

Free Trade Agreements and Environmental Nexus in Pakistan

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Abstract

This study attempts to examine the relationship between Free Trade Agreements (FTAs) and Carbon Dioxide (CO₂) emissions in Pakistan. Panel unit root, panel co-integration, and Fully Modified OLS (FMOLS) estimators were employed to investigate the existence of long-run relationship between Gross Domestic Product (GDP), Trade openness (TO) and energy consumption (EC) with CO₂ emissions in Pakistan from 1980 to 2014. The results show that GDP per capita have a significant positive effect on CO₂ emissions. This implies that an increase in GDP per capita increases CO₂ emissions and show a scale effect. The results also indicate the existence of long run positive relationship of energy consumption on carbon emission and negative relationship with trade openness and FTA. This research is helpful for policy makers to eliminate the negative impact by adopting appropriate policy instruments and promote Pakistan's trade in the international market.

Introduction

In accordance with traditional theory of trade, economists believe that open economies perform better than closed ones. The underlying concept is that trade has significant impact on economic development. Debate on the trade-growth nexus is certainly not new. A theoretical concept that shapes this discussion is of the environmental Kuznets.¹ According to the environmental Kuznet curve (EKC) hypothesis, environmental degradation increases when an economy is at initial level of economic growth, and then decreases when it is at higher level of growth. With the given pollution coefficients, more production is dangerous to the atmosphere and scale effect is said to be negative because it triggers added emissions and pollution. Secondly, change in specialization due to more free trade explains the composition effect.

Economic development resulting from trade can have both negative and positive environmental effects. It is important to note that

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¹ Gene M. Grossman and Elhanan Helpman. "Trade, knowledge spillovers, and growth." *European Economic Review* 35, no. 2-3 (1991): 517-526.

free trade agreements (FTA) are fundamentally aimed at trade promotion and have an eventual impact on the international trade. FTAs are regarded as a significant policy tools for development. International trade theories, from Ricardo comparative advantage model through the two-country endogenous growth model developed by Grossman and Helpman in 1991 can be assessed as rational for the formation of FTA.² Since the early 1990's, number of FTA's signed by countries around the world have increased.

Several studies have been conducted to examine the connection between economic development and financial development on carbon emissions. However, most of the research focused on developed or emerging economies. There is a consensus in literature on significance of economic growth and financial expansion for environmental performance. However, limited research is done on panel of emerging countries. To the best of our knowledge, this is the first research that considers different types of FTAs signed by Pakistan with low developing and emerging economies.

This research makes fourfold contribution in the literature. First, it enables to find out the impact FTA's can have on the quality of the environment after the post-trade liberalization. Second, it estimates the long-run relationship between the variables. Third, the findings of this research may enable to test the environmental Kuznets curve (EKC).³ Fourth, Pakistani negotiators can pay attention to the environmental issues that are associated with FTA clauses and help the policy makers to eliminate the negative impacts by adopting good policy instruments and promote the development of Pakistan's international trade.

The research is divided into two main objectives. First, it examines the effects of Pakistan Free Trade Agreements with China, Malaysia, Sri Lanka and South Asian Free Trade Area (SAFTA) countries on Carbon Dioxide (CO₂) emissions in Pakistan. Second, it estimates the long run relationship between the impact of trade openness and energy consumption, and Gross Domestic Product on CO₂ emissions under the Free Trade Agreements (FTAs) in Pakistan.

The countries under trade agreement have many hypotheses about the impact of trade agreements on greenhouse gas (GHG) emissions that are critical indicators for the quality of the environment. The first hypothesis is "pollution haven hypothesis" (PHH), in which it is presumed that there will be high pollution in developing countries after entering into a FTA because of the country's non-restrictive

² Ibid.

