Is Energy Consumption Sensitive to Foreign Capital Inflows and Currency Devaluation in Pakistan?

Shahbaz, Muhammad and Chaudhary, A. R and Shahzad, Syed Jawad Hussain

Montpellier Business School, France, National College of Business Administration Economics, Lahore, Pakistan

1 December 2018

Is Energy Consumption Sensitive to Foreign Capital Inflows and Currency Devaluation in Pakistan?

Muhammad Shahbaz
Energy and Sustainable Development (ESD), Montpellier Business School, Montpellier, France
Email: muhdshahbaz77@gmail.com

A. R. Chaudhary
National College of Business Administration & Economics, Lahore, Pakistan
Email: amatul.chaudhary@yahoo.com

Syed Jawad Hussain Shahzad
Energy and Sustainable Development (ESD), Montpellier Business School, Montpellier, France
E-mail: jawad.kazmi5@gmail.com; j.syed@montpellier-bs.com

Abstract

This study investigates the relationship between foreign capital inflows and energy consumption by incorporating economic growth, exports and currency devaluation in energy demand function for the case of Pakistan. The long-run and short-run effects are examined via ARDL bounds testing procedure. Foreign capital inflows and currency devaluation (economic growth and exports) decrease (increase) energy consumption in long-run. The results confirm a feedback effect between foreign capital inflows and energy consumption. These findings would be helpful to policy makers in designing comprehensive economic and energy policies for utilizing foreign capital inflows as a tool for optimal use of energy sources to enhance economic development in long run.

Keywords: Energy consumption; foreign capital inflows; ARDL; Pakistan

JEL Classification: F18, F21, O13

1. Introduction

The analysis like how foreign capital inflows (FCI) impacts energy demand is a hot research issue with mixed empirical findings. Developing countries provide incentives to attract FCI in order to reap positive externalities that in turn, may affect income per capita (Shahbaz and Rahman, 2010, 2012). These positive externalities include inter-alia productive efficiency, advancements in technology, human and managerial skillfulness, learning by doing, new methods of production and access to international markets. These externalities may affect energy consumption via different channels. For instance, FCI stimulates economic activity in the host country, which in turn, impacts energy consumption, the so-called *scale effect*. Therefore, FCI has an indirect but positive impact on energy demand (Shahbaz et al. 2011a, Rahman and Shahbaz, 2011).

The structural changes in an economy may change the production patterns of energy intensive goods. During the early stages of economic development, economies transfer from agricultural to industrial sectors and this shift results in higher energy demand, is termed as positive *composite effect*. When the economy achieves matured level of economic development, it shifts from industrial to service sector (light industry) and latter is less energy intensive compared to the former, is termed as negative *composite effect* (Stern, 2004; Lee, 2013). This pattern of economic development is a reason for variations in the *comparative advantage effect* of an economy in international markets (Cole, 2006). The comparative advantage of an economy is influenced by capital-labor ratio, environmental sustainability regulations and availability of skilled human capital. This seems that FCI affects the *composite effect* if the sectoral structure of an economy changes and this sectoral shift can be gauged via industrial contributions in gross domestic product (GDP). The effect of adopting advanced technologies on energy consumption is termed as the *technique effect (*Antweiler et al. 2001; Cole, 2006). The technique effect suggests that the advancements in technology results in less energy consumption coupled with enhanced output compared to traditional technologies (Arrow, 1962).

FCI lowers energy consumption via adoption of energy efficient technology and also increases market competition [Chima, (2007) for the USA; Xiaoli et al. (2007) for China; Irawan et al. (2010) for Indonesia]. On the other hand, FCI may increase energy demand by boosting economic activity (Tang, 2009; Banto, 2011), industrialization (Bekhet and Othman, 2011) and creating cheap business opportunities (Sadorsky, 2010), via *scale*, *composition* and *technique effects* in developing economies (Hubler and Keller, 2009). Further, FCI enhances the export potential of an economy (Sultan, 2012), and raises stock market capitalization in the host country (Zaman et al. 2012).

In Pakistan, foreign capital inflows (foreign remittances, foreign direct investment and foreign portfolio investment) have increased over the selected period of time i.e. 1972-2014. For instance, real foreign remittance per capita was 20.50 Pakistan Rupee (PRS) in 1971-72, which raised to 7533 PRS in 2013-14, a growth of almost 3756 percent (Government of Pakistan, 2015). Pakistan had very low real FDI per capita i.e. 100.27 PRS in 1971-72 but it increased to 1495 PRS in 2013-14, a growth of almost 1395 percent. Foreign portfolio investments (real per capita) were 30.90 PRS in 1984-85, which increased to 495 PRS in 2013-14 (Government of Pakistan, 2015), a growth rate of 1496 percent for the said time period. Notably, a big portion of the foreign capital inflows in Pakistan comes from the foreign remittances and therefore neglecting its impact on energy demand will result in imprecise conclusions. Exports have grown at 245 percent as real exports per capita increased from 1723 PRS (in 1971-72) to 5953 PRS (in 2013-14). The value of real effective exchange rate was 150.78 in 1971-72, which decreased to

73 in 2013-14. The growth of real GDP per capita is 154 percent as real GDP per capital amounted to 36620 PRS (2013-14) from 14400 PRS (in 1971-72). The significant devaluation of currency i.e. 106 percent over the sample period may have impacted the demand of Pakistani exports in international markets, and subsequently energy demand. On the other hand, Pakistan economy is suffering from the biggest energy crises of all times. Komal and Abbas (2015) highlight that circular debt, fragile financial situation of energy supply firms, intense reliance on gas/oil (above 80%), declining gas production, less utilization of cheap hydel as well as coal resources and unexploited power production capacity have contributed to energy scarcity. According to some estimates, electricity shortage is expected to rise to 8000 MW in 2017 and 13,000 MW in 2020.

The existing scenario provides a unique economic setting to study FCI-energy nexus, while incorporating exports and currency devaluations as potential determent of energy demand. Exports may affect energy consumption directly and/or indirectly by stimulating economic activity. Exports impact total factor productivity as well as economies of scale. Exports are also considered as a source of transfer of advance technology and improvement in workers' skills which affects the production level in an economy. Further, exports also provide an opportunity to efficiently utilize the domestic resources without discriminating the domestic market (Shahbaz et al. 2013a) and thus may affect the energy consumption. Currency devaluation can have a positive impact on energy consumption if it is expansionary i.e. devaluation is positively linked with domestic economic activity and stimulates economic growth (Shahbaz et al. 2012). Currency devaluation declines energy consumption if devaluation is inversely related with economic growth i.e. devaluation is contractionary. The impact of currency devaluation on energy demand is neutral if currency devaluation has insignificant impact on domestic economic activity and hence on economic growth. This implies that the impact of currency devaluation on energy demand depends on the relationship between economic growth and energy consumption (Shahbaz et al. 2012)[1].

Hence, this study contributes in the existing energy economics literature by four ways: (i) the relationship between foreign capital inflows and energy consumption is investigated by incorporating economic growth, exports and currency devaluation as factors of GDP growth and energy demand. (ii) The structural break unit tests are employed to test the stationarity properties of the variables. (iii) The cointegration relationship between the variables is examined by applying the ARDL bounds testing in the presence of structural breaks. (iv) The direction of causality is investigated between foreign capital inflows and energy demand by applying the VECM causality test. We find that foreign capital inflows lower energy demand while economic growth increases energy consumption. Exports increase energy consumption but currency devaluations decrease it. The causal nexus between foreign capital inflows and energy consumption is bidirectional and both variables reinforce each other.

2. Literature Review

In existing literature, numerous studies have used foreign direct investment (FDI) as a measure of foreign capital inflows while investigating the foreign capital inflows-energy consumption nexus. For example, Mielnik and Goldemberg (2002), Chima (2007), Hubler (2009), Zheng et al. (2011), Erdem (2012), Elliott et al. (2013) reported that FDI is negatively linked with energy consumption. On contrarily, a positive impact of FDI on energy consumption is confirmed by Sultan (2012), Tang and Tan (2014), Omri and Kahouli (2013) and Leitão, (2015). On similar

[1] Empirical findings reported by Zaman et al. (2012), Mudakkar et al. (2013) and Alam (2013) are conflicting as these studies ignored the potential role of devaluation and exports in determining energy consumption.

lines, the feedback effect is validated between FDI and energy consumption by Dube (2009), Sbia et al. (2014) and Hassaballa (2014) while the unidirectional causality running from energy consumption to FDI is confirmed by Bekhet and Othman (2011), Banto (2012). On the contrary, Alam (2013) reported that FDI causes electricity consumption. These mixed empirical findings might be the outcome of inappropriate use of measure for foreign capital inflows. This reveals that existing studies in literature ignored the potential role of foreign remittances and portfolio investment while investigating the relationship between foreign capital inflows and energy consumption. Foreign remittances and portfolio investment are major contributors to foreign capital inflow and affect economic growth and both variables potential determinants affecting energy consumption via various channels. For example, increasing income level of the households or consumers resulting from increased remittances inflows will enable them to purchase consumer goods, such as automobiles, refrigerators, air conditioners, and washing machines (Akcay and Demirtas, 2015). Eventually, these durable and luxury items consume energy a lot and thereby adding more demand for total energy. Last but not the least, increasing income of the business people due to the inflows of remittances will allow them to renew existing ventures or to create new business ventures. Creating new business ventures or expanding existing businesses, following the consumers' demand for luxury items, require usage of higher energy as it is one of the potential inputs in the process of intermediate and final industrial production activities (Akcay and Demirtas, 2015). Stock market development plays a vital role and it has been attractive particularly for business firms of an economy. The wealth effect caused by stock market development not only increases investors' confidence but also motivates them to diversify their money from other traditional investment ventures to profit-making stock market activity (Ersoy and Ünlü, 2013). In this way, capital gain received from domestic stock market investment and foreign investment (portfolio investment) induces them to expand their business activity as well as motivate them to buy luxurious items. In doing so, domestic business and foreign investors may expand the economy and also require higher amounts of energy for business and consumption activities (Zhang et al. 2011).

