DECOMPOSING THE TRADE-ENVIRONMENT NEXUS FOR SOUTH ASIAN COUNTRIES

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Submitted By

Fizza Shaukat

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Supervisor

Dr. Hafsa Hina

Department of Economics

Pakistan Institute of Development Economics,

Islamabad

Pakistan Institute of Development Economics

CERTIFICATE

This is to certify that this thesis entitled: **"Decomposing the Trade-Environment Nexus for South Asian Countries"** submitted by Ms. Fizza Shaukat is accepted in its present form by the Department of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree of **Master of Philosophy in Economics**.

External Examiner:

Dr. Sabahat Subhan
Assistant Professor
NUML University
Islamabad

Supervisor:

Dr. Hafsa Hina
Assistant Professor
PIDE, Islamabad

Head, Department of Economics:

Dr. Attiya Y. Javid
Professor/Head
Department of Economics
PIDE, Islamabad

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LIST OF ABBREVIATIONS

Asean	Association of South East Asian Nations
ARDL	Autoregressive Distributed Lag Model
Co2	Carbon Dioxide
ECM	Error Correction Method
ECT	Error Correction Term
E	Emission
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GNP	Gross National Product
IMF	International Monetary Fund
K	Composition effect
KO	Comparative advantage effect
K/L	capital Labour Ratio
O	Trade openness
OECD	Organization for Economic Co-operation and Development
N	Population density
PMG	Poole Mean Group
S	Scale effect
TE	Technique effect
UECM	Unrestricted Error Correction Model
WDI	World Development Indicators

Abstract

The relationship between international trade and environment is extremely debatable issue since the enhancement in trade openness. Panel of South Asian countries has been used in this study over the period of 1980-2016 to examine the impact of international trade on environment by decomposition scale, technique, composition and comparative advantage effect. Panel ARDL methodology is used to investigate the long run and short run relationship between trade and environment. The results suggest that the long run relationship exist between international trade and environment, whereas, the short run relation exist in scale effect, composition effect and comparative advantage effect. The results provide the modern approach to examine the impact of international trade in four sub-dimensions of trade openness. Hence, This study allocate more extensive policy mechanism for trade economist to improve method of environmentally feasible trade policies and agreements.

Chapter 1

Introduction

International trade plays a vital role in enhancing the economic activities. It increases the income level of a country but at the same time damages the natural environment (Azahar *et al*. 2007). The sharp changes in environmental quality and the global warming forced the researchers to explore and determine the relationship between trade and environmental quality. Trade liberalization can increase the market share of the country and enhance the competition in the market by utilizing the resources properly. On the other hand, the supporter of environmental quality argues that the eternal cost for expansion in international trade exhausts the natural resources and the natural environment (Ali *et al*. 2015). Accordingly, when country promote dirty industrial goods in order to enhance the trade and does not change the technique of production will damage the environment (Ling *et al*. 2015).

After 1970s, the effect of environment regulation on trade gained importance especially in developed countries (Xu, 2000) and it is observed that environmental policies have strong impact on trade (Beers and Bergh, 2003). Harris (2000) pointed out that stern environmental regulations reduce international trade and affect the competitiveness, whereas Costantini and Crespi (2008) defined that with enforcing environmental regulations, a country become technologically innovative which decreases the cost of production. South Asian countries created acceptable development on free trade policies and decreases tariff on trade since 1990 when some of the sectors familiarize with structural reforms. South Asian countries have also initiate substantial drive for industrial liberation in extension to other organizational improvement. Both the public and private sectors have accepted that strengthened exports are necessary for comprehensive economic development (Jabeen, 2011).

South Asian countries are vulnerable to climate change which also affects the trade performance and livelihoods of the member countries. Agriculture production particularly

affected in South Asia as major crops production gets affected due to extreme weather conditions. The problems can be resolved through better cooperation and adaptation strategies.

International trade has direct[1] and indirect effect on the environmental quality. Researchers have developed the four main components that indicate the indirect effect of trade on environment. Therefore scale, technique, composition and comparative advantage effect (Grossman & Krueger, 1991).

Scale effect occurs when trade enhances with the increase of economic growth in which the nature of activity is unchanged but scale is growing. It ultimately results to increase pollution and resource depletion along with output. The increasing level of pollution due to increase in trade is known as scale effect.