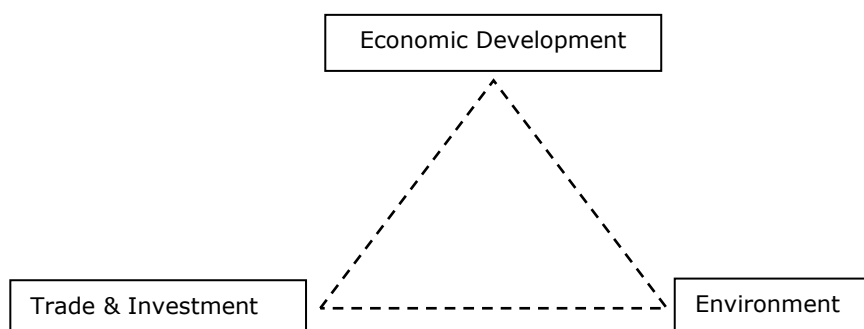
³ Simon Kuznets, "Economic growth and income inequality." *The American Economic Review* 45, no. 1 (1955): 1-28.

environmental regulations. The second hypothesis is "factor endowment hypothesis" (FEH). It argues that the type and volume of resources owned by trading partners determine the trade flows. "Porter hypothesis" or "regulatory chill" assumes race-to-the-top. According to this hypothesis, developed economies make harsh and stricter environmental rules which promote innovation and improve environmental quality of the countries in trade agreements with them.⁴ The "race-to-the-bottom hypothesis" is opposite to that of Porter hypothesis, according to which the developed countries do not make new and stricter environmental regulations in order to compete with countries having less environmental regulation for reduced production cost.

Trade–Environment Triangle

Trade and development cannot be separated. Trade strategies such as imports substitution industrialization (ISI) and Export Promotion industrialization (EPI) are allied with growth and development. In this frame of reference, from 1970-1980s the debates were mainly about ISI against EPI. The discourse switched to free trade after 1980 during the era of trade liberalization and world trade organization (WTO). Till 1990s, the discussion was limited to trade and development.⁵ During recent years, however, the world realized that the environment was in fact the overshadowing issue. The association, therefore, is now three-dimensional rather than two-dimensional: environment, trade and development. It is indispensable because the correlation of environment and trade is not direct. Figure 1 illustrates the connection through a trade–environment triangle.

Figure 1: Trade–Environment Triangle



⁴ Marcel Stoessel, "Trade liberalization and climate change." The Graduate Institute of International Studies, Geneva (2001); Kyle Bagwell and Robert W. Staiger. "The WTO as a mechanism for securing market access property rights: implications for global labor and environmental issues." *Journal of Economic Perspectives* 15, no. 3 (2001): 69-88.

⁵ KV Bhanu Murthy and Sakshi Gambhir. "International trade and foreign direct investment: empirical testing of the trade–environment triangle." *Transnational Corporations Review* 9, no. 2 (2017): 122-134.

The Figure 1 depicts the relationship between development and trade and a simultaneous connection between environment and economic development. With these two extensive relations, we can study the linkage involving trade and environment. Economic development is the result of globalization and rise in the volume of trade, urbanization and industrialization.⁶ As a result, this has led to increase in multinational and foreign direct investment (FDI) outflows. Multinationals often bend foreign trade and resources, thus leading to irregular model of growth; consequently, on the other hand affecting environment and also GDP growth. In the past decades, these leverage patterns have appeared to reinforce the Trade–Environment triangle.

Trade Liberalization in Pakistan

According to World Development Indicators released by the World Bank in 2016, total share of trade in global economy had doubled from 24.2% in 1960 to 58.3% in 2015. Simultaneously however, carbon dioxide emission has increased by 73% with trade openness.⁷ In Pakistan, trade liberalization started to flourish in late 1980s and moved towards more openness with the aim to achieve economic growth. During recent years, the regional or bilateral free trade agreements are exceedingly being advocated by the government of Pakistan. The impact of these agreements on environment has, however, not been a key concern.

The population rate of Pakistan is 3.1% per annum and Pakistan is pretty much urbanized in the context of South Asia. Land degradation is quite common and environmental degradation is visible in air and water pollution. It is estimated that \$9.6 million are lost per day due to rise in environmental degradation, while only 0.00028% of GDP is spent to address this. Pakistan is among few countries that are affected by extreme weather. Particularly, since 2010, the country has experienced extreme climate events, resulting in economic loss of US\$6b.⁸ From 1971 to 2014, 0.64 metric tons per capita CO₂ emissions are emitted on average and also the use of gas, electricity, petroleum and crude oil is increasing 9.5%, 7.2%, 4.7%, and 7.2% respectively.⁹ However, it is necessary to investigate that whether some of trade agreements signed

⁶ Ibid.

