PRIMARY ENERGY, INCOME, FOREIGN DIRECT INVESTMENT (FDI), AND HUMAN CAPITAL IN INDIA: A MULTIVARIATE ANALYSIS

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ABSTRACT

This study investigates about the primary energy consumption function of the Indian economy through cointegration and causality analyses over the period 1970 to 2009. The study employs the bounds-testing procedure for cointegration to examine the potential long-run relationship, while an autoregressive distributed lag model is used to derive the short- and long-run coefficients. The Granger causality test is applied to determine the causal direction between electricity consumption and its determinants. The study finds that, primary energy consumption, income, foreign direct investment (FDI) and human capital are cointegrated. Further results show that, the entry of FDI is positively related to primary energy consumption in India, whereas the impact of human capital is negative, but insignificant and the Granger causality evidence indicates bidirectional causality between FDI and primary energy consumption and no causality between GDP and primary energy consumption. Additional results show that an increase in the human capital reduces the primary energy consumption and also reduces the influx of FDI.

Keywords
Primary energy consumption, India, Foreign direct investment, Economic growth

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1. INTRODUCTION

There are a number of studies examining the dynamics of the relationship between energy consumption/electricity consumption, CO_2 emissions, and economic growth. However, most of these studies have assumed economic growth as dependent variable, very limited attempt has been made to estimate energy/electricity consumption function in the context of developing economies and for India, to the best of our knowledge, there is no such attempt in the multivariate framework. Therefore, the purpose of this study is to investigate the energy consumption function (we used primary energy consumption because of its dominance in the total energy consumption in India) for India through the cointegration and causality analyses in the multivariate framework over the period of 1970 to 2009.

Sahir and Qureshi (2007) argued that energy is considered to be the lifeline of a modern economy, the most imperative instrument of socioeconomic development and has been accepted as one of the most important strategic commodities. Further, Zaleski (2001) documented that energy is not only essential for the economy but its supply is uncertain. It plays a crucial role in the strategic source that influences the outcomes of wars, fuels and strangles economic development and pollutes as well as cleans up the environment.

In the recent years, India's energy consumption has been increasing at one of the fastest rates in the world due to population growth and economic development. The electricity sector in India supplies the world's 6th largest energy consumer, accounting for 3.4% of global energy consumption by more than 17% of global population. Rapid economic growth has created a growing need for dependable and reliable supplies of electricity, gas and petroleum products. India's Planning Commission in the year of 2002 documented that due to the fast-paced growth of the economy, the country's energy demand has grown an average of 3.6% per annum over the past 30 years. Interestingly, primary commercial energy demand in India grew at the rate of six per cent between 1981 and 2001. India ranked fifth in the world in terms of primary energy consumption, accounting for about 3.5% of the world commercial energy demand in the year 2003.

The energy sector in India has been receiving high priority in the planning process. The total outlay of energy in the Tenth Five-year Plan had been projected to be 4.03 trillion rupees at 2001/02 prices, which is 26.7% of the total outlay. The Government of India on the midterm review of the Tenth Plan recognized the fact that under-performance of the energy sector can be a major constraint in delivering a growth rate of 8% GDP during the plan period. It has, therefore, called for acceleration of the reform process and adoption of an integrated energy policy. In the recent years, the government has rightly recognized the energy security concerns of the nation and more importance is being placed on energy independence. On the eve of the 59th Independence Day i.e., on 14 August 2005, the President of India emphasized that energy independence has to be the nation's first and highest priority, and India must be determined to achieve this within the next 25 years.[1]

[1] http://www.indiaenergyportal.org/overview_detail.php.

Exclusively, in the literature of the energy consumption-economic growth the focus had been on testing and validating the four hypotheses namely- growth, conservation, neutrality, and feedback hypotheses. The literature on the causality relationship between energy consumption, in general, and economic growth is rather mixed in the India. The plausible explanations for these inconclusive non-cointegration results in the earlier studies may be due to differences in variables used, data spans, presence of omitted variable bias, and model specification and technique used for analysis. According to the exhaustive survey of Payne (2010) India ranked third next after the USA and Korea in the terms of the highest number of results reported in energy-growth nexus. Now we will present a brief review on energy, growth nexus for India. Nachane et al. (1988) is the first study, to the best of our knowledge, in case of the India that concludes bidirectional causality between the tested variables for the period 1950-1985. In recent studies, Chontanawat et al. (2006, 2008) concludes evidence of no causality between per capita energy consumption and per capita real GDP for the period 1971-2000. Mahadevan and Asafu-Adjaye (2007) provides evidence of a unidirectional causality from per capita energy use to real GDP. Jinke et al. (2008) provides the absence of Granger-causality from any direction between coal consumption and real GDP for the period 1980-2005. Tiwari (2011a) finds that energy consumption does not Granger-cause GDP for the period 1971-2005, whereas consumption of renewable energy source increases GDP (Tiwari, 2011b). Tiwari (2011c) in the production function framework finds that energy consumption has a positive impact on GDP during the period 1971-2007, whereas Tiwari (2011d) finds evidence of unidirectional causality from GDP to primary energy consumption during the period 1970-2007.

