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RESEARCH ARTICLE

Decoupling Growth and Pollution: The Interplay of Globalization, Energy, Economy, Finance, and Environmental Quality in SCO Countries

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Abstract: The study aims to examine how globalization, energy consumption, economic growth, and financial development affect environmental quality in SCO member countries. The data collected spans from 1990 to 2019. We conducted a stationarity test and analyzed the long-term relationships using fully modified OLS. Our results show that an increase in energy consumption, economic growth, and financial development leads to higher CO2 emissions, thus reducing environmental quality. On the other hand, globalization was found to reduce CO2 emissions for the country. Additionally, D.H. panel causality test revealed bi-directional causality between environmental quality and the variables used in our analysis. Evidently these findings are crucial for formulating effective policy recommendations aimed at improving environmental quality.

Keywords: Energy consumption, CO2 emission, environmental degradation, financial development, Globalization, Shanghai Cooperation Organization
JEL Classification Codes:

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1. INTRODUCTION

Climate change was driven by technological advancements and rapid industrialization, enhanced CO2 emissions, and resulted in visible impacts on Earth's temperature, extensive ecological deterioration, potential conflicts about the climate, and global warming with ozone layer reduction (Dogan & Turkekul, 2016); Jackson (2021).The environmental effects of energy consumption and financial development have become significant concerns in today's world (Li & Liao, 2020). This is because they are closely connected, with financial development enabling investment in energy infrastructure and technologies. As global financial markets grow more interconnected, the demand for energy resources also rises, potentially resulting in environmental repercussions. Additionally, there may be other influential factors such as financial variables that affect energy demand. However, the correlation between financial development and energy demand has not been extensively researched to date.

The increasing integration of financial markets and the growing demand for energy resources have raised questions about their impact on the environment. As financial development facilitates investment in energy infrastructure and technologies, it plays a critical role in shaping patterns of energy consumption and production. However, the environmental consequences of these activities are not always positive. It is essential to explore the complex interactions between financial development, energy consumption, and their environmental effects to formulate sustainable policies and practices. In this regard, a comprehensive analysis of the relationships between financial development, energy consumption, and environmental sustainability is crucial for shaping a greener and more sustainable future.

According to Panayotou (2000) Globalization has emerged as a pervasive influence that impacts diverse facets of human existence, encompassing the environment. Furthermore, globalization facilitates the transfer of technology across borders, allowing countries to access foreign knowledge and innovate using foreign technologies. This increased access to foreign knowledge and technology has the potential to positively impact carbon dioxide emissions through improved innovation and adoption of green technologies (De Mello, 1999; Doytch & Uctum, 2016; Grossman & Krueger, 1995; Sbia, Shahbaz, & Hamdi, 2014).

In recent years, there has been growing concern over the impact of CO2 emissions on environmental degradation (Aye & Edoja, 2017; Majeed & Mazhar, 2019). These studies have highlighted the potential economic ramifications of environmental damage caused by CO2 emissions, shedding light on the importance of addressing these issues from a financial standpoint. Understanding the link between CO2 emissions and environmental degradation is crucial for informing policy decisions and investment strategies aimed at fostering sustainable and environmentally responsible practices. Moreover, such research can provide valuable insights for businesses and industries seeking to mitigate their environmental impact while maintaining financial viability (Majeed & Mazhar, 2019). In addition to the environmental impacts of non-consideration of CO2 emissions in financing, there are also social and economic implications to be considered. When banks and financial institutions provide credit without evaluating the potential impact on CO2 emissions, it can perpetuate the use of outdated and polluting technology. This not only contributes to environmental degradation but also hinders progress towards sustainable development.

Financial growth (FG) makes it easier to invest in environmentally friendly technologies, reduces capital risk, and lowers financial costs by increasing economic productivity (Zhang, 2011). According to Tamazian, Chousa, and Vadlamannati (2009), FD has a positive effect on technology, including advanced cleaner technology that helps in maintaining EQ. These energy-saving innovations often allow investors to invest money in environmentally friendly ventures. Majeed (2016) claimed in their study that every country's dream is to achieve sustainable development goals. The focus of green finance in the current financial blueprint helps boost growth while protecting the environment. Banking institutions provide green credit to monitor and control environmental pressure through green investment and funding energy-efficient technologies. To protect the environment while simultaneously creating new employment opportunities, financial institutions are increasingly required to invest in green technology (Lee, Park, & Kim, 2015). Financial tools such as loans at low interest rates to businesses for environment-friendly technology can help control environmental pollution. The globalization impact, economic growth, FD and EC on the EQ of SCO member nations was examined in this study. This study contributes to the corpus of existing literature in the following ways:

i. The effect of FD, EG, and globalization on the EQ of SCO member states
ii. Instead of a trade-based proxy for globalization, this study used a newly developed globalization index.
iii. Instead of market-based performance indicators, we use a novel FD index combining the cumulative performance composite of both financial markets and financial institutions.