⁷ For details, please see: S. Zhang, X. Liu and J. Bae, "Does trade openness affect CO₂ emissions: evidence from ten newly industrialized countries? *Environmental Science and Pollution Research* (2017) 1-10.

⁸ S. Kreft, D. Eckstein, L. Junghans, C. Kerestan, and U. Hagen. "GLOBAL CLIMATE RISK INDEX 2016: Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2014 and 1995 to 2014. Briefing paper. *GermanWatch* eV, dezembro de 2015. Cf." (2015).

⁹ SURVEY, P. E. 2009. *Economic Survey of Pakistan*, Finance Division, Government of Pakistan.

by Pakistan are effecting the environment or not. A brief look at the trade patterns would help the reader get the context of things, however.

Pakistan does not enjoy an enviable share in international trade. Pakistan has been trading with many countries over the years and particularly with the few traditional partners. Due to internal and external economic conditions, the performance of Pakistan exports have been diverse.¹⁰ According to World Bank data of 2016, China is Pakistan's Major importing partner and the second largest exporting partner. It is playing a vital role in the growth of Pakistan's industrialization, technology and infrastructure.¹¹ Table 1 shows the list of top importers and exporters with Pakistan.

Table 1: Pakistan's Top Exporting and Importing partners, 2017

Top 10 export countries	Top 10 import countries
United States	China
China	United Arab Emirates
United Kingdom	Indonesia
Afghanistan	United States
Germany	Japan
Spain	Saudi Arabia
United Arab Emirates	India
Italy	Kuwait
Bangladesh	Germany
Netherlands	Malaysia

Source: World Development Indicators (2017).

Data and Methodology

This study is based on Panel data. The dependent variable is carbon dioxide (CO₂) emissions and independent variables include Gross Domestic Product (GDP), energy consumption (EC) and trade openness. Carbon dioxide (CO₂) is measured in metric tons per capital equivalent (mt CO₂ eq) and obtained from World Development Indicators (WDI).¹² Real GDP per capita is measured in constant 2010 US\$. Per capita energy consumption is measured in kilograms of oil equivalent, and the population is obtained from World Developments Indicators (WDI, 2014). These datasets were also used by several researches.¹³ Other economic

¹⁰ SHAHBAZ M, "Does trade openness affect long run growth? Cointegration, causality and forecast error variance decomposition tests for Pakistan. *Economic Modelling*, 29, 2325-2339. (2012)

¹¹ M. S. Irshad. "One Belt and One Road: Does China-Pakistan Economic Corridor Benefit for Pakistan's Economy?" (2015)

¹² World Development Indicators, *World Bank Report* (2016).

¹³ Burcu Ozcan, "The nexus between carbon emissions, energy consumption and economic growth in Middle East countries: a panel data analysis." *Energy Policy* 62

factors such as trade openness are also collected from WDI. In this study, trade openness ratio (TR) is the total value of import and export as a percentage of GDP.¹⁴

For analysis, following countries are investigated: Pakistan and China under PCFTA, Malaysia and Pakistan under MPCEPA, Pakistan-Sri Lanka under PSFTA and Pakistan and South Asian Free Trade Area under SAFTA (India, Nepal, Bangladesh, and Sri-Lanka). Bhutan, Afghanistan and Maldives had to be excluded from this research due to data limitations. Secondary data is used to investigate the relationship between carbon emissions, GDP, energy consumption and trade openness. The study employs an annual Panel data set for free trade agreements from 1980-2014 for 7 countries Asian countries.

Econometric Model

According to the previous studies CO₂ (Carbon Dioxide) emission is interpreted as a function of GDP, energy consumption, and trade openness (TO).¹⁵ Free Trade Agreement (FTA) has been added and the model is expressed as follows:

$$\ln CO_{2it} = \alpha_{it} + \beta_{1i} \ln GDP_{it} + \beta_{2i} (\ln GDP_{it})^2 + \beta_{3i} \ln EC_{it} + \beta_{4i} TO_{it} + \beta_{5i} FTA_{it} + \varepsilon_{it}$$

Where, *LN* is indicating the log form of variables, *i* is the country and *t* = time, and for each FTA, *k*=1, 2, ..., *K*. FTA is considered as a dummy variable and other variables in log form.