However, the existing studies with bivariate models are potentially mis-specified and may be inconsistent (in terms of yielding biased and/or spurious results).[2] Therefore, we proceed in the study in a multivariate framework by presuming that primary energy consumption is significantly affected by the influx of foreign direct investment (hereafter, FDI) and human capital besides GDP growth. Hence, FDI and human capital are included as the new explanatory variables in the primary energy consumption function. To the best of our knowledge, this is the first study that empirically investigates, in the multivariate framework, the effects of FDI and human capital on primary energy particularly in the context of India.[3] In such a context, the application of the bounds testing procedure for cointegration (Pesaran

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[2] Stern (1993, 2000) argued that the uses of bivariate framework may not be able to detect a causal relationship because the substitution effects that may occur between energy and others inputs for production. In addition to that, changes in energy consumption will be countered by opposite movements in the consumption of other inputs for production. Eventually, the substitution effect may lead to insignificant result of energy consumption on income growth. In the era of globalization, a rapidly increasing demand for energy and dependency of countries on energy indicate that energy will be one of the biggest problems in the world in the next century. This requires for alternative and renewable sources of energy.

[3] Theoretically, the invasion of FDI is inducing primary energy consumption through the expansion of industrialization, transportation and manufacturing sectors development while primary energy is required to support the manufacturing process. Therefore, FDI could Granger cause primary energy consumption or vice-versa. In addition to that, a country's human capital plays an important role in primary energy consumption via reduced consumption in the residential and commercial usage.

et al., 2001) is also novel. Further, we use the Granger causality test to determine the causal direction between primary energy consumption and its determinants after confirming that our used model is valid by conducting a number of diagnostic tests.

The remainder of this study is organized as follows. In section 2, we briefly discuss the data and econometric techniques used in this study. In section 3, we discuss the empirical results. In the final section, we present the conclusions with policy implications.

2. METHODOLOGY AND DATA SOURCE

We test the stationary property of the data series by utilizing Augmented Dickey Fuller (1981), Phillips and Perron (1988) and Dickey-Fuller unit test with GLS Detrending (DFGLS Test)[4] unit root tests and inclusion of the trend and/or constant term in the equations based on the graphical plot of the variables in question. The cointegration among the variables is tested by utilizing bounds testing approach of Pesaran et al. (2001) because of its advantages over other approaches and also because our nature of data warranted.[5] This approach involves estimating the following unconditional error correction version of the Autoregressive Distributed Lag (ARDL) model:

$$\Delta \ln EC_t = \alpha_0 + \alpha_1 \ln EC_{t-1} + \alpha_2 \ln Y_{t-1} + \alpha_3 \ln FDI_{t-1} + \alpha_1 \ln HC_{t-1} + \sum_{i=1}^{p} \alpha_{5i} \Delta \ln EC_{t-i} + \sum_{i=0}^{p} \alpha_{6i} \Delta \ln Y_{t-i} + \sum_{i=0}^{p} \alpha_{7i} \Delta \ln FDI_{t-i} + \sum_{i=0}^{p} \alpha_{8i} \Delta \ln HC_{t-i} + \varepsilon_t \quad (1)$$

where $\alpha_{\circ}$ is the drift component, Δ is the first difference operator, $\alpha's$ are the coefficients associated with the variables, and ε_t is assumed to be white noise error processes. The EC_t, Y_t, FDI_t, and HC_t, respectively, are measured by primary energy consumption, GDP, foreign direct Investment and human capital. The null hypothesis of no cointegration in equation-1 is $H_{\circ}: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ while hypothesis of cointegration among the test variables (in particular primary energy consumption and GDP, FDI and HC) is $H_a: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$. The null hypothesis of no cointegration may be rejected if calculated values of F-statistics are more than Upper Critical Bound (UCB). The decision may be about no cointegration if Lower Critical Bound (LCB) is more than computed F-statistics.