This study is logically organized, starting with a thorough literature review, then delving further into the methodology, clearly presenting the findings, and concluding with a discussion of their implications. The concluding part also discusses the study's limitations, makes policy recommendations, and identifies topics for future research and rounds up the analysis.

2. LITERATURE REVIEW

The importance of EQ in sustainable development cannot be overstated. Climate change and environmental destruction caused by economic development and increasing energy demand must be controlled. Otherwise, a fragile ecosystem may suffer irreversible losses. The link between environmental degradation and EG has been extensively discussed. Grossman and Krueger (1991) developed the Environmental Kuznets Curve (EKC) to illustrate the detrimental impact of EG on EQ. It argued that EG adversely affects EQ in the initial stage, while after certain economic progress, society tries to reduce environmental degradation and focus on improved EQ. This implies that the relationship between EQ and EG is an inverted U. As a result, politicians are working to create environmentally friendly regulations to lower greenhouse gas emissions, including those of CO2 and methane, and to encourage the manufacturing sector to adopt plantations, energy-efficient technologies, and renewable energy sources. Many research scholars have empirically analyzed the relationship between the above-discussed variables (Nasir & Rehman, 2011; Shahbaz, Solarin, Mahmood, & Arouri, 2013; Tahir, Luni, Majeed, & Zafar, 2021).

2.1. Energy and emissions

The nature of the atmosphere is influenced by energy in several ways. Energy from fossil fuels results in increased carbon emissions. Land and water depletion is caused by waste disposal during energy production (Majeed & Luni, 2019). Ben Zaied, Ben Cheikh and Chevallier (2021) also explored this U-shaped pattern among CO_2 emission and EC. The increased CO_2 emissions from energy usage are supported by many scholars, including (Alam, Fatima, & Butt, 2007) (Acaravci & Ozturk, 2010; Jebli & Youssef, 2017; Shahbaz, Shahzad, & Mahalik, 2018), who reported a consistent positive association between energy usage and corban dioxide emission. Furthermore, the findings of Zaman, Shahbaz, Loganathan, and Raza (2016), Majeed and Mazhar (2019); (Xu & Lin, 2016) likewise concur with the idea that higher energy use causes higher CO2 emissions, which in turn exacerbate environmental damage.

2.2. Financial development and emissions

Studies by (Park, Meng, & Baloch, 2018; Samreen & Majeed, 2020; Saud, Chen, & Haseeb, 2019) and (Tahir et al., 2021) indicate a high positive association between FD and EQ. According to these studies, increased financial growth reduces information asymmetries and increases technical advancement and research in the energy sector, ultimately reducing CO_2 emissions and improving EQ. Moghadam and Lotfalipour (2014), claim that a robust financial system and capital market facilitate technological progress and enhance EQ. Additionally, it backs EG, risk diversification, and EQ enhancements (Levine, 2005). Nonetheless, research has shown an inverse U-shaped link between FD and CO2 emissions (Abbasi & Riaz, 2016; Charfeddine & Ben Khediri, 2016; Javid & Sharif, 2016; Shen et al., 2021). The discussion that came before it leads to the conclusion that FD can greatly increase EQ.

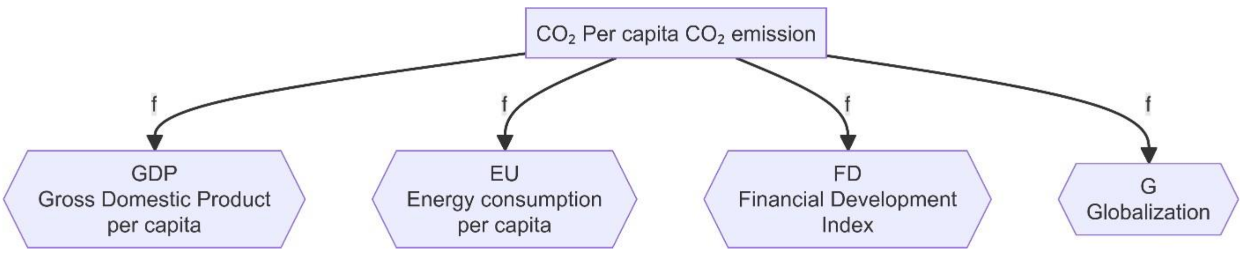
2.3. Globalization and emissions

As Grossman and Krueger (1991) described, globalization promotes trade and eliminates trade restrictions, influencing the extent of economic expansion as well as the composition of economic activities and manufacturing methods. Globalization encourages EG, raises the quality of life, promotes urbanization, and requires more energy and natural resources (Shahbaz, Mallick, Mahalik, & Loganathan, 2015). It also helps spread information and encourages the transformation of economies from inefficient EC towards energy-efficient technologies with less pollution, which ultimately improves the EQ. Previous studies have provided mixed evidence on the link between EQ and Globalization. (Destek, 2020); Kwabena Twerefou, Danso-Mensah, and Bokpin (2017); (Majeed & Mazhar, 2019; Shahbaz et al., 2018), for instance discovered that the effect of globalization is becoming less favorable for sustainability and EQ. However, Studies investigating the correlation between globalization and the environment reveal that it is advantageous (Mishkin, 2009; Saud et al., 2019; Van & Bao, 2018). These findings claim that new technology is incorporated by globalization, which also promotes innovation and creativity, minimizes traditional EC, and increases the use of efficient and renewable energy sources, all of which lower greenhouse gas emissions and enhance EQ.

