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Role of Energy on Economy The Case of Micro to Macro Level Analysis

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Abstract

The present article contributes to the debate on the role of energy variables on firm's stock return, industrial stock return, stock market return and economic growth of Pakistan. In order to investigate the role of oil price, electricity price and electricity consumption, we collect the data of 397 firm listed in Karachi stock exchange, 12 listed industries, KSE-100 index and gross domestic product over the period 1998-2014. By using four econometric techniques; pooled OLS, fixed effect methods, difference GMM and system GMM, oil price confirms significant positive relationship with industry stock return, stock market return and economic growth. On contrary, electricity price verify strong negative effect on firm's stock return, industrial stock return, stock market return and economic growth while electricity consumption indicates different impact across micro and macro level returns. Sector vise results also confirm the adverse impact of electricity price in most of the sectors.

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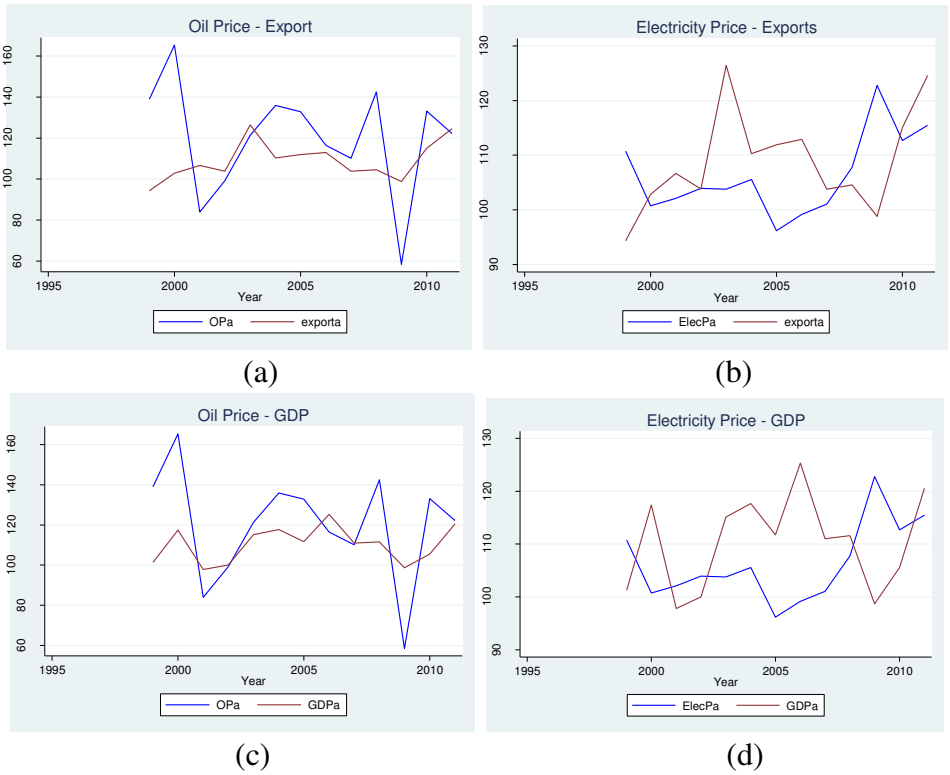
1. Introduction:

Recent studies have shown that rapid population expansion and industrial growth are the main causes of energy consumption (Sarwar, Chen and Waheed 2017, Shahbaz, Sarwar, et al. 2017, Waheed, et al. 2018). The developed countries have taken preemptive measures to counter the unfavorable situations in case of potential energy shortage. In contrast, countries with less developed energy infrastructure are facing looming micro and macroeconomic disasters. As energy consumption is an essential ingredient for economic development (Zaman, Khan, & Saleem., 2011), however, the energy volatility destabilizes the pattern of industrial and economic growth. The consequences of such destabilization differ due to heterogeneity in structural conditions and policy implementation. Numerous researchers have attempted to explore the linkage between energy consumption and economic growth, including such factors as the level of energy intensity in developing and developed countries, whether the country is an oil exporter or importer, etc., but there is no consensus at all. Oil-importing countries are shown to be adversely affected by an oil price increase because of excessive trade dependence (Jiménez-Rodríguez and Sánchez 2005).

After 1973, a wealth of empirical literature has confirmed the negative association of an oil price rise and economic growth (Hamilton J. D., 1983; Hamilton J. D., 1985; Hamilton J. D., 1996; Burbidge & Harrison, 1984; Gisser & Goodwin, 1986; Mork, 1989). The energy policies of recent decades, new technologies, and alternative sources of energy all strive to limit this negative impact (Jbir and Zouari-Ghorbel 2009, Doroodian and Boyd 2003). Oil price shocks are mainly due to two factors, demand side shocks and supply side shocks. Demand-side shocks occur due to the increase in oil demand by developing countries and is argued by many to have a positive impact on economic development (Filis, Degiannakis and Floros 2011, Sarwar, Chen and Waheed 2017, Shahbaz, Sarwar, et al. 2017).

