

SHORT COMMUNICATION

Environmental Pollution a Negative Externality from China Pakistan Economic Corridor (CPEC): Policy implications for Pakistan

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Introduction

The China-Pakistan Economic Corridor (CPEC) is considered as the 'flagship' project of China's Belt and Road Initiative (BRI) and has been widely acclaimed by both Chinese and Pakistani officials often terming it as 'game-changer' to overcome Pakistan's lingering issues of energy and economic crisis. Within the framework of CPEC, China is investing more than 56 billion US dollars as Foreign Direct Investment (FDI) in various energy and infrastructure projects including a vast network of railways, highways, economic zones and gas pipelines. While much has been debated and written about various projects under CPEC in the existing academic discourses, vis-à-vis threats to the biodiversity (Nabi *et al.*, 2017), its potential implications to environmental hazards (Ali, 2018) and to overcome energy shortfall of Pakistan (Kugelman, 2017). However, scientific study to reinforce the issues of environmental pollution, particularly related to CPEC coal-based energy projects have been still lacking.

The pertained literature on CPEC consisted qualitative studies to inspect and judge different aspects such as importance of CPEC for both countries and its effects on geo political of South Asia. Challenges for CPEC in Pakistan, South Asia and foreign policy between China-Pakistan), as Nan, (2015) explained that this project is not only valuable for Pakistan and China, but it is also beneficial for the global economy by including several other countries. Furthermore, Li and Sun, (2015) and Irshad, etal, (2015) reported the importance of CPEC and it long and short-term benefits for both countries. Further, Hussain and Khan (2017) also stated that it will enhance the cooperation between two countries and advantageous for Chinese, Middle Eastern and South Asian people (Ali, 2016). Further, Wolf, (2017) explained the insights, potentials and challenges concerning CPEC and domestic level cooperation between China and Pakistan.

In addition, quantitative studies focused to shed a light on the impact of China Pakistan Economic Corridor (CPEC) (Such as, impact on gdp, socio-economy, trade, stock market, energy sector and infrastructure). CPEC will build rails and roads infrastructure and

infrastructure development may decrease the poverty and increases the agriculture development in Pakistan (Ahmed & Mustafa, 2016). Most recent article examined the impact of CPEC impact on energy (energy consumption and energy saving potential) in the prospect of Pakistan (Mirza, Fatima, Ullah, 2019). A latest study surveyed in Pakistan and their research results shows that entrepreneur's attitude and intentions to China and Pakistan Economic Corridor (CPEC) development is positive, it means CPEC project also designing an entrepreneurial environment (Kanwal et al., 2019).

A large number of studies (Begum, et al., 2015; Ozturk, and Acaravci, 2010) have discussed various elements and causes of CO₂ emissions. Similarly, many researches (Khurshid, et al., 2018; Hadi, et al., 2018; Hussain, 2017; Hussain, 2015) on Pakistan-China relations in the context of economy, society and geopolitical point of view. Present study is aimed to investigate the CPEC development effects i.e. gross domestic product (*gdp*), foreign direct investment (*fdi*), trade openness (*top*), energy consumption (*enguse*) on environmental pollution (CO₂) in Pakistan using FMOLS and DOLS methods.

Materials and Methods

Initially, this study applied Augmented Dicky Fuller (ADF) and Phillips Perron (PP) tests for detecting the unit root in the data. ADF test is the extended form of Dicky and Fuller tests (1979, 1981), which is extended by Dicky and Fuller by introducing lagged value of the dependent variable to remove autocorrelation (Asteriou and Hall, 2007). This test assumes the constant variance of error term and uncorrelated error term. In equation form it is written as:

$$\Delta Y_{t-1} = \beta_1 + \beta_{2t} + \sum_{i=1}^p \alpha_i \Delta Y_{t-1} + \mu_t$$

Similarly, the second test used to detect stationarity is the test developed by Phillips and Perron (1998) test shortly written as PP test. PP test is the reform of t statistics in ADF test and it take into account the less restrictive nature of the error process (Asteriou and Hall, 2007).