[4] This test was proposed by Elliott et al. (1996) this test has significantly greater power than the previous versions of the ADF test. Elliott et al. (1996) propose a simple modification of the ADF tests in which the data are de-trended so that explanatory variables are "taken out" of the data prior to running the test regression.

[5] ARDL bounds testing approach to cointegration posses certain advantages like- in this approach the short- and long- runs parameters are estimated simultaneously; it can be applied irrespective of whether the variable are integrated of order zero i.e. *I(0)* or integrated of order one i.e. *I(1)*; it is more useful when sample size is small (Narayan, 2004); it is free from any problem faced by traditional techniques such as Engle-Granger (1987), and Philips and Hansen (1990); the error correction method integrates the short-run dynamics with the long-run equilibrium, without losing long-run information.

Finally, if calculated F-statistics are between UCB and LCB, then decision about cointegration is inconclusive. Importantly, we derived the appropriate critical values from the response surface procedure developed by Turner (2006).[6] Further, to check the reliability of the results reported by ARDL model we conducted the diagnostic and stability tests.[7] Given the existence of the long run relationship among the test variables, an error correction representation can be developed as follows to examine the direction of causality among them:

$$(1-L)\begin{bmatrix}\ln EC_t\\ \ln Y_t\\ \ln FDI_t\\ \ln HC_t\end{bmatrix}=\begin{bmatrix}\beta_1\\ \beta_2\end{bmatrix}+\sum_{i=1}^{n}(1-L)\begin{bmatrix}b_{11i} & b_{12i} & b_{13i} & b_{14i}\\ b_{21i} & b_{22i} & b_{23i} & b_{24i}\\ b_{31i} & b_{32i} & b_{33i} & b_{34i}\\ b_{41i} & b_{42i} & b_{45i} & b_{46i}\end{bmatrix}\times\begin{bmatrix}\ln EC_{t-1}\\ \ln Y_{t-1}\\ \ln FDI_{t-1}\\ \ln HC_{t-1}\end{bmatrix}$$

$$+\begin{bmatrix}\eta_1\\ \eta_2\\ \eta_3\\ \eta_4\end{bmatrix}(ECM_{t-1})+\begin{bmatrix}\mu_{1t}\\ \mu_{2t}\\ \mu_{3t}\\ \mu_{4t}\end{bmatrix} \tag{2}$$

where $(1-L)$ is indicating the difference operator while ECM_{t-1} is the lagged error-correction term derived from the long-run cointegrating relationship and μ_{it} (where i = 1,2,3,4) are normally distributed residual terms. The presence of a significant relationship in first differences of the variables provides evidence on the direction of the short-run causation while a significant *t*-statistic pertaining to the error correction term (ECM_{t-1}) suggests the presence significant long-run causation. The appropriate lag order for the ARDL and ECM is determined by Akaike's Information Criterion (AIC) because of its superior properties in small sample (Lütkepohl, 1991, 2005). For the analysis all data are obtained from an online database of World Bank with annual observation spanning from 1970-2009. Energy consumption is measured as Primary energy consumption- million tonnes oil equivalent, FDI is measured as net inflows in reporting economy (DRS, current US$), GDP is measured as GDP at constant 2000 US$, and HC is measured by Population ages 15-64 (% of total).

3. DATA ANALYSIS AND EMPIRICAL FINDINGS

The descriptive statistics of variables and Pearson's correlation analysis shows that all variables are log-normally distributed and they have very high correlation

[6] This is because the critical values provided by Pesaran et al. (2001) are not suitable for our small sample size (40 observations).

[7] In the diagnostic tests we examine for the presence of serial correlation, incorrect functional form, non-normality and heteroscedisticity associated with the model. The stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals ($CUSUM_{SQ}$).

with each other. The unit root test results confirm (not reported) that all variables are integrated of order one, i.e., I(1) except human capital (HC).[8]

After finding the order of integration of the variables we conduct cointegration analysis. First, we use Johansen and Juselius (1990) cointegration test in the mixed order of integration.[9] Second, to test the robustness of our results we again investigated cointegration with Johansen and Juselius (1990) cointegration test but keeping HC as exogenous variables. The results of both cases are presented in Table 1 below.