The stock market also reflects the reactions of macroeconomic transformations such as oil price shocks, economic depression, conflict in the Middle East, etc. Degiannakis, Filis, & Kizys (2014) conclude that demand-side increases in the oil price are positively related to European stock returns. Further, Arouri & Rault (2012) find a positive association between the oil price and stock returns for oil-exporting countries. The positive relationship is also confirmed by number of other studies (El-Sharif, et al. 2005, Sadorsky, Risk factors in stock returns of Canadian oil and gas companies. 2001, Faff and Brailsford 1999). In contrast, Kang, Ratti, & Yoon (2015), Cunado & de Gracia (2014), Chen (2010), and M. Jones & Kaul (1996) report a negative relationship between energy prices and stock market returns. Whereas, (Apergis and Miller 2009) find significant relationship between oil price shocks and stock market returns in the case of developing countries. A comprehensive view of the prior literature is thus not sufficient to yield a conclusive result.

Figure 1: Energy price, exports and economic growth



The Pakistani stock market was declared the best performing stock market in 2002, and ranked third among the top ten stock markets in 2014. After 2007, the global financial crisis, political instability, the war on terror, and most importantly a domestic energy crisis hit the Pakistani economy hard and caused the stock market to crash. The market capitalization of the KSE declined from $US70.26 billion in 2007 to $US23.49 billion in 2008. The performance of Pakistan's stock market tends not to follow fundamentals of the listed companies, but rather are significantly correlated with macroeconomic conditions (Haque and Sarwar 2013).

The stock market is a mix of oil-intensive and less oil intensive sectors; these heterogeneous sectors respond differently to oil price shocks (Arouri, Does crude oil move stock markets in Europe? A sector investigation 2011, Degiannakis, Filis and Floros, Oil and stock returns: Evidence from European industrial sector indices in a time-varying environment 2013, Elyasiani, Mansur and Odusami 2011, Moya-Martínez, Ferrer-Lapeña and Escribano-Sotosc 2014). Industry is the backbone of the economy and plays a key role in development of the country; it utilizes domestic raw materials to produce finished goods that reduce the degree of dependence on foreign goods (import substitution), and also helps boost exports and strengthen economic indicators. In addition to overall economic conditions, the profitability of an individual company and industry also is affected by energy volatility. Returns for the oil industry and producers of alternative fuels are positively related to an increase in oil price; in contrast, an oil price rise is unfavorable for oil consumers and the financial industry (Elyasiani, Mansur and Odusami 2011). Similarly, Xundi et al. (2010) find a significant relationship between energy consumption and industry return in China. (Degiannakis, Filis, & Floros, 2013) document an asymmetry between the oil price and industry-level return in Europe. And the oil price is found to be insignificant in

predicting the return of Spanish industrial stocks (Moya-Martínez, Ferrer-Lapeña and Escribano-Sotosc 2014). The present study also attempts to investigate the effect of energy variables on each sector listed in Karachi Stock Exchange (KSE).

Pakistan is a developing country and is facing an energy crisis as a result of incompetent political leadership and an incoherent energy policy. Since 2007, an energy crisis has disrupted Pakistan's economy, burdening its industrial infrastructure, hindering firms' operation, impeding efforts to reduce unemployment, etc. (Zaman, Khan and Ahmad, et al. 2012). The electric power deficit increased frequently, in 2005 it is 1247 MW while 2011 it appears to 6325 MW[1]. Despite rapid economic growth and rising demand for electricity, no worthwhile measures have been taken to install new capacity for electricity generation.

Table 1: Karachi stock exchange history.

Year	Market capitalization of listed companies (current US$)	Market capitalization of listed companies (% of GDP)	Listed domestic companies, total	Stocks traded, total value (current US$)	Stocks traded, total value (% of GDP)	Stocks traded, turnover ratio (%)
1998	5418000000	8.711737602	773	9038000000	14.53242607	110.3271484
1999	6964674700	11.05962883	765	21056750000	33.43728879	340.1001885
2000	6581370000	8.899470778	762	32973710000	44.58776343	486.8389368
2001	4943970000	6.837211797	747	12454840000	17.2242912	216.129676
2002	10199740000	14.1061935	712	26029940000	35.99928728	343.7722989
2003	16578610000	19.91548996	701	66598090000	80.00270182	497.4024912
2004	29002180000	29.60077692	661	73871910000	75.39660565	324.1361547
2005	45936760000	41.9505735	661	140995780000	128.7607971	376.2951011
2006	45517640000	33.16063916	652	126559550000	92.20151945	276.7708279
2007	70262230000	46.10814694	654	100451630000	65.91932133	173.521753
2008	23490665415	13.81171644	653	54358839888	31.96115859	115.9619437
2009	33238531669	19.79957522	651	23526856044	14.01451064	82.94443515
2010	38168586546	21.54401249	644	12917990449	7.291476388	36.18124011
2011	32763702675	15.33971604	638	10141061875	4.747967928	28.59364046

