Evaluating industrial competitiveness strategy in achieving environmental sustainability

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Abstract

Purpose – This study has incorporated competitiveness by considering it a significant factor behind determining as well as moderating industrial value added in the environmental Kuznets curve (EKC) framework. This study aims to explore the moderating role of competitiveness policy in EKC with an aim to promote business led sustainability at national level.

Design/methodology/approach – Considering the environmental deterioration aspect of industrialization, this study tests the existence of EKC for SAARC countries using the data from 1996 to 2021 using second-generation static panel data model.

Findings – Estimated results have validated that moderating effect is responsible for improving environmental sustainability in SAARC countries. Furthermore, population density is responsible for increasing while trade openness is responsible for decreasing carbon emissions.

Originality/value – Higher industrial activities are a symbol of upward-moving economic growth. But its other impact is in the form of environmental deterioration. However, the relationship between industrialization and environmental quality can be identified through EKC.

Keywords Environmental quality, Environment Kuznets curve, Industrialization, Globalization, Business competitiveness

Paper type Research paper

1. Introduction

Before development and industrialization, humans enjoyed intangibles like peace, fresh air, forest cover and natural foods. The initial phase of human development led to the depletion of such intangibles. Now the current issues faced by humans are the effects of environmental degradation on human life, which are evident from the huge difference between the life expectancy from the time of Adam and Eve to the present (Dockery and Pope, 1996; Murphy, 2003). This pressing issue has made governments think about making processes more sustainable. The magnitude of current efforts to slow down and reverse environmental deterioration can be assessed from the United Nations' 8th

JEL classification – Q55, Q56

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Millennium Development Goal and 13th to 15th Sustainable Development Goals (Drabo, 2010) [1].

A global increase in industrialization is responsible for the deterioration of environmental quality (Wang and Liu, 2017). The theoretical relationship between industrialization and environment is understood from the work of economic development and income inequality (Kuznets, 1955, 1979) and known as environmental Kuznets curve (EKC), whereby industrialization would initially be profitable businesses experience leading to expansion in it and creating jobs and production. The consequence of unrestricted growth is realized in terms of increased CO_2 emissions. Later, businesses develop environment-friendly processes leading to higher industrialization (Ahluwalia, 1976; Fields and Jakubson, 1994). Within this background, the EKC phenomenon has been widely tested by empirical studies using economic growth and environmental quality (Özokcu and Özdemir, 2017; Sinha and Shahbaz, 2018; Usman *et al.*, 2019; Altıntaş and Kassouri, 2020; Arshed *et al.*, 2021a, 2021b).

There are some other factors as well, which are responsible for influencing carbon emissions. So, the demographics and composition of an economy are always crucial (Iqbal *et al.*, 2021). An increase in population puts demand pressure on businesses which may lead to pollution (Meng and Han, 2016; Rahman, 2017; Baloch *et al.*, 2018; Dong *et al.*, 2019; Qi, 2020; Illa, 2022). This demand can be met by trade relations to increase production, which leads to increased environmental deterioration (Ibrahim, 2022). But the other side of the picture is the opposite. Countries with efficient foundations regarding clean production trade openness do not harm environmental quality (Khan *et al.*, 2022).

The industrial sector in South Asian association for regional cooperation (SAARC) countries varies by country, but overall, the region has seen significant growth in the industrial sector in recent years (Sawhney, 2010). Despite the increase in the industrial sector, there are challenges that SAARC countries face, such as insufficient infrastructure, inadequate access to financing and a need for more skilled labor (Pandey and Mishra, 2015). Additionally, there are concerns about the environmental impact of industrialization and the need to promote sustainable development (Jadoon, 2021; Rehman and Zeb, 2020). For the attainment of sustainable industrialization, competition is significant (Singh, 2019). It can improve the quality of products besides efficiency in the production process, which leads to less harmfulness to the environmental quality (Khan *et al.*, 2021).

Competition in the industrial sector can drive innovation in SAARC countries, leading to the developing of new technologies and processes that reduce environmental impacts (Pérez *et al.*, 2018). In SAARC countries, this could involve implementing energy efficiency measures in manufacturing processes, optimizing supply chains to reduce transportation emissions or adopting closed-loop manufacturing processes that recycle materials and reduce waste (Jain and Goswami, 2021). Efficiency gains and innovation can lead to cost savings for companies in SAARC countries, making them more competitive in the market. However, it is important to note that cost savings should not come at the expense of environmental sustainability or social welfare (Touré, 2021).

By considering competitiveness within the different sectors of the economy, our study proposes that certain government policies in motivating business competitiveness can influence this EKC threshold so that the expansion of production may lead to a fall in CO_2 emission. For this purpose, global competitiveness index provides an evaluation of competitiveness of economies with the rest of the world [2]. So, prominent role of competitiveness is crucial because it can directly moderate the industry (Grabowska and Saniuk, 2022). It provides a platform where a country can innovate their industry through competition (Schwab and Sala-i-Martin, 2016; Arshed *et al.*, 2022a, 2022b, 2022c). Moreover,

competitiveness can be effective for improved products and environmental quality (Liu *et al.*, 2022).

The prime objective of this study is to test whether there exists an EKC explaining the nonlinear effect of industrialization on CO_2 emissions. Second, this study determines whether competitiveness intervention policy can be used to reduce net CO_2 emissions. The presence of this competitiveness moderator helps us to attain environmental sustainability.

After comprehensively introducing the subject matter, this study is divided into several parts. The second section is about the literature review to understand existing debates and to identify the literature gap. The third section explains the variables and sample to understand the meaning and source of the selected variables, the models to be estimated and the research technique. The fourth section explains and discusses the estimated results. The last section concludes the study's major findings along with some policy implications.

2. Literature review

The concept of EKC is derived from the Kuznets curve proposed by Kuznets (1955, 1979). It describes the relationship between income inequality and economic growth. Later, the work on EKC was started with the work by Grossman and Krueger (1991) later, followed by Selden and Song (1994) and Stern *et al.* (1996). Now, this theory is being widely tested in the literature. There are several empirical studies like Carson *et al.* (1997), Grossman and Krueger (1991, 1995), Panayotou (1993, 1995), Selden and Song (1994) and Vincent (1997) which point out the absence of carbon dioxide emissions–based EKC.

