"Regional Growth and Macroeconomic Indicators in Asian Countries: A Cointegration Analysis"

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Abstract

This study analyses growth theories to estimate determinants of growth using panel data from 1985 to 2016 of selected Asian nations. The ARDL is applied here.

In the long- run foreign direct investment, gross capital formation, manufacturing value-added, and household final consumption expenditure cointegrate by growth. However, manufacturing output maintains an important encouraging relationship with growth and supports the Romer growth model findings. Though gross capital formation keeps notable discouraging relation concerning growth and fails to support structural change theory of development by Hollis B Chenery's. Foreign direct investment and household consumption (significant in short period) hold up an insignificant relationship with growth throughout the short and long-period.

This study calls the attention of policymakers to frame strategies to support the industrial sector by and build the necessary infrastructure to attract FDI.

KEYWORDS: short-run and long-run, economic growth, Cointegration, variables,

I. "Introduction"

Economic growth supports an economy to achieve stable equilibrium during the short and long run and it is arguing matter as multiple causes significantly influence and contribute to the growth of an economy across the world. Some countries concentrate to rise trade to achieve nonstop growth. However, from time to time various economists have suggested different concepts to achieve economic growth. Adam Smith claimed production is a result of Land (natural resources), Labour, and capital and the economy achieves growth by capital rise. David Ricardo attributed labor, capital, and technology are responsible for output. Romer's growth model stated that growth of one industry is directly related to the growth of another industry. Big Push theory stated that investment is to be made across the sectors of the economy simultaneously. So variables are selected in the light of said theories. This study further sets objectives, tests hypotheses to fill the gap and also attempts to discover short and long-run factors that go together with economic growth in Pakistan and among selected Southeast Asian nations. (India, South Korea, China, and Malaysia) during the period 1985-2016 and employs ARDL cointegration technique. The results of this study will encourage policymakers to design policies to achieve non-stop growth and resolve policy issues. This study would be the guideline for one who would continue his research in this field of study.

2 "Literature Review"

This study ponders by reviewing the theoretical as well as empirical literature. As per theoretical literature, Rostow's growth model 1960 found savings, agriculture, social trends, physical and human capital investment, development plans, profit reinvestments, fiscal measure, real wages, decrease in poverty, import substitute affects growth. Harrod Domar's growth model states saving is directly proportional to growth while economic growth inversely relates to growth.

Arthur Lewis in Structural change theory explained the agricultural area and extra labor in the agricultural area, industrial region, and reinvestment of profit affect growth. Hollis B Chenery considered structural changes as an important contributor to growth. Solow's growth model considered proportion of saving needs to be greater than depreciation costs for sustained growth level while the endogenous growth model found technological changes affect growth. The O-Ring Michael Kremer's theory stated the difference in wages causes brain drain and affecting economic growth.

(Hussain A. A., 2015) Found a rise in the export lead to rise import and export brought economic growth in Tunisia. (Hussain M. A., 2014) At 5 % significance level observed no long-run link among growth, export, and import. But analyzed short period causal impact between growth and exports for Pakistan. Furthermore, at 10 % significance level examined association between export and import became insignificant.

(Ruba Abu Shihab, 2014) Tested that rise in growth pushed the export to rise but the rise in export failed to support economic growth in Nigeria. And (Sultan & Haque, 2011) for India also analyzed that rising export had an insignificant relationship with economic growth

(Zaheer, Rummana, Khattak, Ashar, & Khanzaib, 2014), (Azam, 2011), and (Manap, 2004) Explored for Pakistan that a rise in export and import contributed towards growth.

(Umer, 2014) and (Imran Sharif Chaudhry A. M., 2010) Proved statistically for Pakistan that trade volume, investments contributed in the long run to achieve growth but trade restrictions discouraged to achieve growth.

(Meraj, 2013) Tested the Bangladesh data and observed between exports to economic growth bi-directional causal impact and also seen a rise in imports had no impact over export and economic growth. Though globalization and less government involvement positively affected trade.

(Imran Sharif Chaudhry N. S., 2012) In Pakistan analyzed the increase in electricity consumption and trade openness positively influenced economic growth. It also found a bidirectional link between the usage of coal and GDP.

