship between FDI and LC. Upward growth in consumption means increase in aggregate demand. As a result of excess demand more investment opportunities and more FDI inflows. Initially, a demand side shock to consumption indicates no change in FDI flows for the first two years followed by a rise in FDI flows for the next two years. Again, long term variation in FDI flows is explained by consumption. Lastly it does not revert to base line after 10-years indicates that FDI is attracted by aggregate demand in the long run. Both productivity and consumption variables attracts FDI in the long run. These findings are in line with that of Dias et al. (2014).

Any shock to real affective exchange rate (LER) causes a movement along the zero line till the six year. Afterwards LER gets negative indicating a decrease in FDI flows in the long run, which leads to draw a conclusion that real effective exchange rate has an impact on international investment flows, in case of an appreciation of a local currency because items become more expensive abroad which are locally produced (Benassy-Quere et al., 2001). This finding is similar to that of Amal at al. (2010). However, LER is not significantly related to LPP and LPC in figure 1 indicating that variation in productivity is independent of any change in relative prices.

**Figure 1: Impulse Response Function**



## 4.2.2 Variance Decomposition

**Table 2: Variance Decomposition: A Structural VAR Analysis**

<b>Variance Decomposition of LFDI:</b>						
Period	S.E.	LFDI	LPP	LPC	LC	LER
1	0.34332	100	0	0	0	0
2	0.49481	90.1902	9.23192	0.09386	0.25837	0.2257
3	0.66656	69.1126	27.9055	0.05787	2.30856	0.61552
4	0.72327	71.9328	24.0671	0.35113	2.56268	1.08624
5	0.72670	71.4094	23.9104	0.68175	2.67639	1.32200
6	0.74402	69.7029	24.0997	1.06751	3.27937	1.85052
7	0.81153	59.3195	29.2979	3.14248	4.05183	4.1883
8	0.86017	52.9970	31.4975	5.39684	4.20017	5.90843
9	0.90005	48.4350	32.3787	6.52123	5.65088	7.01419
10	0.94194	44.3156	34.3905	7.30477	5.95584	8.03325
<b>Variance Decomposition of LPP:</b>						
1	0.07698	40.7683	59.2317	0	0	0
2	0.11147	46.0621	51.3160	0.05069	1.27651	1.29468
3	0.11772	42.2556	49.6981	5.44243	1.14936	1.45457
4	0.12833	36.0204	52.0173	7.06533	1.01649	3.88047
5	0.13314	37.3666	50.8568	6.68879	1.4171	3.67069
6	0.13577	37.9967	50.3310	6.48022	1.65902	3.53304
7	0.13700	37.8503	49.7485	6.38581	2.51497	3.50042
8	0.14045	39.0068	47.5836	7.17690	2.87469	3.35798
9	0.14480	40.0721	44.989	8.82446	2.78404	3.33042
10	0.15015	40.8667	41.8985	10.2801	3.47321	3.48145
<b>Variance Decomposition of LPC:</b>						
1	0.08147	55.4734	8.45492	36.0717	0	0
2	0.15922	61.7253	16.4898	20.3061	1.47877	4.60E-05
3	0.20366	60.6273	20.5518	15.9157	2.89742	0.00786
4	0.24006	61.163	22.0087	14.699	2.11943	0.00992
5	0.27837	63.7872	21.3789	13.2236	1.60055	0.00977
6	0.30329	64.3821	21.8143	12.0317	1.73337	0.03858
7	0.32905	64.1355	22.4971	11.0928	2.21477	0.05979
8	0.35365	64.9727	21.8177	10.7290	2.30434	0.17627
9	0.36808	65.2808	21.1224	10.5820	2.61195	0.40282
10	0.37776	65.1905	20.1964	10.5876	3.26902	0.75643
<b>Variance Decomposition of LC:</b>						
1	0.09713	51.4604	43.4358	0.0503	5.05352	0
2	0.14090	55.0133	41.0580	0.04323	2.57943	1.30600
3	0.16030	53.0080	42.4299	0.83719	2.00216	1.72284
4	0.17514	50.1253	44.5413	0.97292	1.71328	2.64723
5	0.18978	52.5899	42.5331	1.05084	1.52562	2.30064
6	0.20299	53.6035	41.2960	1.49824	1.59115	2.01109
7	0.21007	53.5246	40.1400	1.99474	2.38949	1.95124
8	0.21666	53.5644	38.1450	3.55325	2.7555	1.98182
9	0.22376	53.5882	35.8711	5.51435	2.83436	2.19201
10	0.23208	53.4566	33.3765	7.09502	3.51523	2.55663
<b>Variance Decomposition of LER:</b>						
1	0.04613	0.45115	50.1312	0.50706	11.5144	37.3962
2	0.06635	0.36238	48.4397	0.55471	15.9732	34.6700
3	0.08479	3.35375	46.4802	0.67054	20.3977	29.0979
4	0.0953	2.93385	48.4211	1.47736	20.1969	26.9708
5	0.10459	4.35432	46.8182	4.06803	18.9673	25.7923
6	0.12099	7.61949	45.3750	7.65163	15.0928	24.2611
7	0.13508	9.66674	43.4095	10.2543	13.3065	23.3629
8	0.14742	11.9062	39.7759	12.7632	13.3415	22.2131
9	0.15966	13.8000	36.4634	15.7355	12.6149	21.3862
10	0.16944	13.9492	35.0370	17.8048	11.8777	21.3313
Cholesky Ordering: LFDI LPP LPC LC LER						