Different empirical studies have different opinions regarding the EKC. Some studies believe it is U-shaped, while others argue it is inverted U-shaped. First, those studies being discussed which have authenticated inverted U-shaped EKC. Shahpouri *et al.* (2016) have selected 54 development-wise countries, and Lorente and Álvarez-Herranz (2016) have selected organization for economic co-operation and development countries. Atasoy (2017) has selected 50 states of the USA, and Zaied *et al.* (2017) have selected 12 Middle East and North African (MENA) countries. Sirag *et al.* (2018) have considered different income group countries, and Raza and Shah (2018) have taken G7 countries. Koilo (2019) has taken 11 emerging economies, and Kong and Khan (2019) have worked on 14 developed and 15 developing countries. Chu (2020) has taken panel data from 118 countries. Altıntaş and Kassouri (2020) have selected 14 European Union countries. Other empirical studies found U-shaped EKC among them; Dietz *et al.* (2012) for the panel data of 58 countries, and Sahli and Rejeb (2015) for 21 MENA countries. Ota (2017) selected 20 Asian countries. Baloch *et al.* (2018) for Pakistan. Arshed *et al.* (2021a, 2021b) for 80 development-wise categorized countries. Chaudhry *et al.* (2022) validated U and inverted U-shaped EKC for organization of Islamic countries.

Recently, several studies have covered the EKC in their way. Ghaderi *et al.* (2023) have confirmed bot U and inverted U-shaped EKC and highlighted the role of tourists in environmental sustainability. Wang *et al.* (2023) have established an inverted U-shaped EKC at the world level. Yan *et al.* (2023) have validated inverted U-shaped EKC using industrialization. This leads to development of hypothesis if industrialization with context of EKC:

- H_{o1}. Industrialization does not have a positive effect on CO_2 emissions below a certain threshold.
- H_{o2}. Industrialization does not have a negative effect on CO_2 emissions after a certain threshold.

Literature highlights the mixed evidence regarding population density and environment quality. Meng and Han (2016) have found a positive causal relationship between population density and carbon emissions. Rahman (2017) has found that population density is damaging the environment in most populous countries of Asia. On the other hand, Ibrahiem (2016) and Baloch *et al.* (2018) reveal that population density decreases carbon emissions or improves the environment in Egypt and Pakistan. Dong *et al.* (2019) and Qi (2020) have found a positive relationship between population density and carbon emissions in China. Rahman and Alam (2021) and Hussain *et al.* (2022) also believe that population density deteriorates the environment quality in Bangladesh and China. Finally, Lewis growth model discusses the rural excel labor absorbing ability of urban centers with the industrialization (Todaro and Smith, 2009) leading to increase in population density in urban centers. This complex nature of relationship requires this factor to be controlled while assessing the effect of industrialization on CO_2 emissions. This led to development of third hypothesis of the study:

H_{o3}. Population density does not have an effect on CO_2 emissions.

With the passage of time, the importance of international trade is increasing. So, it impacts environmental quality, but interestingly, it heterogeneously affects different regions. Sun *et al.* (2019) have validated the environmental destructive and environmental improving aspects of trade openness. Consistent with their findings, belt and road, high-, middle- and low-income countries are the victims of trade openness. While in East Asia, the situation is opposed. According to Wang and Zhang (2021), trade openness is found responsible for environmental deterioration only in lower-income countries, while in high-, upper-middle and lower-middle-income countries, it has the opposite impact. Ibrahim (2022), Wang *et al.* (2022) and Muhammad *et al.* (2022) have found that trade openness is responsible for environmental worsening. Khan *et al.* (2022) have validated that trade openness has the potential to improve environmental quality. This led to development of fourth hypothesis:

H_{o4}. Trade openness does not have an effect on CO_2 emissions.

The main emphasis of our study revolves around competitiveness and industry. Studies like Porter and Van der Linde (1995) and later on Sinyak and Petrov (2009) provided that regulating competitiveness defines how competitiveness would influence the environment. Goldar *et al.* (2017) have found that reducing carbon emissions intensity affects 'India's export competitiveness. Oktris and Sitardja (2018) have collected a sample of non-financial companies and concluded that these companies are significant revelations of carbon emission via competition. Mohammad and Wasiuzzaman (2021) have highlighted the environmental demolition aspect of competitiveness of the firms in Malaysia. Adomako and Tran (2022) have discussed that competitiveness is positively related to the sustainable environmental strategy in Ghana. Moreover, they have also highlighted the role of competitiveness in mediating the relationship between financial performance and a sustainable environment. This leads to development of *H5*, *H6* and *H7*:

H_{o5}. Competitiveness does not have a negative effect on CO_2 emissions.

H_{o6}. Competitiveness does not have a negative effect on Industrialization – CO_2 emissions relationship below a certain threshold.

H_{o7}. Competitiveness does not have a negative effect on Industrialization – CO_2 emissions relationship above a certain threshold.

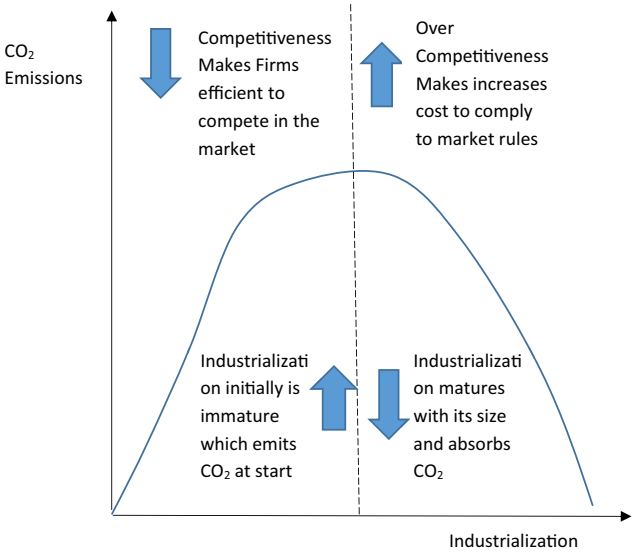
The present study contributes to the literature in a way that the above-discussed studies have used economic growth to test the EKC. But economic growth also contains sub-dimensions (like industrial, agricultural and services value addition), and our study has incorporated industrialization to test this theory. Determining as well as the moderating role of competitiveness has been incorporated. Studies like (Kalim *et al.*, 2019; Hassan *et al.*, 2020; Arshed *et al.*, 2021a, 2021b, 2022a, 2022b, 2022c) have related competitiveness with social development and economic productivity, which may hint that it could help in developing environment-protecting methods (Arshed *et al.*, 2022a, 2022b, 2022c). Specifically, the literature had not endorsed the role of competitiveness in attaining green sustainability. The main objective of integrating the moderator is to test the shifting of EKC or the attainment of environmental sustainability.

