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Does Total Petroleum Consumption Trigger Inflation: An Application for UpperMiddle Countries

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Abstract

The linkage between petroleum consumption and inflation has a special importance in designing the discretionary macroeconomic policies for stabilization purposes. The magnitude of the direction of this relationship between the series gives important signal in policy implementation process with respect to assess the long-run course of the energy policies to economic agents and policy makers. From this point of view, this study investigates the long-run relationship between total petroleum consumption and the inflation rate for 21 upper middle income countries for the period 1980 to 2011 by using the advanced Panel CUSUM cointegration test extended by Westerlund (2005). The empirical result showed a significant positive long-run relationship between petroleum consumption and inflation. This implies that petroleum consumption is an important factor in occurrence of inflation in the selected countries.

Keywords: Energy Consumption, Consumer Price Index, Panel Co-Integration.
JEL Classification Codes: Q43, E31, C33.

1. Introduction

Petrol has been one of the mostly used and therefore consumed sources among other energy sources. Its price inevitably has become one one of the important variables that affect many macroeconomic parameters of both developed and developing nations on their way of economic growth/development. Petrol consumption trends have been on the rise in recent years due to the factors such as progress in technology by the help of globalization, industrialization, increasing numbers of world population, urbanization, transportation and logistics services. Compared to the increase in demand for petrol; capacity increases in petrol supply can not be achieved since it is not a renewable energy source leading to the result of increased petrol prices.

Parallel to the increase in petrol consumption, the increase in petrol prices initially raises the production costs of nations and causes cost inflation. The increase in production cost, decreases the production volume, resulting in the reduction of total demand which increases general prices level and cause inflation. As it is seen, petrol consumption primarily increases the petrol prices and the increase in petrol prices cause inflation.

This study aims to analyze the relationship between petrol consumption and inflation for upper middle income countries. For this purpose, emprical literature on the relationship between petrol consumption and inflation will be discussed, then the data set and the methodology that will be used in the application part of the study will be explained and finally emprical results will be evaluated.

2. Literature Review

Oil price increases can be viewed as an inflationary shock. An increase in oil prices causes to a rise in the CPI , depending on the share of oil products in the consumption basket with the channel of decline of households' purchasing power, asking for increasing wages, leading to price-wage spiral (Lescaroux and Mignon, 2008). Similarly, according to Ahmad and Ali (2012), higher oil prices generate inflation due to increasing input costs, reducing non-oil demand and lower investment in net oil importing countries. Various authors have asserted that high oil prices have been associated with episodes of high inflation (Ahmad and Ali, 2012). Barsky and Kilian (2004) show that an oil price shocks generate high inflation in the CPI and low industrial production. The empirical result of Leblanc and Chinn (2004), who investigate the effects of oil price shocks on inflation for G-5 nations, comprising the United States United Kingdom, France, Germany, and Japan is not in accordance with that of Barsky and Kilian (2004). Leblanc and Chinn (2004) suggest that an increase in oil prices has only a moderate effect on inflation in the US, Japan, and Europe.

Webb (2006) applied dynamic panel data techniques to panel of 73 countries for which oil is not a significant export in order to find price and income elasticities of oil consumption in transportation, the industrial sector and other sectors including commercial and residential. According to Webb (2006)'s the results of empirical research, the transportation sector is the only sector where an increase in the price of crude oil has a statistically and economically important effect.

Mohaddes and Williams (2011) investigated by using the Generalized Method of Moments methodology the factors influencing inflation differentials across the Gulf Cooperation Council (GCC) countries comprising of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates between January 1991 and June 2010. They find that oil revenues are a strongly significant factor in explaining inflation differentials in the GCC countries.

Korap (2007) examined the long and short-run causal links between the changes in energy consumption, real income growth and domestic inflation in the Turkish economy for the period of 1968-2005. The authors considered the energy consumption with three different models, comprising of total energy consumption, residential and commercial energy consumption, and industrial energy consumption. As a result of their study, energy policies designed in the framework of the expectations have the power of affecting domestic inflation significantly. In addition, they find that energy conservation policies may cause to various detrimental results for the economic growth process in the case of the use of industrial energy consumption data.

