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Rule of Law and Environment Nexus in Saudi Arabia

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ABSTRACT

The environmental quality of any country is heavily depending on the rule of law. The Saudi government targets and achieves many transformations to reduce the fossil energy and to shift to cleaner production. To achieve a cleaner environment, the law and order is very important factor. Therefore, we scrutinize the role of rule of law on the CO_2 emissions of Saudi Arabia using the period 1996-2014. We found that the rule of law has a negative effect on the CO_2 emissions of Saudi Arabia and energy consumption has a positive effect. However, we corroborated the insignificant effects of income. We refer the Saudi legal authorities to further improve the rule of law in the country as it has significant positive environmental contribution by reducing CO_2 emissions.

Keywords: CO_2 Emissions, Rule of Law, Income, Energy Consumption
JEL Classifications: Q53, P48, E01, K32

1. INTRODUCTION

Rule of law indicates the society's perception of law and order in the country in which the rule of society is very important for all stakeholders of society along with respect for people's rights (World Bank, 2019). Higher level of rule of law in the society shows the higher trust of society on the law and order situation of the country and also shows higher binding of the society to respect the law. Here, environment has no exception. The countries with a higher level of rule of law may be observed cleaner and have more respect for and demand for cleaner environment as well. On the other hand, a higher level of both cleaner environment and rule of law are demanded once a country is on the track of development. Saudi Arabia is classified as a high income economy as per World Bank classification. The people in Saudi Arabia are demanding a cleaner environment in the country and also a better level of rule of law. Consequently, we may observe that Saudi Arabia has always scored a positive index in the range of rule of law index, −2.5-2.5, which corroborated at least satisfactory rule of law.

The Kingdom of Saudi Arabia has fulfilled a huge shift in the field of environmental protection through adopting the environment protection policy in the Basic Law of Governance. The Saudi state provides support to environmental protection and the reduction of adverse environmental conditions. In 1981, the General Directorate of Meteorology (GDM) was restructured to be an independent institution and has responsibility for environmental protection in the state. The name of the GDM was changed to the Meteorology Department and Environment Protection Administration (MEPA). In 2001, the Royal Decree was issued to restructure and rename the MEPA to the General Presidency of Meteorology and Environment (PME). In 2016, the name of PME was changed to the General Authority of Meteorology and Environmental Protection (GAMEP). The Saudi state has sought through these efforts that considered one of the exceptional achievements in the Saudi environmental sector to support for environmental protection. An example of practicing is a computer test of motor vehicle and motor vehicle with high pollution emissions are not allowed to be fit for public use.

The rule of law may be considered very important for the lower pollution, higher renewable energy usage and better quality of environment as well. Because, law and order may force the society to use more of cleaner energy and lesser utilization of fossil fuel energy. Then, a better quality of environment may be achieved resultantly. The energy consumption always supports the economic growth (Hassan et al., 2018) but its environmental effects cannot be ignored. Further, overall quality of institution is very important to support the concept of cleaner environment. Somma and Rubino (2016) discussed the institutional arrangements in the renewable-energy investment in Middle East and North Africa (MENA) countries. They found that institutional quality became a hurdle in the way of energy investment in most of MENA countries. But, Morocco and Jordan attracted a good amount of investment and it is because of better institutional quality of these countries with compare to the other MENA countries. Therefore, better rule of law and institutional quality may lead to lower pollution emissions. Moreover, Goel et al. (2013) stated that MENA region are having higher emissions rates but reported lesser due to poor institutional quality, corruption and shadow economy.

