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Article:	**Nexus between China-Pak Business Cycle Synchronization and Human Development in Pakistan**
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Abstract

This study has examined the potential impact of China-Pak business cycle synchronization on human development in Pakistan. Data covered the time span of 1975-2017. Other independent variables include inflation, GDP per capita, external debt and FDI. Results of unit root test showed that all variables were stationary with mixture of level and first difference. F-bounds test confirmed the presence of long run relationship among the variables. ARDL technique was applied to obtain long run coefficients. The study found that FDI and GDP per capita had positive and significant impact on human development while China-Pak business cycle synchronization, inflation and external debt had negative and significant relationship with human development in Pakistan. Results showed the value of error correction term -0.16 with 1 percent level of significance which confirmed the presence of short run equilibrium in the model. All independent variables had significant relationship with human development in the short run. CUSUM and CUSUMSQ stability tests showed that parameters of the model were stable. The study suggested that government should focus critically China-Pak business cycle synchronization to uplift human development in Pakistan for which domestic production should be promoted to facilitate domestic producers that might be helpful to improve employment level which finally can raise human development. Control on inflation is significant for the sake of human development. Policy makers should take steps for improvement in GDP per capita and FDI to encourage human development in Pakistan.

Keywords: Business Cycle Synchronization, Human Development, Foreign Direct investment and Gross Domestic Product

Introduction

Sustainable economic growth is possible to achieve by uplifting human development (Mustafa et al., 2017). Bidirectional causality between economic growth and human development was confirmed by Suri et al. (2011). Based on conventional economic approach, globalization and trade openness help in poverty alleviation, economic growth and human development while skeptical view point is that globalization has exploiting impact particularly in developing countries development (Dagdemir and Acaroglu, 2010). Although globalization had poured positive contribution worldwide but its consequences for firms in developing countries remained challenging as results of globalization mainly depends upon competitive capability of companies and institutional quality. Julien and Joyal (1994) argued that globalization had significant positive impact on economic growth and human development through lower cost of production, massive excess towards foreign markets and increase in competitiveness necessity. Contrarily, globalization had harmful impact for developing countries as inflow of products from developed countries to developing countries discourages demand for domestic products in local markets and such situation deteriorate economic growth and human development in developing economies (Goriwondo et al., 2012). Developing countries faced challenging implications of globalization and trade openness for economic growth and human development.

The volume of total world trade as percentage of world GDP has become tripled since 1960. World trade as share of world GDP lifted up from 24.12 percent in 1960 to 59.36 percent in 2018 (World Development Indicators, 2019). These facts and figures indicated a vital momentum behind world globalization and trade volume. Such growth has raised regional economic associations. Flow of capital, goods and services intensified worldwide in the presence of liberalization and globalization in the beginning of 1980s where globalization represents higher degree economic integration among economies worldwide and

liberalization shows removal of trade barriers particularly rules by government imposed on political, social and economic matters Erden and Ozkan (2014). Process of globalization does not include only economic dimensions but political, environmental and cultural dimensions are also important parts of globalization Eriksen (2014). World KOF globalization index value was 39.69 percent in 1970 while 62.1 percent in 2017 and presented three dimensions of globalization, which covered political globalization, social globalization and economic globalization.

Changed production structure and reduced trade barriers led to higher international trade. The growing share of trade across borders suggests that international trade can influence potentially on business cycle fluctuations. Business cycle fluctuations are defined as the periodic rise or fall in macroeconomic variables which includes investment, consumption, employment and GDP etc. Past statistical experiences of macroeconomic variables do not show any smooth movement but fluctuating periodically. The major determinant of business cycle synchronization is trade as shown in literature that more bilateral trade will lead to higher business cycle correlations presented by Frankel and Rose (1998).

This study has examined the implications of such business cycle synchronization on human development in Pakistan. HDI value of Pakistan is 0.562 during 2017 with ranking of 150 out of 189 countries worldwide. To analyze the empirical implications of business cycle synchronization in Pakistan, top one major trading partner China has been selected. China has become 1st largest import market with 27 percent share of total imports and 2nd largest export market with 9 percent share of total exports (Economic Survey of Pakistan, 2017-18). China-Pakistan Economic Corridor (CPEC) era has been considered an optimistic initiative for economy of Pakistan. This aspect has provided further support for selection of China to capture economic implications of business cycle synchronization through time series analyses

in the case of Pakistan. Objectives of the current study include examining the empirical impact of China-Pak business cycle synchronization, inflation, FDI external debt and GDP per capita on human development in Pakistan.