2.4. Theoretical framework

Globalization promotes energy-efficient technological advancements through trade, which improves EG while reducing CO2 emissions (Antweiler, Copeland, & Taylor, 2001). International trade has the potential to improve and reduce EQ. Expanded trade and development necessitated more energy, which resulted in an increase in CO2 emissions, a phenomenon known as scale impact. The manufacturing process requires energy to produce primary products that produce emissions; this is known as the composition effect. Technological advances have increased EQ (Antweiler et al., 2001; Grossman & Krueger, 1995; Zafar, Saud, & Hou, 2019). According to (Zafar et al., 2019) commercial activities therefore enhance EQ when the composition and scale effect is not bigger than the technology effect. FD is regarded as a significant factor in CO_2 emissions. Financial institutions support growth, but some institutions promote it as a cost to the economy, resulting in the deterioration of the EQ and increased emissions. This study uses the following statistical model.

$$CO2 = F(GDP, EU, FD, G)$$



Source: Generated by Authors

3. METHODS

3.1. Econometric model

To reduce multicollinearity and heteroscedasticity, the variables underwent a log-transformation. In addition to producing trustworthy results, logarithmic transformation removes heteroscedasticity and multicollinearity issues (Solarin, Al-Mulali, & Sahu, 2017; Zafar et al., 2019). Therefore, the following can be represented as the equation's econometric log-linear form:

$$lCO_{2it} = \propto_0 + \propto_1 lGDP_{it} + \propto_2 lEU_{it} + \propto_3 lFD_{it} + \propto_4 lG_{it} + \varepsilon_{it}$$

where i symbolizes the number of member countries, t signifies periods, $\propto$ signifies the slope-intercept, and εit denotes the error term.

3.2. Data and description of variables

The Shanghai Cooperation Organization (SCO) member nations' data were examined between 1990 and 2019. The World Bank Indicators provided the historical data for the variables that were selected (WDI). Meanwhile, the KOF index has been used as a source of globalization (Dreher, 2006). The GDP per capita trends of the variables are shown in the graphs below.

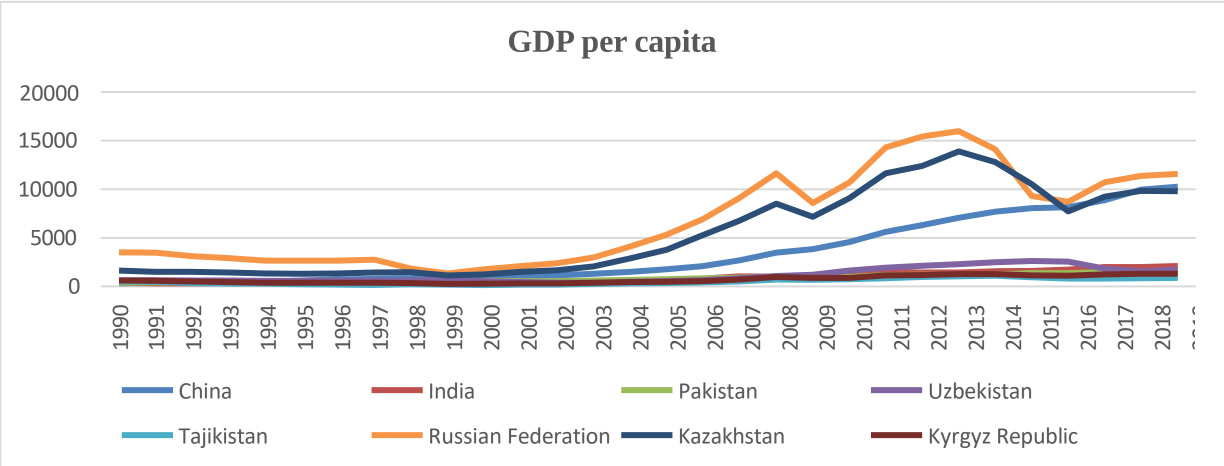


Figure 1 GDP per capita

Figure 1 depicts the trend of GDP per capita. The Russian Federation, Kazakhstan, and China have the highest GDP per capita growth rates. Tajikistan's GDP per capita growth was the slowest among the listed countries. The trend of carbon emissions is depicted in Figure 2, with Kazakhstan having the highest emissions of the listed nations, resulting in deteriorated EQ, and Tajikistan had the lowest emissions during 1990-2019.