Composition effect occurs when trade increases in specialized sector and the country has comparative advantage in that sector, it represents the difference in the economy's structure. It affects the environmental quality depending on the comparative advantage of the economy (Jabeen, 2011). The countries produce surplus commodities in order to exchange commodities against other in which the country has no comparative advantage. When trade openness promotes specialization at international level, composition effect takes place. Thus, economy can move towards the developing stage due to the increase in efficiency and economies of scale. When increase in production of export oriented goods, and it creates less pollution thus the trade is beneficial for the economy. Furthermore, the trade openness spreads the domestic pollution problems in the world from the economy which have comparative advantage in production of dirty goods (goods that producing more pollution) to the economies which have comparative advantage in producing less pollution. Composition effect is also called structural effect (Grossman& Krueger, 1991).

[1] Direct effect includes the increase in transportation level due to NAFTA which degrades the environment (Gallagar & Taylor, 2003).

Technique effects occurs the adoption to modern technologies which reduces the emission per unit output, The production of goods and services by various methods and various contrasts of inputs for manufacturing. If the modern technology produces less pollution while manufacturing of goods thus it would be beneficial for the economic development and do not degrades the environmental quality furthermore if the technology produces the commodities which are toxic for environment creates more pollution in the country thus it has perverse impact on the natural environment (Grossman & Krueger, 1991). Some studies explain that income and natural environment are positively related, as income derives from international trade will increase the demand for environmental quality and enhances the capability of government to spend expensive investment for environmental protection (Tayebi & Younespour, 2012). The relationship between pollution and income is negative since the rising of economic growth give rise to demand for pollution abatement and supply the required resources (Jabeen, 2011).

Comparative advantage occurs when a country produces goods at lower cost; it means that a country produces goods relatively cheaper than other country. Comparative advantage raises to trade theory by Ricardian and Hecksher-Ohlin Theory of trade, accordingly either distinction in the technological use or the various factor of production enables the country to produce goods at lower cost. In the presence of strict environmental policies less degradation of natural environment would be expected and also lead to increase the cost of production. Hence, trade openness transfers the comparative advantage in favour of economy with less environmental policies and it specialize in dirty goods industry.

1.1 Objectives

The main objective of the study is:

- To examine the effect of international trade on environment using Carbon dioxide emission by decomposing total effect into scale , technique, composition and comparative advantage effect.
- To find the short and long run relationship between variables by using panel ARDL model.

1.2 Literature gap

In literature we have found the various studies such as Ling *et al*.(2015), Kakakhel (2012), Jabeen (2011), Loi (2012) Rehman *et al*.(2007), Halicioglu, and Ketenci (2015), Rehman, Ali, A., & Nasir (2007), Karsalari *et al*. (2014), have studied the effect of international trade on $\mathbf{Co_2}$ in case of East Asian countries and south Asian countries. These studies decomposed the effect of international trade on pollution emission into three components that is scale effect, composition effect and technique effect. The scale effect shows the changes in the size of the economic activities, the composition effect represents the changes in the mix of goods being produced and the technique effect shows the changes in the technology i.e. mainly adoption of cleaner technology (Grossman and Krueger, 1991). Though the studies referred above are much comprehensive but do not account for comparative advantage effect in South Asian countries.

Given that now comparative advantage effect on environmental quality depends upon combined effect of overall composition of trade of South Asian countries. It is important to examine the impact of international trade on environment by decomposing four components: scale effect, composition effect, technique effect and comparative advantage effect in case of selected South Asian countries including Pakistan, India, Srilanka and Bangladesh.

1.3 Significance of the study

In trade-environment nexus the relationship can be examined by decomposing the total effect into scale, technique, and composition effect. Therefore this study captures and examines the gap that the indirect effect of international trade on environment can be decomposed via total effect into scale, technique, composition and comparative advantage effect in case of South Asian Countries. Our study will contribute to extensive regulations for trade economist to establish healthier projects environmentally strengthen trade policies and regulations, which facilitate environmental policy maker in developing countries.

1.4 Organization of study

This study is organized into four sections described as follows, Chapter 1 includes introduction, Literature gap and research objectives. Chapter 2 contains existing literature review regarding trade- environment nexus. Chapter 3 provides the theoretical framework, detail information of data source, variable construction and econometric methodology. Chapter 4 contains results and discussion and the last Chapter 5 contains the conclusion and policy implications.

Chapter 2

Literature Review

The existing literature review on the impact of international trade on environment provides the heterogeneous results as the environmentalists focus on the negative impact of generated pollution, whereas the trade supporters show that it has positive effect on environment, hence the final result may depends on specifics factors of economy for example the development stage of the economy ,the comparative advantage of the country, intensity level of traded goods, awareness of environment policies. In early 1971 the literature started publishing work by examining the impact of economic growth on natural environment (Ali *et al.* 2017).