Literature Review

Kwan and Yan (2009) examined the business cycle correlation between China and her trade partner countries. Correlations of business cycles of all country wise pairs were measured through Hordrik Prescot filter. Study included 10 Trading partners of China and data was taken for the time period 1971-2007. Further determinants of business cycle correlation were measured. Results showed no common factor for trading partners. Trade intensity showed negative impact on business cycle correlation for the UK, the USA and three ASEAN countries. Fiscal policy coordination showed positive impact on business cycle co-movement in the case of Korea, the US and the UK.

Paul (2010) investigated the role of monetary policy and trade for co-movement of business cycles between India and USA. The study conducted GARCH models, correlations, impulse response function and variance decomposition to analyze the model of business cycle co-movement. The analyses was divided in pre-liberalization and post-liberalization time period for both economies. Results showed much higher impact of economic integration on synchronization during post-liberalization phase as compare to pre-liberalization between both countries.

Fidrmuc and Korhonen (2010) analyzed business cycles response to global financial crises for Asian emerging economies. Quarterly data used for India and China, covered the time period of 1993-2008. According to results degree of co-movement of business cycle was low between OECD countries and Asian emerging countries. On the other hand, economic development got significant impact of financial crises in Asian emerging countries. Indian and Chines business cycles were found moving close towards the business cycles of OECD

countries. Finally results showed significant nexus between dynamic correlations of GDP growth rates and trade ties in OECD countries and Asian emerging economies.

Hussain et al. (2010) analyzed the influence of balance of trade, GDP growth rate and FDI on human development index in Pakistan. The study used time series data covering time period of 1975-2008. Results showed positive and significant impact of FDI on HDI while real GDP was observed insignificant for HDI. Balance of trade showed positive impact on HDI that improvement in trade balance would enhance HDI. Stability of the model was checked and confirmed through CUSUM and CUSUM square stability tests.

Allegret and Essaadi (2011) considered Asian countries to investigate the impact of bilateral trade on business cycle synchronization. Seasonal adjusted quarterly data for GDP was collected for the time period of 1975 to 2007. Cohesion statistics was estimated to examine synchronization. Results showed long-run co-movement of business cycles among East Asian economies as a result of more bilateral trade within the region. Short-run co-movement was contributed by internal shocks and economic policy responses. The study concluded that policy similarity and improved bilateral trade were major explanatory factors of business cycle co-movement among East Asian countries.

De and Pal (2011) investigated the relationship among globalization, GDP growth and human development in 75 countries during 1970 to 2008. Results depicted positive association between social globalization and GDP growth, negative linkage between political globalization and GDP growth and negative impact of economic globalization on GDP growth due presence of income factor. All three components of globalization social, political and economic were found significant and positive determinants of HDI.

Wu et al. (2011) investigated the relationship between FDI and business cycle synchronization in 15 host countries and G7 countries based on 77 pairs for the time period of 1988 to 2002. Similarity and trade were also taken as explanatory variables of the model.

EC3SLS was employed to conclude results of the model. Results confirmed FDI as positive and significant contributor of business cycle synchronization among countries. Countries with different industrial structure were found with higher bilateral trade. The study showed that FDI was more efficient to explain the synchronization of business cycles among countries than similarity and bilateral trade.

Rana et al. (2012) explained the impact of intra-industry trade on output co-movement in economies of Europe and Asia. Annual data for 15 European and 10 East Asian countries was used during 1986 to 2007. Results of panel regression analysis with fixed and random effect showed bilateral trade as positive and significant factor of output co-movement with fixed effect but positive and insignificant with random effect while intra industry trade proved as positive and significant determinant of output co-movement. With panel regression jointly fixed and random effect with combined variables, bilateral trade was insignificant but intra-industry trade was significant for output co-movement in both regions.

Blonigen et al. (2014) examined the impact of trade intensity on cyclical and trend component of GDP during the time period of 1980 to 2010. The study concluded that trade had important role for both components but the contribution of trade was weaker in trend component as compare to cyclical component in all G7 economies. Results showed transitory impact of cyclical component on level of output in the long term but persistent impact of trend component on output levels. Impact of trade on business cycle co-movement was found insignificant for countries other than G7.