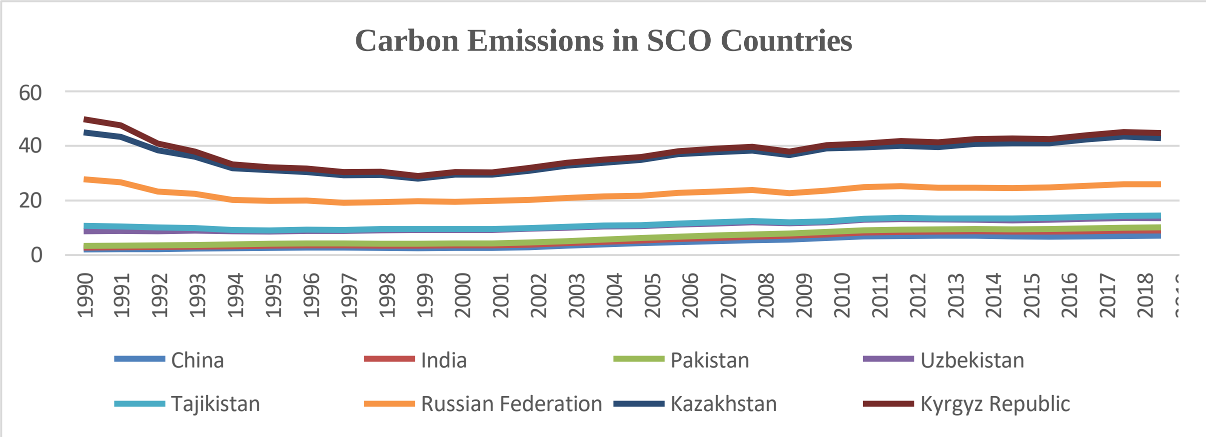


Figure 2 Carbon Emissions in SCO Countries

Figure 3 depicts the trend of energy usage; Russia has the highest usage, and India has the lowest among the listed countries.

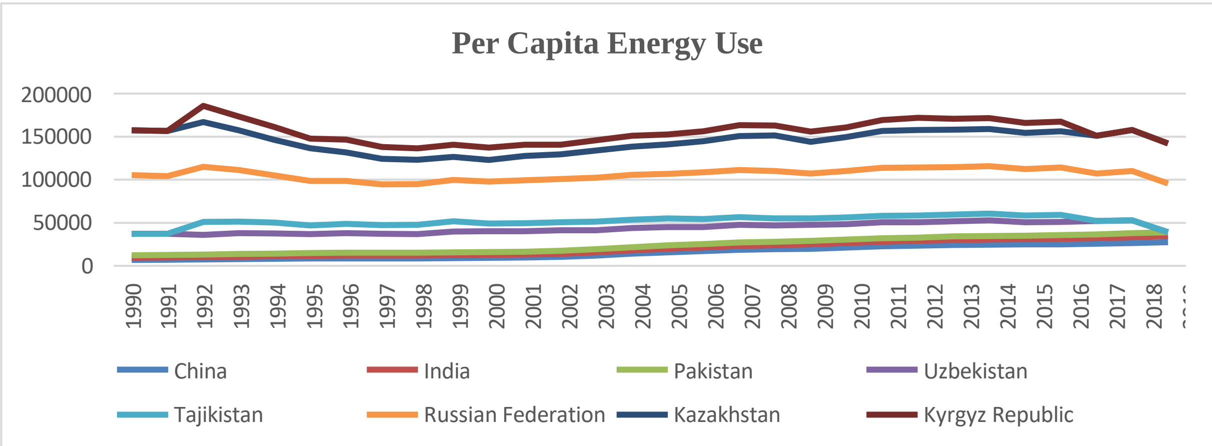


Figure 3 Per Capita Energy Use

Figure 4 shows the FD tendencies. According to the data, China has the highest level of FD, whereas Tajikistan has the lowest.