The recent literature has focused well on the institutional quality and the CO_2 emissions. For instant, Ali et al. (2019) developed the compound index of institutional quality considering three indicators and checked its impact on the CO_2 emissions along with other macroeconomic variables in 47 developing countries. They found that institutional quality helped by reducing CO_2 emissions. They also stated that growth, trade and urban variables and energy usage contributed in emissions. Nguyen et al. (2018) inspected the moderating role of institutional quality in relationship of emissions and macroeconomic variables in the 36 emerging countries. At first, they found that institutions positively determined the emissions and also foreign investment and trade contributed in CO_2 emissions. A negative environmental effects of the institutional quality is due to a reason of growth of the countries so increasing economic activities contributed in the CO_2 emissions. But, the interaction effects of institutional quality with the foreign investment and trade turned the negative environmental effects to the pleasant environmental effects. It means that institutional quality has helped the clean environment through moderating the role of Foreign Direct Investment (FDI) and trade.

Above discussion realizes the importance of institutional quality and rule of law in utilizing the clean energy and in improving the environment. The institutional quality carries many governance and legal indicators but rule of law carries its prime importance in regulating the environmental law which may reduce the pollution emissions. The Saudi literature has investigated the role of oil price, agriculture sector, income, FDI, trade and urbanization on the CO_2 emissions (Mahmood and Alkhateeb, 2017; Mahmood et al., 2018; Mahmood et al., 2019d; Mahmood et al., 2020). But, testing the role of rule of law in determining the environmental quality is scant in the global literature and is missing in the Saudi literature. It gives us a food of thoughts to work on this important dimension. Therefore, this present research is highly motivated to test the role of rule of law in determining the pollution emissions considering the income and energy usage as basic determinants and using a maximum available data range of the years 1996-2014 for an oil producing economy Saudi Arabia.

2. LITERATURE REVIEW

The literature on CO_2 emissions caught a lot of attention. Ahmad et al. (2013) investigated the determinants of CO_2 emissions in South Asian countries. They found that industry value-added and population contributed in pollution. This finding corroborated a fact that developing countries are mostly carrying dirty production process and industries which have a potential to pollute the environment. Mahmood et al. (2019a) probed the effects of FDI and trade in the Egypt for 1990-2014 and corroborated the FDI reduced the emissions and trade could not effect it. A negative effect of FDI on the pollution contradicts the Pollution Haven Hypothesis (PHH) and corroborated a fact that foreign firms are adopting better environmental standards than that of local firms hence are helping the country for a cleaner environment. Zamil et al. (2019) explored the trade and emissions in Oman from 1972-2014 and found that trade degraded the Oman's environment by polluting CO_2 emissions. Hence, PHH is proved in the Oman economy.

Mahmood et al. (2019b) probed Environmental Kuznets Curve (EKC) and found that a significant EKC in Tunisia. But, Tunisia being a developing country was found on the first phase of EKC hence her economic growth is carried dirty environmental consequences. Moreover, they found the positive influence of rising trade and insignificant of falling trade on the CO_2 emissions. Therefore, rising trade is found for dirty environment. Considering spatial concept in the EKC, Mahmood et al. (2019c) investigated the East Asia, the most polluted region of the World. They found the EKC in the East Asia and found the contribution of FDI and trade on the pollution of the region. This result corroborated the PHH of FDI and trade in the East Asia which is a global hub of foreign investment. This region is also very famous for a big trade flows to/from all over the world. Hence, the trade and investment openness polluted the East Asian environment.

Literature also signifies the importance of institutions for the environmental quality and shaping the EKC as well. For instant, Egbetokun et al. (2018) investigated the EKC along with institutional quality of North and South Africa for different pollution proxies. They found the EKC in the both regions while testing the suspended particles but not for the CO_2 and nitrogen emissions. Further, institutional quality negatively affected the nitrogen emissions in the North Africa only. This result showed the importance of institutional quality for a cleaner environment. In addition, education negatively affected the suspended particles in North and South Africa and positively affected the CO_2 and nitrogen emissions in the South Africa. Moreover, population dependency positively contributed in all pollution proxies in North Africa but could not affect in the South Africa.