$\ln CO_{2it}$ = log of carbon Dioxide emission per capita in country *i* at time *t*.

$\ln GDP_{it}$ = log of gross domestic product per capital,

(2013): 1138-1147.; Tun-Hsiang Yu, Man-Keun Kim, and Seong-Hoon Cho. "Does Trade Liberalization Induce More Greenhouse Gas Emissions? The Case of Mexico and the United States Under NAFTA." *American Journal of Agricultural Economics* 93, no. 2 (2010): 545-552.

¹⁴ Behnaz Saboori, Jamalludin Bin Sulaiman, and Saidatulakmal Mohd. "An empirical analysis of the environmental Kuznets curve for CO₂ emissions in Indonesia: the role of energy consumption and foreign trade." *International Journal of Economics and Finance* 4, no. 2 (2012): 243.; Sahbi Farhani and Ilhan Ozturk. "Causal relationship between CO₂ emissions, real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia." *Environmental Science and Pollution Research* 22, no. 20 (2015): 15663-15676.

¹⁵ Matthew A. Cole, "Trade, the pollution haven hypothesis and the environmental Kuznets curve: examining the linkages." *Ecological Economics* 48, no. 1 (2004): 71-81.; Jeffrey A Frankel and Andrew K. Rose. "Is trade good or bad for the environment? Sorting out the causality." *Review of Economics and Statistics* 87, no. 1 (2005): 85-91.

$\ln EC_{it}$ = log of per capita energy consumption,

TO_{it} = Trade openness (Total value of import and export as a percentage of GDP).

Each Free trade agreement, FTA_{it} is the dummy variable by allocating a one (1) after the implementation of the FTA and zero for time period before implementation of the FTA. Except the FTA dummy variable, all variables (GDP, energy consumption and trade openness) are in logarithms. In this study, Panel data has been used due to the fact that it has more advantages over cross section or time series models. As mentioned by Nowak-Lehmann *et al*, there are many advantages offered by Panel Data such as possibility of capturing relationships over variables in time and observing individual effects between the trading partners.¹⁶ In nature, individual countries are heterogeneous. Whereas, cross section or time series studies individually do not account for such heterogeneity and thus the results are biased. The panel data give more information, more efficiency, less co linearity among the variables, more variability, more degree of freedom and the individual country effect can be obtained easily.¹⁷

Under the EKC hypothesis, β_1 sign is assumed to be positive and β_2 to be negative. This hypothesis assumes that as the income per capita of a country rises, the pollution level increases and after an initial level, the pollution levels decreases at income per capita rises; having a negative impact on the pollution. Sign of β_3 is expected to be positive. This analyzes that more energy consumption increases the economic activity and as a result CO₂ emission rise.¹⁸ The sign of β_4 and β_5 is undetermined as it depends on the country under study, the agreement type and also other factors.¹⁹ The expected relationships are listed in Table 3.

¹⁶ Sibylle H. Lehmann and Kevin H. O'Rourke. "The structure of protection and growth in the late nineteenth century." *Review of Economics and Statistics* 93, no. 2 (2011): 606-616.

¹⁷ Mohsen Bahmani-Oskooee, Misbah Nosheen, and Javed Iqbal. "Third-Country Exchange Rate Volatility and Pakistan-US Trade at Commodity Level." *The International Trade Journal* 31, no. 2 (2017): 105-129.

¹⁸ Marcel Kohler, "CO₂ emissions, energy consumption, income and foreign trade: A South African perspective." *Energy Policy* 63 (2013): 1042-1050.; Sahbi Farhani and Ilhan Ozturk. "Causal relationship between CO₂ emissions, real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia." *Environmental Science and Pollution Research* 22, no. 20 (2015): 15663-15676.

¹⁹ Gene M. Grossman and Alan B. Krueger. "Economic growth and the environment." *The Quarterly Journal of Economics* 110, no. 2 (1995): 353-377.