Table 2 shows variance decomposition for the series of FDI. The time horizon is 1 to 10 years. FDI shows 44.32 percent variation due to its own innovations in 10-year. Compiled productivity shocks have shown the contribution of 41.69 percent in explaining variation in FDI flows, but Pakistani productivity shocks are stronger as compare to Chinese productivity shocks in explaining variation in FDI. This predictive power is significant over ten-year time horizon because in 10-year productivity shocks and demand shocks have contributed 41.69 percent and 5.96 percent respectively. This finding leads to accept the hypothesis that productivity attracts FDI.

Forecast error variance of Pakistani productivity (LPP) is defined at the time horizon 1 to 10 years. This productivity shock has contributed 34.39 percent at time horizon 10-year in attracting FDI. However, consumption (LC) shock shows least contribution while attracting FDI flows but remained significant in the long run. LC shows least predictive power among all variables which is 5.96 percent. Real effective exchange rate (LER) is somewhere in the middle showing predictive power of 8.033, followed by LPC attracting FDI flows by 7.30 percent.

LPP remained a dominant variable in attracting FDI flows, followed by real effective exchange rate (LER) which attracts FDI 8.033 percent. While large contribution in innovations is defined by its own shock over ten-year which is 44.32 percent. Overall, 55.58 percent of FDI is predicted by macroeconomic variables and 44.32 % by itself.

The following conclusions have been drawn, on the basis of the SVAR methodology. First, impulse response function (IRF), productivity variation has appeared as a long-term phenomenon exhibiting a long run effect on FDI flows, which returns to baseline values in the long run. Heterogeneity is found in the magnitude, persistence and timing of the responses to productivity shocks. Second, the effects remained modest, on average. Third, variance decomposition indicates that the Pakistani productivity (LPP) is the most dominant factor in attracting forecast error variance of FDI flows.

**Table 3: Diagnostic Test Statistics**

Tests	$\chi^2$	LM-Stat	Prob.
VAR Granger Causality/ Block Exogeneity Wald Tests	27.700		0.0343
Joint Heteroskedasticity Test	334.35		0.4228
VAR Residual Serial Correlation LM Tests		24.811	0.4730
<b>VAR Residual Normality Tests</b>			
Skewness	2.0548		0.8415
Kurtosis	3.2932		0.6549
Jarque-Bera	5.3480		0.8668

Block exogeneity Wald Tests indicate that there exists short run causality. The block exogeneity Wald tests which is based on the VAR Granger causality test indicates that  $\chi^2=27.70$ , which lead to draw a conclusion that there exists a short run causality among the variables undertaken and also meets the criteria of joint exogeneity.

Joint heteroskedasticity test indicates that there is homoskedasticity because the Prob ( $\chi^2$ ) = 0.4228 which is greater than 0.05. The null hypothesis of no heteroskedasticity can not be rejected, which means that there is no need to add any variable in the model and declares that no fluctuation in the data.