The previous findings regarding the impact of foreign direct investment (FDI) on energy consumption are mixed. Further, few studies also indicate that there is no relationship between FDI and energy consumption. For instance, Antweiler et al. (2001) exposed that FDI only affects output growth and has no impact on energy consumption. Cole (2006) suggests that the relationship between FDI and energy demand is dynamic and depends on the economic conditions of recipient countries such as economic structure, economic development and energy prices.

The findings on the casual nexus between FDI and energy consumption are also wide spread. For instance, Ting et al. (2010) revealed that FDI Granger causes industrial energy intensity, but the impact of energy prices, energy consumption structure, industrial structure, technological progress, and regional economic growth on energy intensity depends on the region. Dube (2009) found a feedback effect between FDI and electricity use in South Africa. Bekhet and Othman (2011) investigated the temporal causality between FDI and electricity demand by incorporating consumer prices and economic growth in electricity demand function. They employed the vector error correction model (VECM) causality tests and found that electricity consumption Granger causes FDI, consumer prices and growth in GDP. They argue that electricity supply plays an important role in determining FDI and economic growth in Malaysian economy. On the similar lines, Banto (2012) empirically confirmed that renewable electricity generation Granger causes FDI in the short-run and a feedback effect exists in the long-run. He et al. (2012) using VAR model found that energy demand Granger causes FDI. Oke et al. (2012) investigated the linkage among FDI, exchange rate and energy consumption over the period of 1975-2008 by applying Generalized Method of Moments (GMM) for the Nigerian economy. They unveiled that FDI does not Granger cause energy consumption. Sbia et al. (2014) applied the multivariate model to study the relationship between FDI and clean energy by adding economic growth and trade in CO_2 emissions function in UAE. Their results indicate a feedback effect between FDI and clean energy consumption. Using data of developing economies, Hassaballa (2014) exposed that the bilateral causality exists between FDI and energy consumption. Similarly, Hamdi et al. (2014) confirmed the bidirectional casual nexus between FDI and electricity consumption in Bahrain.

Zaman et al. (2012) reported that electricity consumption is led by FDI in Pakistan. Mudakkar et al. (2013) investigated the energy demand function using the data of SAARC countries, namely Pakistan, Bangladesh, India, Nepal and Sri Lanka over the period of 1975-2011. They applied Toda-Yamamoto-Dolado-Lutkephol (TYDL) approach and found bidirectional causality between FDI and energy consumption in Pakistan. Alam (2013) investigated the link between FDI, economic growth and electricity consumption for Pakistan and India. He found that FDI and economic growth Granger cause electricity consumption in Pakistan.

We find that empirical results reported by various studies in existing literature are ambiguous due to the ignorance of structural breaks stemming in macroeconomic variables such as foreign capital inflows, energy consumption, economic growth, exports and devaluation. These structural breaks may change the relationship between the macroeconomic variables. This study is a humble effort to fill gap in existing literature generally and for Pakistan especially. Additionally, empirical findings would provide policy guidelines in optimal utilization of foreign capital inflows as a source of economic growth and to save energy by adopting energy efficient technology especially for Pakistan and generally for South Asia.

3. Theoretical Background and Model Construction

The general model is given as follows[2]:

$$EC_t = f(FCI_t, Y_t, EX_t, DEV_t) \tag{1}$$

$$\ln EC_t = \delta_0 + \underbrace{\delta_1 \ln FCI_t}_{Foreign\ capital\ inflows\ effect} + \underbrace{\delta_3 \ln Y_t}_{Economic\ growth\ effect} + \underbrace{\delta_4 \ln EX_t}_{Exports\ effect} + \underbrace{\delta_5 \ln DEV_t}_{Devaluation\ effect} + \underbrace{\varepsilon_t}_{Residual\ effect} \tag{2}$$

where, $\ln EC_t$ is natural log of energy consumption per capita (kg of oil equivalent), $\ln FCI_t$ is natural log of foreign capital inflows (index generated by applying principal component analysis using foreign direct investment, foreign portfolio investment, foreign remittances and foreign aid), $\ln Y_t$ is natural log of real GDP per capita, $\ln EX_t$ is natural log of real exports per capita, $\ln DEV_t$ is natural log of real effective exchange rate proxy for devaluation and ε_t is error term.

The data of real GDP, real exports, energy consumption, real foreign direct investment, real foreign aid and real foreign remittances are sourced through World Development Indicators of World Bank (CD-ROM, 2015). The data of real effective exchange rate to proxy currency devaluation is obtained from International Financial Statistics (CD-ROM, 2015). Except real effective exchange rate, all the series are transformed into per capita units using the total

[2] We have adopted log-linear specification for empirical analysis due to its superiority.

population series[3]. The time period of present study is 1972-2014. The quadratic match-sum method is used to transform the annual data into quarter frequency [4].

3.1. Foreign Capital Inflows Index

Different researchers used different proxies to measure the FCI. Many researchers used FDI as a proxy for FCI (c.f. Yasmin 2005, Baharumshah and Thanoon 2006, Hye et al. 2010, Shahbaz and Rahman 2010, 2012, Raza and Jawaid 2012, Rahman and Shahbaz 2013). While others uses foreign portfolio investment and foreign aid (Le and Ataullah 2006), FDI, short term debt and portfolio inflows (Carlson and Hernandez, 2002) net FDI inflows as a share of GDP (Chinn and Ito, 2010) and FDI, foreign loan and portfolio investment (Shah et al. 2012). Previous studies ignored the role of foreign remittances which is a major source of foreign inflows in Pakistan. We use FDI, foreign remittances and portfolio investments as the indicators of foreign capital inflows[5]. These indicators are highly correlated (see Table 1) and therefore may cause multi-colinearity problem during econometric analysis. To avoid the problem of multi-colinearity,

---

[3] The index of foreign capital inflows is generated by authors.

[4] The quadratic match-sum approach is particularly important to avoid the small sample problem. Further, data transforming from low into high frequency is done while adjusting the seasonal variations. Cheng et al. (2012) highlighted that the seasonality problem can be avoided by using a quadratic match-sum approach as it reduces the point-to-point data variations. Hence, this method is preferred due to its convenient operating procedure.

[5] Foreign direct investment affects energy consumption via income (scale) effect, technique effect, composite effect and comparative advantage effect; and wealth effect i.e. stock market channel (Leitão, 2015). Foreign remittances affect energy consumption via consumer effect, business effect and wealth effect. Consumer effect indicates that increasing income level of the households or consumers due to the emergence of remittances inflows will enable them to purchase consumer goods, such as automobiles, refrigerators, air conditioners, and washing machines. Eventually, these durable and luxury items consume energy a lot and thereby adding more demand for total energy. Business effect reveals that increasing income of the business people due to the inflows of remittances will allow them to renew existing ventures or to create new business ventures. Creating new business ventures or expanding existing business ventures following the consumers' demand for luxury items require usage of higher energy as energy is utilized as one of the potential inputs in the process of intermediate and final industrial production activities (Akcay and Demirtas, 2015). Wealth effect entails that stock market development plays a vital role and it has been attractive particularly for business firms of an economy. This is because wealth effect is the cause of stock market development that not only increases investors' confidence but also motivates them to diversify their money from other traditional investment ventures to profit-making stock market activity. In this way, the capital gain received from domestic stock market investment and remittances inflows received from overseas induce them to expand their business activity as well as motivate them to buy luxurious items. In doing so, business firms may expand the economy and also require higher amounts of energy for business and consumption activities (Akcay and Demirtas, 2015).

Mileva (2008) constructed the index of foreign capital inflows using FDI, foreign loans and portfolio (equity and bonds) investment by calculating the weighted average three series. This weighted average approach is sensitive to the outliers in data series and hence does not capture the true nature of series in the presence of high volatility (Sricharsoen and Buchenrieder, 2005).

Table-1: Correlations Matrix

Variables	FDI_t	REM_t	FPI_t
FDI_t	1.0000		
REM_t	0.7575	1.0000	
FPI_t	0.6344	0.6167	1.000

To solve this issue, we use Principal Component Analysis (PCA) to construct the index of foreign capital inflows following Sricharsoen and Buchenrieder (2005). This method transforms the correlated variables into uncorrelated series named as principal components. The results of PCA are reported in Table-2. The first principal component explains 78.04 percent variations of the data and hence provides a reasonable approximation of the three indicators of foreign capital inflows.

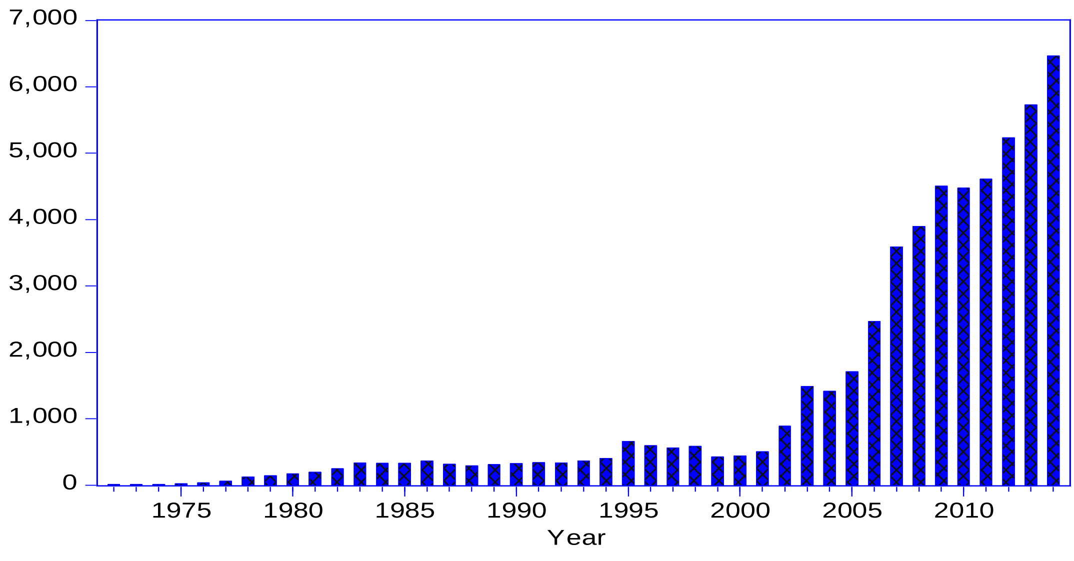
Table-2: Principle Component Analysis

	PAC 1	PAC 2	PAC 3
Eigen value	2.3411	0.4169	0.2418
Variance Prop.	0.7804	0.1390	0.0806
Cumulative Prop.	0.7804	0.9191	1.0000
Eigenvectors			
Variable	Vector 1	Vector 2	Vector 3
FDI_t	0.5879	-0.4309	0.6845

REM_t	0.5925	-0.3466	-0.7271
FPI_t	0.5506	0.8331	0.0515
Note: FDI_t is the real foreign direct investment per capita, REM_t indicates real foreign remittances per capita and FPI_t shows the real foreign portfolio investment per capita.			

