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Growth, FDI and Exports in Pakistan: A Co-integration Analysis

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Abstract

Most of the empirical work has identified openness with trade to analyze the impacts of outward-oriented policies in developing countries. The exports promote both growth and foreign trade, and foreign direct investment is one of the important factors of foreign trade. Therefore, this study analyses the long run co-integrating relationship among foreign direct investment, exports and GDP. The result shows that long run relationship exists between growth and exports but not with FDI. Therefore, FDI is not a significant determinant of growth in the long run. This study also analyses the causality among these variables in the short-run, FDI is also not affecting the growth, but growth affects both FDI and exports. Moreover, export and FDI are also not significantly influencing each other in the short-run.

I. Introduction

A large numbers of empirical studies have analysed the impacts of foreign direct investment (FDI) and exports on economic growth. Most of the studies focussed the export-led-growth hypotheses (ELG) to analyze the relationship between exports and growth. The ELG hypothesis (ELG) suggests a positive correlation between export and growth, and also considered exports as a main determinant of overall economic growth. Because export sector; generates positive externalities through more efficient management and improved production techniques (Feder, 1982), increase productivity by offering potential for scale economies and alleviate foreign exchange constraints and greater access to international market. Therefore, export-oriented policies always positively contributed to economic growth. The Growth rates attained by the South-East Asian tigers since the mid 1960s (higher than those achieved elsewhere in the world) are normally cited as the

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best example for the success of the ELG strategy. These export oriented policies not only increased the trade but also foreign direct investment.

The flow of FDI to was significantly increased during the decades of 1980s & 1990s, and is considered as an important source of advanced technologies for the recipient countries (Barrell and Pain 1997, Cuadros 2001 and Henrik et al 2004). The FDI has grown at least twice rapidly as trade (Meyer, 2003). The very first reason for this increase is the shortage of capital in developing countries that leads to higher marginal productivity of capital in these nations. The second reason is capital owner's desire for higher return on their capital. According to Borensztein et al, (1998), FDI played a key role in the technological progress of the recipient countries. Besides this, FDI also effects economic growth by generating productivity spill over. Blomstrom (1986) found that FDI has positive significant spillover effects on the labour productivity of domestic firms and growth of domestic productivity in Mexico.

The developing countries have changed their strategies from import substitution to export-orientation. These policies were in line with the body of literature, created to examine the determinants of exports & FDI and their impacts on economic growth. The FDI has multi-dimensional issues that include trade, employment, cost of production etc[2]. The inward FDI not only stimulate the local investment but also increase the host country's export capacity. Therefore, liberalization policies of developing countries increased their trade as well as inflow of FDI (Goldberg and Klien, 1999).

Pakistan has also followed the export-oriented policies and reframed its commercial policy towards fewer and fewer controls. The tariffs rates were reduced to enhance the degree of openness. These policies have significantly affected the infow of FDI and it reached to $500.27 million in the decade of 1990s as compared to $88.83 million in the decades of 1980s. These liberalization policies further enhanced the inflow of FDI that reached to $3.52 billion in 2005-2006, $5.14 billion in 2006-2007 and $5.41 billion in 2007-2008. But poor economic performance and terrorist's activities badly affected the flow of FDI. The FDI was suddenly dropped to the level of $3.72 billion in 2008-09 and $1.72 billion in 2009-10. This reduction in FDI was 53% as compared to previous year and 68% as compared to its highest value in 2007-08. The main sectors that have shows largely reduction in FDI were

[2] See, Freenstra and Hanson (1997).

telecommunication and financial services. Only these two sectors contribute 81% of total reduction in FDI[3].