3. Data and methodology

3.1 Theoretical model

Kuznets proposed that with initial development, income inequality would increase later because of the trickle-down effect, development leads to a decrease in income inequality (Kuznets, 1955, 1979). This study has used the environmental Kuznets' curve hypothesis, where an increase in industrialization initially deteriorates the environment, and later on, it matures and becomes environment-friendly (Zaman *et al.*, 2016; Wang and Liu, 2017; Dong *et al.*, 2018; Usman *et al.*, 2019; Altıntaş and Kassouri, 2020; Arshed *et al.*, 2021a, 2021b; Chaudhry *et al.*, 2022). Figure 1 contains an inverted U-shaped where first phase represents environmental deterioration stage, while other is maturity stage, where improvement emerges.

Therefore, when we say that industrialization is responsible for deteriorating environmental quality, it means that the process of industrialization has had negative impacts on the environment, including pollution, deforestation and depletion of natural resources. Moreover, the use of fossil fuels in factories and transportation has caused air



Source: Figure by authors

Figure 1.
Theoretical model of EKC

pollution, which can lead to respiratory illnesses and contribute to climate change. This phase represents the beginning of industrialization. A continuous expansion in industrialization later becomes sustainable. However, industrialization can lead to improvements in environmental quality through implementing ecological regulations, technological advancements that reduce pollution and waste and shifts toward sustainable production methods. For this purpose, competitiveness can play its role (Arshed *et al.*, 2021a, 2021b).

This study assumes that with competitiveness, the maturity stage can be attained earlier. Further, to propose suitable policies, this study has incorporated a moderator of EKC, which is also mentioned in Figure 1. As discussed by; Oktris and Sitardja (2018), Mohammad and Wasiuzzaman (2021) and Adomako and Tran (2022), competition in the production sector can bring about product enhancement. To get ahead in the production race, firms would use updated and innovative techniques of production, which must also be energy efficient. As a result, environmental challenges can also be minimized. This way this study proposes that competitiveness policy can moderate the EKC curve.

Based upon the above-discussed theoretical framework, this study has proposed a regression equation to cover this study's objectives. CO_2 emissions is a dependent variable and representing environmental quality. Here, β_1 and β_2 are coefficients of industrialization and its square, respectively, while β_3 and β_4 are the coefficients of population density and trade openness, respectively, and these are the control variables. Further, β_5 is the coefficient of competitiveness. Finally, β_6 and β_7 are the coefficients of the cross-product of industrial value-added with competitiveness and its square, respectively. Finally, ξ is assumed to be a normally distributed error term of the model.

$$CO_2 = \beta_1 \text{IND} + \beta_2 \text{IND}^2 + \beta_3 \text{PDN} + \beta_4 \text{TOP} + \beta_5 \text{COM} + \beta_6 \text{IND*COM} + \beta_7 \text{IND}^2\text{*COM} + \xi \quad (1)$$

3.2 Variables and sample

To meet the objectives, we have selected secondary data, and all the variables are collected from World Development Indicators (WDI) from 1996 to 2021. Further, Table 1 contains name, symbol, definition and source of the selected variables. The unbalanced panel data is constructed for SAARC [3] countries.

The dependent variable is the carbon emissions per capita and the instrument for environmental quality. Several studies have used this instrument for environmental quality like Sugiawan and Managi (2016), Zoundi (2017), Katircioglu *et al.* (2018), Yao *et al.* (2019), Dogan and Inglesi-Lotz (2020), Hassan *et al.* (2021) and Salem *et al.* (2021). To test the existence of EKC, this study has used industrial value addition. Several studies have tried to

Table 1. Description of the variables

Variable (symbol)	Definition	Source
Environmental quality (CO_2)	CO_2 emissions in metric tons per capita	WDI
Industrialization (IND)	Industrial value-added as % of GDP	WDI
Population density (PDN)	Ratio of total population and land area	WDI
Trade openness (TOP)	Volume of trade as % of GDP	WDI
Competitiveness (GC)	Global competitiveness index	WEF

Source: Table by authors

sort out the same effort. Some recent studies are Hassan *et al.* (2021), Arshed *et al.* (2021a, 2021b) and Wang and Zhang (2021). Different studies have incorporated control variables as determinants of environmental quality. We have extracted population density as one of the determinants. A number of studies, including Ibrahiem (2016), Ribeiro *et al.* (2019), Rahman *et al.* (2020) and Qi *et al.* (2020), have proxied it as a determinant of environmental quality.

The evidence of competitiveness also exists in the literature, several studies have tested its role in carbon emissions, including Goldar *et al.* (2017) and Oktris and Sitardja (2018) have found a significant impact of competitiveness on environmental quality. Following Arshed *et al.* (2021a, 2021b, 2022a, 2022b, 2022c), this study has used it as a moderator of industrial-based EKC. For this purpose, β_6 and β_7 represent the interaction term of this policy moderator with industrialization and its square term, respectively.

3.3 Estimation technique

To estimate these regression equations, this study uses the Driscoll and Kraay fixed effect (Driscoll and Kraay, 1998) and feasible generalized ordinary least square (FGLS) methods. The benefit of using two econometric models helps to comprehend the reliability of the estimated coefficients. Both the estimated techniques are according to the nature of the data. Driscoll and Kraay fixed effect model provide robust standard errors for the presence of cross-sectional dependence (Işık *et al.*, 2019). While the FGLS model accommodates autocorrelation and heteroskedasticity (Javaid *et al.*, 2022). Studies like Hanif *et al.* (2020) and Arshed *et al.* (2022a, 2022b, 2022c) have used the quadratic specification with a moderator in their estimation equation.

4. Results and discussion

The descriptive analysis of the study is presented in Table 2, where 0.951 is the average carbon dioxide emissions per capita in South Asian countries, which is higher than its standard deviation, showing that in this region, countries have similar CO_2 emission pattern. The assessment of skewness and kurtosis values shows that the data is not statistically normal, but this study avails the central limit theorem to assume data to be asymptotically normal.

Table 3 confirms that the data has cross sectional correlation for all variables other than industrialization (IND). Furthermore, as the number of years is less than 20, this study can assume that the data is stationary (Pedroni, 2008), but it has cross sectional dependence. Hence, the Driscoll and Kraay model has been used, a robust second generation panel data analysis approach for cross sectional dependence in static panel data models.

For the estimated results using Driscoll and Kraay fixed effect and FGLS method, Table 4 is presented. Stimulatingly, both results present similar findings in terms of slope

Statistics	CO_2	IND	PDN	TOP	COM
Mean	0.951	24.428	501.504	56.059	4.071
Median	0.735	25.045	319.785	45.983	3.870
SD	0.845	8.917	463.592	31.277	0.619
Skewness	1.794	0.238	1.045	1.492	1.163
Kurtosis	6.114	2.514	2.942	4.825	3.496

Source: Table by authors

Table 2.
Descriptive statistics

coefficients, but the estimates of Driscoll and Kraay are preferred. Positive and negative coefficients of industrialization and its square reveal the inverted U-shaped EKC for South Asian countries. It implies that industry initially deteriorates the environment by releasing carbon emissions, but after a specific level, maturity emerges, and this sector becomes environment friendly. The cutoff value is 19.75, which shows that industrialized economies higher than 19.75% of gross domestic product (GDP) are experiencing the negative effect of industry on the environment. The literature contains evidence of inverted U-shaped relationships following some recent studies; Sirag *et al.* (2018), Raza and Shah (2018), Kong and Khan (2019), Mania (2020), Murshed *et al.* (2021) and Yan *et al.* (2023).