Sethapramote (2015) investigated the impact of similarity of economic policy on business cycle synchronization for Southeast Asian Nations (ASEAN). The study used the data for the time horizon of 2000 to 2012. Correlations among policy and macroeconomic variables were estimated. Dynamic conditional correlation method and VAR were used to attain pattern of synchronization. Results showed inflation, GDP, exchange rate as significant

macroeconomic determinants of business cycle co-movement among all countries while policy similarity was associated with co-movement of business cycle, only in few countries.

Antonakakis et al. (2016) investigated empirically the phenomenon of business cycle synchronization among 27 developing and developed nations. Data for GDP of all countries was used for 139 years during 1875 to 2013. Threshold–Minimum Dominating Set and novel complex network Approach were used for analyses. Results confirmed the era of Gold Standard as de-synchronization but synchronized during Great Depression. Lower synchronization was present during era of Bretton Woods. Recent few decades were faced with high business cycle correlations in the presence of floating exchange rate.

Duval et al. (2016) analyzed the impact of value-added trade on synchronization of business cycles of 63 emerging and developed economies for the time period of 1995 to 2013. Through panel econometric technique results were obtained and proved that trade was most significant factor of business cycle co-movement. The study concluded that contribution of value-added trade towards the business cycle jumped up with increase in intra-industry trade. Financial integration and similar production structure were also found with significant linkage for business cycle synchronization among countries.

Mustafa et al. (2017) investigated the nexus among trade openness, economic growth and human development. The study was conducted for 12 developing Asian countries during 1970-2011. Results did not show significant impact of economic growth on human development but human development showed positive impact on economic growth. Thus, unidirectional linkage between economic growth and human development was found. The study confirmed that sustainable economic growth was possible through achieving human development and for this instance results concluded that trade openness was important factor to improve both the economic growth and human development simultaneously.

Crowley and Hallett (2018) used Classical monetary models and New Keynesian model and explained the mechanism of transfer of volatility from high frequency business cycles to low frequency business cycles in United States. Results concluded that transition of shorter cycles to longer cycles was mainly encouraged through decrease in inflation and reduction in output stability. The study showed that severe recession phase was caused by long term smooth expansion phase of economic stability.

Mihalache-O'Keef (2018) investigated the nexus between FDI and internal civil conflict for host countries. Independent variables of the model were FDI for primary sector, FDI for manufacturing sector, FDI for service sector, trade, ethnic fractionalization and GDP per capita. Results showed that primary sector FDI and Manufacturing sector FDI were causing political violence in the host countries due to many socioeconomic externalities while FDI for service sector was found as discouraging factor for internal civil conflicts.

Data and Methodology

This study captured the potential impact of China-Pak business cycle synchronization on human development in Pakistan. Human development index is dependent variable while China-Pak business cycle synchronization, inflation, gross domestic product, foreign direct investment and external debt are independent variables in the model. Data for variables was obtained from world development indicators (World Bank, 2018) for the time span of 1975-2017. Functional form of the model is given below in equation 1.

$$\mathrm{HDI}_t = \beta_0 + \beta_1 \mathrm{CPBCS}_t + \beta_2 \mathrm{INF}_t + \beta_3 \mathrm{GDPPC}_t + \beta_4 \mathrm{FDI}_t + \beta_5 \mathrm{DEBT}_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathrm{Eq.}\ 1)$$

Where,

HDI = Human Development Index

CPBCS = China-Pak Business Cycle Synchronization

INF = Inflation Rate

GDPPC = Gross Domestic Product

FDI = Net Foreign Direct Investment

DEBT = External Debt

Equation 2 is shows error correction version of ARDL.

$$\Delta HDI_t = \alpha_0 + \sum_{i=1}^{r} b_i \Delta HDI_{t-i} + \sum_{i=1}^{s} c_i \Delta CPBCS_{t-i} + \sum_{i=1}^{u} d_i \Delta INF_{t-i} + \sum_{i=1}^{p} e_i \Delta GDPPC_{t-i} + \sum_{i=1}^{q} f_i \Delta FDI_{t-i} + \sum_{i=1}^{v} g_i \Delta DEBT_{t-i} +$$
$$\delta_1 HDI_{t-1} + \delta_2 CPBCS_{t-1} + \delta_3 INF_{t-1} + \delta_4 GDPPC_{i-1} + \delta_5 FDI_{i-1} + \delta_6 DEBT_{i-1} + \varepsilon_t \text{..........................}(Eq.2)$$

In equation 2,

- Δ is operator of first difference.
- In the above four equations b_i, c_i, d_i, e_i, f_i and g_i show the dynamics in the short run. While, δ_1, δ_2, δ_3, δ_4, δ_5 and δ_6 presents long run coefficients.
- The white noise error term is shown by ε_t.
- Null hypothesis is that $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$ which indicates that long run relationship does not exists.
- Alternative hypothesis is that $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \neq \delta_5 \neq \delta_6 \neq 0$ which indicates that long run relationship exists.