This study has tried to analyse the long run relationship among GDP, Exports and FDI in the present scenario. We used annual data series and co-integration technique to investigate this relationship. Before proceeding to co-integration, we checked all data series for stationarity which one is basic condition for cointegration. For this purpose, we applied two tests; Augmented Dickey-Fuller (ADF) and Kwiatkowski, et al. (KPSS). Both tests results show that all data series are non-stationary but their first differences are stationary. This implies that all data series are having integrating order one I(1). We used Johansen and Juselius (1990) procedure to examine the long run relationship among variables. The results show that GDP has long run relationship with exports but not with FDI. Therefore, FDI is not considered as a determinant of GDP in the long run. We also tried to capture the short-tern dynamics by using the error correction model (ECM). The results of Granger Causality tests predict that FDI is not affecting the GDP whereas GDP affects both FDI and Exports. The study's results also argued that exports and FDI are also not causing each other in the short-run.

The rest of the study is organized as follows: Section II deals with literature review and theoretical framework, section III is specified to specify methodology and data sources whereas section IV discusses empirical results. The last section gives the brief summary of study and conclusion.

II. Literature Review and Theoretical Framework

The existing empirical studies focused a number of factors that determined the flow of FDI but technology and domestic market size got special attention. The FDI will be considered as growth enhancing if it positively influences technology or it increases production through spillover and technological transfers (Shiva and Somwaru, 2004). Some studies like Lim (2001), and Moosa (2002) tried to create a link between domestic market sizes, differences in factor costs and location of FDI. The importance of market size and its growth will further intensified in case of those foreign investors who prefer to invest in those industries, which exhibit relatively large economies of scale. The most of the studies have used GDP, GDP/Capita or growth in GDP as a proxy to measures the market size. All these studies predict a positive relation between FDI and market size.

[3] Pakistan Economic Survey (various issues).

Therefore, growth augmenting FDI and its positive relation with market size created a bi-directional behaviour between two variables FDI and GDP. This bi-directional behaviour also becomes the cause for simultaneity bias between these two variables. In contrast, Charkovic and Levine (2005) have shown either insignificant or negative impact of FDI on growth. This might be due to crowding out effect of FDI on domestic capital.

A similar two-way causality discussion exists in empirical literature for exports and GDP. The first way makes export led growth hypothesis (ELG), while the other way is also equally appealing hypothesis that GDP growth leads to exports growth also. According to Shiva and Somwaru (2004), argued that export growth leads to increase in factor productivity. This might be result of gains acquired from increasing returns to scale. Moreover, export's growth enhances the foreign exchange reserves that make possible to increase the import of capital/technology-intensive intermediate inputs. The rises in exports also enhance the efficiency of exporters and make them able to compete in foreign markets. This practice results in domestically improvement in technology and grooming of domestic entrepreneurs. The open trade regime supports the inflow of better technologies that lead to better investment environment (Grossman and Helpman, 1991). This hypothesis is further supported by the findings of studies like Giles and Williams (2000) and, Ahmad, Alam and Butt (2004).

On the other hand, Jung and Marshal (1985) supported the second hypothesis and suggested that in a growing economy, the process of technological change and learning are not the results of government's export promotion policies. This process might be the result of human capital formation, cumulative productive process, transfer of technology via direct investment or physical capital accumulation. This increased growth leads to increase in the production of goods and if domestic market not able to absorb it. Then, exporters look outward to sell this increased output. This implies that increased growth leads to increase in exports. This causal relationship becomes negative if increased output result in decrease in export instead of increase. This might be due to domestically increased consumers demand for these exportable goods.

At last, there exists a third bi-directional causality between FDI and export. According to Hsiao and Hsiao (2006), exports increase the inflow of FDI. This might be through paving the way for FDI by gathering information about the host country that helps in reduction of investors' transaction costs.

The FDI also become the source of reduction in exports by serving the foreign markets through establishing production facilities there. Therefore, Petri and Plummer (1998) argued that it is not clear whether causality runs from FDI to exports or exports to FDI. Some studies have also mentioned other aspects of FDI like Gray (1998) pointed out market seeking FDI or efficiency seeking FDI, Kjima (1973) mentioned whether FDI is trade oriented or anti trade oriented and Vernon (1966) explored that FDI can be at the early product life cycle stage (substitute) or at the mature stage (complement). Moreover, Johanson & Widershen (1975), Nicholas (1982) and UNCTAD (1996) tried to analyze the linkages between exports and FDI. These studies suggest that manufacturing firms first start trade with foreign nation before making the investment in these economies. They consieder it less risky than FDI. After getting full informations about these countries economies, political and social conditions, these firms establish subsidiaries in these nations and then subsidiary exports. Therefore, FDI-export nexus is also as complicated as the other bivariate causal discussion.