Suslov and Ekaterina (2019) investigated the institution, energy prices and energy intensity in the 69 countries from 2002-2012, using a dynamic panel approach. They found that elasticity of energy prices on the energy intensity is more sensitive to the quality

of institutions. Basically, the energy intensity generally depends on the environmental laws of the country and quality of institutions including the legal institutions do matter for the application of environmental law in the industry. In their results, they concluded that institutional quality played better role in the relationship of the energy prices and energy intensity than that of production sphere. Therefore, institutional quality can also determine environmental quality of the countries through improved energy intensity.

Lau et al. (2014) investigated the law and order, growth, and pollution in Malaysia using a period 1984-2008. They found that law has pleasant environmental contribution by reducing CO_2 emissions. This multidimensional relationship explains that economic growth does matter in developing the law and order in the country which consequently helps to improve environmental regulation as well and would have pleasant effects on the environment. Ibrahim and Law (2016) examined the moderating effects of institution on trade and pollution in Sub-Saharan Africa. They found that trade has negative influence on environment with a low quality of institutions. Therefore, institutional quality is a pre-requisite for the trade variables to have the positive environmental effects.

Some literature investigated Saudi Arabia to probe the determinants of the CO_2 emissions. For instance, Mahmood and Alkhateeb (2017) examined the influences of Gross Domestic Product (GDP) and trade on pollution from 1970 to 2016. They corroborated the presence of EKC and also found that trade helped in protecting the Saudi environment. So, they negated the existence of PHH in the Saudi Arabia. Mahmood et al. (2018) reexamined the EKC and also tested the effect of FDI. They supported the EKC again in the Saudi economy and found the negative influence of FDI on the CO_2 emissions. So, PHH of FDI is rejected for the economy of Saudi Arabia but energy consumption accelerated the CO_2 emissions in the Kingdom. Senan et al. (2018) investigated role of Financial Market Development (FMD) on the energy usage from 1970 to 2015 and found that FMD, urbanization and growth enhanced the energy usage. Hence, FMD and urbanization could pollute the environment of Saudi Arabia through increasing energy consumption.

Mahmood et al. (2019) explored asymmetrical role of agriculture sector on pollution. They found that income and CO_2 emissions have inverted U-shaped relationship so EKC is proved in Kingdom. Further, they found the negative influences of both increased and decreased agriculture value-added and agriculture sector helped the Saudi economy to reduce CO_2 emissions. Mahmood et al. (2020) investigated urbanization, oil price and pollution in Saudi Arabia from 1980 to 2014. They found that urbanization and oil price enhanced pollution. Oil price and its revenue contribute a significant role as these contribute the major income, exports and government spending. Therefore, oil price significantly affected the income, consumption and investment of Kingdom (Mahmood and Alkhateeb, 2018; Mahmood and Zamil, 2019).

A lot of investigated Saudi Literature shed the importance of CO_2 emissions related studies in the oil-rich economy of Saudi Arabia. But, most of studies examined the EKC and also checked influences of oil price, FDI, trade and urbanization on pollution. But, a gap is existing because rule of law, which is a very important determinant of CO_2 emissions, needs attention to be investigated. Exploiting this literature gap, the present study is motivated to check the role of rule of law on the CO_2 emissions using a maximum range of available data of Saudi Arabia.

3. RESEARCH METHODOLOGY

While building the model of the CO_2 emissions, we cannot ignore the income variable as increasing income could damage the environment through increasing activities which need the fossil fuel consumption and pollute the environment by emissions. In the same discussion, we cannot ignore the energy consumption variable because most of energy consumption is source from fossil-fuel. These variables have been investigated in the large amount of previous literature. The innovation of this present study is to focus the role of rule of law in determining the CO_2 emissions as law and order are very important if a country want clean environment. Because, the tough rules and regulation regarding pollution emissions may protect and guarantee a clean environment. Considering above arguments, we may choose the following model.

$$COPC_t = f(GDPC_t, RL_t, ECPC_t) \quad (1)$$

Here, $COPC_t$ is natural log of per capita CO_2 emissions, $ECPC_t$ is natural log of per capita energy consumption, $GDPC_t$ is natural log of per capita GDP and RL_t is rule of law variable. All data is covering maximum available time range of years 1996-2014 and is sourced from World Bank (2019). We expect the positive effects of $GDPC_t$ and $ECPC_t$ and negative effect of RL_t on the $COPC_t$.