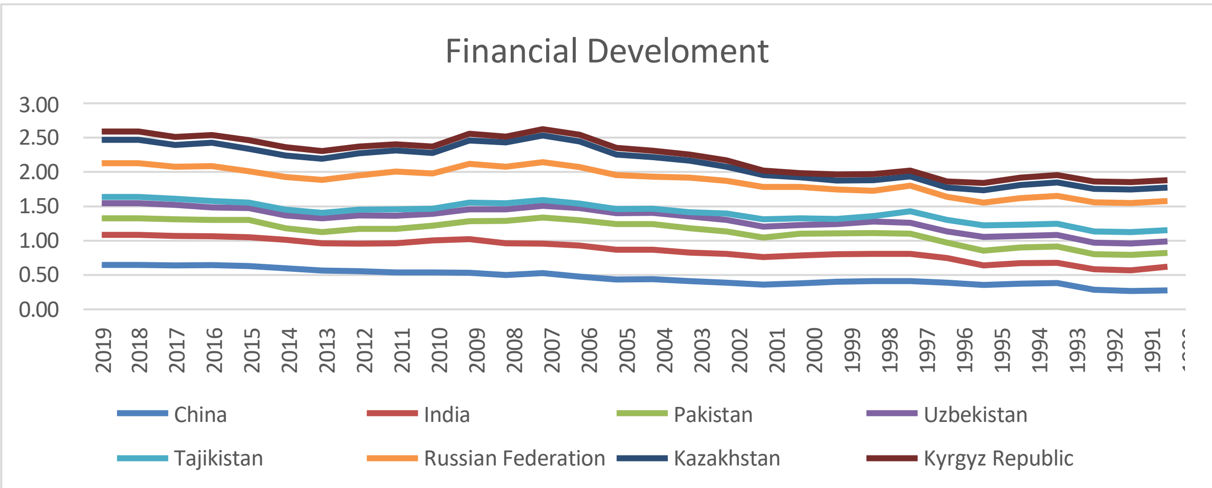


Figure 4 Financial Development

The globalization trend is shown in Figure 5. Russia has the highest level of globalization, while Uzbekistan and Tajikistan have the lowest levels of globalization among the member countries.

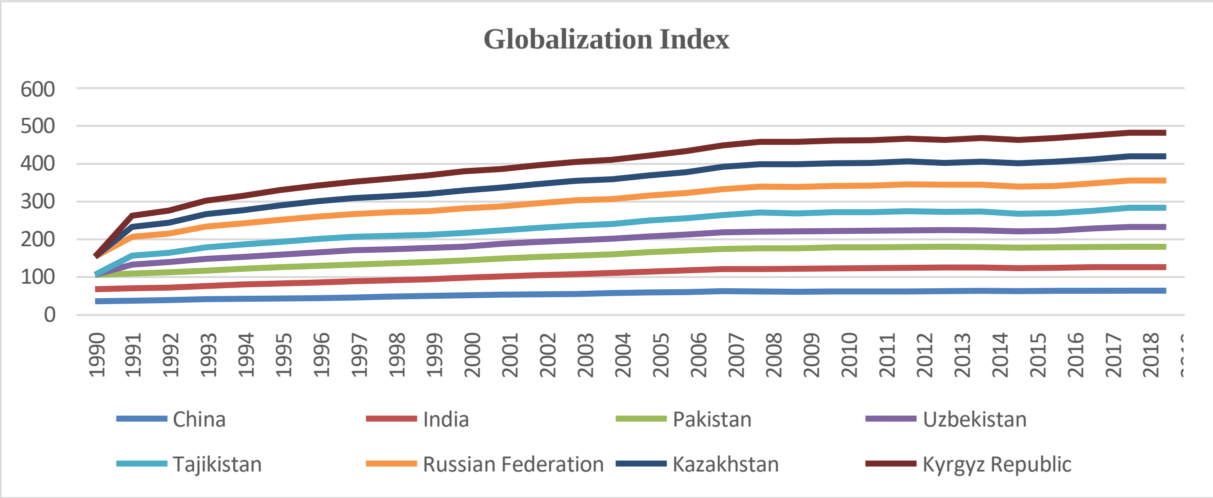


Figure 5 Globalization Index

4. RESULTS & Discussion

4.1. Descriptive statistics

Table 1 illustrates the descriptive data of the region and country bases. Kazakhstan had the highest CO_2 emissions per capita (17.44 mt), while Tajikistan had the lowest CO_2 emissions per capita (0.291417 mt). Tajikistan has the lowest GDP per capita at 138.4289, whereas the Russian Federation has the highest at 15974.64 per person. The Russian Federation has a high EC rate, while low energy usage has been observed in India. Tajikistan has at least, China, on the other hand, boasts the most advanced financial system of any nation. Russia is the highest globalized country, while Uzbekistan and Tajikistan were found the least globalized, respectively.

Table 1

Descriptive Statistics

Regional Statistics

	CO2	EU	FD	GDP	GI
Mean	4.821454	20276.79	0.287177	2431.219	50.70362
Median	2.447312	13328.23	0.284672	1082.286	50.54723
Maximum	17.44800	68047.10	0.647269	15974.64	72.38351
Minimum	0.291417	2619.875	0.059513	138.4289	23.09266
Std. Dev.	4.961308	17539.45	0.154426	3418.767	11.26777
Observations	227	227	227	227	227

China

	CO2	EU	FD	GDP	GI
Mean	4.455909	15719.22	0.467093	3399.296	54.95695
Median	4.105446	14875.86	0.436206	1631.043	58.95388
Maximum	7.096383	27452.48	0.647269	10216.63	64.28267
Minimum	2.056948	6774.271	0.267386	317.8847	36.25551
Std. Dev.	1.979738	7351.153	0.116348	3325.965	9.346219
Observations	30	30	30	30	30