This study uses a multivariate cointegration instead of bi-variate causality tests using three variables FDI, exports and GDP. When we consider two relations like export-GDP and GDP-FDI, then relation between exports and FDI might be through GDP. Because export's growth leads to GDP growth and GDP growth make possible further inflow of FDI. This implies that exports are the driving force for FDI through GDP. After pinpointing the channeling effect, it is necessary to explore that this established causality is either effective in the short run, long run or both.

III. Methodology and Data Sources

This study used Vector Auto Regressive (VAR) model and co-integration to investigate the short run and long run relationship among exports, FDI and Growth. For VAR model estimation and co-integration analysis, it is necessary that all data series must have same cointegration order. Therefore, first we examined the all data series for the presence of unit root (stationarity test for data series). The stationarity of data series can be verified by various techniques like plotting the correlogram of the data series, applying Dickey and Fuller (1979), Augmented Dickey-Fuller (1981), Phillips-Perron test (1988) and Kwiatkowski, et al. (KPSS, 1992). Out of these, we used two main tests KPSS and ADF to check the stationarity problem of all three data series.

3.1. Augmented Dickey-Fuller (ADF) Test

The Dickey-Fuller (1979) used first order auto-regressive model to test the stationarity of data series by including drift and linear time trend in the model as follows:

Y_t is a random walk: $\Delta Y_t = \delta Y_{t-1} + \varepsilon_t$

Y_t is a random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + \varepsilon_t$

Y_t is a random walk with drift around a stochastic trend

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \varepsilon_t$$

According to Dickey and Fuller (1979), under the null hypothesis ($\delta = 0$), the estimated t value of the coefficient of Y_{t-1} follows τ (tau) statistic instead of following t distribution even in large samples. In empirical literature, tau statistic or test is called Dickey-Fuller test.[4] This test suggests that if ($\delta = 0$) is rejected against the ($\delta < 0$), then concerned data series is stationary (no unit root). This test assumes that error term (ε_t) is uncorrelated. Dickey and Fuller also developed a new test to resolve this issue. This test is known as Augmented Dickey-Fuller (1981), ADF test. This test adjusts the Dickey-Fuller test to take care of serial correlation in the error terms by including lagged difference terms of dependent variable (ΔY_t) in the above mentioned equations and becomes as follow:

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

This test also faces some weaknesses; Blough (1992) discussed the trade-off between the size and power of unit root tests, these tests have either a high probability of falsely rejecting the null of non-stationarity when the DGP (data generating process) is a nearly stationary process, or low power against a stationary alternative. Because, in finite samples, it was observed that some unit root processes display their behaviour closer to stationary (white noise) than to a non-stationary (random walk), while some trend-stationary processes behave more likely to random walks (Harris, 1995). Therefore, considering these issues, we also used KPSS test to examine the unit root problem of all data series.

[4] For detail see, Basic Econometrics (4th edition), page 815.

3.2. KPSS Test

The Augmented Dickey-Fuller test, tested the null hypothesis (unit root exists) against the alternative of no unit root (stationarity). However, Charemza & Syczewska (1998) and Maddala & Kim (1998) argued that null hypothesis of no unit root (stationary) must be tested against its alternative, unit root exists (non-stationary) also. This implies that the null hypothesis of data series is stationarity (no unit root) is tested against the alternative of a unit root. For this purpose, Kwiatkowski et al. (1992) developed a test that is known as KPSS test. This test is based on LM test and formulated as follows:

$$Y_t = \delta_t + r_t + \varepsilon_t$$

Where ε_t is stationary but r_t is random walk component and treated as:

$$r_t = r_{t-1} + \upsilon_t \qquad \upsilon_t \sim i.i.d\left(0, \sigma^2{}_\upsilon\right)$$