Equation 3 is used to estimate long run coefficients.

$$HDI_t = \alpha_0 + \sum_{i=1}^{r} \beta_1 HDI_{t-i} + \sum_{i=0}^{s} \beta_2 CPBCS_{t-i} + \sum_{i=0}^{u} \beta_3 INF_{t-i} + \sum_{i=0}^{p} \beta_4 GDPPC_{t-i} + \sum_{i=0}^{q} \beta_5 FDI_{t-i} +$$
$$\sum_{i=0}^{v} \beta_6 DEBT_{t-i} + \varepsilon_t \text{...}(Eq.3)$$

After estimations of long run coefficients, following equation 4 for ECM is formulated to obtain short run coefficients.

$$\Delta HDI_t = \alpha_0 + v_1(ECM_{t-1}) + \sum_{i=1}^{r} \beta_1 \Delta HDI_{t-i} + \sum_{i=0}^{s} \beta_2 \Delta CPBCS_{t-i} + \sum_{i=0}^{u} \beta_3 \Delta INF_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta GDPPC_{t-i} + \sum_{i=0}^{q} \beta_5 \Delta FDI_{t-i} +$$
$$\sum_{i=0}^{v} \beta_6 \Delta DEBT_{t-i} + \varepsilon_t \text{..}(Eq.4)$$

Hypotheses of Regression Model

Null and alternative hypotheses regarding China-Pak business cycle synchronization and other variables in the model, on human development index in Pakistan are given below.

Hypothesis 1

H_0: China-Pak Business Cycle Synchronization has no significant relationship with human development in Pakistan.

H_1: China-Pak Business Cycle Synchronization has significant relationship with human development in Pakistan.

Hypothesis 2

H_0: Inflation Rate has no significant relationship with human development in Pakistan.

H_1: Inflation Rate has significant relationship with human development in Pakistan.

Hypothesis 3

H_0: GDP per capita has no significant relationship with human development in Pakistan.

H_1: GDP per capita has significant relationship with human development in Pakistan.

Hypothesis 4

H_0: Net Foreign Direct Investment has no significant relationship with human development in Pakistan.

H_1: Net Foreign Direct Investment has significant relationship with human development in Pakistan.

Hypothesis 5

H_0: External Debt has no significant relationship with human development in Pakistan.

H_1: External Debt has significant relationship with human development in Pakistan.

Results and Discussion

This section contains the results and discussion of the model to explain impact of China-Pak business cycle synchronization on human development index in Pakistan. This

section explains the results of ADF and PP unit root tests, descriptive statistics, F-bounds test, ARDL long run estimates, ECM regression and stability tests. Dependent variable in this model is HDI while independent variables are China-Pak business cycle synchronization, inflation, GDP per capita, FDI and total external debt. Descriptive statistics of whole series is presented in Table 1.

Unit Root Tests

ADF and PP unit root tests are used to check the stationary of variables and results are shown in Table 2. Probability value is presented in parentheses. Human development index (HDI) is dependent variable and results of both unit root tests showed that HDI was stationary at first difference with 1 percent level of significance. China Pak business cycle synchronization (CPBCS) was also found stationary at first difference with 1 percent level of significance in both tests. Inflation (INF) was stationary at level as well as first difference at1 percent level of significance. GDP per capita (GDPPC) was found stationary at first difference in both tests at 1 percent level of significance. Foreign direct investment (FDI) was stationary at level and first difference in ADF test while at first difference with 1 percent level of significance in PP unit root test. External total debt (DEBT) was stationary at first difference in ADF test with 1 percent level of significance and also at first difference with 1 percent level of significance in PP test but at 10 percent level of significance with intercept and trend. Results concluded that whole series was stationary with mix of level and first difference. Results of both unit root tests were found matching with each other.