India

	CO2	EU	FD	GDP	GI
Mean	1.171464	4344.590	0.398486	919.2820	51.36615
Median	1.014693	3926.212	0.414928	671.3176	54.20436
Maximum	1.915750	6923.931	0.487746	2099.599	62.23346
Minimum	0.662661	2619.875	0.283076	301.1590	31.94126
Std. Dev.	0.406501	1362.580	0.054768	597.1415	10.63202
Observations	30	30	30	30	30

Kazakhstan

	CO2	EU	FD	GDP	GI
Mean	13.50191	38493.47	0.259519	717.1538	51.18893

	CO2	EU	FD	GDP	GI
Median	14.25306	39545.84	0.296525	543.1107	53.35260
Maximum	17.44800	52355.44	0.388813	1309.393	64.13614
Minimum	8.318517	24987.75	0.127133	258.0492	25.87398
Std. Dev.	2.636360	7499.514	0.083469	385.9918	11.31269
Observations	29	29	29	29	29
Kyrgyz republic					
	CO2	**EU**	**FD**	**GDP**	**GI**
Mean	1.335707	13027.65	0.095817	5191.999	51.54675
Median	1.235249	12711.86	0.094241	2874.288	51.65005
Maximum	2.488119	18820.45	0.124929	13890.63	62.60357
Minimum	0.778219	11180.30	0.060465	1130.114	31.95845
Std. Dev.	0.383359	1806.368	0.014494	4425.878	9.136441
Observations	25	25	25	25	25
Pakistan					
	CO2	**EU**	**FD**	**GDP**	**GI**
Mean	0.814491	3736.287	0.266560	820.7076	49.04487
Median	0.788314	3801.669	0.241716	718.3795	50.32996
Maximum	1.165847	4566.901	0.377871	1482.306	55.12311
Minimum	0.609122	2809.260	0.162963	371.6786	38.39639
Std. Dev.	0.145844	522.3829	0.062756	373.0677	5.650055
Observations	30	30	30	30	30
Russian Federation					
	CO2	**EU**	**FD**	**GDP**	**GI**
Mean	11.41526	54404.74	0.463077	6797.630	64.78976
Median	11.19576	54462.28	0.472603	4712.914	66.46895
Maximum	17.11692	68047.10	0.564326	15974.64	72.38351
Minimum	9.895137	47223.33	0.330539	1330.757	47.49065
Std. Dev.	1.595896	5108.663	0.061917	4727.706	7.270054
Observations	30	30	30	30	30
Tajikistan					
	CO2	EU	FD	GDP	GI
Mean	0.465056	9645.832	0.102471	480.8132	40.62421
Median	0.382359	9359.423	0.088942	340.5830	39.03956
Maximum	1.325813	14885.17	0.165610	1104.172	50.66612
Minimum	0.291417	7362.194	0.059513	138.4289	24.27801
Std. Dev.	0.228765	1957.355	0.038147	322.3170	7.328715
Observations	25	25	25	25	25
Uzbekistan					
	CO2	EU	FD	GDP	GI
Mean	4.363633	20483.49	0.173191	1112.909	39.86562
Median	4.479072	21349.52	0.169847	653.5457	41.42608
Maximum	5.398876	24618.92	0.218755	2615.025	52.39651
Minimum	3.291023	15022.42	0.124358	383.3431	23.09266
Std. Dev.	0.656078	2998.569	0.020521	753.8798	6.392889
Observations	28	28	28	28	28

4.2. Cross-sectional dependence test

A growing corpus of research on panel data finds that cross-sectional dependence is typical in panel data sets since countries are interconnected through trade agreements, business contacts, and spillover effects. One of the main causes of this could be that over the past few decades, financial institutions and national economies have been more integrated globally, which has strengthened cross-sectional unit interdependencies (De Hoyos & Sarafidis, 2006). The results can be biased if cross-sectional dependency is not taken into consideration. Through the use of the Breusch-Pegan LM, bias-corrected scaled L.M., Pesaran-scaled LM, and Pesaran CD test, cross-sectional dependency among the variables was examined. Therefore, the rescaled BP-scaled version of the L.M. test is evaluated in this study using the bias-corrected-scaled L.M. statistics that were suggested and utilized by (Tahir et al., 2021) and (Pesaran, Ullah, & Yamagata, 2008). Bias-corrected-scaled L.M. statistics is another name for it.

$$LM_{BC} = LM_P - \frac{n}{2(T-1)} = \sqrt{\frac{1}{N(N-1)}}\left[\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\left(T\rho^2{}_{ij} - 1\right]-\frac{N}{2(T-1)}$$

The research also employed the Pesaran CD test (2004) by using the following equation:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{k=i+1}^{N}\widehat{\rho}_{it}$$

Where N = sample size, i = correlation amongst error terms of cross sections, T = time-period, and k denoted by $\widehat{\rho}$. As shown in table 2, the alternative hypothesis is accepted by all tests at a 1% significance level.