3 "Model and Methodology"

The ARDL technique of cointegration is a detailed version of regression that provides meaningful short and long-run effects. ARDL helps to find cointegration when model variables remain stationary either at level or after difference or combination of both. Error Correction Model (ECM) without affecting long-run results generate short-run outcomes. The unit root test is performed to search the I (2) variable, that seems non-stochastic after differencing twice. (Emaka N Koro, 2016).

So considering the ARDL importance this study sets its objective to quote association of economic growth with manufacturing value added (MVA), Gross Capital Formation (GCF), Foreign direct investment (FDI), and also with Household final consumption expenditure (HHFCE), all through the long and short run.

The proposed long run ARDL model would be as under to predict.

$GDP_t = f(, MVA_t, GCF_t, FDI_t, HHFCE_t,)$ -- *(1)*

Where GDP_t is proxy to measure economic growth in time t, GCF is gross capital formation this study takes as a substitute for domestic investment, FDI is foreign direct investments while HHFCE is household final consumption expenditure.

To make the panel data become simple and easy to understand this study prefers to use log form of data as followed by Kogid, et al., (2010) and Sultan and Haque, (2011).

$$LnGDP_t = \alpha_{0} + \alpha_1\ LnMVA_t, + \alpha_2\ LnGCF_t, + \alpha_3\ LnFDI_t, +\ \alpha_4\ LnHHFCE_t, +\ \epsilon_t\ -- (2)$$

Here Ln is showing a log form of defined variables in the model while ϵ_t is a white noise error term with constant mean and variance regardless of a time period.

This study selects a reliable and authentic source of panel data the world development indicators and considers the period 1985-2016 for analysis purpose and applies the ARDL technique of cointegration.

4 "Results and Discussion"

Unit Root Analysis: To check stationarity of data this study applies unit root Augmented Dickey-Fuller (ADF) test to avoid meaningless results. Because ARDL model results seem fruitless and ARDL is restricted to apply in the presence of any of the model variables remain stationary after differencing twice.

Table 1: Augmented Dickey-Fuller (ADF) test Results.

Variable	At Level			First difference			Decision
	Intercept	Intercept and Trend	None	Intercept	Intercept and Trend	None	
LnGDP	-2.7769	-2.7039	0.21117	-8.9275	-8.9284	-8.9461	I(1)
LnFDI	-3.0401	-3.0803	0.20841	-10.2328	-10.2152	-10.2467	I(1)
LnGCF	-2.6314	-2.5218	0.18683	-8.6533	-8.6714	-8.6713	I(1)
LnMVA	-2.6625	-2.5449	0.22314	-8.9070	-8.9269	-8.9234	I(1)
LnHHFCE	-2.8443	-2.8208	0.14705	-8.7139	-8.7146	-8.7341	I(1)
Critical values at 5%	-2.8797	-3.4388	-1.950395	-2.8798	-3.4392	-1.950384	

The table no: 1 shows all effects of ADF three tests at the level and also at a first difference. All the model regressors seem non-stationary at level form while household final consumption expenditure is stationary I (0) around intercept and intercept and the trend as ADF calculated value is smaller than benchmark value at 5 % significance level and it became nonstationary around none I (1) at the level. At the first difference though all three ADF tests calculated values show all variables remain stationary I (1) and data is stationary as calculated ADF values are less than tabulated values leading to reject *H0: data is nonstationary* and *accept H1: data is stationary.*

Appropriate Lag Choice

Lag is also known as the lapse of time that the dependent variable takes to response independent variable change. Lag selection is important matter as including more lags means to include irrelevant variables

while reducing lags means to omit relevant variables. So, this study uses the system equation model to decide optimum lags.