After deciding the model, we need to check the unit-root in every series. To serve this, we follow the Dickey and Fuller (1981) methodology in following way:

$$\Delta x_t = \beta x_{t-1} + \sum_{i=0}^{p} b_i \Delta x_{t-i} + \psi_t \quad (2)$$

$$\Delta x_t = \alpha + \beta x_{t-1} + \sum_{i=0}^{p} b_i \Delta x_{t-i} + \psi_t \quad (3)$$

$$\Delta x_t = \alpha + \gamma T + \beta x_{t-1} + \sum_{i=0}^{p} b_i \Delta x_{t-i} + \psi_t \quad (4)$$

x is capturing every individual variable of equation 1 to test unit-root. Coefficient β value zero would specify the unit-root and stationary series may be assumed otherwise. Following same way of equation 1, we may incorporate the intercept and trend in equations 3 and 4. After determining the stationarity, we moved to Autoregressive Distributive Lag (ARDL) of Pesaran et al. (2001) to find the cointegration and long and short relationships. The ARDL of equation 1 is as follow:

$$\Delta COPC_t = \delta_0 + \delta_1 COPC_{t-1} + \delta_2 GDPC_{t-1} + \delta_3 RL_{t-1} + \delta_4 ECPC_{t-1} + \sum_{j=1}^{q} \varphi_{1j} \Delta COPC_{t-j} + \sum_{j=0}^{p} \varphi_{2j} \Delta GDPC_{t-j} + \sum_{j=0}^{q} \varphi_{3j} \Delta RL_{t-j} + \sum_{j=0}^{p} \varphi_{4j} \Delta ECPC_{t-j} + \omega_{it} \quad (5)$$

Equation 5 may be regressed after choosing the optimum lag length and bound test would be applied to corroborate the cointegration in the equation. Afterwards, we would test the diagnostic to check the econometric health of equation 5. If cointegration is proved, then we can obtain the long run effects. Thereafter, we may regress the equation 6 to confirm the short run relationship in the system of chosen model and would have the short run effects as well.

$$\Delta COPC_t = \delta_0 + \delta_1 ECT_{t-1} + \sum_{j=1}^{q} \varphi_{1j} \Delta COPC_{t-j} + \sum_{j=0}^{p} \varphi_{2j} \Delta GDPC_{t-j} + \sum_{j=0}^{q} \varphi_{3j} \Delta RL_{t-j} + \sum_{j=0}^{p} \varphi_{4j} \Delta ECPC_{t-j} + \omega_{it} \quad (6)$$

The following section showed the application of all discussed methodology in this section.

4. DATA ANALYSES AND DISCUSSIONS

Table 1 showed unit-root results following Dickey and Fuller (1981). Dependent and independent variables are nonstationary at level. However, all the first differenced variables are stationary. So, order of integration is one in the analyses and we should move to the cointegration analysis.

Table 2 showed the chosen ARDL model's results. At first, the bound test showed that estimated F-value is sufficiently high to corroborate the cointegration in the estimated equation 4. To confirm its econometric validity, the diagnostic tests are run and we found that all tests' estimated values are sufficiently low and their P values are sufficiently high. So, model is passed in the diagnostic tests. Moreover, CUSUM and CUSUMsq in Figure 1 also validate the stability of estimates.