Previously the link between electricity consumption and economic growth also has been debated. The present study is the first in Pakistan to utilize the electricity price. A rise in the electricity price is harmful for developing countries because its infrastructure relies on industries; this raises the cost of production and thus lowers the profitability of the company. Since 2008-11, Pakistan's industrial sector has confronted electricity shortages and price hikes that have

[1] SEPCO data was included in HESCO prior to 2010/11.

increased the costs of production and thus prices of the final product; this in turn has reduced domestic and foreign demand. Another motive for including the electricity price in this study is the electricity tariff policy, which rarely depends on the price of oil in the case of Pakistan[2]. Thus, the role of oil and electricity prices are examined separately for multiple segments of the Pakistani economy over the period 1998-2014. First, we explore the consequence of the oil price, electricity price, and electricity consumption on the micro level—i.e., on the firm's stock return (*FSR*) and industrial-sector stock return (*ISR*). On the macro level of analysis, the paper attempts to explore the relationship between energy variables and the Karachi stock market return (*SMR*) and gross domestic product (*GDP*) as proxies for macroeconomic indicators.

We utilize the econometric techniques followed by (Nayana, et al. 2013), pooled OLs, fixed effect methods, difference GMM, and system GMM to estimate the growth models. We confirm that the oil price (*OP*) has a significant positive relationship with industrial stock return (*ISR*), stock market return (*SMR*), and economic growth (*GDP*). On the contrary, we verify that the electricity price (*EP*) has a strong negative effect on a firm's stock return (*FSR*), industrial stock return (*ISR*), stock market return (*SMR*), and economic growth (*GDP*), while electricity consumption (*EC*) has a different impact on micro vis-à-vis macro level returns.

2. Literature:

Energy is the origin of sustainable development of social dimensions, environment and economic growth (Munasinghe 2002). Empirical studies have no defined censes about univariate, bivariate or no relation between energy price and economic growth. Our first strand of the literature has concentrated on the effect of energy price, energy consumption on economic growth (Ahmed, Zaman, Taj, Rustam, Waseem, & Shabir, 2013; Zaman, Khan, & Saleem, 2011; Costantini & Martini, 2010. Second strand of the review has examined the effect of energy variables on stock market returns (Kang, Ratti, & Yoon, 2015; Cunado & de Gracia, 2014; Degiannakis, Filis, & Kizys, 2014). Third portion of the literature has focused the relation between energy variables and industry returns (Moya-Martínez, Ferrer-Lapeña, & Escribano-Sotosc, 2014; Degiannakis, Filis, & Floros, 2013). The literature further on has investigated the effect of energy on firm-level returns.

Neo-classical school of thought emphasized on technological change, natural resources and both to attain the economic growth (Solow 1956, Aghion and Howitt 1998, Stern and Cleveland 2004). Orthodox has different perspective and has supported conclusions (Sorrell 2010). Orthodox argued the closed economic system in which labor and capital are the key factors to produce goods that exchanged between firms and consumers. Economic growth can be triggered by the better educated workers and technology change (e.g. increase in capital) (H. G. Jones 1975). Ecological economists point out that orthodox ignores the energy factor that sustains the economic activities (Hall, Cleveland and Kaufmann 1995).

(Kraft and Kraft 1978) present the pioneer work to investigate the relationship between economic growth and energy consumption in US, unidirectional causality found from economic growth to energy consumption. (Akarca and Long 1980) re-examined the energy consumption

[2] Over the past 40 years worldwide, the change in the price of oil has also affected the price of other energy sources (Hannesson 2009). However, despite an oil price decline from a peak of approximately $US 140 to $US 50 in 2008-09, the electricity price in Pakistan increased during this period.

and economic growth relation in case of US, results confirm no association. By replacing the time period to (Kraft and Kraft 1978) study, causal relation proved. (Yu and Choi 1985) found the effect of energy consumption on GNP in Philippines, while the inverse relation verified in South Korea, no association confirmed in USA, UK and Poland. (Wolde-Rufael 2004) investigated the relationship among industrial energy consumption and economic growth (GDP) in Shanghai (China) over the period 1952-1999. The empirical result concluded the unidirectional relation from energy consumption to GDP. (Lee and Chang, Structural breaks, energy consumption, and economic growth revisited: Evidence from Taiwan 2005) empirically investigate the relationship between energy consumption and economic growth in Taiwan from 1971-2001 and found the significant effect of energy consumption to economic growth. (Lee & Chang, 2008) analyzed 16 Asian countries from 1971-2002, pedroni panel cointegration affirmed the effect of energu usage on real GDP. (Abosedra, Dah and Ghosh 2009) explored the Lebanon over the period 1995-2005 by using monthly data, the finding of the study supported the unidirectional relationship from energy consumption to economic growth. (Al-mulali and Sab 2012) empirically examined the Sub-Saharan African countries by using the data 1980-2008. Panel model estimated a significant positive association between energy consumption and economic growth.