F-Bounds Test

F-bounds test was used to verify long-run relationship of all variables in the model. Results are shown in Table. 3. Value of F-statistics was 5.962 while for K=5 critical value of lower bound and upper bound were 3.06 and 4.15 respectively at 1 percent level of significance. Null hypothesis of no long-run relationship was rejected while alternative

hypothesis of long-run relationship presence was accepted because calculated value of F-statistics was greater than critical value of upper bound with 1 percent level of significance.

Table 1

Descriptive Statistics

	HDI	CPBCS	FDI	DEBT	GDPPC	INF
Mean	0.444613	0.406255	0.839754	3.20E+10	626.3222	8.438082
Median	0.452662	0.986121	0.612998	3.01E+10	470.2489	7.844265
Maximum	0.558000	0.999999	3.668323	8.45E+10	1547.853	20.90451
Minimum	0.331285	-0.999594	0.061630	5.75E+09	169.7912	2.529328
Std. Dev.	0.072403	0.778686	0.804819	2.06E+10	392.5785	4.159261
Skewness	-0.065223	-0.799638	2.134731	0.725990	1.003150	0.997165
Kurtosis	1.711484	1.891671	7.316395	2.598385	2.657771	4.292822
Jarque-Bera	3.005142	6.783383	66.04007	4.066260	7.421726	10.12066
Probability	0.222557	0.033652	0.000000	0.130925	0.024456	0.006343
Sum	19.11835	17.46897	36.10941	1.37E+12	26931.85	362.8375
Sum Sq. Dev.	0.220170	25.46677	27.20481	1.78E+22	6472952.	726.5770
Observations	43	43	43	43	43	43

Author's calculations

Table 2

Unit Root Tests

Variables	**ADF Test at Level**		**ADF Test at 1st difference**	
	Intercept	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
HDI	-0.464	-2.349	-4.890***	-4.815***
	(0.887)	(0.399)	(0.000)	(0.001)
CPBCS	-2.382	-1.406	-8.530***	-8.387***
	(0.152)	(0.146)	(0.000)	(0.000)
INF	-4.008***	-3.994**	-9.522***	-9.351***
	(0.004)	(0.018)	(0.000)	(0.000)
GDPPC	-0.606	-1.708	-5.394***	-5.315***
	(0.858)	(0.729)	(0.000)	(0.000)
FDI	-2.766*	-5.321***	-4.168***	-4.566***
	(0.072)	(0.000)	(0.002)	(0.005)
DEBT	-1.087	-2.691	-4.520***	-4.475***
	(0.711)	(0.245)	(0.000)	(0.005)

Variables	PP Test at Level		PP Test at 1st difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
HDI	-0.167	-2.268	-4.888***	-4.810***
	(0.934)	(0.441)	(0.000)	(0.002)
CPBCS	-2.382	-1.757	-9.732***	-5.00***
	(0.152)	(0.706)	(0.000)	(0.001)
INF	-4.542	-4.460***	-9.532***	-9.373***
	(0.000)	(0.005)	(0.000)	(0.000)
GDPPC	-0.629	-1.987	-5.394***	-5.315***
	(0.853)	(0.591)	(0.000)	(0.000)
FDI	-2.161	-2.252	-4.168***	-4.172***
	(0.222)	(0.448)	(0.002)	(0.011)
DEBT	-1.620	-2.715	-3.684***	-3.315*
	(0.463)	(0.235)	(0.008)	(0.078)

*,**,*** significant at 10%, 5% and 1% level respectively

Table 3

F-Bounds Test

Null Hypothesis: No levels relationship		
Test Statistics	**Value**	**K**
F-statistic	5.962***	5
	Critical Value Bounds	
Significance	**I(0) Bound**	**I1 Bound**
10%	2.08	3
5%	2.39	3.38
2.5%	2.7	3.73
1%	3.06	4.15

*,**,*** significant at 10%, 5% and 1% level respectively

Results of ARDL Model

Table 4 shows long run results of the model with dependent variable HDI and remaining variables as independent variables which include China-Pak business cycle synchronization, inflation, GDP per capita, FDI and external debt. Results showed negative impact of CPBCS on human development index. Coefficient value was -0.02 for this nexus between CPBCS and HDI with 5 percent level of significance. Dagdemir and Acaroglu