It is validated that population density is responsible for the environmental deterioration in selected South Asian countries. In this context, Meng and Han (2016), Rahman (2017), Dong *et al.* (2019) and Qi (2020) have found population density as an increasing determinant of carbon emissions.

Expansion in trade volume is responsible for environmental improvement in South Asian countries. Most literature supports the environmental descriptive aspect of trade openness, though the opposite evidence exists only for fiscally developed and stable countries. Keeping in view the findings of Sun *et al.* (2019), Wang and Zhang (2021) and Khan *et al.* (2022), trade openness can improve the environment quality.

Independently, competitiveness has been found responsible for environmental deterioration. However, competition among the productive units of the economy increases production hugely, and eventually, environmental quality starts to decline. These results are somewhat comparable with Mohammad and Wasiuzzaman (2021) and Adomako and Tran (2022). The negative coefficient of interaction terms of competitiveness and industrialization implies that expansion in both reduces the environmental challenges. In other words, higher competitiveness leads to decrease in CO_2 at each level of industrialization before threshold.

Variables	CD test	Prob.	corr	abs (corr)
CO_2	21.230	0.000	0.909	0.909
IND	−1.500	0.135	−0.076	0.387
PDN	22.800	0.000	0.976	0.976
TOP	3.660	0.000	0.238	0.534
COM	10.761	0.000	0.817	0.947

Source: Table by authors

Table 3. Cross sectional dependence test

	Driscoll–Kraay fixed effect			FGLS model		
Variables	Coeff.	Prob.	t-test	Coeff.	Prob.	z-test
IND	0.237	0.000	8.030	0.170	0.033	2.140
IND^2	−0.006	0.000	−6.740	−0.004	0.012	−2.510
PDN	0.003	0.000	14.990	0.003	0.000	8.900
TOP	−0.001	0.743	−0.340	−0.003	0.094	−1.670
COM	0.748	0.000	14.270	0.672	0.000	3.570
IND*COM	−0.066	0.000	−10.580	−0.056	0.003	−2.940
IND^2*COM	0.001	0.000	7.900	0.001	0.007	2.710
C	−2.937	0.000	−8.110	−5.249	0.000	−5.010

Source: Table by authors

Table 4. Panel estimated model

But interaction with the square term has a positive impact. This indicates that the ability of high industrialization to reduce environmental deterioration diminishes with the increase in the competitiveness. Thus, this model indicates the optimization of industrialization and competitiveness policy in achieving environmental sustainability.

A graphical presentation of moderating effect is accessible in Figure 2, where the solid line is EKC at low competitiveness and dotted line is the EKC with high competitiveness. Considerably, interaction term of competitiveness with industrialization is negative, and the interaction with squared industrialization is positive, which shows that the competitiveness intervention flattens the EKC curve, this means that competitiveness will reduce the peak level CO_2 emissions, which was evident at the turning point of EKC. And based on the incidence of industrialization and competitiveness, countries in South Asia are experiencing a net negative effect on CO_2, while countries having high competitiveness will experience a further reduction in CO_2.

Figure 3 shows the average incidence of industrialization (in blue solid line) and competitiveness of countries in the sample (in red dashed line), and using that, the net effect on CO_2 is calculated while allowing the average values of control variables to determine the net effect. We can see that none of the countries is experiencing a negative net effect on CO_2, which means that either they are not industrialized enough to experience downward sloping

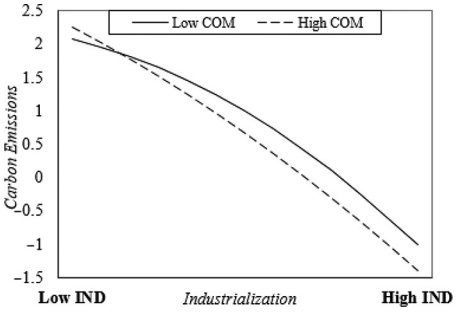


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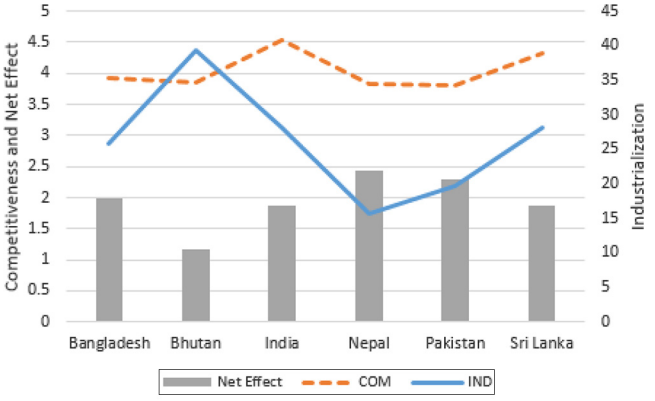
Figure 2.
Moderating effect



Source: Figure by authors

Figure 3.
Country level EKC incidence

EKC or the competitiveness policy is not triggering the fall in net CO_2 emissions to a point where industrialization can reduce CO_2.

5. Conclusion and policy implementation

SAARC region constitutes highly populated countries of the world, where an increase in population demand is leading to environmental issues. Industrialization plays a role in providing goods and services but has environmental consequences. The primary objective of this study was to explore industry EKC along with the determining and moderating role of competitiveness. While the existence of trade openness and population density as controlling factors of environment quality, where only population density had significant positive effect.

This study uses the second-generation static panel data model by Driscol and Kraay. The estimation confirms an inverted U-shaped industrial sector-based EKC. Population density is responsible for deteriorating, while trade openness improves environment quality in SAARC countries. In the case of business competitiveness, it is reducing the positive effect of industrialization and reducing the negative effect of squared industrialization. Generally, it indicates that the competitiveness-induced industry EKC is flatter, causing a smaller variation in the environmental quality, and it also speeds up the reduction in CO_2 for each level of industrialization. Hence, to attain this environmental sustainability, competitiveness can play its role. Competitiveness, specifically in the industrial sector, can encourage efficiency in the manufacturing process. These theoretical implications can help future studies to explore gains from moderating EKC curves rather than putting efforts in validating/invalidating the EKC relationship.