(Masih and Masih 1996) studied six Asian countries; Pakistan, India, Indonesia, Malaysia, Philippine, Singapore, Johansen-Juselius, VDC presented the bivariate relationship between energy consumption and economic growth in Indonesia while India confirmed univariate link from energy consumption to economic growth, reverse association found in the case of Pakistan. Malaysia, Singapore and Philippine had no evidence of significant relation. (Rufael, Energy consumption and economic growth: The experience of African countries revisited 2009) analyzed 17 African countries from 1971-2004 and demonstrated different conclusion across countries, results reported that energy consumption is not a significant determinant of economic growth. Tunisia, Zambia, Algeria, Benin, South Africa, Egypt, Ivory Coast, Morocco, Nigeria, Senegal and Sudan supported the effect of economic growth on energy consumption; bidirectional causality affirmed in Gabon, Ghana, Togo and Zimbabwe; no relationship confirmed in Cameroon and Kenya. (Tsani 2010) studied Greece economic from 1960-2006, results provided the evidence on unidirectional relation from total energy consumption and economy at aggregate level. At disaggregate level, residential and industrial energy consumption reported a bidirectional relationship.

(Chen, Kuo and Chen 2007) studied the 10 industrialized countries from 1971-2001, result confirm the effect of electricity consumption on GDP. (Yuan, et al. 2007) empirically analyzed the relationship between GDP and electricity consumption from 1978-2004 in case of China. Johansen-Juselius; Hodrick Prescott filter and VDC have drawn a univariate association from electricity consumption to real GDP. (Narayana and Singh 2007) studied Fiji Island for the time period 1971-2002, ARDL bound test verified that electricity consumption play a significant role for economic development. (Yuan, et al. 2008) applied Johansen-Juselius; IRF test to find the relationship between electricity consumption and real GDP in the case of China. The finding of the study validated the bidirectional linkage between economic growth and electricity consumption.

(Narayan and Prasad, Electricity consumption–real GDP causality nexus: Evidence from a bootstrapped causality test for 30 OECD countries 2008) used bootstrap granger causality test on

30 countries to explore the relationship between electricity consumption and economic growth (real GDP). Unidirectional causality from electricity consumption to economic growth found in case of Australia, Czech Republic, Italy and Portugal; from economic growth to electricity consumption in the Finland, Hungary and Netherlands; bidirectional causality found in Iceland, Korea while Austria, Belgium, Canada, Denmark, France, Germany, Greece, Ireland, Japan, Luxembourg, Mexico, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, Turkey and USA found no granger causality. (Karanfil and Li 2015) demonstrated a long run relationship between electricity consumption and economic growth in aggregate sample of 160 countries from 1980-2012; for the short run, economic growth effected the energy consumption that supported the conservation hypothesis.

(Farzanegan and Markwardt 2009) analyzed the effect of oil price shock on macroeconomic variables in Iran for the period 1975-2006. The study incorporated real government expenditure, real industrial GDP per capita, inflation, real effective exchange rate and real imports. Positive oil price supply side shock increased the industrial production and imports while negative shock decreased the industrial production and imports. Oil price shock, due to demand side, increase the inflation that caused the decline of real disposable income and consumers real effective demand. In term of trade, oil exporting country get benefit from increment in oil price. (Timilsina 2015) used the data set of 25 countries to explore the effect of oil price on GDP; Oil price rise has adverse impact in GDP of developing countries because their industrial structure rely on oil supply. On the other hand, oil price rise strengthens the economy activities in case of oil exporting countries.

(Apergis and Miller 2009) found a small significant relationship between structural oil price and developing countries stock returns. (Narayan & Gupta, 2015) applied predictive regression model to in US over the time 1859-2013, result supported a significant effect of oil price on stock market returns. (Kang, Ratti and Yoon 2015) employed structural VAR test to investigate the impact of oil price shock on US stock market returns and volatility, result validated statistically significant spillover. (Nandha & Faff, 2008; Miller & Ratti, 2009; Chen S.-S. , 2010) documented a negative relationship between oil price and stock market return. Oil price rise associated with demand side is positively related with European stock return (Degiannakis, Filis, & Kizys, 2014). Oil price change has significant positive relation with oil exporting stock market returns (Arouri & Rault, 2012).