(2010) explained that impact of globalization and trade openness remained challenging as fruits from synchronizing with other economies depend upon institutional quality and capability of companies of an economy. So, negative impact of CPBCS on HDI demands for further economic and institutional improvements to get appreciable results from CPBCS for human development in the case of Pakistan. Negative impact of inflation for HDI was found with -0.001 coefficient value which was very minor. Results were similer with Kasidi and Mwakanemela, (2013) which explained that control over inflation is important to uplift human development index. Probability value was 0.140 which showed inflation and HDI nexus was not significant even at 10 percent level of significance. This was concluded that in the long-run inflation was not much crucial matter regarding HDI. The study used GDP per capita instead of GDP to capture more real outcomes. Results showed positive influence of GDP per capita on HDI having 0.15 coefficient value with 1 percent level of significance as p-value was 0.000. This outcome was matching with findings of Khodabakhshi (2011) which suggested that to increase in GDP per capita can play vital role for improvement of HDI. FDI was also among significant factors to improve HDI in Pakistan with 1 percent level of significance and 0.023 coefficient value. External debt had negative impact on HDI in the long-run with -0.148 coefficient value and 1 percent level of significance. Results conclude that except inflation all other independent variables were found as significant long-run determinants of HDI in the case of Pakistan.

Table 4

Long Run Estimates of ARDL

Dependent Variable = HDI				
Selected Model: ARDL(3, 3, 3, 3, 3, 1)				
Variables	**Coefficients**	**Standard Error**	**t-Statistics**	**Probablity**
CPBCS	-0.024875	0.009819	-2.533314	0.0208**
INF	-0.001182	0.000766	-1.543359	0.1401
GDPPC	0.150432	0.035730	4.210309	0.0005***
FDI	0.023051	0.006235	3.696850	0.0017***
DEBT	-0.148702	0.025143	-5.914364	0.0000***
C	-1.635127	0.341545	-4.787441	0.0002***

*,**,*** significant at 10%, 5% and 1% level respectively

Short-Run ECM Regression

Relationship of all independent variables with HDI in the short run was estimated through ECM regression and results are presented in the Table 5. CPBCS was significantly associated with HDI in the short run and CPBCS had negative impact towards the HDI with 1 percent, 5 percent and 10 percent level of significance at all 3 lags respectively. Such level of significance showed that small lag had more significant impact than farther lags. Impact of inflation on HDI was found positive in short run with 3 lags. Level of significance was 10 percent at first lag while 1 percent at 2nd and 3rd lags which indicated that farther lag had more significant impact in the short run. GDPPC had positive impact on HDI where 1st lag was not significant but coefficients at 2nd and 3rd lags were significant with 1 percent level of significant. Results indicated that GDPPC had higher and more significant impact on HDI with 2nd and 3rd lags instead of 1st lag. FDI also had positive impact on HDI in the short run and results were significant at 1 percent level of significance for 1st and 3rd lag while coefficient of 2nd lag was insignificant. Debt had negative impact on HDI in the short run with 1 percent level of significance and it included only first lag.

Table 5

Short-Run ECM regression results

Dependent Variable = D(HDI)				
Selected Model: ARDL(3, 3, 3, 3, 3, 1)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.240408	0.036900	-6.515187	0.0000***
D(HDI(-1))	-0.324151	0.104785	-3.093474	0.0063***
D(HDI(-2))	-0.322575	0.100118	-3.221933	0.0047***
D(CPBCS)	-0.001447	0.000632	-2.287910	0.0345**
D(CPBCS(-1))	-0.001113	0.000586	-1.901162	0.0734*
D(CPBCS(-2))	-0.003256	0.000590	-5.522240	0.0000***
D(INF)	0.000197	0.000103	1.906074	0.0727*
D(INF(-1))	0.000507	0.000108	4.696806	0.0002***
D(INF(-2))	0.000344	9.28E-05	3.712409	0.0016***
D(GDPPC)	0.003009	0.010766	0.279521	0.7830
D(GDPPC(-1))	0.043658	0.011375	3.838035	0.0012***
D(GDPPC(-2))	0.079587	0.009756	8.157709	0.0000***
D(FDI)	0.006450	0.000938	6.879283	0.0000***
D(FDI(-1))	0.000550	0.000840	0.654558	0.5210
D(FDI(-2))	0.002575	0.000808	3.184525	0.0051***
D(DEBT)	-0.061185	0.014085	-4.343862	0.0004***
CointEq(-1)*	-0.167757	0.024813	-6.760985	0.0000***
R-squared	0.874849	**Mean dependent var**		0.005411
Adjusted R-squared	0.787787	**S.D. dependent var**		0.003490
S.E. of regression	0.001608	**Akaike info criterion**		-9.731261
Sum squared resid	5.95E-05	**Schwarz criterion**		-9.013487
Log likelihood	211.6252	**Hannan-Quinn criter.**		-9.471737
F-statistic	10.04862***	**Durbin-Watson stat**		2.345470
Prob(F-statistic)	0.000001			