Table 3: Expected Signs

Dependent variable: carbon emission (CO₂)	Expected signs
GDP per capita (constant 2010 US\$)	Positive
GDP per capita (constant 2010 US\$) square	Negative
Energy use (kg of oil equivalent per capita)	Positive
Trade (% of GDP)	Undetermined
FTA (Dummy Variable)	Undetermined

Methodology

Various methods are used to find out co-integration analysis and the most recently approach used is the Autoregressive Distributed Lag (ARDL).²⁰ Co-integration analysis in ARDL has many advantages compared to other approach and this is the method that will be used in this study.²¹ First, it avoids endogeneity problems. Second, long-run effects between the variable can be assessed. Third, the establishment of the order of integration of the variables (unit-root test) is not required. ARDL approach is applicable despite the fact that regressors are I(0) or I(1) or fractionally integrated. Lastly, this approach is accepted in small samples as in case of this research.²² To check I(0) and I(1) we will apply the unit root test. In this research ARDL approach will be used to find out the long-run relationship between CO₂ emissions, GDP, energy consumption and trade openness.

Results and Discussions

Descriptive Statistics

Descriptive statistics are used to summarize the data in meaningful way. It is important to transfer the raw data into some useful insights to get better understanding of the data. The study planned to investigate the relationship between free trade agreements (FTAs) with carbon emissions (CO₂). The carbon emission per capita is dependent variable. GDP per capita, GDP per capital square, Energy use (kg of oil equivalent per capita) and trade openness as a percentage of GDP are independent variables. The study includes seven countries with which Pakistan has signed FTAs covering the period from 1980-2014. Table 4 shows the descriptive statistics of individual countries included in the panel.

²⁰ M. Hashem Pesaran, Yongcheol Shin, and Richard J. Smith. "Bounds testing approaches to the analysis of level relationships." *Journal of Applied Econometrics* 16, no. 3 (2001): 289-326.

²¹ M. Hashem Pesaran, Yongcheol Shin, and Ron P. Smith. "Pooled mean group estimation of dynamic heterogeneous panels." *Journal of the American Statistical Association* 94, no. 446 (1999): 621-634.

²² Ferda Halicioglu, "An econometric study of CO₂ emissions, energy consumption, income and foreign trade in Turkey." *Energy Policy* 37, no. 3 (2009): 1156-1164.

Table 4: Descriptive Statistics

	CO ₂	FTA	GDP	GDP2	EC	TO
Mean	1.5605	0.2122	1828.9540	8326518.00	668.3998	57.3650
Median	0.6567	0.0000	839.5137	704783.20	416.3740	39.9424
Maximum	8.0330	1.0000	10398.2300	108000000.00	2967.5410	220.4074
Minimum	0.0284	0.000000	283.0523	80118.62	102.4145	12.3521
Std.Dev.	2.0690	0.4097	2236.4840	19258341.00	651.2400	47.5045
Skewness	1.779932	1.4075	2.0559	3.10	1.9273	1.8982
Kurtosis	5.0524	2.9810	6.4603	12.54	5.8229	5.8622
Jarque-Bera	172.3664	80.8933	294.8167	1323.82	233.0292	230.7615
Probability	0.0000	0.0000	0.000000	0.00	0.000000	0.000000

The statistical information below tells about the data, its pattern and what is going on in the data. The mean and median of all the variables are closed enough. All the data are positively skewed for being greater than zero. Descriptive statistics table indicating carbon emission average value 1.56 with a standard deviation of 2.06 and maximum and minimum values 8.03 and 0.02 respectively. Minimum values of carbon emissions values indicate that there are countries in panel which have low carbon emissions but maximum values indicate that few panel countries have high carbon emissions. The difference between standard deviation and mean is not very large, indicating that the series has no outliers. The mean of FTA is 0.2 with minimum .0 and maximum 1 values. The standard deviation of FTA is 0.4. The mean value of energy consumption is 668 with minimum 2967 and maximum 102. From the table 3 it shows that the highest mean value is of GDP per Square, Maximum of GDP and minimum of FTA.

Panel Unit Root Test

According to the results, all the series of the null hypothesis of unit root are not rejected for Levin *et al* and Lin *et al* tests.²³ Hence by taking first difference there is enough evidence that the null hypothesis for unit root is rejected for all series at 5% significance level.