Transportation industry faced significant negative impact due to oil price shocks, although most of the sectors witnessed positive relationship (Hammoudeh and Li 2004). (Cong, et al. 2008) proved negligible association between oil price and industrial stock return in China. (Elyasiani, Mansur and Odusami 2011) confirmed positive relation between oil price and stock returns in case of oil related and oil substitute industry while significant negative relation in oil user and financial industries. (Li, Zhu and Yu 2012) verified positive relationship between real oil price and Sector return by using panel method in case of China. (Huang, et al. 2015) supported the asymmetric association between oil price and stock returns of different industries in China. Oil and gas industry exhibits significant positive relationship with oil price (Arouri, 2011; Ramos & Veiga, 2011; Boyer & Filion, 2007; El-Sharif, Brown, Burton, Nixon, & Russell, 2005).

(Soytas & Sari, 2007) studied the Turkey economy for the time 1968-2002; Johansen-Juselius; IRF and VDC confirmed the effect of industrial electricity on value added manufactring. The significant effect of oil price on sector-level and firm-level stock returns had confirmed in US.

(Narayan & Sharma, 2011) concluded the relation between oil price and firms return depends on sectors; lagged oil price also proved a significaant determinent of firms return. (Narayan & Sharma, 2014); 14 sector and 560 firm-level data set over the period Jan 2000- Dec 2008 reported calamitous impact on small size firms. (Demirer, Jategaonkar and Khalifa 2015) used the firm level data of 6 oil exporting countries to examined the oil price sensitivity exposure of stock return, results stated the stock with high sensitivity to oil price yield higher return.

Developing countries like Pakistan cannot afford electricity shortage (Riaz 1987). (Aqeel and Butt 2001) found significant positive association between energy consumption and economic growth in Pakistan; electricity consumption boosts the economic growth and stimulates the employment opportunities. (Siddiqui 2004) studied Pakistani economy from 1971 to 2003; results reported the significant effect of energy consumption, capital stock and petroleum products on economic activities. (Shahbaz, Zeshan and Afza, Is energy consumption effective to spur economic growth in Pakistan? New evidence from bounds test to level relationships and Granger causality tests 2012) empirically investigated the association among energy consumption and economic growth in Pakistan. Structural break cointegration and ARDL confirmed the cointegration between energy consumption and economic growth.

(Shahbaz & Feridun, 2012) reported the long run association between electricity consumption and economic growth in case of Pakistan, unidirectional relation from economic growth to electricity consumption while no evidence of vice versa. (Ahmed, et al. 2013) empirically examined the relationship between energy consumption per capita and real per capita income over the time 1975-2009 in case of Pakistan. Electricity consumption and energy consumption confirmed a significant relationship with economic growth. In short run, energy consumption and economic growth are negatively associated due to insufficient supply of energy and high cost of firm's operational activities decrease the economic growth.

3. Materials and Methods:

3.1. Data:

We incorporated the data of all listed firms in Karachi stock exchange for the period July 1, 1998 to December 31, 2014. Firm level data of stock price has obtained from Bloomberg, firm level stock return is presented as (*FSR*). KSE-100 index is utilized as a proxy of stock market return (*SMR*) while industrial stock return (*ISR*) calculated as equally weighted method[3]. Stock return's calculated as $R_{i,t} = ln\ (P_{i,t} - difference\ P_{i,t})$, where $P_{i,t}$ and $P_{i,t-1}$ represents the current and lagged closing stock price/index respectively. The data on gross domestic product (*GDP*) has collected from World Development Indicator. Data of KSE 100 index and Crude Oil in Dollars per Barrel has taken from Yahoo Finance and EIA, respectively. Finally, electricity price (*EP*) and electricity consumption (*EC*) are acquired from National Transmission & Despatch Company, we utilize industrial electricity supply data of Karachi Electric Supply Company Ltd for electricity consumption.

[3] (Saeed 2012) method has adopted for ISR.

3.2. Models:

Our approach is to estimate the significance of energy variables from micro to macro growth models. Firm's stock return, industrial stock return, stock market return and GDP are examined by using panel model estimations. Study model's presented as follows:

$$FSR_{it} = \alpha_i + \gamma_0 FSR_{i,t-1} + \gamma_1 OP_{it} + \gamma_2 EP_{it} + \gamma_3 EC_{it} + \varepsilon_{it} \quad (1)$$

$$ISR_{it} = \alpha_i + \gamma_0 ISR_{i,t-1} + \gamma_1 OP_{it} + \gamma_2 EP_{it} + \gamma_3 EC_{it} + \varepsilon_{it} \quad (2)$$

$$SMR_{it} = \alpha_i + \gamma_0 SMR_{i,t-1} + \gamma_1 OP_{it} + \gamma_2 EP_{it} + \gamma_3 EC_{it} + \varepsilon_{it} \quad (3)$$

$$GDP_{it} = \alpha_i + \gamma_0 GDP_{i,t-1} + \gamma_1 OP_{it} + \gamma_2 EP_{it} + \gamma_3 EC_{it} + \varepsilon_{it} \quad (4)$$

Model-1 represents the micro level study; an association among energy variables and firm's stock returns (*FRS*). The energy variables *OP*, *EP* and *EC* represent the oil price, electricity price and electricity consumption, respectively.