Ogbonna and Ebimobowei (2012) evaluated the effects of oil revenue, the share of petroleum profit tax in royalties (PPT/R), and licensing fees on gross domestic product (GDP), per capita income (PCI), and inflation (INF) for Nigerian economy over the period 2000-2009. As a result of their study, oil revenue and PPT/R have a positive and significant relation with GDP and PCI, LF has a positive but insignificant relation with GDP, PCI and INF. In addition, the finding of that oil revenue has a negative and insignificant effect on inflation was obtained.

Lee and Chang (2008) investigated the causal relationship between energy consumption and GDP over the period 1971-2002 for 16 Asian countries. According to their study, there exists a unidirectional long-run relationship running from energy consumption to economic growth, while there doesn't exist a short-run relationship between economic growth and energy consumption.

Leesombatpiboon (2010) measured the elasticity of economic growth with respect to oil consumption and oil prices for the Thai economy. Empirical results show that a sharp 10 percent decrease in oil prices would cause economic growth to shrink by 2 percent while a sharp 10 percent increase in oil prices would lead output growth to a fall by about 0.5 percent within the same year. This finding is interpreted as that an oil supply disruption is usually associated with a rapid rather than gradual increase in oil prices and an economy cannot adjust immediately to that shock.

Lescaroux and Mignon (2008) investigated the short-run and long-run links between oil prices and various variables representative of economic activity: gross domestic product, consumer price index, household consumption, unemployment rate, and share prices over the period of 1960-2005. The authors find the direction of causality generally from oil prices to the other variables. According to Lescaroux and Mignon (2008)'s short-run empirical results can be summarized as: i) the impact of oil prices on consumption is generally weak. ii) Oil prices have a large effect on consumer price index for United Arab Emirates, UK, Mexico and Libya. iii) Oil prices have a large influence on the unemployment rate in the US, Luxembourg, France, Canada and Venezuela. iiii) There is no causality running from oil prices to GDP for the group of oil-exporting countries. Finally, oil price movements have strongly negative influence on share prices on the short run. According to their long-run empirical results, the majority of long-run relation concerns GDP, unemployment rate and share prices.

Layade and Okoruwa (2012) examined by employing panel data estimation technique the effect of oil price movements on capital stock of agro-allied companies in Nigeria for the period 1997:01-2006:12. The empirical results show that oil price change has significantly positive relationship with stock prices, but inflation and interest rate on bank deposit have negatively effect on stocks.

Kiani (2010) investigated the effects of high oil prices in the Pakistan's economy over the period of 1990-2008. The empirical result show that a 1 percent rise in oil prices will lead to a rise in the real GDP by less than 1 percent (0.051). Ishaque (2008) suggested that oil prices affect the whole economy through the cost of production, income effects, reallocation of resources, terms of trade (Kiani, 2010).

Ahmad and Ali (2012) estimated the impact of oil prices on inflation GDP, FDI using regression analysis in four South Asian oil importing countries over the period of 1985-2010. The empirical results indicated that inflation, GDP, and FDI are seen to increase with a rise in oil prices.

Ali et al. (2012) analyzed the effect of high speed diesel oil prices on food sector prices in Pakistan for the years 2001-2010. The empirical study was concluded that there is strongly significant relationship between oil prices and food inflation.

L'oeillet and Licheron (2009) estimated augmented Phillips curve with oil prices by using energy prices and overall inflation rates in Euro area between 1970 and 2007. The estimation results show that oil prices affect significantly overall inflation but, this relationship has an asymmetric pattern. Rising oil prices are expected to trigger a higher inflation rates through three mechanisms. Those mechanisms are described as: i) a direct impact occurred by the transmission from crude oil prices to the prices of refined products that are directly included in the CPI. ii) Since oil is an input for firms, they may adjust the prices of final goods and services to shifts in energy prices which would affect CPI inflation. iii) An increase in oil price may trigger a wage-price spiral through higher inflation expectations and higher wages.