Table 1: Cointegration test

Cointegration test [Trend assumption: Linear deterministic trend, Lags interval (in first differences): 1 to 3]					
Unrestricted Cointegration Rank Test (Trace)					
Cointegration without HC as exogenous				**Cointegration with HC as exogenous**	
H_0	H_a	Trace Statistic	5% Critical Value	Trace Statistic	5% Critical Value
None	At most 1	122.7182*	47.85613	42.79652*	29.79707
At most 1	At most 2	64.70331*	29.79707	13.26810	15.49471
At most 2	At most 3	32.77607*	15.49471	3.286059	3.841466
At most 3	At most 4	3.684104	3.841466		
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					
H_o	H_a	Max-Eigen Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None	At most 1	58.01489*	27.58434	29.52842*	21.13162
At most 1	At most 2	31.92724*	21.13162	9.982042	14.26460
At most 2	At most 3	29.09197*	14.26460	3.286059	3.841466
At most 3	At most 4	3.684104	3.841466		
Note: * denotes rejection of the hypothesis at the 0.05 level.					
Source: Author's calculation					

[8] The results of descriptive statistics of variables and Pearson's correlation analysis are reported in appendix 1 along with the graphical plot of the variables.

[9] We used Johansen and Juselius (1990) cointegration test in the mixed order of integration as following referee's suggestion.

It is evident from Table 1 that when we take variables with different order of integration for testing cointegration we find that there are at most 3 cointegrating relations However, when we take variables with the same order of integration as endogenous and HC as exogenous we find evidence of one cointegration relation. Further, evidence of one cointegration relations is also supported by the results obtained from ARDL bounds testing approach.[10] The results of ARDL bounds testing approach to cointegration are shown in Table 2.

Table 2: Results of Bounds testing to cointegration

Panel I: Bounds testing to cointegration		
Estimated Model	$F_{CPI_t}(\ln EC_t \mid \ln Y_t, \ln FDI_t, \ln HC_t)$	
Optimal Lag Length	(2, 2, 2, 2)	
F-Statistics	7.207806	
	Critical values (T = 40)#	
	Lower bounds $I(0)$	Upper bounds $I(1)$
1 per cent level	7.397	8.926
5 per cent level	5.296	6.504
10 per cent level	4.401	5.462
Panel II: Diagnostic tests	Statistics	Statistics
R^2	0.828561	
Adjusted- R^2	0.677291	
F-statistics	5.477373 [0.000617]	
J-B test	0.403773 [0.817188]	
Breusch-Godfrey LM test	0.994003 [0.3336]	
ARCH LM test	0.023398 [0.8795]	
White Heteroscedisticity test	0.348994 [0.7859]	
Ramsey RESET	2.310757 [0.1480]	
CUSUM	Stable	
CUSUMsq	Stable	
Note: The optimal lag structure is determined by AIC. The parenthesis [ ] is the prob-values of diagnostic tests. # Critical values bounds computed by surface response procedure developed by Turner (2006).		

It is evident from Table 2 that the calculated F-statistics, which is 7.2078, is higher than the upper critical bound, i.e., 6.504 at the 5% level of significance using unrestricted intercept. This implies that there is a long run relation between the tested variables.[11] After establishing the relationship between the test variables we, in the next step, present the results pertaining to the long run relation and the short

[10] Importantly, ARDL test gives valid results if applied of the variables having different order of integrations but limited to I(0) to I(1) i.e., it cannot be applied if, for example, one variable is integrated of order I(0) and other I(2) or one variable is integrated of order (1) and other is of order I(2).

[11] Results of lag length selection test are available upon request.

run dynamics using Error Correction Modelling (ECM) version of the ARDL model in Table-3. The results of the long run analysis are obtained from Ordinary Least Square (OLS) Canonical Cointegration Regression (CCR), Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) estimations techniques, whereas results of the short run dynamics are obtained using ARDL approach.

Table 3: Short-run and long-run results

Variable	Dependent variable = $\Delta \ln PEC_t$					
	Results from short run analysis		Results from long run analysis			
	ARDL approach		OLS	CCR	FMOLS	DOLS
	Coefficient	T-Statistics	Coefficients (P-value)			
Constant	0.037300	3.264181***	7.74293 (0.0984)	8.08157 (0.1508)	7.76148 (0.143)	3.45498 (0.4552)
$\Delta \ln GDP_t$	0.445766	2.449796**	1.71524 (0.0000)	1.74711 (0.0000)	1.74377 (0.0000)	1.52422 (0.0000)
$\Delta \ln FDI_t$	0.010280	2.079560**	-0.0075 (0.4945)	-0.0139 (0.278)	-0.0147 (0.2529)	0.06562 (0.0003)
$\Delta \ln HC_t$	-3.606878	-1.324006	-11.711 (0.000)	-11.989 (0.000)	-11.887 (0.000)	-9.4385 (0.0001)
ECM_{t-1}	-1.162600	-3.069489***	-----	-----	----	----
Note: The asterisks ***, ** and * denote the significant at the 1%, 5% and 10% levels, respectively.						