Table 1 Unit root results.

variables	Intercept		Intercept & trend	
	level	1st difference	level	1st difference
Augmented Dicky Fuller Test Statistic				
<i>gdp</i>	1.086992 (0.9960)	-3.398641 (0.0223)	-3.564703 (0.0558)	-3.683558 (0.0454)
<i>fdi</i>	-2.761718 (0.0777)	-3.370614 (0.0217)	-2.671947(0.2549)	-3.327720(0.0840)
<i>enguse</i>	0.375696 (0.9780)	-4.797507(0.0007)	-1.514376(0.7992)	-5.349401 (0.0010)
<i>CO₂</i>	-1.519529(0.5087)	-4.826022(0.0007)	-0.676296(0.9649)	5.378054 (0.0010)
<i>top</i>	-1.544643 (0.4963)	-2.400884(0.3708)	-6.354414(0.0000)	-6.344303 (0.0001)
Phillips-Perron Test Statistic				
<i>gdp</i>	3.059424 (0.0420)	-6.498925(0.0000)	-3.076820 (0.1316)	-6.433451(0.0001)
<i>fdi</i>	-2.090487 (0.2497)	-3.406713(0.0200)	-2.022708 (0.5633)	-3.366766(0.0780)
<i>enguse</i>	0.375696 (0.9780)	-4.796175(0.0007)	-1.467173 (0.8159)	-5.349401(0.0010)
<i>top</i>	-1.544643 (0.4963)	-6.354414 (0.0000)	-2.409669 (0.3667)	-6.344303 (0.0001)
<i>CO₂</i>	-1.498359(0.5192)	-4.866675 (0.0006)	-0.827741 (0.9502)	-5.349733 (.0010)

$$\Delta Y_{t-1} = \alpha + \Delta \beta Y_{t-1} + \varepsilon_t$$

Later, Fully Modified Least Square Method (FMOLS) is used to inspect the effects of the explanatory variables on environmental pollution. In addition, Dynamic Least Square Method (DOLS) was also used during this study.

Model Specification

The theoretical model is given below

$$CO_2 = f(gdp, fdi, top, enguse)$$

Alternatively, it is written as

$$CO_{2t} = \beta_0 + \beta_1 gdp + \beta_2 fdi + \beta_3 top + \beta_4 enguse + \mu_t$$

Results and Discussion

The results reveal that growth (Agugliaro et al., 2013; Lee and Brahmarsene, 2014; Oztruk and Bilgili, 2015) and energy (Sbia, et al., 2014; Wanget al., 2014) are influential factors of environmental pollution in Pakistan (Table 2). However, some studies also found a negative relationship among energy consumption and growth (Asafu-Adjaye, 2000; Mehrara and Musai, 2012; Shahbaz and Rahman, 2012; Ali, et al., 2013; Kumar and Kumar, 2013). The effect of foreign direct investment and trade openness is positive but their effect is in significant. However, Bakhsh et al. (2017) suggest the key role of foreign direct investment in CO₂ emissions.

The results reveal that the study recent inflow of foreign direct investment from China would enhance environmental pollution in Pakistan. The results of the

Table 2 Estimation results.

Variables	FMOLS		DOLS	
	Coefficients	Probability	Coefficients	Probability
<i>gdp</i>	0.001393	0.0000	0.001175	0.0028
<i>top</i>	0.005442	0.0893	0.002815	0.4861
<i>fdi</i>	0.011407	0.3261	0.019062	0.2585
<i>enguse</i>	0.010115	0.0006	0.007332	0.0492
<i>R-squared</i>	0.871265		0.985789	
<i>N</i>	28		28	

By following the previous studies (Merit and Boluk, 2016; Oztruk and Bilgili, 2015; Wang et al., 2014) CO₂ emissions were chosen as a proxy for environmental pollution. The proxy for economic growth (*gdp*) is natural log of gross domestic per capita. Likewise, the proxy for openness (*top*) in economy is trade as percentage of the GDP and lastly for inflow of foreign direct investment the present study uses foreign direct investment as a percentage of GDP. The main source of the data is World Development Indicators (WDI).

DOLS show that 1% increase in growth will increase the environmental pollution by 0.0014%. Though, the effect is small but its effect is significant. However, this effect will increase in future due to higher economic growth in Pakistan. Similarly, the role of energy consumption is also effective and an increase in consumption of energy have significant impact on the pollution in Pakistan. On the other hand, the effect of foreign direct is not significant but its effect is positive increasing the environmental pollution in Pakistan (Muhammad et al., 2019; Bakhsh et al., 2017). The

effect of open trade policies have also positive influence on the pollution. Earlier workers also observed that trade openness increases the CO₂. The researches of (Zafar et al. 2019; Shahzad et al. 2017; Sbia et al., 2014).