VAR Residual Serial Correlation LM test under the null hypothesis of no serial correlation at lag order h is applied to find serial correlation in the data. Prob ( $\chi^2$ ) = 0.4730 is greater than 0.05 of LM test, which leads to accept the null hypothesis of no serial correlation.

According to Jarque Bera normality test, the residuals are normally distributed because Prob (Jarque Bera) = 0.8668 is greater than 0.05 and the Jarque-Bera test for normality yields  $\chi^2 = 5.3480$ . This result leads to accept the null hypothesis of the normality of the SVAR residuals. Overall, the acceptance of the null hypothesis of normality in the data i.e. residuals are multivariate normal which declares that no structural breaks or outliers in the data. All these diagnostic tests indicate that the SVAR model is well specified.

## 5. Conclusion

This paper investigates the role of labor productivity in attracting foreign direct investment in Pakistan employing SVAR model taking Chinese economy as a reference. This article inquires into a new set of macroeconomic variables that appear significant in attracting investment flows into Pakistan. The aim of this research study is to examine the contagion effects of productivity variations on FDI flows in Pakistan for the period of 1980 to 2015. It is hypothesized that foreign direct investment inflows may be encouraged by an increase in domestic productivity; while the FDI may be discouraged an increase in foreign productivity, *ceteris paribus*; the role of aggregate demand in attracting FDI may also be tested over the long run.

On the basis of proposed hypothesis, Structural vector autoregressive (SVAR) technique is employed to take into account simultaneity problem by imposing long-run restrictions. Identification is achieved by assuming that labor productivity is able to attract foreign direct investment in the long run. The results of impulse response function confirm that productivity is a long-term phenomenon in attracting foreign direct investment. It is also found that FDI flows into Pakistan react to consumption changes in the long run.

The results of variance decomposition suggest that the productivity of Pakistan is the most dominant factor in predicting forecast error variance of foreign direct investment in Pakistan. Pakistani productivity shocks are stronger as compare to Chinese productivity shocks in explaining variation in FDI. This finding leads to accept the hypothesis that an increase in productivity of Pakistan attracts FDI. The real effective exchange rate behaves negatively to FDI flows in the long run, reflecting that locally produced goods are more expensive. It is recommended that, all the economic policies that increase countries' productivity and consumption growth in the long run are caused to attract FDI. The findings of this research study also recommend sound policy implications for policy makers to make strategic decisions in the context of China-Pak Economic Corridor (CPEC).

## References

- Amal M (2005) Determinantes do Investimento Direto Externo na Indústria de Transformação no Brasil: Um Estudo em Dados de Paineis. *Revista de Negócios* 10: 135-152
- Amal M, Tomio BT, Raboch H (2010) Determinants of Foreign Investment in Latin America. *Journal of Globalization, Competitiveness and Governability* 4:116-233
- Amisano. G and Giannini. C (1997) *Topics in Structural VAR Econometrics*, Second, revised and Enlarged Edition, Heidelberg: Springer, Berlin.
- Azam, K. M. Naeem-ur-Rehman Khattak ( 2009) Effect of economic factors on foreign direct investment inflow: Evidence from Pakistan (1971-2005). *Sarhad J. Agric*, 25(1), 135-140.
- Benassy-Quere, A., Fontagne, L., and Lahreche-Revil, A. (2001) Exchange – rate Strategies in the Competition for Attracting Foreign Direct Investment. *Journal of the Japanese and International Economics*, Vol. 15, No. 2, pp. 178 – 198.
- Bernanke, Ben S. and Alan Blinder (1992) The Federal Funds Rate and the Channels of Monetary Transmission, *American Economic Review*, vol. 82, no. 4, pp. 901-21.
- Blanchard, O. and D. Quah (1989) The Dynamic Effects of Aggregate Demand and supply Disturbance. *American Economic Review*, 79: 655-73.