Table 3 presents the short- and -long run coefficients derived from ARDL model. The results indicate that in the long run, the explanatory variables, GDP, FDI and HC are statistically significant at the 10% level and the variables (except HC) are positively related to primary energy consumption. This infers that GDP and FDI growth will induce an increase in primary energy consumption, whereas HC growth will decrease the primary energy consumption. Similarly, in the short run, we find that the explanatory variables are positively related to primary energy consumption and statistically significant at the 10 % level (except HC). A remarkable finding of this study is that both the short- and -long run coefficients showed the positive relationships for GDP and FDI and negative for HC. Further, we find that the coefficient of the lagged error-correction term, ECT_{t-1} has a negative sign and statistically significantly different from zero at the 1% level in the primary energy consumption equation. The significant negative sign of the error-correction term implies that the variable is not overshooting and therefore, the long run equilibrium relationship is achievable. However, as Bahmani-Oskooee and Bohl

(2000) demonstrated that cointegration may not imply a stable relationship among the set of variables. Thus, following Bahmani-Oskooee and Bohl (2000) and Bahmani-Oskooee (2001), we carry out the CUSUM and CUSUM of Squares tests to the recursive residuals of the estimated ARDL. The plots of the CUSUM and CUSUM of Squares statistics reveal that the test statistics are always staying within the 5 per cent critical bounds.[12] Next, we have conducted diagnostic tests such as serial autocorrelation, heteroskedasticity, misspecification and nonlinearity of residuals. We find none of the problem exists in our estimates.[13] In the next step, using lag interval (1, 3), model 3 (which assumes a linear trend in the data, and an intercept in the cointegrating equation in the Johansen and Juselius (1990) cointegration test), and one cointegrating error term the Vector Error Correction Modelling (VECM) analysis has been carried out and then the Engle-Granger causality analysis has been performed on those results. Results of Engel-Granger causality analysis are reported below in Table 4.

Table 4: VECM Engle-Granger causality analysis

VEC Granger Causality Short Run (Wald test/χ^2)			
	D(Ln(PEC))	D(Ln(GDP))	D(Ln(FDI))
D(Ln(PEC))	-------	1.159028	18.17235***
D(Ln(GDP))	4.490765	------	5.413874
D(Ln(FDI))	6.799556*	0.048769	-------
VEC Granger causality from exogenous variable			
Ln(HC_{t-1})	-5.039515***	4.552772**	-155.6581***
VEC Granger Causality Long Run			
ECM_{t-1}	-0.421458***	0.349928*	-13.65130***
Note: (1) ***, **and *denotes significant at 1%, 5%, and 10% level respectively; (3) "D" denotes first difference.			
Source: Author's calculation			

It is evident from Table 4 that FDI Granger-cause primary energy consumption and primary energy Granger cause FDI. Hence, our study shows bidirectional causality between FDI and primary energy consumption. Further, we find that causality is running from HC to primary energy consumption, GDP, and FDI. The interesting point is, increase in past year's human capital is positively associated with the GDP, while it is negatively associated with primary energy consumption and FDI. Thus we have an interesting finding that the increase in human capital reduces the primary energy consumption, indicating that as the proportion of people with age 15-64 increases in coming years the energy consumption is reduced. And the

[12] Results are available upon request.

[13] For short run analysis we had Ad-R^2, F-Statistics, D.W, J-B test, $\chi^2 Serial$, $\chi^2 ARCH$, $\chi^2 Hetero$ and $\chi^2 Reset$ as 0.256828, 3.591874, 1.793787, 3.248729 (0.197037), 0.037763 (0.8475), 0.050872 (0.8233), 1.216781 (0.3277) and 0.288820 (0.5957) respectively, with P-Value in parentheses.

negative impact on FDI of HC indicates that FDI is replaced by human capital, i.e., physical foreign capital is replaced by human capital.