Table 2: Proper lag selection

Order LL test	AIC	SBC	LR test		Adjusted LR
8 197.6807	-6.3195	-317.2672	------	------	
7 189.7231	8.7230	-264.4263	CHSQ(25)= 19.9154[.752]		14.5435[.952]
6 177.7218	21.7217	-213.6291	CHSQ(50)= 43.9178[.716]		32.0717[.978]
5 166.9749	35.9749	-161.5775	CHSQ(75)= 65.4117[.779]		47.7678[.995]
4 161.8516	55.8516	-103.9023	CHSQ(100)= 75.6584[.968]		55.2505[1.00]
3 157.4764	76.4767	-44.5788	CHSQ(125)= 84.4084[.997]		61.6404[1.00]
2 148.0981	92.0981	8.9514	CHSQ(150)= 103.1655[.998]		75.3379[1.00]
1 142.7838	111.7838	66.5256	CHSQ(175)= 113.7938[1.01]		83.0996[1.01]
0 -609.2169	-613.2169	-620.8766	CHSQ(200)= 1613.9[.000]		1178.6[.000]

According to table no: 2 the VAR model through the systematic way by putting 0 to 8 lags, has selected 0 lag at lower AIC value for all model independent variables and the model is said to become good. As all LL and SBC calculated values are like with the lowest AIC value. Moreover, chi-square LR and adjusted LR test values are also significant at 0 lag.

 Projected ARDL outcomes and Expected Autoregressive lag selection by SBIC.

Table 3: As per Schwarz Bayesian criteria lag (1, 0, 0, 1, and 1) and estimated ARDL Regression Results

Regressors	β- Coefficient	Error	T-Ratio	[P-value]
LnGDP(-1)	.93978	.026303	35.7298	[.001]
LnFDI	.002447	.0085918	.28484	[.778]
LnGCF	-.17875	.051875	-3.4456	[.002]
LnMVA	1.5809	.086503	18.2745	[.001]
LnMVA(-1)	-1.3658	.091339	-14.9519	[.000]
LnHHFCE	-.54301	.090707	-5.9863	[.000]
LnHHFCE(-1)	.57187	.088338	6.4736	[.002]
Intercept	-.080291	.24189	-.33195	[.741]

The table no: 3 demonstrates the ARDL estimated coefficients keeping GDP as regressand. All variables except FDI and intercept are looking significant contributors towards economic growth at a 95 % confidence interval.

 Model Summary

Table 4: Summary of Estimated ARDL model.

R^2	Adjusted R^2	DW- Test statistics	F- value
0.99359	0.99321	1.9	0.000

The table no: 4 while discussing R^2, shows a 99 % change in regressand GDP, and is due to explanatory variables in the model. The slight difference from R^2 to adjusted R^2 asserts variable selection is super. Further high R^2 with low D-W statistics allows for cointegration. Here the DW test value is not sufficient to say there is no serial correlation problem as d statistic value is mostly close to two 2 in the autoregressive model. So the LM test is applied for serial correlation analysis. The F test is showing the suitability of the model to test hypothesis as F statistics stands significant at the 5 % benchmark level.

Diagnostics Tests

To examine serial correlation, problem of heteroscedasticity and nonlinear link among model variables this study applies the various analytical tests.

Table 5: Diagnostic Test Results

Test Statistics	LM Version	F Version
Serial Correlation	CHSQ(1) = .27195 [.604]	F(1,151) = .25698 [.615]
Ramsey Reset	CHSQ(1) = 3.4276 [.066]	F(1,151) = 3.3049 [.073]
Heteroscedasticity	CHSQ(1) = .90322 [.344]	F(1,158) = .89695 [.347]

With regards to Breusch Godfrey serial correlation F version LM test calculated p-value stands more than 0.05 also LM modified version calculated p-value is 0.604 is also more than 0.05 at 95 % confidence interval. Hence, we agree to take the null hypothesis at hand is no problem of serial correlation and expected coefficients are consistent and responsible. The Ramsey Reset test is telling there is no nonlinear relationship and further giving assurance about data Breusch Pagan Godfrey test confirms data is homoscedastic as the calculated p-values are insignificant.

Bound Test of Cointegration

After all, the level of the relationship among variables is tested through employing the bound test.

Table 6. Bound and Wald Test results

F-statistic Upper limit	95% Lower limit	95% Upper limit	90% Lower limit	90%
3.1064	2.9442	4.1081	2.5083	3.5694
W-statistic limit	95% Lower limit	95% Upper limit	90% Lower limit	90% Upper
15.5315	14.7204	20.5403	12.5408	17.8468

The Bound Cointegration and the Wald statics calculated values lie in the middle of the upper and lower limit values according to the table no: 6 and decision about the cointegration seems inconclusive and unsettled. Hence, this study here assumes cointegration and to examine the short and long-run impacts applies the restricted Vector Error Correction Model (VECM). While the ultimate judgement about the cointegration will be finalized through the Error Correction Model ECM value.