- Blonigen BA, Christopher JE, Dietrich F. (2005) Industrial Groupings and Foreign Direct Investment, *Journal of International Economics* 65: 75-91
- Buckley PJ, Casson M (1981) The Optimal Timing of a Foreign Direct Investment, *Economic Journal* 91: 75-87
- Buckley PJ, Ghauri PN (1999) *The Internationalization of a Firm: A Reader*. London: International Thomson Business Press.
- Cushman DO (1985) Real Exchange Rate Risk, Expectations, and the Level of Direct Investment, *Review of Economics and Statistics* 67: 297-308.
- Davies RB (2004) Tax Treaties and Foreign Direct Investment: Potential Versus Performance, *International Tax and Public Finance* 11: 775-802
- De Mooij RA, Ederveen S (2003) Taxation and Foreign Direct Investment: A Synthesis of Empirical Research, *International Tax and Public Finance* 10: 673- 693
- Dias MHA, Dias J, Hirata J (2014) Foreign Direct Investment in Brazil: The Effects of Productivity and Aggregate Consumption. *J Stock Forex Trad* 3:127
- Dunning JH (2001) The Eclectic (OLI) Paradigm of International Production: Past, Present and Future. *International Journal of Economics and Business* 8: 173-190
- Engle, R. F., & Granger, C. W. (1987) Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276
- Froot KA, Stain JC (1991) Exchange Rates and Foreign Direct Investment An Imperfect Capital Markets Approach, *Quarterly Journal of Economics* 106: 1191-1217
- Goldberg LS, Kolstad CD (1995) Foreign Direct Investment, Exchange Rate Variability and Demand Uncertainty, *International Economic Review* 36: 855-873.
- Gottschalk, Jan (2001) An Introduction into the SVAR Methodology: Identification, Interpretation and Limitations of SVAR models, Kiel Working Paper No.1072
- Hunjra, A. I., Raza, S. A., & Asif, M. U. (2013) Impact of Macroeconomic Variables on Foreign Direct Investment in Pakistan. *Bulletin of Business and Economics*, 2(2), 40-52.
- Hymer SH (1960) *The International Operations of National Firms: A Study of Direct Foreign Investment*, Cambridge: MIT Press, UK.
- Khan (2008) Short Run Effect of an Unanticipated change in Monetary Policy: Interpreting Macroeconomic Dynamics in Pakistan, *SBP Research Bulletin*, vol.4, no.1.
- Mattos LB, Cassuce FCC, Campos AC (2005) Determinantes do Investimento Estrangeiro no Brasil: 1980-2004, *Revista Economia Contemporânea* 11: 39-60
- Melo GM, Rodrigues Jr W (1998) Determinantes do Investimento Privado no Brasil: 1970-1995. *Texto para Discussão N 605 IPEA*
- Nonnemberg MJB, Mendonça MJC (2004) Determinantes dos investimentos Diretos Externos em Países em Desenvolvimento, *Texto para Dsicussão N 1016 IPEA*.
- Pakistan Economic Survey, Ministry of Finance, Government of Pakistan
- Shahzad and Kaid Al-Swidi (2013) Effect of Macroeconomic Variables on the FDI inflows: The Moderating Role of Political Stability: An Evidence from Pakistan, *Asian Social Science* 9(9): 270-279.
- Shapiro, M., & Watson, M. (1988) Sources of business cycles fluctuations. In *NBER Macroeconomics Annual 1988, Volume 3* (pp. 111-156). MIT Press
- Sims, C.A.(1980) Are Forecasting Models Usable for Policy Analysis? *Quarterly Review* (Federal Reserve Bank of Minneapolis), Vol.10, No.1, pp, 2-16.
- Tashrifov.M (2005) Monetary Policy Model of Tajiskistan: Astructural Vector Autoregression Approach, *Asia Pacific School of Economics and Government Working Papers* 05-9
- Vernon, R. (1966) International Investment and International Trade in the Product Cycle, *Quarterly Journal of Economics* 80: 190-207.
- Wang, J. Y. (1990) Growth Technology Transfer and the Long – run Theory of International Capital Movements. *Journal of International Economics*, 29, Pp. 255 – 271.
- Wei SJ (2000) How Taxing is Corruption on International Investors? *Review of Economics and Statistics* 82: 1-11
- Zivot. E. (2002) Notes on Structural VAR Modeling, <http://faculty.washington.edu/ezivot/econ584/584notes.htm>