The initial value of r_0 is treated as fixed and it plays as a role of an intercept. The stationary hypothesis is simply, $H_0 : \sigma^2{}_\upsilon = 0$ (Stationary process). Then KPSS statistic can be calculated as:

$$KPSS = LM = T^{-2} \frac{\sum_{t=1}^{T} S_t^2}{s^2(l)}$$

$$s^2(l) = T^{-1} \sum e_t^2 + 2T^{-1} \sum_{\tau=1}^{l} w_{\tau l} \sum e_t e_{t-\tau}$$

Where $S^2(l)$ indicates long-run

variance, $\omega_{\tau l} = 1 - \frac{\tau}{l+1}$ *is Bartlett weight function*

and $S = \sum_{i=1}^{t} e_i \quad t = 1,2,...,T$ is partial sum process of the residuals.

This study used both ADF and KPSS tests to check the stationarity problem of data series. According to Baillie et al. (1996), combination of both ADF and KPSS tests statistic make following four possible outcomes:

(i) Rejection of null hypothesis by ADF and failure to reject it by the KPSS will considered as a strong evidence of covariance stationary I(0) process.

(ii) Failure to reject null hypothesis by ADF and rejection by the KPSS statistic will strongly recommend a unit root I(1) process.

(iii) Failure to reject null hypothesis both ADF and KPSS will indicate that data is not able to give sufficient information required for the long-run characteristics of the process.

(iv) Rejection of null hypothesis by both tests ADF and KPSS indicate that the process is described by neither I(0) nor I(1) processes.

3.3. Multivariate Cointegration Analysis and Error Correction Modeling

A common method for testing the long run relationship (cointegration) among the economic series is the Engel-Granger's two-step bivariate, residual-based method. According to Banerjee et al. (1990), "this method is incapable to deal multivariate cases due to; a priori assumption of a single co-integrating vector in the system, it tends to yield biased parameter estimates in small samples and is sensitive to the choice of endogenous variables in the co-integrating regression". Therefore, Johansen (1988), Johansen and Juselius' (1990), Maximum Likelihood (ML) procedures are considered the best alternative to the Engle-Granger technique. The main charm in this method is its capability to test the possibility of multiple co-integrating relationships among the variables. Johansen and Juselius (1990), further formulated time series in the form of reduced rank regression. In this procedure, they calculated the ML estimates in the multivariate cointegration model with the help of Gaussian Errors. This model is based on the Error Correction that can be shown as follows:

$$\Delta X = \mu + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \prod X_{t-1} + \varepsilon_t \qquad \text{(A)}$$

Where X_t is an (n*1) column vector of k variables, μ is an (n*1) vector of constant terms, Γ and Π represent coefficient matrices, Δ is a difference operator, p denotes the lag length and ε_t is i.i.d. k-dimensional Gaussian Error, which has mean zero and variance matrix (white noise disturbance term). The coefficient matrix Π is called impact matrix that contains information about the long-run relationships among variables. Equation (A) shows VAR model in first differences, except the term, lagged level of X_{t-1} and an error correction term. This error correction term provides information about the long run relationship among variables in the vector X_t. This way of specifying the equation system is known as VECM model. This model gives information about short run as well as long run adjustment to changes in X_t through the estimates of Γ and Π, respectively. The VECM equation allows three following model specifications.

(i) If Π is of full rank, then X_t is stationary in levels and a VAR in levels is an appropriate model.
(ii) If Π has zero rank, then it contains no long run information, and the appropriate model is a VAR in first differences.

(iii)If the rank of Π is a positive number, r and is less than k (where k is the number of variables in the system), there exists matrices α and β, with dimensions (k x r), such that β α =Π. In this presentation β contains the coefficients of the r distinct long run co-integrating vectors that render β' X_t stationary, even though X_t is itself non-stationary, and α contains the short run speed of adjustment coefficients for the equations in the system.