Table 5 reports the outcome for the sample of three panel unit root tests: Levin, Lin & Chut (LLC), ADF Fisher Chi-Square and LM,

²³ Andrew Levin, Chien-Fu Lin, and Chia-Shang James Chu. "Unit root tests in panel data: asymptotic and finite-sample properties." *Journal of Econometrics* 108, no. 1 (2002): 1-24.

Pesaran & Shin (IMP) tests to conform either variables are stationary or not.²⁴ The null hypothesis of LLC is there in unit root. It is important to check the stationarity of variables because of non-stationary variables may produce spurious results.²⁵ Hence the above results are showing that all the variables are tested at the level first on the base of LLC test and no one variable is found stationary, but while variables are tested on first difference all variables got stationary at I(1). Alternatively, when variables are tested at the base of IMP test, all variable get stationary at first difference. Hence all variables on the base of both the tests got stationary at I(1). According to the results all the series – carbon emissions, GDP, energy consumption and trade openness – become stationary by first difference at 5% significance level. Findings show that all the series are integrated with order I(1) and so stationary in the first difference. So, we may proceed now to check co-integration either variables are co-integrated or not. Therefore, we can implement a test for panel co-integration between the variables.

Table 5: Panel Unit Root Test

Variable	Levin, Lin & Chut		LM, Pesaran & Shin	
	Statistic	P-values	Statistic	P-values
CO2	1.1105	0.8666	3.8956	1.0000
ΔCO2	-1.7536	0.0397*	-3.9096	0.0000*
GDP	-0.0579	0.4769	0.9621	0.8320
ΔGDP	5.6018	0.0000*	-6.8661	0.0000*
GDP ²	-0.0579	0.4769	0.9621	0.8320
ΔGDP ²	-5.6018	0.0000*	-6.8661	0.0000*
EC	2.6837	0.9958	5.4633	1.0000
ΔEC	-4.3086	0.0000*	-6.5366	0.0000*
TO	1.1525	0.8755	1.0242	0.8479
ΔTO	-5.1209	0.0000*	-5.7899	0.0000*
FTA	0.3569	0.6394	1.2443	0.8933
ΔFTA	-7.9207	0.0000*	-5.5224	0.0000*

Note: *5% significance

The results reveal the existence of relationship between FTAs with carbon emissions. Hence, panel co-integration test are used to figure out the relationship among the variables: carbon emission (CO₂), GDP, energy consumption and trade openness.

The pre-assumption before running the panel co-integration tests were: there must be panel data, all the series in the data must be stationary and the series must be integrated at same order level. After

²⁴ Ibid.

²⁵ Ibid.

fulfilling the specifications of panel co-integration test the study used Pedroni panel co-integration (2004) test.²⁶ The results are documented in Table 6.

Table 6: Results of co-integration test

	Within-dimension (panel)				Between-dimension (group)		
	v-Stats	rho-Stats	PP-Stats	ADF-Stats	rho-Stats	PP-Stats	ADF-Stats
-	0.8183	-2.6384	-12.4724	-9.88614	-	-17.0384	-11.1711
5					1.92481		
P-Value	0.793	0.0042**	0.0000**	0.0000**	0.0271*	0.0000**	0.0000**
1		*	*	*	*	*	*
Weighted	1.5005	-2.5683	-12.3267	-9.63052			
8							
P-Value	0.933	0.0051**	0.0000**	0.0000**			
3		*	*	*			

Notes: Results with a trend and time-dummies. The test statistics are normalized so that the asymptotic distribution is standard normal. *, **, *** indicate rejection of the null hypothesis of non-cointegration at the 10, 5, and 1 percent significance levels, based respectively on critical values of 1.281, 1.644 and 2.326.

The columns labeled as 'within-dimension' contain the computed value of the statistics based on estimators that pool the autoregressive coefficient across different countries for the unit root tests on the estimated residuals. The columns labeled between-dimension report the computed value of the statistics based on estimators that average individually estimated coefficients for each country. According to the outcome of co-integration test there are five statistics that are significant at 1%, 5% and 10% and two statistics are insignificant. According to the finding of co-integration test majority of the test statistics are showing enough evidence to reject the null hypothesis. The outcomes confirm the co-integration, which means that there are some long-run relationships between the variables. The test has conclusive evidence to reject the null hypothesis of no co-integration. The findings of these tests are in line with the findings of several researchers.²⁷ Furthermore, after the Panel co-integration test the study use fully modified ordinary least square (FMOLS) estimator for long-run coefficients.