Chima (2005) employed a macroeconomic model based on Multiple Model estimation in order to determine the relationship between energy consumption and GDP in the United States for the period of 1949-2003. Results based on the tools of methodology used in the study indicate that causality was bi-directional, running from energy to the components of GDP and from GDP to energy consumption. Similarly, Ebohon (1996) analyzed the causal relationship between energy consumption and economic growth in Nigeria and Tanzania. The empirical results indicate that there is a simultaneous causal relationship between energy consumption and economic growth for both countries.

Masih and Masih (1996) investigated whether there is a long-run relationship between energy consumption and real income for India, Pakistan, Malaysia, Singapore, Indonesia, and Philippines. The empirical results show that temporal causality results imply at least one-way Granger causality, either unidirectional or bi-directional for India, Pakistan, and Indonesia while the simple bivariate vector autoregressive models didn't show any causality relationship for the non-integrated systems in Malaysia, Singapore, and Philippines (Chima, 2005).

3. Data, Model and Econometric Methodology

3.1. Data

Hondroyiannis et al. (2002) included prices to the energy consumption – real income relationship to that prices would represent a proxy variable for the efficient functioning of the economy and that such an inclusion may reveal the role of prices in affecting the use of energy especially for a developing country (Korap, 2007).

We now test for the existence of a long-run relationship between total petroleum consumption and inflation rate for the selected 21 upper middle income countries[1]. Our sample is based on 32-year annual panel data (1980-2011). All data are taken from World Bank. Petrol consumption (thousand barrels per day) is represented by total petroleum consumption (pet_cons) data. Inflation is represented by consumer price index (cpi) (2005=100) that reflects the annual percentage changes in the price level of consumer goods and services purchased by households. In order to carry out the paper, E views 7.0, RATS 7.0 are used.

Table 1 presents the descriptive statistics and correlation matrix of the variables used in the study. According to correlation matrix petrol consumption that is core explanatory variable of our study is positively correlated with inflation rates. And the intensity of this correlation is about six percent.

Table 1: Descriptive Statistics and Correlation Matrix of the variables

	pet_cons (thousand barrels per day)	**cpi (%)**
Mean	382.1062	59.41194
Median	130.1290	60.95000
Maximum	2793.000	248.4000
Minimum	2.000000	0.000000
Std. Dev.	557.8919	46.82011
Correlation Matrix	pet_cons	cpi
pet_cons	1.000000	0.059571
cpi	0.059571	1.000000

3.2. Model

To examine the long-run stationary relationship between petrol consumption and inflation, we pursue a panel data analysis. The model is following as:

$$cpi_{it} = \gamma_0 + \gamma_1 . pet\_cons_{it} + e_{it} \quad (1)$$

According to Baltagi (2005), panel data technique or longitudinal data technique that is used in empirical section of the study has some advantages. These advantages are summarized as: 1-) Panel data are able to control the heterogeneity that occurs among individuals, firms, states or countries whereas time-series and cross-section studies do not control the heterogeneity for these units. 2-) Panel data give more informative data, more variability, less co-linearity among the variables, more degrees of freedom and so, more efficiency. 3-) Panel data are relatively more suitable about the dynamics of adjustment than other techniques. 4-) Panel data model is better able to study than more complicated behavioral models in which pure time-series or pure cross-section models cannot study.

[1] Algeria, Argentina, Botswana, Brazil, Bulgaria, Colombia, Costa Rica, Dominican Republic, Ecuador, Gabon, Iran, Jamaica, Jordan, Malaysia, Mexico, Panama, Peru, South Africa, Tunusia, Turkey, Uruguay.

3.3. Econometric Methods and Findings

3.3.1. Unit Root Characteristics

According to Yule (1926), who introduced spurious regression problem and further analysed by Granger and Newbold (1974) using non-stationary time series steadily diverging from long-run mean will produce biased standard errors, which causes to unreliable correlations and unbiased estimations within the regression analysis leading to unbounded variance process (Korap, 2007). Several different panel unit root tests are available. Panel unit root testing emerged from time series unit root testing. The major difference to time series testing of unit roots is that we have to consider asymptotic behavior of the time-series dimension T and the cross-sectional dimension N (Nell and Zimmermann, 2011). In order to get unbiased estimations, we investigate the existence of unit root in the series. We have used the approaches of Im et al. (2003) and Levin, Lin and Chu (2002). These are denoted by IPS and LLC, respectively.