Long- Run Effects

Table 7: The ARDL model expected long -run Coefficients as per Schwarz Bayesian selected Lags (1, 0, 0, 1 and 1).

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LnFDI	.040641	.14831	.27405 [.783]
LnGCF	-2.9685	1.1066	-2.6828[.009]
LnMVA	3.5718	1.0274	3.4768[.001]
LnHHFCE	.47932	.44721	1.0717[.287]
INPT	-1.3335	4.2526	-.31355 [.756]

The ARDL model has found the manufacturing output, household consumption expenditure, gross capital formation, and abroad investment cointegrate with economic growth. However, manufacturing value-added has an encouraging contribution to rising growth while gross capital formation maintain continuous a noteworthy negative influence at a 5 % significance level. While household spending and overseas direct investment have an insignificant positive link with growth as per table no: 7.

Error Correction Model (ECM)

Table 8: ECM Short Run coefficients for the selected ARDL model as per Schwarz Bayesian lag selection (1, 0, 0, 1 & 1).

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
DLnFDI	.0024472	.0085917	.28483[.775]
DLnGCF	-.17873	.051874	-3.4456[.001]
DLnMVA	1.5809	.086503	18.2745[.000]
DLnHHFCE	-.54309	.090708	-5.9861[.000]
ecm(-1)	-.060213	.026302	-2.2894 [.023]

The ECM estimates the short-run effects without affecting the long-run effects in the table no: 8. the manufacturing value-added has a significant contribution towards growth all through the short-run also. Further defines that an average 1 % increase in the manufacturing output reasons GDP to increase by 1.58 %. While the (DLNGCF) gross capital formation association by GDP stands negatively significant. Moreover, the household final consumption expenditure DLnHHFCE maintains an extensive discouraging, relation with growth throughout the short-run, while foreign direct investment has an insignificant positive relationship. An important but negative the ECM p-value is -0.060213 tells about the presence of cointegration of the model regressors with growth. While it telling in brief, illustrates that if due to any reason the equilibrium position of the predictand disturbs it would be correctly adjusted about 6 % in the current time and following years widespread the Pakistan, India, China, Malaysia, and South Korea.

The balanced panel data has been developed by taking the combined data of Pakistan, India, China, Malaysia, and South Korea. However, economically they all are different but if we compare on an average analysed cointegration results of selected countries with Pakistan economic growth, it comes to know that are same may because of global effects, team work, financial cooperation, mutual trade, CPEC contract, or due to some geographical effects.

5   "Conclusions"

The ARDL cointegration method with the ECM model this study has employed to discover the short and long-run dynamic forces which cointegrate with economic growth in selected Asian nations (India, Pakistan, South Korea, China, and Malaysia,) for the period 1985-2016. This study has checked unit root by applying the Augmented Dickey-Fuller (ADF) unit root test and found entirely the model included variables stationary at the first difference. The LM Serial Correlation test found no problem of serial correlation, Ramsey Reset test seen linear relationship and found absence of non-linear relationship, and Breusch Pagan Godfrey test analyzed data homoscedasticity and observed constant mean and variance willy-nilly of a time period. This study by using Bound cointegration and Wald Statistics found the existence of cointegration inconclusive and last exact judgement going on for cointegration made by the ECM significant negative value. The manufacturing value-added, foreign direct investment, household consumption expenditure, and gross capital formation cointegrate with economic growth. Whereas, the manufacturing output contribution towards economic growth is positively significant and favors the Romer's Growth model, coordination and complementary theory. On the other side, the gross capital formation maintains an important negative relationship by growth and does not support structural change and development Hollis B Chenery's theory. The relationship of household final consumption expenditure with growth was seen insignificant during the long-period while significant during the short-period. Moreover, overseas direct investment holds positive but minor relationship during the small and long- period.

The research study in the light of found results diverts the attention of the policy creator towards an important factors which cointegrate with growth, and further recommends the policy makers to frame strategies to help manufacturing sector and provide them electricity and gas at a nominal charges, basic infrastructure to make export competitive at an international level. It would make foreign direct investment become significant contributor on the road to growth.

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