Johansen's methodology requires the estimation of the VAR, equation (A) because its residuals are used to compute two likelihood ratio (LR) test statistics that can be used in the determination of the unique cointegrating vectors of X_t. The first test, which considers the hypothesis that the rank of Π is less than or equal to r cointegrating vectors, is given by the 'trace test' as below:

$$Trace = -T \sum_{i=r+1}^{n} \ln(1-\lambda i)$$

The second test statistic is known as the maximal eigen value test or 'max test' that computes the null hypothesis that there are exactly *r* cointegrating vectors in X_t and is as follows:

$$\lambda_{mas} = -T \ln(1-\lambda_r)$$

The distributions for these tests are not usual chi-squared distributions. The asymptotic critical values for these likelihood ratio (LR) tests are calculated by Johansen & Juselius (1990) and Osterwald-Lenum (1992) through numerical simulations.

For short run dynamic analysis, we included an Error Correction (EC) term in the differenced model to capture the equilibrium relationship among the co-integrating variables in their dynamic behavior, following the Granger Representation Theorem. This addition of EC in the first differentiated VAR model, make possible to separate the long-term relationship among economic variables from their short-run responses. This will also determine the direction of the Granger causality. Following Johansen and Juselius (1990), the corresponding ECM can be written as follows:

$$\Delta GDP_t = \mu_1 + \delta_1 \Delta GDP_{t-1} + \delta_2 \Delta FDI_{t-1} + \delta_3 \Delta EXP_{t-1} + \Phi_1 \, ECT1_{t-1} + \varepsilon_1$$
$$\Delta FDI_t = \mu_2 + \delta_4 \Delta GDP_{t-1} + \delta_5 \Delta FDI_{t-1} + \delta_6 \Delta EXP_{t-1} + \Phi_2 ECT2_{t-1} + \varepsilon_2$$
$$\Delta EXP_t = \mu_3 + \delta_7 \Delta GDP_{t-1} + \delta_8 \Delta FDI_{t-1} + \delta_9 \Delta EXP_{t-1} + \Phi_3 ECT3_{t-1} + \varepsilon_3$$

We used annual data series to investigate long run as well as short run relationships among these three variables; FDI, exports and GDP for Pakistan. All data series are collected from International Financial Statistic (IFS) for the period of 1960 to 2010, except FDI that is taken from the annual publications of State Bank of Pakistan[5].

IV. Empirical Results

We used Johansen & Juselius (1990) Cointegration technique to investigate the long run equilibrium relationship among the variables; FDI, exports and growth. For this, we need to address the issue of unit root for all data series. We used two unit root tests ADF and KPSS.

4.1. Unit Root Test Results

Before applying the unit root tests, we plot the graphs for all data series. These graphs show that all data series have trend[6], so we included trend in the model in case of unit root tests. The results of both tests are presented in table 1. The statistic estimated with the help of both unit root tests gave the strong evidence of difference stationary because ADF is failed to reject the

Table: 1. Unit-root Analysis on Nominal Variables

Variables	Level		First difference		Second difference		Decision
	ADF	KPSS	ADF	KPSS	ADF	KPSS	
GDP	-1.30 (-3.5162)	0.237 [0.146(2)]	-5.88 (-3.53)	0.145 [0.463(5)]	-6.23 (-2.94)	0.065 [0.463(2)]	Both recommend for **I(1)**
FDI	-2.36 (-3.5162)	0.251 [0.146(2)]	-7.55 (-2.94)	0.152 [0.463(3)]	-7.57 (-2.94)	0.0461 [0.463(2)]	Both recommend for **I(1)**
EXP	-2.92 (-3.5162)	0. .194 [0.146(2)]	-4.92 (-2.94)	0.060 [0.463(1)]	-5.60 (-2.94)	0.029 [0.463(2)]	Both recommend for **I(1)**

Values in parenthesis () are MacKinnon critical values while in KPSS tests, we used Automatic bandwidth selection (maxlag) and Autocovariances weighted by Quadratic Spectral kernel.

[5] Annual Publications of State Bank of Pakistan (various issues).
[6] For detail see, figure 1 in appendix.