In general, this type of panel unit root tests is based on the following regression:

$$\Delta Y_{i,t} = \beta_i . Y_{i,t-1} + Z_{i,t}.\gamma + u_{i,t} \tag{2}$$

where i = 1,2,…,N is individual, for each individual t=1,2,…,T time series observations are available, $Z_{i,t}$ is deterministic component and $u_{i,t}$ is error term. The null hypothesis of this type is ρ_i=0 for $\forall i$.

The first of first generation panel unit root tests is LLC that allow for heterogeneity of individual deterministic effects and heterogeneous serial correlation structure of the error terms assuming homogeneous first order autoregressive parameters. They assume that both N and T tend to infinity but T increase at a faster rate, so N/T$\rightarrow$0. They assume that each individual time series contains a unit root against the alternative hypothesis that each time series stationary. Thus, referring to the model (2), LLC assume homogeneous autoregressive coefficients between individual, i.e. $\beta_i = \beta$ for all i, and test the null hypothesis $H_o : \beta_i = \beta = 0$ against the alternative $H_A : \beta_i = \beta \prec 0$ for all i.

The structure of the LLC analysis may be specified as follows:

$$\Delta Y_{i,t} = \alpha_i + \beta_i . Y_{i,t-1} + \delta_i.\tau + \sum_{j=1}^{p_j} \phi_{ij}.\Delta Y_{i,t-j} + u_{it} \tag{3}$$

i = 1, N t= 1,T where τ is trend, α_i is individual effects, u_{it} is assumed to be independently distributed across individuals. LLC estimate to this regression using pooled OLS. In this regression deterministic components are an important source of heterogeneity since the coefficient of the lagged dependent variable is restricted to be homogeneous across all members in the panel (Barbieri, 2006).

Other test, Im, Pesaran and Shin (2003) test allows for residual serial correlation and heterogeneity of the dynamics and error variances across units. Thus, the Im-Pesaran-Shin (IPS) test is not as restrictive as the Levin-Lin-Chu test, since it allows for heterogeneous slope coe□cients. Hypothesis of IPS may be specified as follows:

$H_0 : \beta_i = \beta = 0 \quad H_A : \beta_i \prec 0$ for all i

The alternative hypothesis allows that for some (but not all) of individuals series to have unit roots. IPS compute separate unit root tests for the N cross-section units. IPS define their t-bar statistics as a simple average of the individual ADF statistics, t_i, for the null as: $\overline{t} = \sum_{i=1}^{N} t_i / N$

It is assumed that t_i are i.i.d and have finite mean and variance and E(t_i), Var(t_i) is computed using Monte-Carlo simulation technique (Barbieri, 2006).

Results for the panel unit root tests are showed in Table 2. According to LLC, only the first difference of cpi is not stationary variable for constant model. Hence, we cannot mostly reject stationary in the first differences of the variables. Results show that the panel series are I(1), which signals a possible cointegration relationship between the series.

Table 2: Panel Unit Root Tests

Variable	LLC		IPS	
	Constant Trend	**Constant**	**Constant Trend**	**Constant**
cpi	0.22 [0.58]	11.48 [1.00]	2.28 [0.98]	14.28 [1.00]
Δcpi	-3.49 [0.00]	-0.89 [0.18]	-3.71 [0.00]	-2.32 [0.01]
pet_cons	0.306 [0.62]	1.16 [0.87]	-0.56 [0.28]	5.57 [1.00]
Δpet_cons	-12.44 [0.00]	-14.95 [0.00]	-15.73 [0.00]	-17.05 [0.00]

Numbers in brackets are p-values. The max lag lengths were set to 7 and Schwarz Bayesian Criterion was used to determine the optimal lag length.

3.3.2. Panel Cointegration Analysis

After the determining the order of stationary, our next step is to apply panel co-integration methodology. To analyze the existence of the long-run equilibrium relationship between the variables, we perform Panel CUSUM test of the null of co-integration extended by Westerlund (2005).