Table 2

Results of Cross-sectional Dependence

Variables	Breusch-Pegan LM	Pesaran-Scaled LM	Bias-Corrected Scales LM	Pesaran CD
CO2	302.901***	36.73519***	36.59726***	4.930593***
GDP	704.0719***	90.34391***	90.20598***	26.50438***
FD	221.2126***	25.81912***	25.68119***	3.750628***
GI	763.139***	98.23707***	98.09914***	27.61552***
EU	298.7063***	36.17465***	36.03672***	0.216751***

Probabilities *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

4.3. Unit Root test

The unit root test is essential to the empirical study of the panel data (Hurlin & Mignon, 2007). Additionally, this study employed the Shin and second generation I.M. Pesaran tests as recommended by Pesaran et al. (2008). This approach takes the order of integration into account while controlling cross-sectional dependence. The results of the unit root test are shown in Table 2. We reject the H_0 that all of the panels include unit-roots since the variables CO2, energy use (E.U.), financial development (F.D.), gross domestic product (GDP), and globalization (G.I.) are stationary at the first difference, respectively.

Table 3

Unit Root Test (IM, Pesaran and Shin W-Stat)

Variable	Statistics	Prob**
CO_2	-5.16064	0.0000
EU	-9.04906	0.0000
FD	-10.8631	0.0000
GDP	-5.76348	0.0000
GI	-7.90140	0.0000

4.4. Co-integration Test

The study used the Kao residual co-integration test for the variables. The H_0 of no co-integration of the Kao test has been rejected. The result indicates that all variables, CO_2, E.U., F.D., GDP, and G.I. are co-integrated.

Table 4

Kao Residual Cointegration Test

	t-Statistic	Prob.
ADF	-4.851110	0.0000
Residual variance	0.136517	
HAC variance	0.098495	

Source: author's analysis

4.5. Fully modified Ordinary Least Square (FM-OLS)

For the long-term elasticity of variables, this study used a fully modified OLS model. FM-OLS technique takes care of endogeneity and small sample biases. The result of FM-OLS is shown in Table 4. Every variable included in the research has considerable effects on emissions. The findings indicate a significant and positive correlation between GDP per capita and environmental degradation, with an increase in GDP per capita being associated with a 6.81205 per cent increase in environmental deterioration. Because industrial economies are undergoing structural development, EQ decreases as per capita income rises. Moreover, some nations' economic growth is predicated on the processing of primary goods that require a lot of energy and lack environmental regulations, which over time degrades EQ. The findings of (Anwar, Ahmad, & Madni, 2020; Solarin et al., 2017; Tahir et al., 2021; Zafar et al., 2019) are in line with the results of this investigation. A 1% increase in energy usage results in a 0.000279 % rise in carbon emissions (CO2). This is indicated by the positive and substantial coefficient of energy usage (E.U.). Fossil fuels, which are the main source of environmental damage, are used to generate energy. Fossil fuels contribute to global warming and environmental deterioration by releasing mercury, emitting carbon dioxide, and producing garbage. The findings of this research are consistent with those of the studies: Majeed & Mazhar, 2019; Acaracchi & Ozturk, 2010).

The positive and significant values of F.D. indicate that it deteriorates EQ. The availability of low-cost credit has increased the purchasing of products such as cars, other vehicles, and homes, resulting in increased energy demand and economic development, which further increased CO_2 emissions (Koengkan, Santiago, Fuinhas, & Marques, 2019). Financial institutions provide loans and promote economic activities with no regard to environmental considerations. It reduces the costs while transferring the implications to the environment and increases CO_2 emissions drastically (Majeed & Mazhar, 2019; Schmidheiny & Zorraquin, 1998). Easy credit availability facilitates the expansion of polluting industries, resulting in environmental degradation (Adams & Klobodu, 2018; Hafeez, Chunhui, Strohmaier, Ahmed, & Jie, 2018; Koengkan et al., 2019; Shahbaz et al., 2013). The negative coefficient significant level of globalization (G.I.) shows that a 1% rise in globalization reduces CO_2 by 0.036412%. Globalization improves the quality of the environment by advancing skills, information, and technology. It also brings changes in commercial practices as a resulting removal and minimization of trade barriers. It encourages and supports the development of energy-efficient technologies that enhance resource allocation, EQ, and ecosystem management while reducing the harmful effect of CO_2 emissions (Shahbaz et al., 2018). Our result is consistent and in line with the finding of (Shahbaz et al., 2018) and shows that the technological effect is dominant over the scale effect.