Temurshoev (2006) finds the correlation between pollution intensity and capital intensity of manufacturing is small and raised the ambiguity about presence of factor of endowment. Taylor & Copeland (2001) studied the linkage between trade and pollution and found that income effect plays vital role to determine the effect of liberalization on environmental quality. However, the effect on environmental quality can be different in developing and developed countries as Mccarney & Adamowicz (2006) concluded that organic water pollutant (BOD) and carbon dioxide Co_2 affect the environmental quality more in developing countries as compared with the developed countries. Duy (2012) studied the interrelationship between trade liberalization and environmental degradation and found that trade liberalization is harmful for environment in developing countries and it needs some efficient environment policies to overcome this damage. Low and Yeats (1992), Mani and Wheeler (1998), Dinda (2006) investigated that trade liberalization has impact on environment in developing countries whereas in developed economies the trade liberalization enhances the environmental quality. Moreover Cole (2006) examine that developing countries do not implement the rules of World Health Organization (WHO) thus environmental quality is affected. According to Takeda and Matsuura (2006) trade affects the environmental quality in

East Asian countries from the time duration of 1988-2000. They concluded that environmental quality damages when there is export in dirty goods but importing dirty goods do not affect environmental quality.

Dean (2002) examines that the trade liberalization directly effects the natural environment and indirectly effects the income growth. Jabeen (2011) studied that net impact of trade liberalization policies damages the environmental quality by using Co_2 whereas in case of sulphur dioxide the net impact will be beneficial for environmental quality once it is reduced.

Ali *et al*. (2017) studied the relationship between trade and environmental quality and examined that there is negative impact of trade on environmental quality but at the same time the study showed the beneficial impact of trade. On the other hand Rezazadeh *et al.* (2014) found that there is long run positive relationship between international trade and environment.

Country specific studies are also being done in literature as Jha & Rabindran (2004) studied the impact of trade liberalization on environment in India. The study concludes that trade liberalization enhances economic growth in India but it also affects environmental quality. Azhar *et al*. (2007) studied the environmental effect of trade liberalization in case of Pakistan and found that long run trade liberalization has negative impact on environmental quality as it increases air and water pollution (BOD).

Ali *et al*. (2015) studied the effect of international trade on carbon emission in case of Pakistan and concluded that foreign direct investment effects the environment; trade liberalization is not as much beneficial for Pakistan's environment. Pakistan economy emphasizes foreign direct investment that effect the technology and it may cause emission of carbon dioxide which effects the environment. Halicioglu (2009) examines the causal relationship between carbon dioxide, economic growth, energy consumption and trade liberalization in case of turkey. He found that international trade increases the carbon dioxide

emission, energy consumption and also the other factor that increase carbon dioxide emission.

Environmental cost is major element which cannot be neglected as Gallagher & Taylor (2003) examined the economic cost of shipping emission has been increased from $1.1 billion to $126 million, without proper policies the environmental cost may rises in future. However environmental policies also vary across the economics and they exerted significant impact on trade (Beers and Berh, 1997).

Keho (2016) examined the environment degradation has negative and long run effect on productivity and human capital, when the economy produces less polluting goods this will give rise to sustainable development.

Some other factors are also analyzed by the studies in their analysis while examining trade and environment relationship. As Rehman *et al.* (2007) pointed that positive relationship between trade openness and environmental quality. Mahidi (2013) pointed out that comparative advantage in polluted goods can create more pollution while better sustainable development can be possible in healthy environment. Zamfir (2014) stressed that proper policies can protect the industries by tightening up the emission standard and utilize the proper allocation of resources which creates positive impact of trade on environment. Ling *et al.* (2015) founded that scale and comparative advantage have positive effect on Co_2, whereas, technique effect, composition effect and trade openness has negative impact on Co_2.

Moreover a great deal of numerous studies has determined the relationship between international trade and environment drawing the work of Tayebi & Younespour (2012) studied the impact of inter industry trade on Iran's environment, panel cointegration has been used in this study and finds the positive effect of rising GDP on pollution of the countries. Moreover, Iran could not gain benefits from the trade with Middle East and OECD countries as Iran has comparative advantage in dirty goods. Zaman (2012) studied the relationship

between international trade, environmental quality and economic growth in case of Bangladesh. Johansen cointegration has been used to check the interaction between the variables. Findings show that speed of adjustment is faster than trade and low for co2 emission and GDP. They found that current scenario needs to gain attention to lower the emission without effecting the trade relations for causing the pollution but focus on the growth to enhance the per capita GDP.