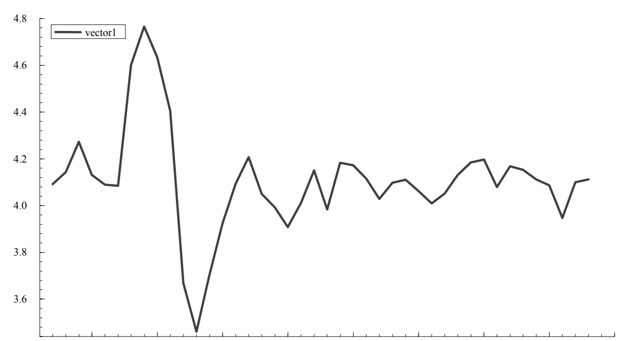
null hypothesis while KPSS rejected the null hypotheses in all cases. As all data series are having same integrating order I(1), so we further proceed for the investigation of long run equilibrium analysis through co-integration. The co-integration concept is closely linked with the notion of long-run equilibrium in case of economic theory. According to this notion, the variables in a system may deviate from their steady sate value in the short run but in the long run, it is expected that they ultimately converge to their steady state. To examine the long run equilibrium relationship among FDI, exports and GDP, we used Johansen and Juselius (1990) procedure.

4.2. Multivariate Cointegration Results

The results of unit root tests predict that all data series are first difference stationary I(1). We used VAR to investigate the relationship between variables. First, we determined the lag length of the VAR model using AIC and SC criterion. We also applied LR test by estimating VAR twice, each with different lags (to compute LR statistic). We estimated VAR with lag order 2 and 3[7]. Since the lower the values of AIC or SC, statistics give the evidence for better model. On the basis of these values, we can say that model one with lag order 2 is more parsimonious than the model with lag order 3. The same is confirmed by the results of LR test.

We estimated VAR (2) to investigate the long run relationship among Exports, GDP and FDI. We applied Johansen (1988) procedure to estimate the VAR (2) cointegration analysis because it gives the most efficient estimate of the long-run relationship between non-stationary variables at level. The Trace test results indicate that only one co-integrating vector exists. The co-integrating vector is shown in figure 1. The results of trace test are presented

Figure: 1. Co-integrating Vector



[7] For results see, table A1 in appendix.

in table 2. With one cointigrating vector (r = 1) and three variables (k=3), there are (k-r = 2) common stochastic trend driving the system. As the co integrating vector is not identified, cannot be interpreted without further restrictions. Therefore, we assume that the cointegration rank is one and GDP is normalized to have a unit coefficient in order to identify β. The results are reported in table 3.

Table: 2. Johansen's Cointegration Test VAR (2)

Hypothesis	Trace Test	P Value	Decision
H0: r=0, r>0	35.321	0.010*	Trace test results indicate that there is only one co-integrating vector
H0: r<1, r>1	8.8833	0.383	
H0: r<2, r>2	0.17264	0.678	

Table: 3. Identification of Restriction

Variables	GDP	FDI	Export
Coefficient of β	**1.000**	0.101	-0.8001
(standard errors)	**(0.000)**	(0.046)	(0.0651)
Coefficient of α	-0.0487	-1.6621	0.41754
(standard errors)	(0.0223)	(0.429)	(0.152)

We analysed co-integrating vector further by imposing different restrictions on β matrix. For example, we impose zero restriction on coefficient of FDI in β matrix. This restriction is accepted by applying LR test and indicates that FDI is not co-integrated with GDP and Exports in the long run. These results differ from previous studies carried on Pakistan[8]. This might be due to difference in sample periods or estimation technique. We excluded the FDI variable from long run co-integrating vector due to its zero performance and test results are presented in table 4. We also imposed zero restriction on export variable but it was rejected[9]. So we concluded from long run co-integrating vector that GDP and exports are co-integrating in long run but not with FDI. Beside co integrating vector, we also imposed and tested different restriction on adjustment (weighting) coefficient (α). The variables

[8] See for example, Ahmad et al. 2004.