Model-2 examines the effect of energy variables on industrial level, where *ISR* represents the industrial stock return. We distributed all listed companies in twelve different industries to explore the effect on different industries[4]. Model-3 attempts to examine the effect of energy variables on stock market return. The significant relationship among energy and growth is confirmed (Arouri, 2011; Arouri & Rault, 2012; Degiannakis, Filis, & Floros, 2013). Model-4 explore the relationship between economic growth (*GDP*) and energy variables (*OP, EP* and *EC*).

Present study contains the longitudinal panel data with N > T, so, we apply advance panel data technique as well as the little old estimations to investigate the role of energy variables on macro and micro level growth of Pakistan. Generalized Method of Moments estimations employed namely Difference GMM and System GMM (Arellano & Bover, 1995; Blundell & Bond, 1998)[5]. System GMM corrects the unobserved heterogenity, potential endogenity, measurement error and omitted variable bias that frequently influence growth estimation (Bond, Hoeffler and Temple 2001). Further more, pooled OLS (POLS) and fixxed effect methods (FED) applied for the robustness check.

4. Results:

4.1. Descriptive:

Table 2 mentions the descriptive statistics; mean value, minimum and maximum contains very less deviation which indicates no discrepancy in the variables; *GDP* has mean value 4.7 with 0.079 deviation, *SMR* contains 8.325 average with deviation of 0.919, *ISR* has 1.630 mean while

[4] (Narayan and Sharma, New evidence on oil price and firm returns 2011) hypothesis 1 examined; the relation between oil price and firms return depends upon their sectoral location.

[5] We follow (Nayana, et al. 2013) study for GMM estimation technique to find relationship between energy and growth.

standard deviation is 0.728, *FSR* shows the mean value 2.668 with -5.288 and 8.220 minimum and maximum value, respectively.

Table 2: Descriptive statistics

Variable	*FSR*	*ISR*	*SMR*	*GDP*	*OP*	*EP*	*EC*
Obs	4841	5558	5161	5161	5558	5558	5558
Mean	2.668	1.891	8.325	4.700	3.655	1.613	7.961
Std. Dev.	1.485	0.528	0.919	0.079	0.613	0.206	0.167
Skewness	0.253	-2.071	-0.213	-0.099	-0.299	1.149	-0.460
Kurtosis	3.218	7.049	1.372	1.752	1.952	3.359	1.997
Min	-5.288	0.000	7.031	4.583	2.477	1.340	7.630
Max	8.220	2.324	9.453	4.831	4.516	2.105	8.173

Notes: The Table reports the results of mean, standard deviation, skewness, kurtosis etc, *SMR* is a proxy of stock market return and calculated from KSE-100 index closing price (*P*), *SMRi,t = ln (Pi,t – difference Pi,t)*, *FSR* is individual firm's stock return [*FSRi,t* is the $ln(P_{i,t}$ *- difference* $P_{i,t})$.while *ISR* is calculated as weighted average method, *GDP* is $100*(GDP/GDP_{i,t-1})$. *OP* employs crude oil price ($US) per barrel, Electricity price (*EP*) is average electricity price per year by KESE. *EC* represents the electricity consumption, industrial electric supply data is used from National Transmission & Despatch Company.

4.2. Estimations:

Table 3 presents the statistical estimations; Model 1 reports the result of pooled OLS, fixed effect method (FEM), difference GMM and system GMM techniques; colum-1 presents pooled OLS results, lagged *FSR* and *EC* confirm significant positive association with *FSR*. The oil price has no influence on *FSR* in case of Pakistan; *OP* proves significant negative at 10% level within system GMM. Whereas, *EP* are significant negative at 1% level of significance; the electricity price provides the result as expected, rise in electricity price is due to electricity shortage in Pakistan and has an adverse effect on firm's production, sales, financial performance and stock returns.

Model-2 displays the results of Equation-2 at industry level returns; pooled OLS, FEM and difference GMM and system GMM find the significance of oil price (*OP*); the finding is similar to (Narayan & Gupta, 2015; Kang, Ratti, & Yoon, 2015). The results of electricity price (*EP*) turn out to be significant negative for all statistical techniques at 1% level. Electricity consumption (*EC*) has confirm negative relationship with *FSR* in pooled OLS, difference GMM and system GMM.