Table 5

Long-run Finding (FM-OLS) Model

Variable	Coefficient		Std. Error	t-Statistic	Prob.
EU	0.000279		1.47E-05	19.01499	0.0000
FD	0.142993		1.129966	0.126546	0.8994
GDP	6.81E-05		2.37E-05	-2.874900	0.0045
GI	-0.036412		0.008498	4.284683	0.0000
R-squared	0.989743	Mean dependent var			4.786272
Adjusted R-squared	0.989198	S.D. dependent var			4.889739
S.E. of regression	0.508200	Sum squared resid			53.46139
Long-run variance	0.491692				

4.6. Dumitrescu-Hurlin panel causality test

The study used a pairwise Dumitrescu-Hurlin (D.H.) panel causality test to explore the causality link between the selected variables over both long-run and short-run (Dumitrescu & Hurlin, 2012). The causality between variables will assist the policymakers in regulating applicable economic policies and strategies to improve EQ in the member economies. Table 6 displays the outcomes of the Dumitrescu-Hurlin (D.H.) causality tests. The result's substantial level indicates that CO2 and the EU are closely linked. Al-Mulali, Ozturk, and Lean (2015) discovered a bidirectional causal link between F.D. and CO2 emissions, suggesting that both variables have joint impacts on one another. Given that there are two paths of causality between EG and CO2 emission, it can be concluded that EG not only destroys EQ but also contributes to global warming and has an impact on human health in the mentioned countries. Excessive EG causes long-term pollution, which is manageable with modern technology. This is consistent with the findings from (Katircioglu, 2017). The result's significance level indicates that there was a causal association between EU and EG.

Table 6

Causality Test of Pairwise Panel (Dumitrescu Hurlin)

Null Hypothesis:	**W-Stat.**	**Zbar-Stat.**	**Prob.**
E.U. has a disparate causal relationship with CO2	8.83710	7.65829	0.1214
CO2 has a disparate causal relationship with the EU	6.29448	4.72156	0.0086
FD has a disparate causal relationship with CO2	6.51935	5.08036	0.0037
CO2 has a disparate causal relationship with FD	5.46269	3.84026	0.0001
GDP has a disparate causal relationship with CO2	9.96103	9.11950	0.0000
CO2 has a disparate causal relationship with GDP	4.43372	2.63266	0.0085
GI has a disparate causal relationship with CO2	10.1263	9.26522	0.0000
CO2 has a disparate causal relationship with GI	2.60164	0.47477	0.6350
FD has a disparate causal relationship with EU	4.48743	2.63442	0.0084
EU has a disparate causal relationship with FD	6.32909	4.76154	0.6676
GDP has a disparate causal relationship with EU	2.89248	0.79226	0.4282
EU has a disparate causal relationship with GDP	4.46655	2.61030	0.0090
GI has a disparate causal relationship with EU	6.37681	4.80237	2.E-06
EU has a disparate causal relationship with GI	1.99249	-0.24953	0.8029

GDP has a disparate causal relationship with FD	2.83917	0.76130	0.4465
FD has a disparate causal relationship with GDP	5.45616	3.83259	0.0001
GI has a disparate causal relationship with FD	3.43829	1.45215	0.1465
FD has a disparate causal relationship with GI	3.23029	1.20917	0.2266
GI has a disparate causal relationship with GDP	5.52753	3.89284	0.0001
GDP has a disparate causal relationship with GI	3.63837	1.68589	0.0918

Source: author analysis

5. CONCLUSION AND POLICY RECOMMENDATIONS

The study explored FD, EC, EG (GDP per capita) and Globalization's impact on Carbon dioxide (CO_2) emission in member countries of the Shanghai Cooperation Organization (SCO) from 1990 to 2019. Numerous econometric tests, such as the Pesaran-scaled LM, 2nd-generation Pesaran CD test, Breusch-Pagan LM test, and bias-corrected-scaled test, were used to achieve the study's objectives. Using the Fully Modified Ordinary least square (FM-OLS) method, variables were seen to be co-integrated. The findings of the study show that an increase in EU, FD, and EG increases CO2 emission, resulting in the deviation of EQ in member countries of SCO. The availability of credit facilities without considering environmental aspects deteriorates EQ. The low-cost financing changes the consumption trend and production technologies which are dangerous for EQ and thus the environmental degradation issue is on the rise in some member countries of SCO. To overcome this issue and ensure sustainable development along with better EQ, the member countries need to allocate financial resources for R&D in green financing and encourage financial institutions in this regard. Financial institutions can thus contribute significantly to ecological sustainability by using green funding to support and promote contemporary innovations. Globalization should also be promoted as it improves EQ through the transfer of green technology across the world. Traditional energy resources should be used as little as possible while renewable resources should be used to generate energy. Renewable energy can play its role not only in the betterment of EQ but also in ensuring energy security, affordability, and long-term sustainability, all of which are crucial components of sustainable development.

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