[9] For results see, appendix table A2.

GDP and FDI have negative sign in α metrics. This implies that both variables also respond to correct their own past disequilibrium error. According to the signs of the adjustment coefficient, co-integrating relation is error correcting[10].

Table: 4. Identification Restrictions on β

Variables	GDP	FDI	Export	LR Test	Status
Coefficient	1.000	0.000	-0.662	2.89	Accepted
(standard errors**)**	(0.000)	(0.000)	(0.029)	Prob. (0.09)	
Coefficient	1.000	0.4356	0.000	16.065	Rejected
(standard errors**)**	(0.000)	(0.072)	(0.000)	Prob. (0.0001)	

Moreover, we also applied a test on constant, whether it should be included inside the cointegrating vector or not. By imposing restriction on constant, two models are estimated; one restricted and other is unrestricted. Then, we used LR test to select more parsimonious model. The null hypothesis assumes that constant lie inside the cointegrating vector and is rejected. It means, we cannot restrict the constant inside the cointegratingn vector. It is due to the fact that series has trend and it was confirmed by the graph of these series. The test results are presented in table 5. All these results

Table: 5. Restriction on Constant

	Log-Likelihood	LR Statistics with $chi^2(1)$	P value
Restricted Constant	78.20	17.56	0.0002
Un restricted Constant	86,98		

confirm that long-run equilibrium relationship exists between GDP and export but FDI is not co-integrating with these variables. We also carried out short run dynamic analysis to capture the short-run affects.

[10] For restrictions on α metrics, see appendix table A3.

4.3. Short-run Dynamics Analysis

We used Johansen's (1988) technique to determine the order of integration between data series and identify the possible long-term relationships among the integrated variables. Following the Granger Representation Theorem, we included ECT in equation of the first difference VAR model in order to capture the equilibrium relationship among the cointegrated variables in their dynamic behavior. We estimated the model after adding ECT and imposed different exclusion restriction on the coefficients of lag differenced variables and ECT. Then, we apply exclusion restrictions test of the joint significance of lags of other variables (Wald test), and the significance of the lagged ECT. The results for these tests are reported in table 6.

Table: 6. Results of Short-run dynamic analysis on ECM model (Imposing exclusion restrictions)

Variables	ΔGDP_{t-1}	ΔFDI_{t-1}	ΔEXP_{t-1}	ECM_{t-1}	Wald Test	Prob	Status
ΔGDP_t	------	00000	------	------	2.73	0.11	**Accepted**
ΔGDP_t	------	------	00000	00000	2.71	0.08	**Accepted**
ΔFDI_t	00000	------	------	------	4.63	0.04	Rejected
ΔFDI_t	------	------	00000	------	0.204	0.654	**Accepted**
ΔEXP_t	00000	------	------	00000	5.75	0.007	Rejected
ΔEXP_t	------	00000	------	------	3.13	0.08	**Accepted**

0000 indicates the exclusion restrictions on particular variable and ------ indicates no restrictions just their coefficients.

The results indicate that there is a uni-directional causality that runs from GDP to FDI but not in reserve order. It implies that FDI play zero roles in GDP growth in short run. The results also predict uni-directional causality from GDP to exports but not from exports to GDP. It means the export-led-growth (ELG) hypothesis does not hold in short-run in case of Pakistan. The Granger Causality test also explores that FDI lead growth in trade sector also does not hold. We can conclude that FDI and exports both does not causing the GDP in short-term in case of Pakistan where as GDP causing both FDI and exports in short run.

V. Summary and Conclusions

This study has tried to investigate the long-run co-integrating relationship among GDP, Exports and FDI for Pakistan. Annual data series are used for this analysis. The ADF and KPSS unit root tests are used for the presence of unit root. The results of these tests indicate that all data series are stationary at their first difference. After resolving the issue of stationarity, we used VAR model for long run cointegration analyses. The estimated results with VAR suggest that long-run relationship exists between GDP and exports but not with FDI. It means FDI has very little role in determining the GDP growth in long run for Pakistan. However, VAR results suggest that exports are having long run co-integrating relation with GDP.