Panel CUSUM Test of the Null of Cointegration

Westerlund (2005) extended the CUSUM test proposed in the time series context by Xiao and Phillips (2002) and Xiao (1999), which is based on measuring the fluctuation in the residuals. The CUSUM test is fundamentally based on the intuition that if dependent and independent variable are co-integrated, then the residuals should be stable and the residuals' fluctuations reflect only equilibrium errors. If dependent and independent variable aren't co-integrated vectors, then the residual fluctuations can be expected to be much larger in magnitude. The test has a limiting normal distribution under the null hypothesis that is free of nuisance parameters and it is robust to heteroscedasticity. Results obtained from Monte Carlo simulations suggest that the CUSUM test has small size distortions and reasonable size-adjusted power against a series of local alternatives (Westerlund, 2005: 255).

As earlier and above showed in equation (1) the estimated equation is given by

$$cpi_{it} = \gamma_0 + \gamma_1 . pet\_cons_{it} + e_{it} \tag{1}$$

where i= 1,2,3, …, 21 t=1,2,3,…, 32

cpi_{it} ~ I(1),

pet_cons_{it} ~ I (1),

Cov(e_{it}, e_{jt})=0 and the vector pet_cons = $pet\_cons_{it-1}+v_{it}$, has dimension $K \times 1$ and contains the regressors,

$$e_{it} = \varphi e_{it-1} + u_{it}$$

We may formulate the null and alternative hypothesis as

$H_0 : \varphi = 0$ against $H_1 : \varphi \succ 0$

To be able to measure the fluctuations in e_{it}, Westerlund (2005) propose the following panel CUSUM test statistic. The statistic is defined as

$$CS_{NT} \equiv 1/N . \sum_{i=1}^{N} \left(\max_{t=1,\ldots,T} \frac{1}{\widehat{\varpi}_{i1.2} . T^{1/2}} \left| S*_{it} \right| \right), \tag{4}$$

where $S*_{it} = \sum_{j=1}^{t} \widehat{e}*_{ij}$, $\widehat{\varpi}^2_{i1.2} = \widehat{\varpi}^2_{i11} - \widehat{\varpi}'_{i21} . \widehat{\Omega}^{-1}_{i22} . \widehat{\varpi}_{i21}$

The statistic measures the magnitude of the residual variation from the regression of cpi_{it} on pet_cons_{it} against the magnitude of the estimated long-run conditional variance of e_{it} given v_{it}. If

cpi_{it} and pet_cons_{it} are co-integrated, then the statistic should stabilize asymptotically. If not, then the increased residual variation will cause the statistic to diverge (Westerlund, 2005: 237).

The null hypothesis of co-integration in case $T \to \infty$ with N held fixed as follows:

$$CS_{NT} \Rightarrow 1/N \sum_{i=1}^{N} \left(\sup_{0 \le r \le 1} |Q_i| \right), \tag{5}$$

where

$$Q_i = W_{i1.2} - \int_0^r \overline{W}'_{i2} \left(\int_0^1 \overline{W}_{i2} \overline{W}'_{i2} \right)^{-1} \int_0^1 \overline{W}_{i2} dW_{i1.2}$$

$\left(\sup_{0 \le r \le 1} |Q_i| \right)$ showed in equation (5) is referred to as generalized Kolmogorov–Smirnov distribution. Thus it is defined $K_i \equiv \sup_{0 \le r \le 1} |Q_i|$ (Westerlund, 2005: 239).

Z_{NT}, the standardized CUSUM statistic, converges to a standard normal variate passing $T \to \infty$ and $N \to \infty$ sequentially. Z_{NT} is following as:

$$Z_{NT} \equiv \frac{N^{1/2}.(CS_{NT} - \mu)}{\sigma} \Rightarrow N(0,1). \tag{6}$$

where μ and σ^2 denote the two first moments of K_i.

The simulations were carried out by repeated application (10.000 replications) of the CUSUM test statistic to a generated co-integration regression. All regression parameters were set equal to 1, and the estimation was carried out using both the DOLS and FMOLS estimators and it is expected the asymptotic moments to provide reasonable approximations even in very small samples (Westerlund, 2005: 240). Thus, after determining the co-integration relationship we employed the FMOLS and DOLS as an efficient estimator in this study.