Lastly, the results of the present study show the negative effects of energy on environment pollution. Similarly, the empirical studies (Tariq et al., 2019; Mert and Boluk; 2016; Wanget al., 2014) have also shown that higher CO₂ emissions are caused due to energy consumption.

Conclusion

The results of the present study show the negative effects of energy on environment pollution. Therefore, the rise in energy consumption in future would further deteriorate the environment in Pakistan. Thus, to overcome the environmental issues, it is necessary to consider the sustainable development as a priority to ensure in the policymaking and implementation environmental sustainability in the country.

References

Ali, S., Ali, A., Amin, A. (2013). The impact of population growth on economic development in Pakistan. *Middle-East J. Sci. Res.*, **18**(4), 483–491.

Ali, A. (2016). China Pakistan Economic Corridor: Prospects and challenges for regional integration. *Arts and Social Sciences Journal*, **7**(4), 1-5.

Agugliaro, F. M., Alcayde, A., Montoya, F. G., Sierra, A. Z., Gil, C. (2013). Scientific production of renewable energies worldwide: An overview. *Renewable and Sustainable Energy Reviews*, 134-143.

Asafu-Adjaye, J. (2000). The relationship between energy consumption, energy prices and economic growth: Time series evidence from Asian developing countries. *Energy Economics*, **22** (6), 615–625.

Asteriou, D., Hall, S. G. (2007) Applied econometrics: A modern approach. Revised ed. New York: Palgrave Macmillan, . PMCid: PMC1868797.

Ali, M. (2018). Pakistan's quest for coal-based energy under the China-Pakistan Economic Corridor (CPEC): Implications for the environment. *Environmental Science and Pollution Research*, **25**, 31935-31937.

Bakhsh, K., Rose, S., Ali, M.F., Ahmad, N., Shahbaz, M. (2017). Economic growth, CO₂ emissions, renewable waste and FDI relation in Pakistan: New evidences from 3SLS. *Journal of Environmental Management*, **196**, 627-632.

Begum, R. A., Sohag, K., Abdullah, S. M. S., Jaafar, M. (2015). CO₂ emissions, energy consumption, economic and population growth in Malaysia. *Renewable and Sustainable Energy Reviews*, **41**, 594-601.

Davidson, R., MacKinnon, J. G. (2004). *Econometric Theory and Methods*. New York: Oxford University Press. 623 pages.

Hadi, N. U., Batool, S., Mustafa, A. (2018). CPEC: An opportunity for a prosperous Pakistan or merely a mirage of growth and development. *The Dialogue*, **13**(3), 295-231.

Hussain, E. (2015). *China–Pakistan economic Relations*.<https://dailytimes.com.pk/101508/pakistan-china-economic-relations>.

Hussain, M. (2017). *China Pakistan Economic Corridor (CPEC): Challenges and the way forward*. Naval Postgraduate School. California: Monterey.

Hussain, S., Khan, A. M. (2017). CPEC; A road map of region's development. *FWU Journal of Social Sciences*, 52-59.

Irshad, M. S., Xin, Q., Arshad, H. (2015). One Belt and One Road: Does China-Pakistan Economic Corridor benefit for Pakistan's Economy? *Journal of Economics and Sustainable Development*, **6**, 200-2007.

Khurshid, D. M., Rashid, A., Zahid, A. (2018). Proceedings of the international conference on renewable, applied and new energy technologies. ICRANET2018 (194-199). Islamabad, Air University.

Kumar, R., Kumar, R. (2013). Effects of energy consumption on per worker output: A study of Kenya and South Africa. *Energy Policy*, 1187–1193.

Kanwal, S., Pitafi, A. H., Nadeem, M. A., Younis, A., Chong, R. (2019). China–Pakistan Economic Corridor (CPEC) development projects and entrepreneurial potential of locals. *Public Affairs*, 1-12.

Kugelman, M. (2017). The China-Pakistan Economic Corridor: What it is: How it is perceived, and implications for energy and geopolitics. In Downs E, Herberg, M. E., Kulgleman, M., Len C., Yu, K. (eds.). *Asia's energy security and China's Belt and Road Initiative*. The National Bureau of Asian Research, Washington, DC. 15-28.