We also tried to capture the short-term dynamics by using the error correction model. In short-run analysis of Granger causality indicates that FDI not affecting the GDP even in the short run whereas GDP affects both FDI as well as Exports. We also tried to investigate the notion that FDI increases the host country's exports. The causality results fail to support this hypothesis also in case of Pakistan. It means, both export and FDI are not causing each other in the short-run. The results indicate that role of FDI in Pakistan's economy is very negligible in long run as well as in short run. Therefore, it is recommended that government must increase the inflow of FDI along with its direction towards those sectors that has spill over effects and can increase Pakistan's exports.

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Appendix

Figure: A1. Graph of all data series showing trend

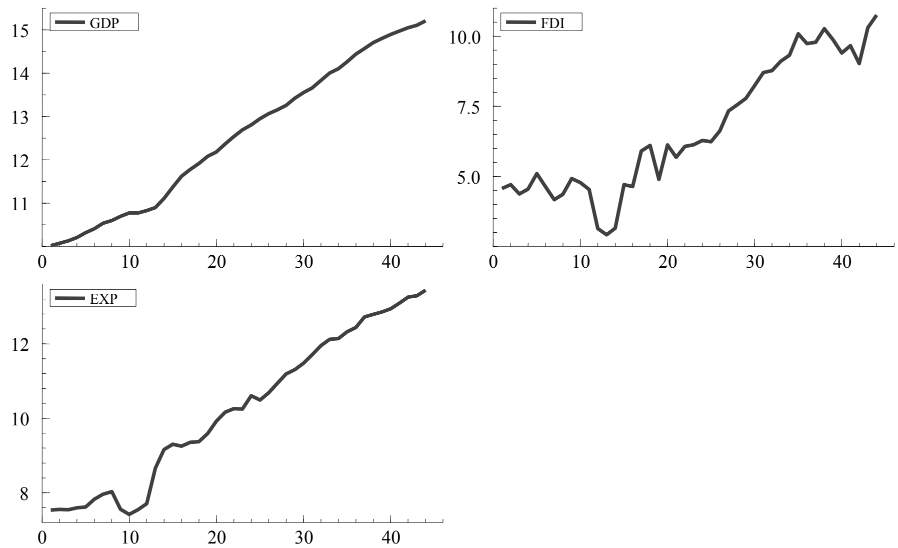

Table: A1. Choice of Lag length of VAR

Lag Interval	Lag 1-3 (sample 1960-2010)	Lag 1-2 (sample 1960-2010)	LR Statistic
Log Likelihood	93.927850	89.898203	$Chi^2(9)$= 8.0593 [0.5282]
AIC	-3.1184	-3.3609	

Table: A2. Imposing different Restrictions on Coefficient β

Dependent Variable	Independent variable	β Coefficient	Standard error of β	LR Stat $Chi^2(1)$	P value
GDP (Export=0)	Export	0.0000	0.0000	12.667	0.0004
	FDI	0.41912	0.0734		
FDI (Export=0)	EXP	0.000	0.000	12.667	0.0004
	GDP	2.3860	0.38434		
Export (FDI=0)	FDI	0.0000	0.000	2.1316	0.1443
	GDP	1.5286	0.0625		

Table: A3. Test results of imposing different Restrictions on Coefficient α

Restrictions	Variables	Coefficient of α	Standard error of α	LR Statistics $chi^2(1)$	P value
Alpha coefficient of GDP=0	GDP	0.0000	0.0000	2.667	0.0246
	FDI	-1.73	0.41		
	EXPORT	0.46	0.14		
Alpha coefficient of FDI=0	GDP	-0.06	0.03		0.0012
	FDI	0.000	0.000	10.498	
	EXPORT	0.63	0.19		
Alpha coefficient of EXPORT=0	EXPORT	0.000	0.000	6.1599	0.0131
	GDP	-0.035	0.015		
	FDI	-1.1745	0.28014		