To test the null of no-cointegration in the panel, the Panel CUSUM test extended by Westerlund (2005) is employed.

The empirical results indicated in Table 3 provide the evidence of the steady-state equilibrium in the long-run between petroleum consumption and inflation rates for 21 upper middle income countries.

Table 3: Panel CUSUM test

Results	CUSUM test statistic		p-value	
	Constant	Constant Trend	Constant	Constant Trend
Results from DOLS	2.467	3.389	0.000	0.000
Results from FMOLS	4.047	5.252	0.000	0.000

The estimation is carried out using the two lags and one leads DOLS.

3.3.3. Panel Cointegration Estimation

Pedroni (2000) proposes fully modified ordinary least square (FMOLS) estimation while Kao and Chiang (2000) and Mark and Sul (2001) propose the dynamic ordinary least squares (DOLS) as the alternative approach of panel cointegration estimation. FMOLS estimation corrects for endogeneity and serial correlation to the ordinary least square (OLS) estimator. To overcome the problem of endogeneity bias and to obtain an unbiased estimator of the long-run parameters, DOLS uses a parametric adjustment to the errors by augmenting the static regression with leads, lags, and contemporaneous values of the regressors in first differences. According to Kao and Chiang (2000) FMOLS and DOLS estimators have normal limiting properties, even though DOLS estimator outperforms FMOLS estimator in empirical analysis (Kutlu, 2010).

In this study the parameters are estimated by the group-mean panel FMOLS and DOLS methods developed by Pedroni (2000 and 2001) because the OLS estimator is a biased and inconsistent estimator when applied to cointegrated panels.

Specifically, the FMOLS statistic is defined by Pedroni (2000):

$$\hat{B}_{i,FMOLS} = N^{-1}.\left[\sum_{i=1}^{N}(\sum_{t=1}^{T}(X_{it}-\overline{X}_i)^2\right]^{-1}.\left[\sum_{t=1}^{T}(X_{it}-\overline{X}_i).Y^*_{it-}T.\hat{Y}_i\right] \quad (7)$$

where

i: cross section data,
t: time series data,
N: number of cross section data,
T: number of time series data,

$\hat{B}_{i,FMOLS}$: FMOLS estimator,

$\overline{X}_i$: average of X_i,

$Y^*_{it} = (X_{it} - \overline{X}_i) - \left[(\hat{\Omega}_{21i}/\hat{\Omega}_{22i}).\Delta X_{it}\right]$,

$\hat{Y}$: act to correct for the effect of serial correlation due to heterogenous Dynamics (Pedroni, 2000).

The Panel DOLS estimator requires estimating the following models by the OLS for each country belongs equation 8:

$$cpi_{it} = \beta_{0i} + \beta_{1i}pet\_cons_{it} + \sum_{k=-K_i}^{K_i}\Psi_{ik}.dpet\_cons_{it-k} + v_{it} \quad (8)$$

where $-K_i$ and K_i are leads and lags.

Specifically, the DOLS statistic is (Harris and Sollis, 2003):

$$\hat{B}_{i,DOLS} = .\left[N^{-1}\sum_{i=1}^{N}(\sum_{t=1}^{T}(Z_{it}-Z'_{it})^{-1}.\sum_{t=1}^{T}(Z_{it}-\tilde{Y}_{it})\right]_1$$

where

$\hat{B}_{i,DOLS}$: Dynamic OLS estimator,

Z_{it} is the 2.(K+1)x1 vector of independent variables,

$Z_{it} = \left\langle(X_{it}-\overline{X}_i), \Delta X_{it-k}, ..., \Delta X_{it+k}\right\rangle$,

$\tilde{Y}_{it} = Y_{it} - \overline{Y}_i$, and the subscript 1 outside the brackets indicates that only the first element of the vector is taken to obtain the pooled slope coefficient.