Table 2 showed long-run effects and GDP per capita has no effect. This result contradicts the positive contribution of income on the CO_2 emissions mentioned by Mahmood and Alkhateeb (2017) and Mahmood et al. (2018). This result signifies the importance of including institutional quality indicator in the CO_2 emissions model as institutional quality has removed the negative environmental effects of growth. Further, energy consumption has positive influence on the CO_2 emissions with a coefficient 1.7164. It means that 1% change in energy consumption per capita has 1.7164% change in CO_2 emissions. The result confirms a fact that most of Saudi energy consumption is from fossil-fuel and increasing fossil-fuel is responsible for pollution emissions. This Result matches with the results of Mahmood et al. (2018). This result also realizes the importance of renewable and clean energy consumption. Saudi Arabia has recently put efforts to have solar and other clean energy consumption. But, this result inforce to have further transformation toward clean energy instead of fossil-fuel. It has further implication that fossil-fuel users should pay for its use and the collected revenues can be provided to the clean energy users for an appreciation. This regulation may appreciate the use

Table 1: Stationarity test

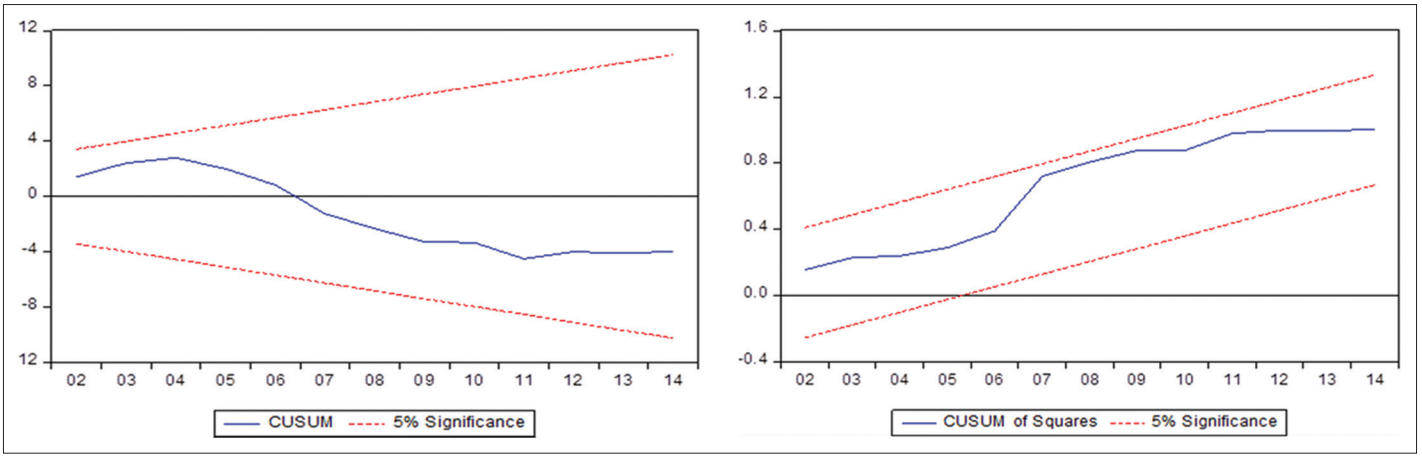
Variable	C	C&T	None
$COPC_t$	−0.9345	−2.3949	1.4682
$GDPC_t$	0.8008	−0.6242	−2.4460
RL_t	−1.9065	−2.2735	−3.2775
$ECPC_t$	2.0058	−0.8790	−1.8412
$\Delta COPC_t$	−2.9911*	−3.5680*	−4.1159*
$\Delta GDPC_t$	−3.1633*	−3.2510*	−3.6507*
ΔRL_t	−3.4367*	−3.3002*	−3.5693*
$\Delta ECPC_t$	−6.2654*	−9.5895*	−9.3550*

*shows stationary

Table 2: ARDL cointegration results

Variable	Coefficient	Std. error	t-statistic	Prob.
Long run				
$GDPC_t$	−0.4799	0.7698	−0.6234	0.5438
RL_t	−1.1637	0.5022	−2.3173	0.0374
$ECPC_t$	1.7164	0.3979	4.3136	0.0008
Intercept	−7.2328	5.6511	−1.2799	0.2230
Short run				
$\Delta GDPC_t$	−0.2774	0.4255	−0.6519	0.5258
ΔRL_t	−0.6726	0.2313	−2.9080	0.0122
$\Delta ECPC_t$	0.9921	0.2314	4.2871	0.0009
ECT_{t-1}	−0.5780	0.1607	−3.5974	0.0032
Diagnostic tests				
Bound test	F-value = 5.2656			
Heteroscedasticity	F-value = 0.5818			0.6812
Serial correlation	F-value = 1.2514			0.3238
Normality	Chi-square = 0.7965			0.6715