4. Conclusions and policy implications

The aim of this study is to investigate the primary energy consumption function for India through the cointegration and causality analyses. This study utilizes the bounds testing approach for cointegration to examine the existence of the long run equilibrium relationship between primary energy consumption and its determinants. Furthermore, the study uses the Granger causality with an error - correction model to investigate the causal link between primary energy consumption and its determinants. This study finds that first, primary energy consumption, income, foreign direct investment and human capital in India are cointegrated. This implies that the explanatory variables are uniting with primary energy consumption to achieve their steady-state equilibrium in the long run. Second, the entry of foreign direct investment is positively related to primary energy consumption in India, whereas the impact of human capital is negative but insignificant. Third, the study supports for the neutrality hypothesis on the Granger-causal relationship between primary energy consumption and GDP this indicates that energy saving policies such as reducing primary energy consumption may not have an adverse effect on economic growth. Fourth, the study finds the evidence of bidirectional causality between FDI and primary energy consumption. Last but not least, the study finds that increase in human capital reduces the primary energy consumption and also reduces the influx of FDI.

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APPENDIX 1

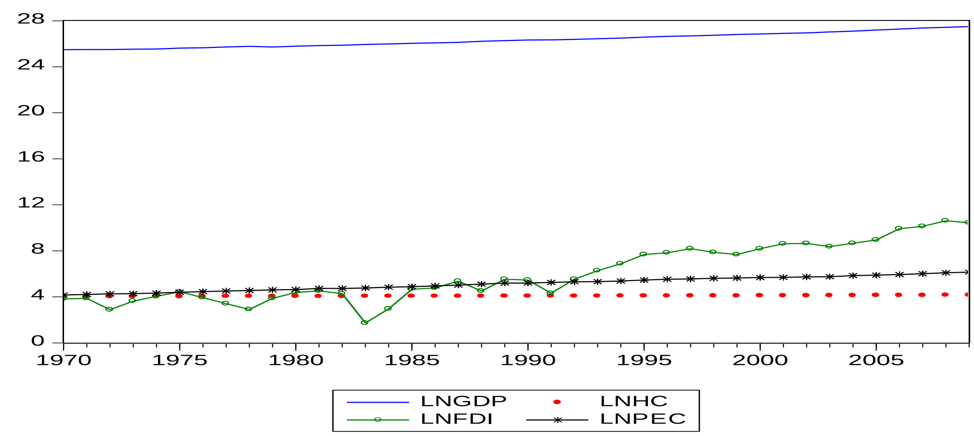

Figure 1: Plot of GDP, HC, FDI and PEC (value in logarithms)

Table 2: Descriptive statistic and pair-wise correlation

Variables	$\ln PEC_t$	$\ln GDP_t$	$\ln FDI_t$	$\ln HC_t$
Mean	5.141418	26.33057	5.993423	4.074855
Median	5.195113	26.29661	5.412423	4.064554
Maximum	6.150289	27.49743	10.60704	4.157185
Minimum	4.171900	25.48708	1.729884	4.021918
Std. Dev.	0.593579	0.613502	2.440347	0.038514
Skewness	-0.041015	0.291285	0.333173	0.599866
Kurtosis	1.761802	1.892089	1.879803	2.219156
Jarque-Bera	2.566440	2.611424	2.831431	3.415120
Probability	0.277143	0.270980	0.242752	0.181308
Pair-wise correlation				
$\ln PEC_t$	1.000000			
$\ln GDP_t$	0.990911	1.000000		
$\ln FDI_t$	0.921969	0.943021	1.000000	
$\ln HC_t$	0.968282	0.991129	0.946549	1.000000

Table-3: Results of unit root tests

Unit root tests					
Variables	ADF Test		DF-GLS Test	P-P Test	
	T-calculated	Prob-value	T-calculated	T-calculated	Prob-value
$\ln DFI_t$	-2.927126	0.1661	-2.481579	-2.869949	0.1834
$\Delta \ln FDI_t$	-5.172580	0.0003	-5.993883***	-9.300450	0.0000
$\ln GDP_t$	-1.548726	0.7948	-0.909970	-1.548726	0.7948
$\Delta \ln GDP_t$	-5.654361	0.0000	-4.925345***	-5.677880	0.0000
$\ln HC_t$	-5.637670	0.0002	-6.382635***	2.602980	1.0000
$\ln PEC_t$	-2.356608	0.3953	-2.389708	-2.445100	0.3521
$\Delta \ln PEC_t$	-6.859366	0.0000	-6.397245***	-6.857721	0.0000

Note: The asterisks *** denotes the significant at %1 level. The figure in the parenthesis is the optimal lag structure for ADF and DF-GLS tests, bandwidth for the PP unit root test is determined by the Schwert (1989) formula.