Figure-1 shows low increments in foreign capital inflows till 1995, a sudden drop for few years thereafter. After 2001, foreign capital inflows started increasing, a possible effect of 9/11. The overseas Pakistani felt that "Pakistan is safe a place for their earnings" and remitted their money to Pakistan. Furthermore, government of Pakistan has implemented economic, financial and investment liberalizations during 1999-2002 that may also have attracted foreign capital inflows. The State of Bank of Pakistan (SBP) also announced foreign remittance package policy and crackdown was started to stop the illegal Hundi and Hawala money transfer channels which increased the volume of foreign remittances (SBP, 2011).

Figure-1: Foreign Capital Inflows per Capita (PKR)



3.2.Methods

3.2.1. Unit Root Test with Structural Breaks

Clemente et al. (1998) unit root test provides better inference on the time series properties in the presence of structural breaks. This test has more power, compared to the Perron and Volgelsang (1992), Zivot-Andrews (1992), ADF, PP and Ng-Perron unit root tests. Perron and Volgelsang (1992) and Zivot-Andrews (1992) unit root tests are appropriate if the series has one potential structural break. Clemente et al. (1998) extended the Perron and Volgelsang (1992) method to allow for two structural breaks in the mean. The null hypothesis H_0 against alternate H_a is stated as follows:

$$H_0 : x_t = x_{t-1} + a_1 DTB_{1t} + a_2 DTB_{2t} + \mu_t \quad (3)$$

$$H_a : x_t = u + b_1 DU_{1t} + b_2 DTB_{2t} + \mu_t \quad (4)$$

In equation-3 and equation-4, DTB_{1t} is the pulse variable which equals 1 if $t = TB_i + 1$ and zero otherwise. Moreover, $DU_{it} = 1$ if $TB_i < t (i = 1,2)$ and zero otherwise. Modification of mean is represented by TB_1 and TB_2 time periods. To further simplify, we assume that $TB_i = \delta_i T (i = 1,2)$ where $1 > \delta_i > 0$ while $\delta_1 < \delta_2$ (see Clemente et al. 1998). If two structural breaks are contained by innovative outlier, then unit root hypothesis can be investigated by applying equation-5, as provided in the following model:

$$x_t = u + \rho x_{t-1} + d_1 DTB_{1t} + a_2 DTB_{2t} + d_3 DU_{1t} + d_4 DU_{2t} + \sum_{i=1}^{k} c_j \Delta x_{t-1} + \mu_t \quad (5)$$

This equation helps us to estimate minimum value of t-ratio through simulations and the value of simulated t-ratio can be utilized to identify all break points if the value of autoregressive parameter is constrained to 1. For the derivation of the asymptotic distribution of the estimate, we assume that $\delta_2 > \delta_1 > 0, 1 > \delta_2 - 1 > \delta_0$ where δ_1 and δ_2 obtain the values in interval i.e. $[(t+2)/T,(T-1)/T]$ by applying the largest window size. The assumption i.e. $\delta_1 < \delta_2 + 1$ is used to show that cases where break points exist in repeated periods are purged (see Clemente et al. 1998). Two steps approach is used to test the unit root hypothesis, if shifts can explain the additive outliers. In 1st step, we remove deterministic trend, following equation-8 for estimation as follows:

$$x_t = u + d_5 DU_{1t} + d_6 DU_{2t} + \hat{x} \quad (6)$$

The second step involves search for the minimum t-ratio to test the hypothesis $\rho = 1$, using the following equation:

$$\hat{x}_t = \sum_{i=1}^{k} \phi_{1i} DTB_{1t-1} + \sum_{i=1}^{k} \phi_{2i} DTB_{2t-1} + \rho \hat{x}_{t-1} + \sum_{i=1}^{k} c_i \Delta \hat{x}_{t-1} + \mu_t \quad (7)$$

To make sure that the $\min t_{\rho\ t}^{IO}(\delta_1, \delta_2)$ congregates i.e. converges in distribution, we have included dummy variable in estimated equation for estimation:

$$\min t_{\rho\ t}^{IO}(\delta_1, \delta_2) \to \inf_{\gamma} = \wedge \frac{H}{[\delta_1(\delta_2 - \delta_1)]^{1/2} K^{1/2}}$$

3.2.2. ARDL Bounds Testing Approach

Initially, Engle and Granger (EG, 1987) developed the residual based cointegration test. Later on, Philips and Hansen (1990) argued that EG cointegration test is insensitive whether the model is estimated with or without a trend. Furthermore, the cointegration test proposed by Johansen and Juselius (1990) cannot be applied if any of the time series is stationary at level in the VAR system, mixed order of integration. Pesaran et al. (2001) developed the bounds testing approach to examine the long-run relationship between the variables. This approach can be applied irrespective of the order of integration; however, none of the variable should be I(2). The ARDL framework provides efficient results for small sample size in comparison with other conventional cointegration approaches. Further, the bounds testing procedure provides the long-run and short-run empirical robust estimates. The functional form of the ARDL model ($p, q_1, q_2, ...q_k$) is modeled as following:

$$\alpha(L, p)Y_t = \alpha_\circ + \sum_{i=1}^{k} \beta_i (L, q_i) X_{it} + \lambda' W_t + \varepsilon_t, \; t = 1, ..., n \tag{8}$$

where

$$\begin{aligned} &\alpha(L, p) = 1 - \alpha_{i1} L - \alpha_{i2} L^2 - .... - \alpha_{pi} L^{pi}, \\ &\beta_i (L, q_i) = \beta_{i\circ} + \beta_{i1} L + \beta_{i2} L^2 + ... + \beta_{iq_1} L^{q_1} \end{aligned}, \qquad i = 1, 2..., k.$$

where, X_t indicate the independent variables to be used in the model and α is constant term. L is lag operator i.e. $X_t = X_t - 1$. W_t is $s \times 1$ which is vector of deterministic variables. These variables are constant term, time trend or forcing actors having fixed lags. This shows that equation-8 is helpful in estimating the long-run linkages:

$$\varphi_i = \frac{\hat{\beta}_i (1, \hat{q}_i)}{\alpha(1, \hat{p})} = \frac{\hat{\beta}_{i0} + \hat{\beta}_{i1} + ... + \hat{\beta}_{i\hat{q}}}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - ..... - \hat{\alpha}_{\hat{p}}}, \tag{9}$$

$$i = 1, 2, \ldots, k.$$

where, $\hat{p}_i$ and $\hat{q}_i$, i = 1, 2… k shows the coefficient of estimates (see equation-8). The equation-9 is used to estimate the coefficients of the long-run relationship as formula is given as follows:

$$\pi = \frac{\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \ldots, \hat{q}_k)}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - \ldots - \hat{\alpha}_{\hat{p}}}. \quad (10)$$

The ordinary least squares (OLS) estimates are reported by $\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \ldots \hat{q}_k)$ which are the coefficients of λ of an unrestricted error correction model of the ARDL version (see equation-9). The appropriate lag order selection is a necessary condition to compute F-statistic. The F-value varies with different lag orders. We follow Akaike Information Criteria (AIC) which performs better than Schwartz Bayesian Criteria (SBC). Lastly, we calculate F-statistic to take decision about the presence of cointegration amid the series (Narayan, 2005). The unrestricted error correction model (UECM) contains unrestricted intercept and unrestricted time trend to F-statistic for cointegration. The equation of UECM is given as follows:

$$\Delta Y_t = c_1 + c_T T + \pi_{YY} Y_{t-1} + \pi_{YX.X} X_{t-1} + \sum_{i=1}^{p-1} \beta \psi_i \Delta Z_{t-1} + \sum_{i=0}^{q-1} w \Delta X_{t-i} + c_D D + \mu_i \quad (11)$$

The intercept term and time trend are represented by c_1 and c_T. The c_D is coefficient of dummy variable which is based on Clemente et al. (1998) single unknown structural break unit root test. We use F-test or Wald test to compute F-statistic in taking decision whether cointegration exists or not between the variables. We follow null hypothesis as $H_\circ : \pi_{YY} = 0$, $H_\circ : \pi_{YX.X} = 0$ while alternate hypothesis is $H_a : \pi_{YY} \neq 0, H_a : \pi_{YX.X} \neq 0$. The calculated F-value is compared with critical bounds developed by Pesaran et al. (2001). The inference is in favor of no cointegration if lower bound exceeds calculated F-statistic. We favor for the presence of cointegration if computed F-statistic exceeds upper bound. The decision about cointegration is inconclusive if computed F-statistic exceeds lower bound but less than upper bound.