Government should announce some subsidies to fascinate industrial competition. World Economic Forum has provided many dimensions of competitiveness which can be used as a policy to alleviate competitiveness in the country. The productivity induced by competitiveness is proven to bring social and environmental sustainability. Further, the government should bring about door-to-door campaigns to instruct the people regarding its harmfulness. The textbooks should add specific chapters to prepare the upcoming generation for this challenge. Not only this, SAARC countries should strengthen the institutional framework. The results pointed out that competitiveness can help SAARC countries at the initial level of EKC where industrialization has a positive effect on CO_2 emissions. These insights can be crucial for the policymakers to instill relevant competitiveness promoting policies at the start so that industrialization process can be greenified.

Besides these comprehensive findings, this study still has some limitations. This study has specifically targeted SAARC countries, but the limit of sampled countries can also be extended, like association of Southeast Asian nations, emerging and newly industrialized countries. Moreover, this study has included only one factor, competitiveness, as a moderating factor of industrialization. However, other factors like the knowledge economy, green finance and renewable energy consumption can also be tested. Researchers can consider these limitations for further research on the subject matter. Future studies can also address the time taken to find carbon neutral level of industrialization.

Notes

1. UN Sustainable Development Goals – www.un.org/sustainabledevelopment/sustainable-development-goals/
2. www.weforum.org/reports/
3. www.saarc-sec.org/

References

Adomako, S. and Tran, M.D. (2022), "Sustainable environmental strategy, firm competitiveness, and financial performance: evidence from the mining industry", *Resources Policy*, Vol. 75, p. 102515.

Ahluwalia, M.S. (1976), "Income distribution and development: some stylized facts", *The American Economic Review*, Vol. 66 No. 2, pp. 128-135.

Altıntaş, H. and Kassouri, Y. (2020), "Is the environmental Kuznets curve in Europe related to the per-capita ecological footprint or CO2 emissions?", *Ecological Indicators*, Vol. 113, p. 106187.

Arshed, N., Hameed, K. and Saher, A. (2022a), "An empirical analysis of supply chain competitiveness and cleaner production", *SAGE Open*, Vol. 12 No. 4.

Arshed, N., Hanif, N., Aziz, O. and Croteau, M. (2022b), "Exploring the potential of institutional quality in determining technological innovation", *Technology in Society*, Vol. 68, p. 101859.

Arshed, N., Kalim, R., Iqbal, M. and Shaheen, S. (2022c), "Role of real sector and HDI: does competitiveness contribute?", *Journal of the Knowledge Economy*, pp. 1-27.

Arshed, N., Munir, M. and Iqbal, M. (2021a), "Sustainability assessment using STIRPAT approach to environmental quality: an extended panel data analysis", *Environmental Science and Pollution Research*, Vol. 28 No. 14, pp. 18163-18175.

Arshed, N., Sardar, M.S. and Iqbal, M. (2021b), "Can efficient transport moderate real sector productivity?", *Competitiveness Review: An International Business Journal*, Vol. 32 No. 6, pp. 915-933.

Atasoy, B.S. (2017), "Testing the environmental Kuznets curve hypothesis across the US: Evidence from panel mean group estimators", *Renewable and Sustainable Energy Reviews*, Vol. 77, pp. 731-747.

Baloch, A., Shah, S.Z., Noor, Z.M. and Magsi, H.B. (2018), "The nexus between income inequality, economic growth and environmental degradation in Pakistan", *GeoJournal*, Vol. 83 No. 2, pp. 207-222.

Carson, R.T., Jeon, Y. and McCubbin, D.R. (1997), "The relationship between air pollution emissions and income: US data", *Environment and Development Economics*, Vol. 2 No. 4, pp. 433-450.

Chaudhry, I.S., Yusop, Z. and Habibullah, M.S. (2022), "Financial inclusion-environmental degradation nexus in OIC countries: new evidence from environmental Kuznets curve using DCCE approach", *Environmental Science and Pollution Research*, Vol. 29 No. 4, pp. 5360-5377.

Chu, L.K. (2020), "Economic structure and environmental Kuznets curve hypothesis: new evidence from economic complexity", *Applied Economics Letters*, Vol. 28 No. 7, pp. 1-5.

Dietz, T., Rosa, E.A. and York, R. (2012), "Environmentally efficient well-being: is there a Kuznets curve?", *Applied Geography*, Vol. 32 No. 1, pp. 21-28.

Dockery, D. and Pope, A. (1996), *Epidemiology of Acute Health Effects: summary of Time-Series Studies*, Harvard University Press, Cambridge, MA, pp, pp. 123-147.

Dogan, E. and Inglesi-Lotz, R. (2020), "The impact of economic structure to the environmental Kuznets curve (EKC) hypothesis: evidence from European countries", *Environmental Science and Pollution Research*, Vol. 27 No. 11, pp. 12717-12724.

Dong, K., Sun, R., Li, H. and Liao, H. (2018), "Does natural gas consumption mitigate CO_2 emissions: testing the environmental Kuznets curve hypothesis for 14 Asia-Pacific countries", *Renewable and Sustainable Energy Reviews*, Vol. 94, pp. 419-429.

Dong, F., Yu, B. and Pan, Y. (2019), "Examining the synergistic effect of CO2 emissions on PM2. 5 emissions reduction: Evidence from China", *Journal of Cleaner Production*, Vol. 223, pp. 759-771.

Drabo, A. (2010), "Environment quality and economic convergence: extending environmental Kuznets curve hypothesis", *Economics Bulletin*, Vol. 30 No. 2, pp. 1617-1632.

Driscoll, J.C. and Kraay, A.C. (1998), "Consistent covariance matrix estimation with spatially dependent panel data", *Review of Economics and Statistics*, Vol. 80 No. 4, pp. 549-560.

Fields, G.S. and Jakubson, G.H. (1994), *New Evidence on the Kuznets Curve*, Cornell University,. Ithaca, New York, NY, Processed.

Ghaderi, Z., Saboori, B. and Khoshkam, M. (2023), "Revisiting the environmental Kuznets curve hypothesis in the MENA region: the roles of international tourist arrivals, energy consumption and trade openness", *Sustainability*, Vol. 15 No. 3, p. 2553.

Goldar, B., Parida, Y. and Sehdev, D. (2017), "Reduction in carbon emissions intensity and impact on export competitiveness: evidence from Indian manufacturing firms", *Journal of International Commerce, Economics and Policy*, Vol. 8 No. 2, p. 1750012.

Grabowska, S. and Saniuk, S. (2022), "Assessment of the competitiveness and effectiveness of an open business model in the industry 4.0 environment", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 8 No. 1, p. 57.