The results of Equation-3 are reported in Model-3; *lagged SMR, OP* and *EC* are affirmed positive significant results, result of *OP* is in line with (El-Sharif, et al. 2005, Sadorsky, Risk factors in stock returns of Canadian oil and gas companies. 2001, Faff and Brailsford 1999). The developing countries have projects with high rate of investments and firms can easily avail the bank loan to finance the projects which convey a good signal to stock market that leads to trigger the stock purchasing. The Electricity price (*EP*) has validated the negative influence on stock market return at 1 percent level by applying difference GMM technique.

Table 3: Empirical estimations

Model 1				
FSR	**Pooled OLS**	**FEM**	**Difference GMM**	**System GMM**
Lagged FSR	0.984*	0.735*	0.933*	0.937*
OP	-0.066	-0.035	-0.008	-0.037***
EP	-0.662*	-0.803*	-0.709*	-0.601*
EC	0.348**	1.108*	0.538*	0.540*
Constant	-1.368	-6.674*	-2.900**	-2.998*

Notes: Model-1 represent the results of eq-1, It regress the oil price (*OP*), electricity price (*EP*), electricity consumption (*EC*). *FSR* represents the firms's stock return while *Lagged FSR* is the lagged value of firm's stock return. First colum presents the results of pooled OL; second colum describes the fixed effect methods (FEM) while third and fourth colum reports the result of Difference GMM and System GMM, respectively.
* indicates significance at 1% level
** indicates significance at 5% level
*** indicates significance at 10% level

Model 2				
ISR	**Pooled OLS**	**FEM**	**Difference GMM**	**System GMM**
Lagged ISR	0.768*	0.696*	0.767*	0.764*
OP	0.065*	0.054*	0.066*	0.066*
EP	-0.045*	-0.029*	-0.039*	-0.039*
EC	-0.177*	-0.035	-0.168*	-0.167*
Constant	1.746*	0.761*	1.660*	1.661*

Notes: Model-2 represent the results of eq-2, It regress the oil price (*OP*), electricity price (*EP*), electricity consumption (*EC*). *ISR* represents the industrial stock return while *Lagged ISR* is the lagged value of industry stock return. First colum presents the results of pooled OL; second colum describes the fixed effect methods (FEM) while third and forth colum reports the result of Difference GMM and System GMM, respectively.
* indicates significance at 1% level
** indicates significance at 5% level
*** indicates significance at 10% level

Model 3	
SMR	**Difference GMM**
Lagged SMR	0.361*
OP	0.211*
EP	-0.408*
EC	3.942*
Constant	-26.260*

Model 4	
GDP	**Difference GMM**
Lagged GDP	-0.101*
OP	0.225*
EP	-0.157*
EC	-0.503*
Constant	8.606*

Notes: Model-3 show the results of eq-3, which estimates the effect of oil price (*OP*), electricity price (*EP*) and electricity consumption (*EC*) on SMR. *SMR* represents the KSE-100 index return while *Lagged SMR* is the lagged value of KSE-100 index return. Model-4 regress energy variables on economic growth (*GDP*). The results of Difference GMM are presented in the table.
* indicates significance at 1% level
** indicates significance at 5% level
*** indicates significance at 10% level

Table 4: Industry-wise analysis

		Lagged ISR	*OP*	*EP*	*EC*
Textile	Sig - Pos	√	√		√
	Sig - Neg			√	
	Insig				
Chemical	Sig - Pos	√		√	√
	Sig - Neg				
	Insig		√		
Engineering	Sig - Pos	√			√
	Sig - Neg				
	Insig		√	√	
Sugar	Sig - Pos	√	√		√
	Sig - Neg				
	Insig			√	
Paper & Board	Sig - Pos	√			√
	Sig - Neg			√	
	Insig		√		
Cement	Sig - Pos	√			√
	Sig - Neg			√	
	Insig		√		
Fuel & Energy	Sig - Pos	√	√		√
	Sig - Neg				
	Insig			√	
Transport & Communication	Sig - Pos	√			√
	Sig - Neg			√	
	Insig		√		
Tobacco	Sig - Pos	√			√
	Sig - Neg				
	Insig		√	√	
Jute	Sig - Pos	√	√		
	Sig - Neg			√	
	Insig				√
Vanaspati	Sig - Pos	√			
	Sig - Neg				
	Insig		√	√	√
Miscellaneous	Sig - Pos	√		√	√
	Sig - Neg				
	Insig		√		

Note: The table presents the results of difference GMM technique, *ISR* is regressed on *lagged ISR, OP, EP* and *EC* saoerately for each industry. *ISR* identify industrial stock return, *OP* represents the oil price, *EP* is the electricity price while *EC* is electricity consumption. Oil price employs crude oil price ($US) per barrel, Electricity price (*EP*) is average electricity price per year by KESE. *EC* used the data of industrial electric consumption from National Transmission & Despatch Company. Sig-Pos indicates the significant positive relationship, Sig-Neg specify the significant negative and Insig show the insignificant relationship. Data set is divided into eleven main industries and remaining industries identified as miscellaneous industries.