After finding long-run relation amid the series then we apply error correction model (ECM) approach to examine the short-run impacts of independent variables on the dependent variable. The functional form of the short-run model is given as follows:

$$\Delta Y_t = \Delta\alpha_\circ - \alpha(1,\hat{p})ECM_{t-1} + \sum_{i=1}^{k}\beta_{i\circ}\Delta X_t + \lambda'\Delta w_t - \sum_{j=1}^{\hat{p}-1}\alpha^{\bullet} j\Delta Y_{t-1}$$

$$-\sum_{i=1}^{k}\sum_{j=1}^{\hat{q}_{t-1}}\beta_{ij}\Delta X_{i,t-j} + \varepsilon_t \quad (12)$$

The matrix of independent variables is x_t and no multi-colinearity exists between the variables. The ε_t is error term which is supposed to be normally distributed i.e. mean of the variance is zero while variance is constant. The significance of the estimate of lagged error term supports our recognized cointegration between the variables. The short-run convergence rate towards the equilibrium long-run path is also indicated by the estimate of the lagged error correction term (Masih and Masih, 1996). Furthermore, we apply diagnostic tests such as normality of the error term, serial correlation, autoregressive conditional heteroscedasticity (ARCH) test, White heteroskedasticity and functional form of the short-run model. We use CUSUM and CUSUMsq tests to scrutinize the goodness of fit of the ARDL model.

3.2.3. Vector Error Correction Model (VECM) Granger Causality Approach

Granger, (1969) exposed that if the variables are cointegrated then there must be causality at least from one side between the variables. The existence of cointegration establishes the short-run and long-run causal relationship. The Granger causality from X to Y is present if and only if, the changes in Y can be predicted by the past values of X and similarly, Y Granger causes X when the past values of Y predict the deviation in X. Granger, (1969) also suggested to use the VECM when the variables are integrated at I(1). The empirical equation for causality test is modelled as following:

$$(1-L)\begin{bmatrix} \ln EC_t \\ \ln FCI_t \\ \ln Y_t \\ \ln EXP_t \\ \ln DEV_t \end{bmatrix} = \begin{bmatrix} \phi_1 \\ \phi_2 \\ \phi_3 \\ \phi_4 \\ \phi_5 \end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} & \beta_{15i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} & \beta_{25i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} & \beta_{35i} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} & \beta_{45i} \\ \beta_{51i} & \beta_{52i} & \beta_{53i} & \beta_{54i} & \beta_{55i} \end{bmatrix} + \begin{bmatrix} \theta \\ \chi \\ \delta \\ \lambda \\ \vartheta \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \eta_{1t} \\ \eta_{2t} \\ \eta_{3t} \\ \eta_{4t} \\ \eta_{5t} \end{bmatrix} \quad (13)$$

The difference operator is shown by $1-L$. The lagged error term i.e. ECM_{t-1} is generated using the long-run OLS regression. The η_{1t} and η_{2t} are error terms which are assumed to have normal distributions with zero mean and constant variance. The presence of the long-run causality is validated by the statistically significance of *t*-statistic of the lagged error term i.e. ECM_{t-1}. The significance of the first differenced of the variables show the presence of the short-run causality. FCI Granger causes EC if $\beta_{12i} \neq 0 \forall_i$ and EC Granger causes FCI if $\beta_{11i} \neq 0 \forall_i$.

4. Results and Discussion

The descriptive statistics and pair-wise correlation between foreign capital inflows, economic growth, exports, real effective exchange rate (currency devaluation) and energy consumption are reported in Table-3. The Jarque-Bera test of normality fails to reject the null hypothesis of normality and show that all time series are normally distributed. Foreign capital inflows are negatively correlated with energy demand while domestic output growth and energy consumption are positively correlated. Exports and energy consumption are also positively correlated. Currency devaluation is negatively associated with energy demand. Domestic output growth, exports and currency devaluation are positively correlated with foreign capital inflows. The negative association is present between currency devaluation and exports.

Table-3: Descriptive Statistics and Correlation Matrix

Variables	$\ln EC_t$	$\ln FCI_t$	$\ln Y_t$	$\ln EXP_t$	$\ln DEV_t$
Mean	4.5701	-1.1740	5.9342	8.0323	4.7469
Median	4.5977	-1.1716	5.8611	8.0784	4.5940
Maximum	4.8846	-0.9879	8.4365	8.7037	5.2868
Minimum	4.2376	-1.3736	2.7934	7.2173	4.3277
Std. Dev.	0.1967	0.1091	1.5065	0.4680	0.3415
Skewness	-0.1045	-0.0494	-0.3366	-0.1878	0.3286
Kurtosis	1.7101	2.0072	2.9023	1.7669	1.4526
Jarque-Bera	2.9236	1.6589	0.7716	2.7693	2.7105
Probability	0.2218	0.4362	0.6798	0.2504	0.2648
$\ln EC_t$	1.0000				

$\ln FCI_t$	-0.1889	1.0000			
$\ln Y_t$	0.1645	0.1309	1.0000		
$\ln EXP_t$	0.0967	0.2009	0.3669	1.0000	
$\ln DEV_t$	-0.2188	0.210	-0.0354	-0.3100	1.0000

Table-4: Unit Root Tests without Structural Break

Variables	Augmented Dickey-Fuller Test		Philips-Perron Test	
	T-statistics	Prob. Values	T-statistics	Prob. Values
$\ln EC_t$	-2.6542(9)	0.2573	-2.3110 [3]	0.3252
$\ln FCI_t$	-2.0658 (4)	0.5603	-1.8349 [9]	0.6831
$\ln Y_t$	-2.1212 (9)	0.5593	-2.7789 [3]	0.2073
$\ln EXP_t$	-2.4031 (9)	0.3764	-2.3986 [3]	0.3796
$\ln DEV_t$	-2.0844 (4)	0.5500	-2.5171 [6]	0.3196
$\Delta \ln EC_t$	-3.7551 (8)**	0.0216	-6.7525 [6]***	0.0000
$\Delta \ln FCI_t$	-3.5111 (6)**	0.0417	-5.3424 [12]***	0.0001
$\Delta \ln Y_t$	-4.8647 (7)***	0.0006	-6.7551 [6]***	0.0000
$\Delta \ln EXP_t$	-4.7997 (6)***	0.0007	-6.6276 [6]***	0.0000
$\Delta \ln DEV_t$	-3.8081 (4) **	0.0186	-5.7611 [3]***	0.0000
Note: *** and ** indicate significance at 1 percent and 5 percent levels, respectively. () and [] indicate lag order and bandwidth based on AIC for ADF and PP unit root tests respectively.				

We apply a battery of unit root tests to determine the unit root properties of the variables. The results of traditional unit root tests i.e. ADF and PP are shown in Table-4. The results show that all the series are non-stationarity with intercept and time trend. However, the variables become stationary when first differenced and hence show that integrating order of the variables is 1 i.e. I(1). The traditional unit root tests do not accommodate the structural breaks, if present, and therefore provide biased results.

The presence of structural breaks and thereafter unit root properties can be examined through structural break unit root test which accommodates two unidentified structural breaks stemming in the series. The results are shown in Table-5. We noted the problem of unit root at level while accommodating structural breaks. The series such as energy consumption, foreign capital inflows, economic growth, exports and currency devaluation show structural breaks in period of 1984Q2, 2001Q4, 2003Q1, 1985Q2 and 1985Q1 respectively.

Table-5: Unit Root Tests with Structural Break

Clemente-Montanes-Reyes Detrended Structural Break Unit Root Test						
Variable	Innovative Outliers			Additive Outliers		
	T-statistic	TB1	TB2	T-statistic	TB1	TB2
	-2.013 (6)	1984Q2	….	-5.559 (3)***	1985Q2	….
$\ln EC_t$	-3.801 (6)	1985Q3	2001Q2	-5.377 (5)**	1986Q3	2001Q2
$\ln FCI_t$	-4.100 (6)	2001Q4	….	-4.699 (5)**	1988Q1	….
	-4.221 (5)	1995Q1	2001Q2	-6.245 (6)***	1985Q3	1987Q2
$\ln Y_t$	-1.880 (6)	2003Q1	….	-6.890 (3)***	1980Q2	….
	-4.863 (2)	1979Q1	2003Q1	-8.610 (3)***	1992Q2	2001Q3

ln EXP_t	-2.629 (4)	1985Q2	….	-5.587 (5)**	1977Q1	….
	-3.701 (5)	1985Q2	2004Q4	-5.905 (5)***	1977Q3	2001Q1
ln DEV_t	-3.753 (2)	1985Q1	….	-4.769 (6)**	1982Q3	….
	-3.803 (3)	1985Q1	1998Q1	-6.244 (5)*	1985Q2	1987Q1
Note: *** and ** show significance at 1 per cent and 5 per cent levels respectively. () indicates lag length to be used.						

The government of Pakistan implemented numerous economic reforms over selected period of time. For example, the structural break in energy consumption is consistent with the significant shift of economy towards private sector in 6th five year plan i.e. 1983-1988. This shift affected the domestic production and target economic growth rate was 6.5% over the period of 1983-84. The change in education and occupational structure as well as in industrial policy in 2002 affected economic growth and technological development in 2003Q1. The structural break in foreign capital inflows reflects the terrorist's event of 9/11 and thereafter the fear that encouraged the overseas Pakistanis to feel that Pakistan is a safe place for their savings. This led a sharp increase in foreign remittances from $ 1 billion in 2001 to $ 7 billion in 2008 (Ahmed, 2009). Pakistan adopted trade reforms such as exports expansion and imports substitution policies to diversify exports from 1979 until 1985. These trade reforms affected the exports performance of Pakistan in 1985 (Akbar and Naqvi, 2000). During this period, exports of primary items grew and manufactured exports declined. There was a noticeable reduction in exports diversification after 1985 as democratic government did not pay her attention to export sector of Pakistan. The government of Pakistan devalued local currency in January 1985 to improve trade balance. The overseas Pakistanis were only allowed to take currency in and out of the borders (country) after converting it into Pak Rupees or foreign exchange bearer certificate following effective exchange rate policy.