Results for the panel FMOLS estimation of the eq.1 is presented in Table 4. The cointegration parameters in table 4 indicate that total petroleum is positively associated with the inflation rate. More specifically, the panel DOLS estimator shows that 1 percent increase in the petroleum consumption stimulates inflation rate by 1.86 and the panel FMOLS estimator shows that 1 percent increase in the petroleum consumption stimulates inflation rate by 1.68 percent.

Table 4: Panel Cointegration Estimation

pet_cons	Statistic	P-value
Panel FMOLS	1.68	31.25***
Panel DOLS	1.86	51.90***

Note: Leads and lags were set to 1 for the panel DOLS estimator. *** denotes statistical significance at 1 percent level.

4. Conclusion

The linkage between petroleum consumption and inflation has a special importance in designing discretionary macroeconomic policies for stabilization purposes for developed as well as developing countries**.** Thus revealing and the magnitude the direction of this relation between the series give important signal in policy implementation process so as to assess the long-run course of the energy policies to economic agents and policy makers.

This paper empirically investigates whether there is a long-run relationship between total petroleum consumption and consumer price index as a measure of inflation for 21upper middle income countries. The empirical results obtained from panel cointegration for the period 1980-2011 provide the evidence of the steady-state equilibrium in the long-run between petroleum consumption and inflation rate. According to the findings, the direction of this relationship is positive and statistically significant. More specifically, the panel DOLS estimator shows that 1 percent increase in the petroleum consumption stimulates inflation rate by 1.86 and the panel FMOLS estimator shows that 1 percent increase in the petroleum consumption stimulates inflation rate by 1.68 percent.

References

[1] Ahmad, M. and Ali, S.A. 2012. "Impact of Oil Prices on Country's Economy: A Case Study South Asian Countries" (July 16, 2012). Available at SSRN: http://ssrn.com/abstract=2147341 or http://dx.doi.org/10.2139/ssrn.2147341, pp.1-10.

[2] Ali, S.A. Ramzan, M., Razi A. and Bhatti, A.G. 2012. "Impact of Oil Prices On Food Inflation in Pakistan", *Interdisciplinary Journal of Contemporary Research in Business*, Vol 3, No 11, pp.123-140.

[3] Baltagi, B. 2005. *Econometric Analysis of Panel Data*, Third Edition, Chichester: John Wiley Sons, Ltd.

[4] Barbieri, L. (2006). "Panel Unit Root Tests: A Review", *Quaderni Del Dipartimento Di Scienze Economiche E Sociali*. Serie Rossa, N.43, Università Cattolica Del Sacro Cuore, Piacenza, pp.1-53.

[5] Barsky, R.B. and Kilian, L. 2004. "Oil and the Macroeconomy Since The 1970s", *Journal of Economic Perspectives*, Volume 18, Number 4, pp.115–134.

[6] Chima, C.M. 2005. "Empirical Study Of The Relationship Between Energy Consumption And Gross Domestic Product In The U.S.A.", *International Business & Economics Research Journal*, Volume 4, Number 12, pp.101-112.

[7] Ebohon, O. J. 1996. "Energy, Economic Growth and Causality in Developing Countries. A Case Study of Tanzania and Nigeria", *Energy Policy* 24 (3), pp. 447-453.

[8] Harris, R and Sollis, R. 2003. *Applied Time Series Modelling and Forcasting*, John Wiley & Sons, ISBN/ISSN: 0 470 84443 4.

[9] Hondroyiannis, G., Lolos, S. and Papapetrou, E. 2002. "Energy Consumption and Economic Growth: Assessing the Evidence from Greece", *Energy Economics*, 24, pp.319-336.

[10] Im, K.S, Pesaran, M. H. and Shin,Y. 2003. "Testing for Unit Roots in Heterogeneous Panels", *Journal of Econometrics,* 115, pp.53-74.

[11] Kiani, A. 2010. "Impact of High Oil Prices on Pakistan's Economic Growth", *International Journal of Business and Social Science*, 2(17), pp. 209-216.

[12] Korap, L. 2007. "*Testing Causal Relationships Between Energy Consumption, Real Income and Prices: Evidence from Turkey", Beykent University Journal of Social Sciences*, Vol. 1, No. 2, pp. 1-29.