Grossman, G.M. and Krueger, A.B. (1991), *Environmental Impacts of a North American Free Trade Agreement (No. w3914)*, National Bureau of Economic Research.

Grossman, G.M. and Krueger, A.B. (1995), "Economic growth and the environment", *The Quarterly Journal of Economics*, Vol. 110 No. 2, pp. 353-377.

Hanif, N., Arshed, N. and Aziz, O. (2020), "On interaction of the energy: human capital Kuznets curve? A case for technology innovation", *Environment, Development and Sustainability*, Vol. 22 No. 8, pp. 7559-7586.

Hassan, M.S., Bukhari, S. and Arshed, N. (2020), "Competitiveness, governance and globalization: what matters for poverty alleviation?", *Environment, Development and Sustainability*, Vol. 22 No. 4, pp. 3491-3518.

Hassan, M.S., Iqbal, M. and Arshed, N. (2021), "Distribution-based effects of disaggregated GDP and environmental quality—a case of quantile on quantile estimates", *Environmental Science and Pollution Research*, Vol. 28 No. 22, pp. 28081-28095.

Hussain, M., Wang, W. and Wang, Y. (2022), "Natural resources, consumer prices and financial development in China: measures to control carbon emissions and ecological footprints", *Resources Policy*, Vol. 78, p. 102880.

Ibrahiem, D.M. (2016), "Environmental Kuznets curve: an empirical analysis for carbon dioxide emissions in Egypt", *International Journal of Green Economics*, Vol. 10 No. 2, pp. 136-150.

Ibrahim, R.L. (2022), "Post-COP26: Can energy consumption, resource dependence, and trade openness promote carbon neutrality? Homogeneous and heterogeneous analyses for G20 countries", *Environmental Science and Pollution Research*, Vol. 29 No. 57, pp. 86759-86770.

Illa, E.I. (2022), "Impact of foreign direct investment on international trade in west African economic and monetary union countries using dynamic panel", *Modern Economy*, Vol. 13 No. 6, pp. 833-851.

Iqbal, M., Ur Rehman, H., Arshed, N. and Sardar, M.S. (2021), "The macroeconomic and demographic determinants of saving behavior in selected countries of Asia", *Journal Global Policy and Governance*, Vol. 10 No. 1, pp. 49-65.

Işık, C., Ongan, S. and Özdemir, D. (2019), "Testing the EKC hypothesis for ten US states: an application of heterogeneous panel estimation method", *Environmental Science and Pollution Research*, Vol. 26 No. 11, pp. 10846-10853.

Jadoon, A.K. (2021), "Is economic growth and industrial growth the reason for environmental degradation in SAARC countries", *International Journal of Energy Economics and Policy*, Vol. 11 No. 6.

Jain, P. and Goswami, B. (2021), "Energy efficiency in South Asia: trends and determinants", *Energy*, Vol. 221, p. 119762.

Javaid, A., Arshed, N., Munir, M., Amani Zakaria, Z., Alamri, F.S., Abd El-Wahed Khalifa, H. and Hanif, U. (2022), "Econometric assessment of institutional quality in mitigating global climate-change risk", *Sustainability*, Vol. 14 No. 2, p. 669.

Kalim, R., Arshed, N. and Shaheen, S. (2019), "Does competitiveness moderate inclusive growth: a panel study of low-income countries", *Competitiveness Review: An International Business Journal*, Vol. 29 No. 2.

Katircioglu, S., Katircioglu, S. and Kilinc, C.C. (2018), "Investigating the role of urban development in the conventional environmental Kuznets curve: evidence from the globe", *Environmental Science and Pollution Research*, Vol. 25 No. 15, pp. 15029-15035.

Khan, A., Sicen, L., Khan, B. and Salman, N. (2021), "On the influence of demographic structure and industrial growth on environmental quality", *Journal of Environmental Management*, Vol. 288, p. 112453.

Khan, H., Weili, L. and Khan, I. (2022), "Environmental innovation, trade openness and quality institutions: an integrated investigation about environmental sustainability", *Environment, Development and Sustainability*, Vol. 24 No. 3, pp. 3832-3862.

Koilo, V. (2019), "Evidence of the environmental Kuznets curve: Unleashing the opportunity of industry 4.0 in emerging economies", *Journal of Risk and Financial Management*, Vol. 12 No. 3, p. 122.

Kong, Y. and Khan, R. (2019), "To examine environmental pollution by economic growth and their impact in an environmental Kuznets curve (EKC) among developed and developing countries", *Plos One*, Vol. 14 No. 3, p. e0209532.

Kuznets, S. (1955), "Economic growth and income inequality", *The American Economic Review*, Vol. 45 No. 1, pp. 1-28.

Kuznets, S. (1979), *Growth, Population and Income Distribution. Selected Essays*, Norton, New York, NY.

Liu, X., Zhang, W., Liu, X. and Li, H. (2022), "The impact assessment of FDI on industrial green competitiveness in China: based on the perspective of FDI heterogeneity", *Environmental Impact Assessment Review*, Vol. 93, p. 106720.

Lorente, D.B. and Álvarez-Herranz, A. (2016), "Economic growth and energy regulation in the environmental Kuznets curve", *Environmental Science and Pollution Research*, Vol. 23 No. 16, pp. 16478-16494.

Mania, E. (2020), "Export diversification and CO2 emissions: an augmented environmental Kuznets curve", *Journal of International Development*, Vol. 32 No. 2, pp. 168-185.

Meng, X. and Han, J. (2016), "Roads, economy, population density, and CO2: a city-scaled causality analysis", *Resources, Conservation and Recycling*, Vol. 128, pp. 508-515.

Mohammad, W.M.W. and Wasiuzzaman, S. (2021), "Environmental, social and governance (ESG) disclosure, competitive advantage and performance of firms in Malaysia", *Cleaner Environmental Systems*, Vol. 2, p. 100015.

Muhammad, I., Ozcan, R., Jain, V., Sharma, P. and Shabbir, M.S. (2022), "Does environmental sustainability affect the renewable energy consumption? Nexus among trade openness, CO2 emissions, income inequality, renewable energy, and economic growth in OECD countries", *Environmental Science and Pollution Research*, Vol. 29 No. 60, pp. 90147-90157.

Murphy, L. (2003), "Environmental resources management and assessment for technological advancement", *African Journal of Environmental Studies*, Vol. 2 No. 2, pp. 150-160.

Murshed, M., Alam, R. and Ansarin, A. (2021), "The environmental Kuznets curve hypothesis for Bangladesh: the importance of natural gas, liquefied petroleum gas, and hydropower consumption", *Environmental Science and Pollution Research*, Vol. 28 No. 14, pp. 17208-17227.