The ARDL bounds testing approach requires necessary information regarding the appropriate lag length using unrestricted VAR (vector auto- regression). An appropriate lag length provides reliable empirical evidence i.e. the ARDL F-statistic which helps in deciding either cointegration is valid or not. The computable F-statistic varies with lag length selection. We have chosen lag length following AIC which performs better than other criterion such as sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) respectively. The AIC provides consistent and reliable results regarding lag length selection (Lütkepohl, 2006). The lag length selection criteria show that appropriate lag length is six (6) and same was used for ARDL and VECM analysis.

Table-6: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
1	2283.218	3107.412	8.02e-19	-27.4782	-26.9112	-27.2480
2	2455.785	321.9853	1.33e-19	-29.2778	-28.2382*	-28.8558
3	2468.189	22.38677	1.55e-19	-29.1242	-27.6121	-28.5103
4	2473.498	9.2598	1.98e-19	-28.8841	-26.8994	-28.0784
5	2590.945	197.6547	6.45e-20	-30.0115	-27.5543	-29.0139
6	2670.508	129.0469*	3.35e-20*	-30.6769*	-27.7471	-29.4875*
7	2676.363	9.1398	4.29e-20	-30.4434	-27.0411	-29.0622

8	2680.925	6.8429	5.60e-20	-30.1942	-26.3193	-28.6211

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

The results of the ARDL bound testing analysis are shown in Table-7. The results reveal that the ARDL F-statistics are higher than the upper critical bounds. These results are significant at 1%, 10% and 5% levels respectively once we treated energy demand, economic growth and exports as dependent variables. These findings confirm the presence of long-run relationship between the variables over the period of 1972Q1-2014Q4.

Table-7: The Results of Cointegration Tests

Bounds Testing to Cointegration			Diagnostic tests		
Estimated Models	F-statistics	Structural Break	$\chi^2 NORMAL$	$\chi^2 SERIAL$	$\chi^2 REMSAY$
$F_{EC}(EC/FCI, Y, EXP, DEV)$	4.925 ***	1984Q2	0.2991	[1]: 1.2606	[1]: 2.8014
$F_{FCI}(FCI/EC, Y, EXP, DEV)$	4.434	2001Q4	0.1967	[2]: 0.3291	[1]: 0.0108
$F_{Y}(Y/EC, FCI, EXP, DEV)$	3.690 *	2003Q1	0.1424	[2]: 2.6901	[1]: 2.4718
$F_{EXP}(EXP/EC, FCI, Y, DEV)$	4.609 **	1985Q2	0.6203	[2]: 0.9052	[1]: 0.3008
$F_{DEV}(RER/EC, FCI, Y, EXP)$	2.611	1985Q1	0.1308	[2]: 0.1705	[3]: 0.8714

Significant level	Critical values (T = 172)			
	Lower bounds *I*(0)	Upper bounds *I*(1)		
1 per cent level	3.60	4.90		
5 per cent level	2.87	4.00		
10 per cent level	2.53	3.59		

Note: ***, ** and * show significance at 1 per cent, 5 per cent and 10 per cent levels respectively. The optimal lag is determined by AIC. Upper and lower critical bounds are obtained from Pesaran et al. (2001).

Next, we discuss the long-run impact of foreign capital inflows, economic growth, exports and currency devaluation on energy consumption (see Table-8). We find that foreign capital inflows negatively (significant at conventional levels) impact energy demand in the long-run. A 1% increase in foreign capital inflows lowers energy demand by 0.0151% keeping other things constant. This finding is in line with the conclusion drawn by Mielnik and Goldemberg (2002), Chima (2007), Hubler (2009), Hai (2009a), Zheng et al. (2011) and Lee (2013) and confirms the presence of *technological effect*. Our results are contradictory with Tang (2009), Hubler and Keller (2009), Bekhet and Othman (2011), Tang and Tan (2014) who report that FDI increases energy demand by stimulating real GDP growth, heavy investments in manufacturing and high-tech industries etc. Notably, Zaman et al. (2012) examined the impact of FDI on energy consumption in Pakistan and found that FDI increases energy consumption. Real GDP per capita has a positive (0.7925) and significant impact on energy demand. Exports also have a positive (0.0435) but significant impact on energy consumption. This empirical evidence is similar with Shahbaz et al. (2013b) who reported that exports positively impact energy consumption (natural gas consumption). Currency devaluation also decreases energy consumption in Pakistan. Pakistan devalued its domestic currency numerous times to improve the trade balance, but failed. For example, Shahbaz et al. (2011c) reported that domestic currency devaluation deteriorates trade balance in Pakistan and Bahmani-Oskooee and Cheema (2009) did not support the J-curve phenomenon. Furthermore, Shahbaz et al. (2012) found that currency devaluation impedes economic growth. Low economic growth is linked with lower levels of exports (Shahbaz et al. 2011b, 2012). We can safely conclude that currency devaluation decreases domestic output and exports, and hence reduces energy demand. The structural changes (incorporated through structural break dummy variable) also have a negative impact on energy consumption. This shows that implementation of electrification policy (adopted in 1984) could not fulfill the target and energy consumption is declined.

Table-8: Long Run Results

Dependent Variable = $\ln EC_t$				
Variable	Coefficient	Std. Error	t-Statistic	Prob. values
Constant	-1.5069***	0.3600	-4.1857	0.0000
$\ln FCI_t$	-0.0151***	0.0041	-3.6800	0.0003
$\ln Y_t$	0.7925***	0.0396	20.0006	0.0000
$\ln EXP_t$	0.0435***	0.0115	3.7619	0.0002
$\ln DEV_t$	-0.1210***	0.0162	-7.4594	0.0000
D_{1984}	-0.0330***	0.0046	-7.0427	0.0000
R-squared		0.8417		

Adj. R-squared	0.6415		
F-statistic	62.4766***		
Durbin-Watson Test	2.1665		
Note: *** shows significance at 1 per cent level.			

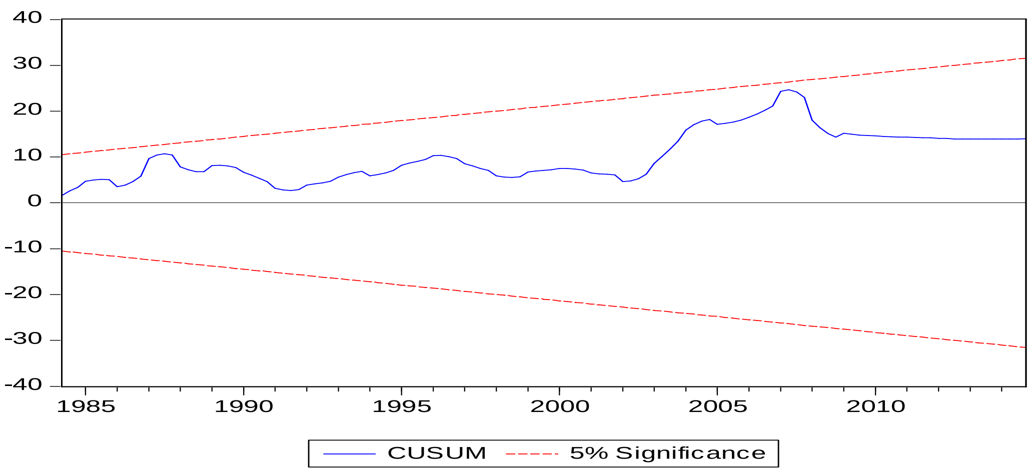
Table-9 reports the results of short-run dynamics. In the short-run, we find that impact of foreign capital inflows on energy demand is negative but insignificant. Economic growth positively and significantly impacts energy consumption. There is a positive and significant link between exports and energy demand. A negative and significant impact of currency devaluation on energy consumption is found. The short-run coefficient of dummy variable is negative but statistically insignificant. The sign of ECM_{t-1} is negative and significant at 1 percent level and authenticates the long-run relationship between the variables. The significance of ECM_{t-1} with negative sign reveals the speed of adjustment from short-run to long-run equilibrium. The estimate of ECM_{t-1} is -0.0795 showing that any short run shock in energy demand is corrected by 6.58 percent in each quarter and it will take 3 years and 2 months to accomplish the long-run equilibrium path. Table-9 also reports the results of diagnostic tests. The results show no problem of non-normality of residual term. The serial correlation does not exist and no problem of autoregressive conditional heteroskedasticity is found. We find no evidence of white heteroskedasticity. The findings by Ramsey Reset show that the short-run model is well specified. We find that graph of CUSUM is within critical bounds (Figure-2). The CUSUMsq test indicates a structural break point as graph of CUSUMsq crosses the upper critical bounds at 5 per cent level (Figure-3). The break year (1993Q1) is related to political violence in Karachi. During 1993-1994, there were large scale political killings in Karachi. The Chow forecast test is applied to examine as if the structural break reported by CUSUMsq significantly impacts the estimates or not? It is argued by Leow (2004) that we should not only rely on CUSUM and CUSUMsq tests and we must confirm the robustness of results by applying Chow forecast test. The results (Table-10) reveal that there is no indication of structural break as found by CUSUMsq test. We may conclude that our estimates of bounds testing approach are consistent and same inference is drawn for long-run and short-run parameters.