*,**,*** significant at 10%, 5% and 1% level respectively

Negative ECM value indicates speed of adjustment from disequilibrium of previous year to equilibrium of present year while positive ECM value has vice versa interpretations. ECM value estimated in this model was -0.061 with 1 percent level of significance which showed 6 percent speed of adjustment towards the equilibrium in one year. Probability value of ECM coefficient was 0.000 which indicated that ECM value was significant at 1 percent level of significance. R-square value indicates the magnitude of variation in the dependent variable due to independent variables which are included in the model. Value of r-square in this model was 0.874 which showed that 87 percent changes in HDI were captured through included explanatory variables. F-statistics was 10.048 with 1 percent level of significance which confirmed the significance of the model. Value of D.W was 2.345 which showed that that there was no auto correlation in the model.

Stability Tests

Stability of the model was confirmed through CUSUM and CUSUMSQ introduced by Brown et al. (1975). Results of CUSUM are shown in the Figure 1 and CUSUMSQ in Figure 2.

Figure 1

CUSUM Test

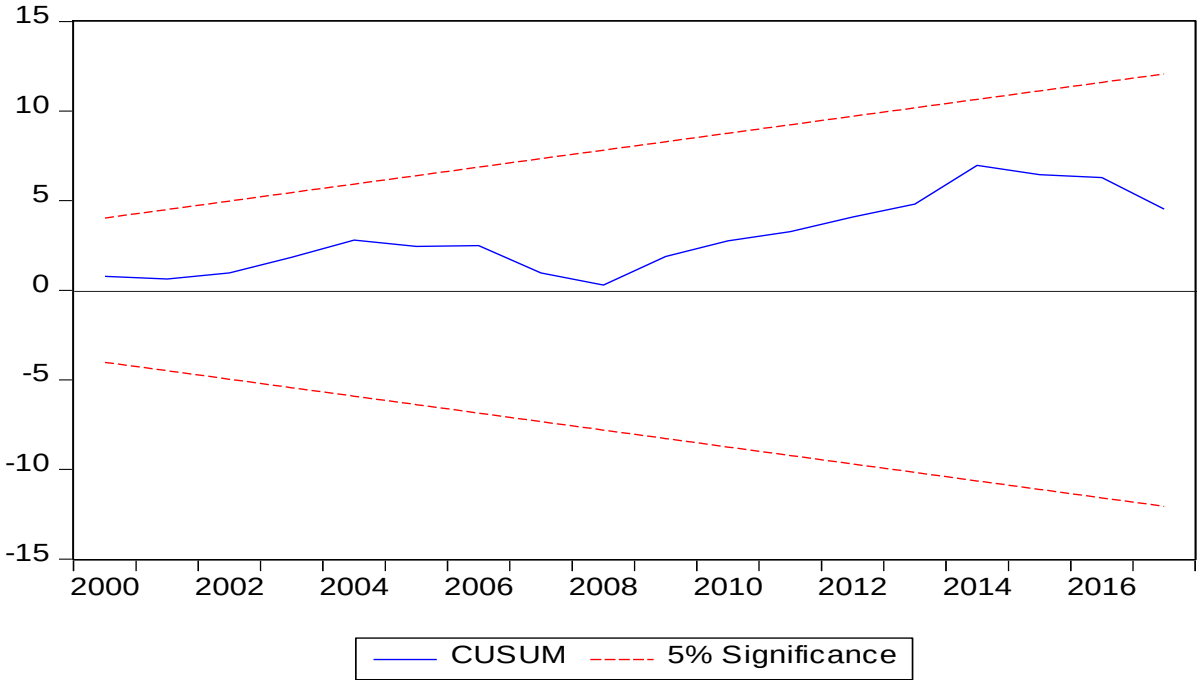
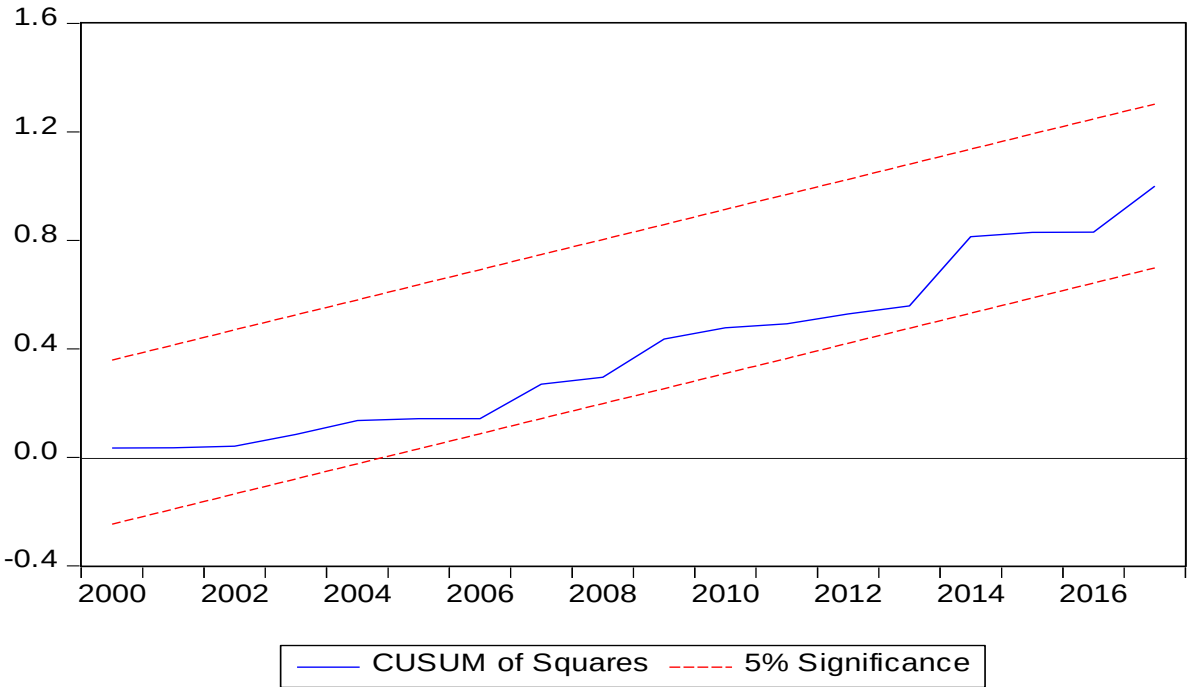