Li, X., Sun, L. (2015). The strategic value and security situation of the China-Pakistan economic corridor *Frontiers*, **12**, 5 pages.

- Lee, W. J., Brahmastre, T. (2014). Investigating the influence of tourism on economic growth and carbon emissions: Evidence from panel analysis of the European Union. *Tourism Management*, 69-76.
- Mert, M. Bölük, G. (2016). Do foreign direct investment and renewable energy consumption affect the CO₂ emissions? New evidence from a panel ARDL approach to Kyoto Annex countries. *Environmental Science and Pollution Research*, **23** (21), 21669-21681.
- Mehrara, M., Maysam, M. (2012). Energy consumption, financial development and economic growth: An ARDL approach for the case of Iran. *Int. J. Bus. Behav. Sci.*, **2** (6), 92–99.
- Mirza, F. M., Fatima, N. Ullah, K. (2019). Impact of China-Pakistan economic corridor on Pakistan's future energy consumption and energy saving potential: Evidence from sectoral time series analysis. *Energy Strategy Reviews*, 34-46.
- Muhammad, F., Karim, R., Qureshi, J. A., Razzaq, N., Zahra, M., Ali, I. (2019). Environmental degradation, quality of institutions and tourism: New evidence from Pakistan. *International Journal of Economic and Environmental Geology*, **10** (3), 125-128.
- Nabi, G., Khan, S., Ahmed, S., Khan, A., Siddique, R. (2017). China-Pakistan Economic Corridor (CPEC): An alarming threat to the biodiversity of northern Pakistan. *Biodiversity and Conservation*, **26**, 3003-3004.
- Nan, G. (2015). *Opening Ceremony of the International Academic Symposium on CPEC*. Peking University. Beijing: Office of International Relations.
- Ozturk, I., Acaravci, A. (2010). CO₂ emissions, energy consumption and economic growth in Turkey. *Renewable and Sustainable Energy Reviews*, **14** (9), 3220-3225.
- Ozturk, I. & Bilgili, F. (2015). Economic growth and biomass consumption nexus: Dynamic panel analysis for Sub-Saharan African countries. *Applied Energy*, **137**, 110-116.
- Pasha, H.A. (2019). Growth and inequality in Pakistan: Agenda for Reforms. Friedrich –Ebert- Stiftung (FES), Pakistan. ISBN: 978-969-9675-16-4.
- Phillips, P. C. B., Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, **75**, 335–346.
- Riaz, A., Mustafa, U. (2016). Impact of CPEC Projects on Agriculture Sector of Pakistan: Infrastructure and Agricultural Output Linkages. *AGM32* Islamabad: PSDE, 31 pages.
- Shahzad, S. J. H., Kumar, R. R., Zakaria, M, Hurr, M. (2017). Carbon emission, energy consumption, trade openness and financial development in Pakistan: A revisit. *Renewable and Sustainable Energy Reviews*, **70**, 185-192.
- Sbia, R., Shahbaz, M., Hamid, H. (2014). A contribution of foreign direct investment, clean energy, trade openness, carbon emissions and economic growth to energy demand in UAE. *Econ Model*, **36**, 191–197.
- Shahbaz, M., Rahman, M. M. (2012). The dynamic of financial development, imports, foreign direct investment and economic growth: Cointegration and causality analysis in Pakistan. *Glob Bus Rev.*, **13**(2), 201–219.
- Tariq, M., Xu, Y., Muhammad, F., Alam, K. M. (2019). The dirty energy dilemma via financial development and economic globalization in Pakistan: New evidence from asymmetric dynamic effects. *Environmental Science and Pollution Research*, **26** (25), 25500-25512.
- Wolf, S. O. (2017). China-Pakistan Economic Corridor and its impact on regionalisation in South Asia. *Contemporary South Asian Studies*, 99-112.
- Wang, S., Fang, C., Guan X., Pang, B., Ma, H. (2014). Urbanization, energy consumption, and carbon dioxide emissions in China: A panel data analysis of China's provinces. *Appl. Energy*, 738–749.
- Zafar, M. W., Mirza, F. M., Zaidi, S. A. H., Hou, F. (2019). The nexus of renewable and nonrenewable energy consumption, trade openness, and CO₂ emissions in the framework of EKC: Evidence from emerging economies. *Environmental Science and Pollution Research*, **26** (15), 15162–15173.