Table-9: Short Run Results

Dependent Variable = $\Delta \ln EC_t$				
Variable	Coefficient	Std. Error	t-Statistic	Prob. Values
Constant	0.0021**	0.0009	2.1691	0.0315
$\Delta \ln FCI_t$	-0.0074	0.0070	-1.0609	0.2903
$\Delta \ln Y_t$	0.3891***	0.0748	5.1968	0.0000
$\Delta \ln EXP_t$	0.0355***	0.0121	2.9250	0.0039
$\Delta \ln DEV_t$	-0.0809***	0.0250	-3.2303	0.0015
D_{1984}	-0.0005	0.0009	-0.2680	0.7890
ECM_{t-1}	-0.0795***	0.0278	-2.8556	0.0049
R-squared		0.2250		
Adj. R-squared		0.1966		
F-statistic		8.9361***		
Durbin-Watson Test		2.0431		
Diagnostic Tests		F-statistic	Prob. Value	
$\chi^2 NORMAL$		0.2800	0.7499	

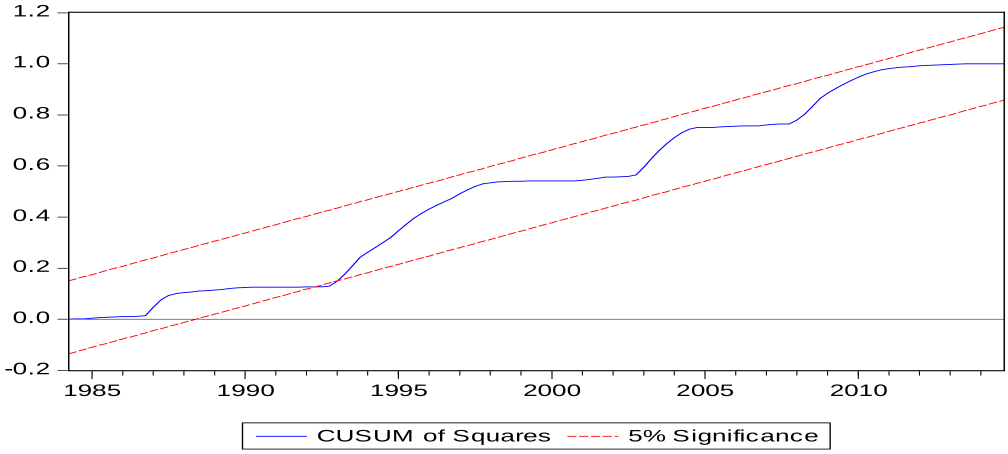
$\chi^2 SERIAL$	0.3200	0.6500	
$\chi^2 ARCH$	0.2316	0.6606	
$\chi^2 WHITE$	2.3960	0.1199	
$\chi^2 RAMSEY$	0.1579	0.6970	
Note: *** and ** shows significance at 1 per cent and 5 per cent levels respectively. Normality of error term, serial correlation, autoregressive conditional heteroskedasticity, white heteroskedasticity and functional of short run model is indicated by $\chi^2 NORMAL$, $\chi^2 SERIA$, $\chi^2 ARCH$, $\chi^2 WHITE$ and $\chi^2 RAMSEY$ respectively.			

Figure-2: Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Figure-3: Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Table-10: Chow Forecast Test

Chow Forecast Test		
	Value	Probability
F-statistic	0.8061	0.8160
Likelihood ratio	96.037	0.0423

The VECM Granger causality test is employed to test the causal nexus between the variables. Table-11 shows the empirical evidence of the VECM Granger causality test. In the long-run, we find that foreign capital inflows Granger cause output growth and as a result, energy consumption Granger causes foreign capital inflows. Our results are consistent with Dube (2009) for South Africa and Kuo et al. (2012) for China who report that foreign capital inflows (proxies by FDI) and energy consumption are complementary i.e. bidirectional causality exists. However, the results are in contradiction with Tang (2009), Bekhet and Othman (2011) and, Tang and Tan (2014) for Malaysia, Sultan (2012) for Mauritius, Zaman et al. (2012) for Pakistan. They report that energy consumption causes foreign capital inflows in Granger sense. Moreover, our causality results that foreign capital inflows and economic growth are interdependent are consistent with Iqbal et al. (2010), Attari et al. (2011) and, Shahbaz and Rahman (2012) and contradict Yasin and Ramzan (2013) who found no relationship between FDI and energy consumption. Economic growth Granger causes energy demand and in resulting, energy demand Granger causes economic growth. The relationship between exports and energy demand is bidirectional. This empirical finding is contradictory with Narayan and Smyth (2009) for MENA countries and Sultan (2012) for Mauritius. However, Sami (2011) for Japan, Sadorsky (2011) for Middle Eastern countries, Sadorsky (2012) for South American countries, and Hossain (2012) for SAARC countries reported that energy consumption is Granger caused by exports. In the case of Pakistan, Siddiqui (2004) found the neutral effect between exports and energy demand.

Our results show a feedback effect between exports and economic growth. For Pakistan, Afzal et al. (2008) and Abbas (2012) found that exports are led by economic growth whereas Shirazi and Manap (2004) found that exports lead economic growth. Moreover, Ahmed et al. (2000) found no causal link between exports and GDP growth. Furthermore, foreign capital inflows and exports Granger cause each other and this findings is in line with Ahmed et al. (2003), Shahbaz and Rahman (2012) and Rahman and Shahbaz (2013). The link between economic growth and foreign capital inflows is also bidirectional (Shahbaz and Rahman 2012, Rahman and Shahbaz 2013). This finding is in contrast with Khan and Khan (2011) who found that FDI Granger cause real income growth. We find that currency devaluation Granger causes foreign capital inflows, real GDP per capita, exports and energy consumption. It is argued that currency devaluations attract foreign capital inflows if the price level in the host country remains low.

Table-11: Long-and-Short Run Causality

Dependent Variable	Direction of Causality						
	Short Run						Long Run
	$\Delta \ln EC_{t-1}$	$\Delta \ln FCI_{t-1}$	$\Delta \ln Y_{t-1}$	$\Delta \ln EXP_{t-1}$	$\Delta \ln DEV_{t-1}$	Break Year	ECM_{t-1}
$\Delta \ln EC_t$	….	0.4500 [0.6368]	6.0847*** [0.0024]	5.8640*** [0.0065]	3.9808** [0.0209]	1984Q2	-0.0894*** [-3.6930]
$\Delta \ln FCI_t$	0.5239 [0.5933]	….	3.6451** [0.0285]	9.8690*** [0.0001]	6.3933*** [0.0022]	2001Q4	-0.0306*** [-2.6455]
$\Delta \ln Y_t$	5.5055*** [0.0050]	2.7777*** [0.0700]	….	7.2107*** [0.0008]	0.5797 [0.5620]	2003Q1	-0.0776*** [-3.9292]
$\Delta \ln EXP_t$	3.8969** [0.0345]	9.5389*** [0.0000]	7.7789*** [0.0004]	….	8.6996*** [0.0002]	1985Q2	-0.1202*** [-4.3860]
$\Delta \ln DEV_t$	4.9498** [0.0134]	6.0098** [0.0024]	2.0294 [0.2212]	10.2650*** [0.0000]	….	1985Q1	….

Note: ***, ** and * show significance at 1 per cent, 5 per cent and 10 per cent levels respectively.

Table-12: Long-and-Short Runs Joint Causality

Dependent Variable	Direction of Causality				
	Long-and-Short Runs Joint Causality				
	$\Delta \ln EC_{t-1}, ECM_{t-1}$	$\Delta \ln FCI_{t-1}, ECM_{t-1}$	$\Delta \ln Y_{t-1}, ECM_{t-1}$	$\Delta \ln EXP_{t-1}, ECM_{t-1}$	$\Delta \ln DEV_{t-1}, ECM_{t-1}$
$\Delta \ln EC_t$	….	4.9979*** [0.0022]	9.0789*** [0.0000]	8.2289*** [0.0001]	7.9889*** [0.0002]

$\Delta \ln FCI_t$	2.7789** [0.0234]	....	4.0818*** [0.0109]	9.9826*** [0.0000]	6.6656*** [0.0002]
$\Delta \ln Y_t$	8.5578*** [0.0000]	6.9690*** [0.0001]	....	9.5050*** [0.0000]	5.9006*** [0.0008]
$\Delta \ln EXP_t$	8.9944*** [0.0000]	10.9400*** [0.0000]	9.9379*** [0.0000]	....	14.6756*** [0.0000]
Note: *** and ** show significance at 1 per cent and 5 per cent levels respectively.					

In Pakistan's economy, currency devaluation is positively linked with price level (Khan and Schimmelpfennig, 2006). Increase in inflation retards domestic output due to increase in cost of production and by decreasing exports. We find that currency devaluation raises inflation in Pakistan and hence affects foreign capital inflows, exports and economic growth.

The short run causality results show bidirectional causality between economic growth and energy consumption, between exports and energy consumption, and between currency devaluation and energy consumption. The affiliation between foreign capital inflows and exports is also bidirectional. The feedback effect exists between foreign capital inflows and devaluation. Exports have a bidirectional causal links with economic growth and currency devaluation. The joint test of long run and short run Granger causality re-enforce our long-run and short-run causality results (see Table-12).

V. Conclusion and Policy Implications

The present paper deals with the impact of foreign capital inflows on energy consumption by incorporating economic growth, exports and currency devaluation in energy demand function.

We use ADF and PP and Clemente et al. (1998) structural break unit root tests. The cointegration between the variables is examined through ARDL bounds testing approach. The direction of causal relationship between the variables is investigated by VECM Granger causality test. The study covers the period of 1972Q1-2014Q4.

Our results show that the variables have long run relationship. Foreign capital inflows negatively impact energy consumption i.e. foreign capital inflows lower energy intensity due to adoption of energy efficient technology. Economic growth and exports (currency devaluation) increase (decrease) energy demand. The VECM Granger causality analysis shows the feedback effect between foreign capital inflows and energy consumption, between economic growth and energy consumption, between foreign capital inflows and economic growth. The relationship between exports and energy consumption, economic growth and exports, foreign capital inflows and exports is also bidirectional. Currency devaluation also Granger causes energy consumption, foreign capital inflows, economic growth and exports in Pakistan.

Although, we find a negative relationship between foreign capital inflows and energy consumption but impact is minimal. Foreign capital inflows need to be directed towards the energy sector for consistent supply of energy. The government should o encourage foreign investors to adopt innovative technologies with better management to enhance efficiency of energy sector and to save energy for future generations. In doing so, research and development expenditures should be increased to develop energy efficient and environment friendly technologies as this will help in saving the energy resources for maintaining economic development for long run. In this regard, foreign remittance is a good source to import energy efficient and environment friendly technology from developed world for enhancing domestic production. Side-by-side, government must pay attention to provide a friendly environment to foreign investors as foreign direct investment comes with advanced technology to host country which consumes less energy and improves environmental quality by declining carbon emissions.