Model-4 illustrates the results of Equation-4 at macro level concerns; difference GMM provides an evidence of positive relationship between oil price (*OP*) and GDP. Oil price is a global concern; developing countries with good manufacturing infrastructure have potential to absorb the oil price shocks. Oil price shocks increase the economic risk and such high risk is perceived to follow the higher stock market performance and economic growth (J. D. Hamilton 1983).

Figure 1 (a) and (c) indicates the oil price, exports and *GDP* relationship, rise in oil price cause to depreciate the currency and enhance the exports which leads to increase the *GDP* or vice versa, our results differ from (Timilsina 2015, Aydın and Acar 2011). On contrary, rise in electricity price negatively influence the macroeconomic indicators, the result reports the strong negative relationship between electricity price (*EP*) on macro level as well as micro level growth model. Electricity consumption (*EC*) is negatively affected on economic growth (*GDP*), energy consumption and economic growth are negatively associated due to insufficient supply of energy and high cost of firm's operational activities decrease the economic growth (Ahmed, et al. 2013).

Table 4 presents the result of energy variables on sector level; the study used the data of eleven main industries and remaining industries identified as miscellaneous industries (miscellaneous)[6]. The results of difference GMM demonstrate the insignificance of oil price in chemical, engineering, paper & board, cement, transport & communication, tobacco, vanaspati and miscellaneous sectors while textile, sugar, fuel & energy and jute industries have significant positive relationship. The rise in electricity price tends to decrease the returns of textile, paper & board, transport & communication and jute industries. On contrary, engineering, sugar, fuel and energy, tobacco and vanaspati prove no significant relationship between electricity price and returns. The electricity consumption (*EC*) having a strong positive impact on ten industries.

5. Conclusion:

Present study investigates the impact of energy variables on micro level to macro level growth of Pakistan. Our approach is to address the growth on four levels; firstly, find a relationship of oil price, electricity price and electricity consumption on firm's stock return (*FSR*); secondly, the effect of energy variables on industrial stock return (*ISR*); on third level, energy variables regress on stock market returns (*SMR*); fourth level examines the effect on macroeconomic growth (*GDP)*. The study employs four econometrics technique; pooled OLS, fixed effect methods (FEM), difference GMM and system GMM by using the data of 397 KSE listed firms over the period 1998-2014.

All the techniques verify that Lagged *FSR* and *EC* are positively related to firm's stock return; oil price proves to be insignificant, whereas, rise in electricity price lead to decrease the firm's stock return. For industrial stock return, pooled OLS, FEM and difference GMM and system GMM find the significance of oil price (*OP*); the result of electricity price (*EP*) is significant positive which is similar to Model-1. Electricity consumption (*EC*) turns out to be significant negative at 1% level of significance. The next level examines the relationship between energy variables and stock market return; rise in oil price and energy consumption boost the stock market return but electricity price is negatively associated with stock market returns. Forth level regress the energy variables on GDP; oil price has significant positive relationship which indicates that developing countries with good manufacturing infrastructure have potential to

[6] Due to less number of observations, we combined the data of other industries into one set named miscellaneous.

absorb the oil price shocks. Rise in oil price caused to depreciate the currency that enhances the export which leads to increase the GDP or vice versa. On contrary, rise in electricity price negatively influence the macroeconomic indicators. The electricity price provides the result as expected, rise in electricity price is due to electricity shortage in Pakistan and has an adverse effect on firm's production, sales, financial performance and stock returns.

Finally, we examine the role of energy variables on sector level returns. We form twelve sectors; textile, chemical, engineering, sugar, paper and board, cement, fuel and energy, transport and communication, tobacco, jute, vanaspati and miscellaneous sector. Difference GMM technique confirms the persistent role of electricity price and electricity consumption in most of the sectors. On contrary, oil price has no strong influence on most of the sectors.

Overall, the result of rise in electricity price indicates an adverse consequence on micro and macro level returns. The implication of the study is multifold, Pakistan is facing the electricity shortage since many years, government should initiate practical measures to explore and utilize additional efficient energy sources, such as hydro, solar, coal and wind power. Secondly, the sound energy policies help to strengthen the industrial infrastructure which facilitates to push the exports and reduce import burden that leads to set a stage for better micro and macro-economic development. The next implication is related to investor's point of view, energy price should be segregated into oil price and electricity price to find the better determinant of stock return; electricity price is a better measure to determine the stock return.

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