Figure 2

CUSUM SQUARE Test



CUSUM statistic shown in Figure 1, was within the lower and upper bounds of standard deviation. The null hypothesis that parameters had no stability was rejected as

recursive residual inside of the critical boundaries with 5 percent level of significance. Alternative hypothesis was accepted that parameters of the model had stability. Results of CUSUMSQ were presented in the Figure 2 which also indicated the similar outcomes with CUSUM and this confirmed the reliability of relationship of variables which were included in the model.

Conclusion and Policy Recommendations

The study attempted to examine the potential impact of China-Pak business cycle synchronization on human development index in the case of Pakistan. Other independent variables in the model were inflation, GDP per capita, foreign direct investment and total external debt. ADF and PP unit root tests were used to check the stationary among the series of variables and both the techniques gave the same results. All the variables were stationary with mix of level and first difference which provided the base for suitability of ARDL approach for regression analysis. F-bounds test was employed to assess the presence of co-integration in the model and results confirmed it through significant value of F-statistic. Long run estimates of ARDL method showed that all the independent variables except inflation had significant impact on human development index in Pakistan. Short run ECM regression also confirmed the presence of significant impact of all explanatory variables. Value of ECM was 0.16 with 1 percent level of significance which indicated that model converged 16 percent from disequilibrium of previous year to equilibrium of the present year. Value of R-square was 0.787 which showed that 78 percent changes in the dependent variable HDI were due to included variables in the model. Durbin Watson value was 2.345 which confirmed the absence of autocorrelation in the model. SUSUM and CUSUMSQ stability test were used which proved the reliability of the parameters in the model. Impact of China-Pak business cycle synchronization on HDI in Pakistan was found negative which alerts the government to take steps for monitoring the trade trends of Pakistan with China. In the case when imports of

Pakistan to China will be much higher than exports, this can be harmful for domestic producer which can lower the economic ability of individuals to improve HDI. Government should follow steps to control inflation and external debt while uplift in FDI and GDP per capita is needed to enhance HDI in Pakistan.

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