The existence of feedback effect between economic growth and energy consumption suggests utilizing energy sources efficiently for long run economic development and explore new sources of energy such as renewable energy for maintaining future energy demand. A technology fund can be introduced by the Pakistan government to encourage the energy efficient-projects to enhance domestic production and hence exports. This would help to earn foreign exchange via boosting exports. Exports should be utilized as a source for importing advanced technology. Furthermore, devaluation of local currency can be helpful after improving the quality of exports otherwise it would be harmful not only for foreign capital inflows, exports but also for economic growth. There is dire need of comprehensive policy framework to direct institutional, political, social and economic factors which affect energy intensity in Pakistan.

This paper can be extended by for future research by incorporating new and potential determinants of energy demand in Pakistan. For instance, foreign remittances is potential factor affecting economic growth and hence, energy demand. Foreign remittances may affect energy demand via income effect, consumer effect and business effect. Natural resource abundance may also affect energy demand which depends on the relationship between natural resource abundance and economic growth. Natural resource abundance affects energy demand positively if natural resource abundance boosts economic activity and hence economic growth. On contrary, energy demand is declined if resource curse hypothesis is valid or if natural resource revenues are allocated to environment friendly investment ventures. Last but not least, military spending is also a potential factor affecting energy demand.

References

Abbas, S. (2012). Causality between Exports and Economic Growth: Investigating Suitable Trade Policy for Pakistan. *Eurasian Journal of Business and Economics*, 5 (10), 91-98.

Afzal, M., Rahman, H. and Rehman, J. (2008). Causal Nexus between Exports, Economic Growth and External Debt Servicing: The Case of Pakistan. *International Economic Journal*, 20(1), 63-77.

Ahmed, H. (2009). Capital Flows and Real Exchange Rate Overvaluation - a Chronic Ailment: Evidence from Pakistan. *The Lahore Journal of Economics*, 14 (9), 51-86.

Ahmed, Q. M., Alam, S. and Butt, M. S. (2003). Foreign Direct Investment, Exports and Domestic Output in Pakistan. *The Pakistan Development Review*, 42(4), 715-723.

Ahmed, Q. M., Butt, M. S. and Alam, S. (2000). Economic Growth, Export, and External Debt Causality: The Case of Asian Countries. *The Pakistan Development Review*, 39(4), 591-608.

Akbar, M. and Naqvi, Z. F. (2000). Export Diversification and the Structural Dynamics in the Growth Process: The Case of Pakistan. *The Pakistan Development Review*, 39(4), 573-589.

Akcay, S. and Demirtas, G. (2015). Remittances and energy consumption: evidence from Morocco. International Migration, 53, 125-144.

Alam, A. (2013). Electric Power Consumption, Foreign Direct Investment and Economic Growth: A Comparative Study of India and Pakistan. World Journal of Science, Technology and Sustainable Development, 10(1), 55-65.

Antweiler, W., Copeland, B. R. and Taylor, M. S., (2001). Is free trade good for the environment? The American Economic Review, 91, 877-908.

Arrow, K. J. (1962). The economic implications of learning by doing. The Review of Economic Studies, 29(3), 155-173.

Attari, M. I. J., Kamal, Y. and Attari, S.M. (2011). The Causal Link between Foreign Direct Investment (FDI) and Economic Growth in Pakistan Economy. *The Journal of Commerce*, 3 (4), 61-68.

Baharumshah, Z. and Thanoon, M. A-M. (2006). Foreign capital flows and economic growth in East Asian countries. *China Economic Review*, 17(1), 70-83.

Bahmani-Oskooee, M. and Cheema, J. (2009). Short-run and Long-run Effects of Currency Depreciation on the Bilateral Trade Balance between Pakistan and Her Major Trading Partners. *Journal of Economic Development,* 34(1), 19-46.

Banto, P. J. (2011). Energy savings via foreign direct investment? empirical evidence from Portugal. Research Unit in Governance, Competitiveness and Public Policy and Department of Economics Management and Industrial Engineering, University of Aveiro, 3810-193 Aveiro, Portugal.

Banto, P. J. (2012). The role of foreign direct investment in the renewable electricity generation and economic growth nexus in Portugal: a cointegration and causality analysis. Research Unit in Governance, Competitiveness and Public Policy and Department of Economics Management and Industrial Engineering, University of Aveiro, 3810-193 Aveiro, Portugal.

Beck, N. and Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. American Political Journal Review, 89(3), 634-647.

Bekhet, A. B. and Othman, S. N. (2011). Causality analysis among electricity consumption, consumer expenditure, gross domestic product (GDP) and foreign direct investment (FDI): Case study of Malaysia. Journal of Economics and International Finance, 3(4), 228-235.

Carlson, M. and Hernandez, L. (2002). *Determinants and Repercussions of Decomposition of Capital Inflows*. IMF Working paper, WP/02/86.

Cheng, M., Chung, L., Tam, C-S., Yuen, R., Chan, S. and Yu, I-W. (2012). *Tracking the Hong Kong Economy*. Hong Kong Monetary Authority, Occasional Paper 03/2012.

Chima, C. M. (2007). Intensity of energy use in the U.S.A: 1949-2003. Journal of Business & Economics Research, 5(11), 17-30.

Chinn, M. and Ito, H. (2008). A New Measure of Financial Openness. *Journal of Comparative Policy Analysis*, 10(3), 307-320.

Clemente, J., Montañés, A., and Reyes, M. (1998). Testing for a Unit Root in Variables with a Double Change in the Mean. *Economics Letters*, 59(2), 175-182.

Cole, M. A. (2006). Does trade liberalization increase energy use? Economics Letters, 92(1), 108-112.

Dube, S. (2009). Foreign Direct Investment and Electricity Consumption on Economic Growth: Evidence from South Africa. International Economics, 62(2), 175-200.

Elliot, R. J. R., Sun, P. and Chen, S. (2013). Energy Intensity and Foreign Direct Investment: A China City-Level Study. *Energy Economics*, 40, 484-494.

Elliott, R. J.R., Sun, P. and Chen, S. (2012). Growth, FDI and Energy intensity: Evidence form Chinese cities. Department of Economics, University of Birmingham, United Kingdom.

Engle, R. F. and Granger, C. (1987). Cointegration and Error Correction Representation: Estimation and Testing. *Econometrica*, 55(2), 251–276.

Erdem, D. (2012). Foreign direct investments, energy efficiency, and innovation dynamics. Mineral Economics, 24(2), 119-133.

Ersoy, E. and Ünlü, U. (2013). Energy Consumption and Stock Market Relationship: Evidence from Turkey. International Journal of Energy Economics and Policy, 3, 34-40.

GoP. Economic Survey of Pakistan. Islamabad, Pakistan: Published by the Ministry of Finance, 2014-15.

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica*, 37(3), 424-438.

Hai, S. (2009). On the ways of FDI's effect on the consumption of energy in China. Technology and Innovation Management, 2, 1-10.

Hamdi, H., Sbia, R. and Shahbaz, M. (2014). The nexus between electricity consumption and economic growth in Bahrain. *Economic Modeling*, 38(2), 227-237.

Han, Y. (2011). Analysis about the impact on FDI to energy consumption intensity in China. Business Management and Electronic Information, 3, 128-131.

Hassaballa, H. (2014). Testing for Granger Causality between Energy Use and Foreign Direct Investment Inflows in Developing Countries. *Renewable and Sustainable Energy Reviews*, 31(3), 417-426.

He, W., Gao, G. and Wang, Y. (2012). The relationship of energy consumption, economic growth and foreign direct investment in Shanghai. Advances in Applied Economics and Finance, 507, 507-512.

Herrerias, M. J., Cuadros, A. and Orts, V. (2012). Energy intensity and investment ownership across Chinese provinces. School of Contemporary Chinese Studies China Policy Institute, The University of Nottingham.

Hossain, Md. S. (2012). Multivariate Granger Causality between Economic Growth, Electricity Consumption, Exports and Remittances for the Panel of Three SAARC Countries. *Global Journal of Management and Business Research,* 12(4), 41-54.

Hubler, M. (2009). Energy saving technology diffusion via FDI and trade using CGE model of China. Working paper no.1491, Kiel Institute of World Economy.

Hubler, M. and Keller, A. (2009). Energy savings via FDI? empirical evidence from developing countries. Environment and Development Economics, 15(1), 59-80.

Hye, Q. M. A., Shahbaz, M. and Hye, A. (2010). Foreign Capital Inflow and Economic Growth Nexus: A Case Study of Pakistan. *The IUP Journal of Applied Economics*, 1 (1), 16-26.

Iqbal. M. S., Shaikh, F. M. and Shar, A. H. (2010). Causality Relationship between Foreign Direct Investment, Trade and Economic Growth in Pakistan. *Asian Social Science*, 6(9), 82-89.

Irawan, T., Hartono, D. and Achsani, N. A. (2010). An analysis of energy intensity in Indonesian manufacturing. Working Paper in Economics and Development Studies, No. 201007, Department of Economics, Padjadjaran University.

Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

Khan, M. A. and Khan, S. A. (2011). *Foreign Direct Investment and Economic Growth in Pakistan: A Sectoral Analysis*. PIDE Working Papers, No. 2011/67, Pakistan Institute of Development Economists, Islamabad, Pakistan.

Khan, M. S. and Schimmelpfennig, A. (2006). Inflation in Pakistan: Money or Wheat? *SBP-Research Bulletin*, 2 (1), 213-234.

Komal, R. and Abbas, F. (2015). Linking financial development, economic growth and energy consumption in Pakistan. Renewable and Sustainable Energy Reviews, 44, 211-220.

Kuo, C. K., Chang, C. Y., Chen, M. H. and Chen, Y. W. (2012). In Search of Causal Relationship between FDI, GDP, and Energy Consumption-Evidence from China. Advanced Materials Research, 524-527, 3388-3391.

Le, M. H. and Ataullah, A. (2006). Foreign Capital and Economic Performance of Pakistan. The Lahore Journal of Economics, 7 (1), 1-32.