Figure 1: CUSUM and CUSUMsq tests



of clean energy. Alternatively, Saudi government has increased the prices of fuel and electricity which may reduce the fossil-fuel usage but its results may be expected in the longer run because the positive outcomes cannot be achieved immediately.

Further, the rule of law showed a negative effect. It means that increasing rule of law could reduce emissions. This result corroborates the findings of Ali et al. (2019) in case of a panel of 47 developing countries, Wu (2017) in case of a panel of 167 countries and Lau et al. (2014) in case of Malaysia. Our estimated parameter of rule of law is 1.1637 which shows that 1% increase in index of rule of law may reduce the 1.1637% of CO_2 emissions per capita. This result showed that response of decreasing CO_2 emissions per capita is even sharper than that of increasing rule of law. This result corroborated the strong institutional quality of the Saudi Arabia. If government puts more emphasis on the rule of law, then the cleaner environment would be achieved at faster rate as per our elastic results of this research. Moreover, Saudi government targets the clean production in the long run plans. Our results corroborated the government efforts at first and also appreciated government efforts to settle the strong law and order situation in the country. Secondly, further efforts to ensure the strong rule of law may also further improve the environment consequently.

The parameter, −0.5780, of ECT_{t-1} showed a negative and significant value so short run relationship is proved in the analyses. Moreover, a speed of converge at a rate 0.578 is corroborated and model needs less than two years to be settle on the long run path once face any disequilibrium. GDP per capita has again insignificant influence during short-run. Energy usage has positive influence on the CO_2 emissions with a coefficient 0.9921. Though, its elasticity is lower than that of long run but 1% increase in energy consumption is responsible for 0.9921% increase in CO_2 emissions. The result corroborated again the fact of use of most of fossil-fuel. So, there is dire need to change the energy composition towards the cleaner sources. This result also showed that increasing fuel price policy of government could not affect the pollution emissions in the short run and it needs longer time to be effective. Further, cleaner energy consumption should be accelerated by the government efforts to have pleasant environmental effects of energy consumption.

Lastly, the rule of law again showed negative influence on the CO_2 emissions. The elasticity parameter significantly declines in the short run though effect remains negative. It corroborated the fact that rule of law can't produce faster environmental effects which it can perform in the longer run. But, the negative effects again appreciated the government efforts towards law and order situation in the country. Moreover, 1% increase in index of rule of law can decrease the 0.6726% of pollution. Hence, the rule of law produces positive environmental effects.

5. CONCLUSIONS

Law and order are very important for any country's progress and to achieve any target including the target of cleaner production and environment. This research examined the influence of rule of law on emissions considering other important determinants like income and energy consumption using a period 1996-2014 and ARDL cointegration technique. The results corroborated income has an insignificant but energy usage has positive influence on pollution and 1% change of energy usage has 1.7164% change in pollution. The result proves a fact of using most of fossil-fuel and realizes the importance of renewable energy. Though, Saudi Arabia is planning to have more-cleaner energy production. Still, there is need to transform the economy toward cleaner energy from fossil-fuel.

We recommend to put penalty to the fossil-fuel users and to provide financial incentive for clean energy users to appreciate the use of cleaner energy. The rule of law has a positive environmental consequences during long-run as per our result and 1% increase in index of rule of law could reduce 1.1637% of pollution. This corroborated the strong institutional quality and law and order situation of the Saudi Arabia and we also recommend to put more emphasis on the rule of law to achieve more cleaner environment.

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