Oktris, L. and Sitardja, M. (2018), "The effect of global competitive index on carbon disclosure", *OIDA International Journal of Sustainable Development*, Vol. 11 No. 4, pp. 35-44.

Ota, T. (2017), "Economic growth, income inequality and environment: assessing the applicability of the Kuznets hypotheses to Asia", *Palgrave Communications*, Vol. 3 No. 1, pp. 1-23.

Özokcu, S. and Özdemir, Ö. (2017), "Economic growth, energy, and environmental Kuznets curve", *Renewable and Sustainable. Energy Reviews*, Vol. 72, pp. 639-647.

Panayotou, T. (1993), *Empirical Tests and Policy Analysis of Environmental Degradation at Different Stages of Economic Development (No. 992927783402676)*, International Labour Organization.

Panayotou, T. (1995), "Environmental degradation at different stages of economic development", in Ahmed, I. and Doelman, J.A. (Eds), *Beyond Rio: The Environmental Crisis and Sustainable Livelihoods in the Third World*, Macmillan Press, London.

Pandey, S. and Mishra, M. (2015), "CO2 emissions and economic growth of SAARC countries: evidence from a panel VAR analysis", *World Journal of Applied Economics*, Vol. 1 No. 2, pp. 23-33.

Pedroni, P. (2008), "Nonstationary panel data", Notes for IMF Course (not publicly available).

Pérez, J.A.H., Kunc, M.H., Durst, S., Flores, A. and Geldes, C. (2018), "Impact of competition from unregistered firms on R&D investment by industrial sectors in emerging economies", *Technological Forecasting and Social Change*, Vol. 133, pp. 179-189.

Porter, M.E. and Van der Linde, C. (1995), "Toward a new conception of the environment-competitiveness relationship", *Journal of Economic Perspectives*, Vol. 9 No. 4, pp. 97-118.

Qi, X., Han, Y. and Kou, P. (2020), "Population urbanization, trade openness and carbon emissions: an empirical analysis based on China", *Air Quality, Atmosphere and Health*, Vol. 13 No. 5, pp. 1-10.

Rahman, M.M. (2017), "Do population density, economic growth, energy use and exports adversely affect environmental quality in Asian populous countries?", *Renewable and Sustainable Energy Reviews*, Vol. 77, pp. 506-514.

Rahman, M.M. and Alam, K. (2021), "Clean energy, population density, urbanization and environmental pollution nexus: evidence from Bangladesh", *Renewable Energy*, Vol. 172, pp. 1063-1072.

Rahman, M.M., Saidi, K. and Mbarek, M.B. (2020), "Economic growth in South Asia: the role of CO2 emissions, population density and trade openness", *Heliyon*, Vol. 6 No. 5, p. e03903.

Raza, S.A. and Shah, N. (2018), "Testing environmental Kuznets curve hypothesis in G7 countries: the role of renewable energy consumption and trade", *Environmental Science and Pollution Research*, Vol. 25 No. 27, pp. 26965-26977.

Rehman, H. and Zeb, S. (2020), "Determinants of environmental degradation in economy of Pakistan", *Empirical Economic Review*, Vol. 3 No. 1, pp. 83-105.

Ribeiro, H.V., Rybski, D. and Kropp, J.P. (2019), "Effects of changing population or density on urban carbon dioxide emissions", *Nature Communications*, Vol. 10 No. 1, pp. 1-9.

Sahli, I. and Rejeb, J.B. (2015), "The environmental Kuznets curve and corruption in the MENA region", *Procedia - Social and Behavioral Sciences*, Vol. 195, pp. 1648-1657.

Salem, S., Arshed, N., Anwar, A., Iqbal, M. and Sattar, N. (2021), "Renewable energy consumption and carbon emissions—testing nonlinearity for highly carbon emitting countries", *Sustainability*, Vol. 13 No. 21, p. 11930.

Sawhney, U. (2010), "Growth and structural change in SAARC economies", *International Journal of Economics and Finance Studies*, Vol. 2 No. 2, pp. 95-103.

Schwab, K. and Sala-I-Martin, X. (2016), "The global competitiveness report 2015-2016", Geneva. The World Economic Forum (Vol. 403).

Selden, T.M. and Song, D. (1994), "Environmental quality and development: is there a Kuznets curve for air pollution emissions? ", *Journal of Environmental Economics and Management*, Vol. 27 No. 2, pp. 147-162.

Shahpouri, A., Biabi, H. and Abolhassani, L. (2016), "Economic development and environmental quality: the environmental Kuznets curve for water pollution", *Journal of Applied Sciences and Environmental Management*, Vol. 20 No. 1, pp. 161-169.

Singh, L. (2019), "Competitiveness, skill formation and industrialization: the South Asian experience", *Manufacturing and Jobs in South Asia: Strategy for Sustainable Economic Growth*, pp. 213-227.

Sinha, A. and Shahbaz, M. (2018), "Estimation of environmental Kuznets curve for CO2 emission: role of renewable energy generation in India", *Renewable Energy*, Vol. 119, pp. 703-711.

Sinyak, Y.V. and Petrov, V.Y. (2009), "Assessing the impact of environmental pollution damage on the competitiveness of hydrogen as a motor fuel", *Studies on Russian Economic Development*, Vol. 20 No. 2, pp. 158-168.

Sirag, A., Matemilola, B.T., Law, S.H. and Bany-Ariffin, A.N. (2018), "Does environmental Kuznets curve hypothesis exist? Evidence from dynamic panel threshold", *Journal of Environmental Economics and Policy*, Vol. 7 No. 2, pp. 145-165.

Stern, D.I., Common, M.S. and Barbier, E.B. (1996), "Economic growth and environmental degradation: the environmental Kuznets curve and sustainable development", *World Development*, Vol. 24 No. 7, pp. 1151-1160.

Sugiawan, Y. and Managi, S. (2016), "The environmental Kuznets curve in Indonesia: exploring the potential of renewable energy", *Energy Policy*, Vol. 98, pp. 187-198.

Sun, H., Attuquaye Clottey, S., Geng, Y., Fang, K. and Clifford Kofi Amissah, J. (2019), "Trade openness and carbon emissions: evidence from belt and road countries", *Sustainability*, Vol. 11 No. 9, p. 2682.

Todaro, M.P. and Smith, S.C. (2009), *Economic Development*, Pearson education.

Touré, N. (2021), "Culture, institutions and the industrialization process", *Journal of Economic Behavior and Organization*, Vol. 186, pp. 481-503.

Usman, O., Iorember, P.T. and Olanipekun, I.O. (2019), "Revisiting the environmental Kuznets curve (EKC) hypothesis in India: the effects of energy consumption and democracy", *Environmental Science and Pollution Research*, Vol. 26 No. 13, pp. 13390-13400.