Lee, J. W. (2013). The contribution of foreign direct investment to clean energy use, carbon emissions and economic growth. Energy Policy, 55(4), 483-489.

Leitão, N. C., (2015). Energy consumption and foreign direct investment: A panel data analysis for Portugal. International Journal of Energy Economics and Policy, 5(1), 138-147.

Leow, Y. G. (2004). A Reexamination of the Exports in Malaysia's Economic Growth: After Asian Financial Crisis, 1970-2000. *International Journal of Management Sciences*, 11(1), 79-204.

Lütkepohl, H. (2006). Structural Vector Autoregressive Analysis for Cointegrated Variables. *AStA Advances in Statistical Analysis,* 90 (1), 75-88.

Masih, A. M. M. and Masih, R. (1996). Energy Consumption, Real Income and Temporal Causality: Results from a Multi-county Study Based on Cointegration and Error-Correction Modeling Techniques. *Energy economics*, 18 (1), 165-183.

Mielnik, O. and Goldemberg, J. (2002). Foreign direct investment and decoupling between energy and gross domestic production in developing countries. Energy Policy, 30, 87-89.

Mileva, E. (2008). *The Impact of Capital Flows on Domestic Investment in Transition Economies*. Working paper series, No. 871 / FEBRUARY, 2008, European Central Bank.

Mudakkar, S. R., Zaman, K., Shakir, H., Arif, M., Naseem, I. and Naz, L. (2013). Determinates of Energy Consumption Function in SAARC Countries: Balancing the Odds. *Renewable and Sustainable Energy Reviews*, 28(12), 566-574.

Narayan, P. K. and Smyth, R. (2009). Multivariate Granger Causality between Electricity Consumption, Exports and GDP: Evidence from a Panel of Middle Eastern Countries. *Energy Policy,* 37(1), 229-236.

Narayan, P.K. (2005). The Saving and Investment Nexus for China: Evidence from Cointegration Tests. *Applied Economics,* 37(17), 1979-1990.

Oke, B. O., Ezike, J. E. and Ojogbo, S. O. (2012). Locational determinants of foreign direct investments in Nigeria. International Business Research, 5(4), 103-111.

Omri, A. and Kahouli, B. (2014). Causal Relationship between Energy Consumption, Foreign Direct Investment and Economic Growth: Fresh Evidence from Dynamic Simultaneous-equations Models. *Energy Policy*, 67(4), 913-922.

Perron, P. and Vogelsang, T. J. (1992). Nonstationarity and Level Shifts with an Application to Purchasing Power Parity. *Journal of Business and Economic Statistics*, 10(3), 301-320.

Pesaran, M. H., Shin, Y. and Smith, R. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Phillips, P. C. B. and Hansen, B. E. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economic Studies,* 57(1), 99-125.

Rahman, M. M. and Shahbaz, M. (2011). Foreign direct investment-Economic Growth Link: The role of domestic financial sector development in Bangladesh. Academy of Taiwan Business Management Review, 7(2), 104-113.

Rahman, M. M. and Shahbaz, M. (2013). Do Imports and Foreign Capital Inflows Lead Economic Growth? Cointegration and Causality Analysis in Pakistan. *South Asian Economic Journal*, 14 (1), 59-81.

Raza, S. A. and Jawaid, S. T. (2012). Foreign capital inflows, economic growth and stock market capitalization in Asian countries: an ARDL bound testing approach. *Quality & Quantity*, 48(1), 375-385.

Sadorsky, P. (2010). The impact of financial development on energy consumption in developing economies. Energy Policy, 38, 2528-2535.

Sadorsky, P. (2011). Trade and Energy Consumption in the Middle East. *Energy Consumption,* 33 (5), 739-749.

Sadorsky, P. (2012). Energy Consumption, Output and Trade in South America. *Energy Consumption,* 34 (2), 476-488.

Sami, J. and Makun, K. K. (2011). The Relationship between Exports, Electricity Consumption and Economic Growth: Empirical Evidence from Brazil. *World Review of Business Research,* 1, 28-37.

Sbia, R., Shahbaz, M. and Hamdi, H. (2014). A Contribution of Foreign Direct Investment, Clean Energy, Trade Openness, Carbon Emissions and Economic Growth to Energy Demand in UAE. Economic Modelling, 36, 191-197.

Shah, S.H., Hasfa, H. and Li, L. J. (2012). Does Foreign Capital Inflows Really Stimulate Domestic Investment: A Case Study of Pakistan. *International Research Journal of Finance and Economics*, 85 (2), 78-86.

Shah, Z., Ahmed, Q. M., (2002). Measurement of cost of capital for foreign direct investment in Pakistan: a neoclassical approach. The Pakistan Development Review, 41, 807-823.

Shahbaz, M. and Rahman, M. M. (2010). Foreign capital inflows-growth nexus and role of domestic financial sector: an ARDL cointegration approach for Pakistan. Journal of Economic Research, 15, 207-231.

Shahbaz, M. and Rahman, M. M. (2012). The Dynamics of Financial Development, Imports, Foreign Direct Investment and Economic Growth: Cointegration and Causality Analysis for Pakistan. *Global Business Review*, 13 (2), 201-219.

Shahbaz, M. Khan, S. and Tahir, M. I. (2013a). The Dynamic Links between Energy Consumption, Economic Growth, Financial Development and Trade in China: Fresh Evidence from Multivariate Framework Analysis. *Energy Economics,* 40(1), 8-21.

Shahbaz, M. Lean, H. H. and Farooq, A. (2013a). Natural Gas Consumption and Economic Growth in Pakistan. *Renewable and Sustainable Energy Reviews*, 18 (2), 87-94.

Shahbaz, M. Rahman, M. M. (2013). Do imports and foreign capital inflows lead economic growth? cointegration and causality analysis in Pakistan. South Asia Economic Journal, 14(1), 59-81.

Shahbaz, M., Awan, R. U. and Ahmad, K. (2011b). The Exchange Value of the Pak-Rupee & Pak-trade Balance: An ARDL Bounds Testing Approach. *Journal of Developing Areas*, 44 (2), 69-93.

Shahbaz, M., Azim, P. and Ahmad, K. (2011c). Exports-led Growth Hypothesis in Pakistan: Further Evidence. *Asian Economic and Financial Review*, 1 (3), 182-197.

Shahbaz, M., Islam, F. and Aamir, N. (2012). Is Devaluation Contractionary? Empirical Evidence for Pakistan. *Economic Change and Restructuring*, 45 (4), 299-316.

Shahbaz, M., Leitão, N. C. and Malik, S. (2011a). Foreign direct investment-economic growth nexus: the role of domestic financial development in Portugal. Economics Bulletin, 31, 2824-2838.

Shirazi, N. S. and Manap, T. A. A. (2004). Exports-led Growth Hypothesis: Further Econometric Evidence from Pakistan. *The Pakistan Development Review*, 43(4), 563-581.

Siddiqui, R. (2004). Energy and Economic Growth in Pakistan. *The Pakistan Development Review,* 43 (2), 175-200.

Sricharoen, T. and Buchenrieder, G. (2005). *Principal Component Analysis of Poverty in Northern Thailand*. Paper presented at the Conference on International Agricultural Research for Development, 11-13 October. Stuttgart-Hohenheim.

Stern D. I. (2004). Energy and economic growth, in: C. J. Cleveland (ed.) *Encyclopedia of Energy*, Academic Press, San Diego CA, 35-51

Sultan, R. (2012). An investigation of the determinants of energy intensity for the design of environmental strategies in emerging markets. Department of Economics and Statistics, University of Mauritius, Mauritius.

Tang, C. F. (2009). Electricity consumption, income, foreign direct investment, and population in Malaysia: new evidence from multivariate framework analysis. Journal of Economic Studies, 36(4), 371-382.

Tang, C. F. and Tan, B. W. (2014). The linkages among energy consumption, economic growth, relative price, foreign direct investment, and financial development in Malaysia. Quality & Quantity: International Journal of Methodology, 48(2), 781-797.

Ting, K., Linyan, S. and Zhe, H. (2010). A Study on Regional Industrial Energy Intensity: An Empirical Analysis Based on Panel Data Model of Different Provinces in China. Resource Science, 3, 1-7.

Ting, Y., Yin, L. R. and Ying, Z. Y. (2011). Analysis of the FDI effects on energy consumption intensity in Jiangsu province. Energy Procedia, 5, 100-104.

Xiaoli, S., Junfeng, S. and Xuefei, S. (2007). Empirical of industry distribution of FDI impact on China's energy consumption analysis. Finance & Trade Economics, 3, 117-121.

Yasin, K. and Ramzan, M. (2013). The Impact of Foreign Direct Investment on Pakistan Economic Growth. *Interdisciplinary Journal of Contemporary Research in Business*, 4(11), 287-296.

Yasmin, B. (2005). Foreign Capital Inflows and Growth in Pakistan**: A** Simultaneous Equation Model. *South Asia Economic Journal*, 6(9), 207-219.

Yuan-yuan, C. and Hai-ning, W. (2011). FDI, Human Capital and Regional Industrial Energy Efficiency. International Journal of Trade, 3, 1-12.

Zaman, K., Khan, M. M. Ahmad, M. and Rustem, R. (2012). Determinants of electricity consumption function in Pakistan: old wine in new bottles. Energy Policy, 50(11), 623-634.

Zheng, Y., Qi, J. and Chen, X. (2011). The effect of increasing exports on industrial energy intensity in China. Energy Policy, 39(5), 2688-2698.

Zivot, E. and Andrews, K. (1992). Further Evidence on the Great Crash: The Oil Price Shock, and the Unit Root Hypothesis. *Journal of Business and Economic Statistics*, 20 (1), 251-270.

Zhang, Y-j., Fan, J-i. and Chnag, H-r. (2011). Impact of China's Stock Market Development on Energy Consumption: An Empirical Analysis. Energy Procedia, 5, 1927–1931.