[13] Kutlu, V. 2010. The *Long Term Relation Between Indirect And Direct Real Estate*. Msc Thesis in Economics and Finance Aging, Tilburg University.

[14] Layade, A.A. and Okoruwa, V.O. 2012. "Effects of Oil Price Change on Capital Stocks of Selected Companies in Agro-Allied Industry in Nigeria", *ARPN Journal of Agricultural and Biological Science, 7*(6), pp.402-406.

[15] LeBlanc, M., and Chinn M. 2004. "Do High Oil Prices Presage Inflation? The Evidence from G-5 Countries", *Business Economics*, 39, pp.38–48

[16] Lee, C.C. and Chang, C.P. 2008. "Energy Consumption and Economic Growth in Asian Economies: A More Comprehensive Analysis Using Panel Data", *Resource and Energy* Economics, Vol. 30, pp.50-65.

[17] Leesombatpiboon, P. 2009. *A Multivariate Cointegration Analysis of The Role of Oil in The Thai Macroeconomy*, Ph.D. Dissertation, The George Washington University, Washington, D.C.

[18] Lescaroux, F. and Mignon V. 2008. "On The Influence of Oil Prices On Economic Activity and Other Macroeconomic and Financial Variables", *OPEC Energy Review*, 32 (4), pp. 343–380.

[19] Levin, A., Lin, C-F and Chu, J. C-S. 2002. “Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties”, *Journal of Econometrics,* 108, pp.1-24.

[20] L'oeillet, G. and Licheron, J. 2009. “The Asymmetric Transmission of Oil Prices to Inflation: Evidence for the Euro Area”, *The 26th Symposium on Money, Banking and Finance*, 25-26 June 2009, University of Orléans, pp.1-44.

[21] Mohaddes, K. and Williams, O. 2011. “Inflation Differentials in the GCC: Does the Oil Cycle Matter?”, *IMF Working Paper*, WP/11/294, pp.1-29.

[22] Nell, C. and Zimmermann, S. 2011. Panel Unit Root Tests Term Paper at the Department of Economics at University of Vienna, PhD Course: Panel Data. Lecturer: Prof. Dr. RobertKunst.Available at: <http://homepage.univie.ac.at/robert.kunst/pan2011_pres_nell.pdf> [Accessed 10 May 2012].

[23] Ogbonna, G.N. 2012. “Petroleum Income and Nigerian Economy: Empirical Evidence”, *Arabian Journal of Business and Management Review (OMAN Chapter)*, Vol. 1, No.9, pp.33-59.

[24] Pedroni, P. 1999. “Critical Values For Cointegration Tests In Heterogeneous Panels With Multiple Regressors”, *Oxford Bulletin of Economics and Statistics*, Blackwell Publishers, Special Issue 0305-9049 61, pp.653–670.

[25] Pedroni, P. 2000. “Fully Modified OLS for Heterogeneous Cointegrated Panels, in Nonstationary Panels, Panel Cointegration, and Dynamic Panels”, *Advances in Econometrics*, Vol. 15, (Ed.) B. H. Baltagi, (JAI), pp. 93–130.

[26] Torres-Reyna, O. Panel Data Analysis: Fixed and Random Effects (Using Stata 10.x) (Ver.4.1) [PDFDocument]. Available at: <http://dss.princeton.edu/training/Panel101.pdf> [Accessed 10 January 2012], pp.1-40.

[27] Webb, M. 2006. Analysis for Oil Consumption with Dynamic Panel Data Models. From a Thesis Supervised by Dr Chirok Han and Professor Viv Hall, August. Available at: <http://divcom.otago.ac.nz/econ/events/NZESG/Papers/S4_Webb.pdf> [Accessed 05 October 2012].

[28] Westerlund, J. 2005. “A Panel CUSUM Test of the Null of Cointegration”, *Oxford Bulletin of Economics and Statistics*, 67, 2, pp.231-262.

[29] World Bank, http://data.worldbank.org/indicator, [Accessed 10 November 2012].

[30] Worrall, J and Pratt, T. 2004. “Estimation Issues Associated With Time Series-Cross Section Analysis in Criminology”, *Western Criminology Review*. 5(1), pp.35-49.