Vincent, J.R. (1997), "Testing for environmental Kuznets curves within a developing country", *Environment and Development Economics*, Vol. 2 No. 4, pp. 417-431.

Wang, S. and Liu, X. (2017), "China's city-level energy-related CO2 emissions: spatiotemporal patterns and driving forces", *Applied Energy*, Vol. 200, pp. 204-214.

Wang, W., Rehman, M.A. and Fahad, S. (2022), "The dynamic influence of renewable energy, trade openness, and industrialization on the sustainable environment in G-7 economies", *Renewable Energy*, Vol. 198, pp. 484-491.

Wang, Q. and Zhang, F. (2021), "The effects of trade openness on decoupling carbon emissions from economic growth – evidence from 182 countries", *Journal of Cleaner Production*, Vol. 279, pp. 123838.

Wang, Q., Zhang, F. and Li, R. (2023), "Revisiting the environmental Kuznets curve hypothesis in 208 counties: the roles of trade openness, human capital, renewable energy and natural resource rent", *Environmental Research*, Vol. 216, p. 114637.

Yan, M., Zhao, J., Qiao, J., Han, D., Zhu, Q., Yang, Y., . . . Wang, Z. (2023), "Spatial pattern evolution and influencing factors on agricultural non-point source pollution in small town areas under the background of rapid industrialization", *International Journal of Environmental Research and Public Health*, Vol. 20 No. 3, p. 2667.

Yao, S., Zhang, S. and Zhang, X. (2019), "Renewable energy, carbon emission and economic growth: a revised environmental Kuznets curve perspective", *Journal of Cleaner Production*, Vol. 235, pp. 1338-1352.

Zaied, Y., Cheikh, N.B. and Nguyen, P. (2017), "Longrun analysis of environmental Kuznets curve in the middle east and north Africa", *Environmental Economics*, Vol. 8 No. 4, pp. 72-79.

Zaman, K., Shahbaz, M., Loganathan, N. and Raza, A.S. (2016), "Tourism development, energy consumption and environmental Kuznets curve: trivariate analysis in the panel of developed and developing countries", *Tourism Management*, Vol. 54, pp. 275-283.

Zoundi, Z. (2017), "CO2 emissions, renewable energy and the environmental Kuznets curve, a panel cointegration approach", *Renewable and Sustainable Energy Reviews*, Vol. 72, pp. 1067-1075.

Further reading

Boivin, J. and Ng, S. (2006), "Are more data always better for factor analysis? ", *Journal of Econometrics*, Vol. 132 No. 1, pp. 169-194.

Chiang, C.A. and Wainwright, K. (2005), *Fundamental Methods of Mathematical Economics*, 4th ed., McGraw. Hill International.

Cho, H.S. and Choi, M.J. (2014), "Effects of compact urban development on air pollution: Empirical evidence from Korea", *Sustainability*, Vol. 6 No. 9, pp. 5968-5982.

Cui, L. and Shi, J. (2012), "Urbanization and its environmental effects in shanghai, China", *Urban Climate*, Vol. 2, pp. 1-15.

Dawson, J.F. (2014), "Moderation in management research: what, why, when, and how", *Journal of Business and Psychology*, Vol. 29 No. 1, pp. 1-19.

Esty, C. and Charnovitz, S. (2010), *Environmental Sustainability and Competitiveness: Policy Imperative and Corporate Opportunity*, Harvard Business School. U.S. Competitiveness Project.

Fang, C., Wang, S. and Li, G. (2015), "Changing urban forms and carbon dioxide emissions in China: a case study of 30 provincial capital cities", *Applied Energy*, Vol. 158, pp. 519-531.

Greene, W.H. (2012), *Econometric Analysis*, 7th ed., Prentice Hall.

Hameed, K., Arshed, N., Grant, K.A., Munir, M. and Aziz, O. (2022), "Forces of dynamic capability and incidence of entrepreneurship: a macroeconomic policy intervention approach", *Journal of the Knowledge Economy*, pp. 1-25.

Iqbal, M., Kalim, R. and Arshed, N. (2019), "Domestic and foreign incomes and trade balance-a case of South Asian economies", *Asian Development Policy Review*, Vol. 7 No. 4, pp. 355-368.

Lin, S., Wang, S., Marinova, D., Zhao, D. and Hong, J. (2017), "Impacts of urbanization and real economic development on CO2 emissions in non-high income countries: empirical research based on the extended STIRPAT model", *Journal of Cleaner Production*, Vol. 166, pp. 952-966.

Martin, S. and Andres, E. (2012), "The role of governance for improved environmental outcomes", Swedish Environmental Protection Agency. Report 6514.

Rafiq, S., Salim, R. and Nielsen, I. (2016), "Urbanization, openness, emissions, and energy intensity: a study of increasingly urbanized emerging economies", *Energy Economics*, Vol. 56, pp. 20-28.

Sadorsky, P. (2014), "The effect of urbanization on CO2 emissions in emerging economies", *Energy Economics*, Vol. 41, pp. 147-153.

Shafik, N. (1994), "Economic development and environmental quality: an econometric analysis", Oxford economic papers, pp. 757-773.

Shahbaz, M. (2019), "Globalization–emissions nexus: testing the EKC hypothesis in next-11 countries", *Global Business Review*, Vol. 23 No. 1, pp. 1-26.

Shahbaz, M., Mahalik, M.K., Shahzad, S.J.H. and Hammoudeh, S. (2019), "Testing the globalization-driven carbon emissions hypothesis: international evidence", *International Economics*, Vol. 158, pp. 25-38.

Spearman, C. (1904), "The proof and measurement of association between two things", *The American Journal of Psychology*, Vol. 15 No. 1, pp. 72-101.

Stavropoulos, S., Wall, R. and Xu, Y. (2018), "Environmental regulations and industrial competitiveness: evidence from China", *Applied Economics*, Vol. 50 No. 12, pp. 1378-1394.

Takayama, A. and Akira, T. (1985), *Mathematical Economics*, Cambridge university press.

Tian, X., Dai, H., Geng, Y., Huang, Z., Masui, T. and Fujita, T. (2017), "The effects of carbon reduction on sectoral competitiveness in China: a case of shanghai", *Applied Energy*, Vol. 197, pp. 270-278.

Uttara, S., Bhuvandas, N. and Aggarwal, V. (2012), "Impacts of urbanization on environment", *International Journal of Research in Engineering and Applied Sciences*, Vol. 2 No. 2, pp. 1637-1645.

Wolde, T. (2015), "Economic growth and environmental degradation in Ethiopia: an environmental Kuznets curve analysis approach", *Journal of Economics and International Finance*, Vol. 7 No. 4, pp. 72-79.

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