²⁶ Peter Pedroni, "Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis." *Econometric Theory* 20, no. 3 (2004): 597-625.

²⁷ Kais Saidi and Mounir Ben Mbarek. "The impact of income, trade, urbanization, and financial development on CO 2 emissions in 19 emerging economies." *Environmental Science and Pollution Research* 24, no. 14 (2017): 12748-12757.; Ais Omri, Saida Daly, Christophe Rault, and Anissa Chaibi. "Financial development, environmental quality, trade and economic growth: What causes what in MENA countries." *Energy Economics* 48 (2015): 242-252

The fully modified ordinary least square estimator provides relationship among the variables such that in which direction and with how much magnitude the independent variables are affecting the dependent variable. The results of (FMOLS) are reported in Table 7.

Table 7: Cointegration Results (FMOLS)

Variables	Coefficient	p-value	S.E.
LnGDP	0.18975	0.0782	0.24641
lnGDP(sqr)	-0.29277	0.0478	0.38491
lnEC	0.542835	0.0007	0.60142
lnTO	-0.89498	0.0015	0.27822
FTA	-0.73141	0.0007	0.21281

The results show that GDP per capita have significance and positive relationship with carbon emissions. A 1% increase in GDP per capital causes 18.9% increase in CO₂ emissions for the long-run at 5% significance level. The Panel results also show that with 1% increase in GDP per square will decrease the carbon emissions by 29.2 % at 5% significance. Thus it shows significance and negative relationship between GDP per square and CO₂ emissions. The model includes the GDP per capital square to test the existence of invert-U shape relationship between carbon emission and growth. Similar findings have been reported by few authors in case of Pakistan.²⁸

Conclusions and Recommendations

This study attempted to examine the relationship between free trade agreements (FTAs) and carbon emissions in Pakistan. The study claims the existence of some relationship between FTA's with carbon emissions. Hence, panel co-integration test was used to figure out the relationship among the variables. The fully modified Ordinary least Square estimator provided relationship among the variables such that in which direction and with how much magnitude the independent variables are affecting the dependent variable.

This study also analyzed that there is positive relationship between energy consumption and carbon emission. Coefficient value of total energy in long run is 0.54 which is positive. The model also interestingly provides significant and Negative relationship between

²⁸ Khalid Ahmed and Wei Long. "An empirical analysis of CO₂ emission in Pakistan using EKC hypothesis." *Journal of International Trade Law and Policy* 12, no. 2 (2013): 188-200.

trade openness and CO₂ emissions. Coefficient value of total energy in long run is 0.54 which is positive. A 1% increase in trade openness leads to 0.89 increase in CO₂ emissions. The conclusion of this study is that this research is helpful to see the environmental impact of the FTA's in Pakistan, so that Pakistan negotiators can pay attention to environment issues associated with the FTA clauses, to help policy makers to eliminate the negative impact by adopting appropriate policy instruments and promote Pakistan's trade in the international market by seeing that whether the FTA's are benefiting Pakistan trade.

According to the findings of this study following policy recommendations are suggested. To reduce the energy intensity, energy conservation should be the major strategy compared to energy structure adjustment. This is considered to be a cheaper and feasible way to reduce energy related CO₂ emissions. Diversification of the energy supply mix and promotion of a cleaner energy structure are effective to contain the acceleration of CO₂ emissions. To modify the fossil fuel dominating energy structure, the consumption of oil and gas, especially in the power generation sector, should be replaced by cleaner source of energy such as hydro, solar, wind, etc. In the core of the earlier estimated results and significant existence of EKC the policy recommendations are advised to reduce CO₂ emissions.

The large emerging economies of Asia with whom Pakistan has signed FTA agreements (China and India) should promote environment friendly projects and should contribute their role for the betterment of the environment. The trade liberalization should be continued as it assists to import latest technology. Revisiting the urban planning and forest policy need may potentially help offset the adverse effects of urbanization and deforestation because of growth (income).

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