One of the most comprehensive study of Ferrantino and Linkins (1999) that considered two trade scenarios, one is trade increasing from Uruguay Round and the other is agreement which remove all tariffs of manufacturing sectors and found that trade and environmental preservation are complimentary on worldwide scale.

Antweiler *et al*. (2001), Liddle (2002) found that trade liberalization creates small change in pollution when it changes the composition of output. The trade induced technique effect and scale effect may reduce the pollution and concluded that trade liberalization is beneficial for environmental quality in developed and under developed economies. Whereas, Kukla-Gryz (2009) found that trade liberalization increases the air pollution in developing countries.

According to Managi *et al*. (2009) trade liberalization is good for environmental quality by decrease the carbon dioxide emission in OECD. But, Iwataa *et al.* (2012) examines that trade liberalization insignificantly effects the carbon dioxide emission in OECD.

Frankel and Rose (2005) similarly examined the impact of trade openness on natural environment is strong when an economy has capital-labour ratio is more than the per capita income. They used cross sectional data and evaluated the impact of trade on Co_2 and particulate matter, energy consumption, dirty water. They incorporate an interaction term between capital and trade openness to check the comparative advantage of capital abundance economy in dirty good and finds the mixed results whereas interaction term is insignificant. Lucas *et al.* (1992) examined the impact of trade on toxic intensity output. They conclude

that high growth rate of toxic output from trade openness may increase the pollution emission in growing economies. A similar study has been carried out by Anderson (1992) on coal industry and world food, describing that trade liberalization in food and coal products will decrease the global pollution related with these products. Mendez and Gale (1998) investigate the relationship between international trade, growth and natural environment and concluded that rise in income has harmful effect on natural environment whereas trade has insignificant impact on pollution emission. Moreover, Wu *et al.* (2012) analyzed the impact of countries environment on its trade intensity and finds the positive impact on trade between highly rule base economies and relation base economies. They concluded that any relation base countries have negative impact on trade flows.

Empirical analysis conducted by Ghana and Lopez (1997) revealed the empirical evidence for international trade impacts on the natural environment. They find that impact of international trade on biomass reduction is rather significant. Lee and Roland-Holst (1997) investigate the linkage between the international trade and natural environment by using general equilibrium model for Japan and Indonesia. When Indonesia reduces the nominal tariffs on imports from Japan thus it will increase the pollution emission to real output. If the tariff removal policies and the effluent taxes are combined then the environmental quality cannot be more depleted.

Summary of Literature

The literature of various studies concludes that trade liberalization does not only enhances the economic growth of a country but also damages the natural environment. In developing countries there is rapid increase in population which leads to increase in demand and it enhances the use of energy which can damage the environment, moreover the comparative advantage of labour abundant and capital abundant countries can also play vital role in affecting the natural environment, there are mixed results for long and short run relationship

between trade and environment. Most of the low level income countries should adopt environmental policies to protect environmental damages caused due to trade.

Chapter 3

Data and Methodology

3.1 Introduction

The objective of this study is to examine the impact of international trade on environment by decomposing scale, technique, compositions and comparative advantage effect. In this chapter we identify the theoretical framework to practically examine the impact of international trade on environment. This chapter also discusses the econometric technique which will be use for empirical analysis. This study will use Panel data set over the period 1980-2016.

3.2 Theoretical Framework

The theoretical model which is used in our study is pollution model of Tayebi and Younespour (2012). This model allows comparative advantage to be managed by the factors like labor and capital, and it is based in Hechscher-Ohlin model which provides precise description of impact of trade on environmental quality.

According to Tayebi and Younespour (2012), a population that lives in small open economy, the small economy manufactures two different products, X and Y with two factor of production labour (L) and capital (k). Commodity Y is labour intensive and does not generate pollution, commodity X is capital intensive and generates pollution as by-product. According to constant return of scale manufacturing technique for good X and Y are assumed by unit cost function c^x(w,r) and c^y(w,r). Supposing Y be the numeraire, Let $p^y = 1$ and shows the relative price(p) of commodity X. Production of commodity X by 1 unit will increase the pollution by 1 unit, it is known as the initial stage of pollution and denoted by B. Manufacturers have access to mitigate technology, however, for an ease we use input as commodity X. Given initial stage of pollution B, the decrease in pollution A, shows:

$\emptyset_A(x_a, x)$ hence Ø is the parameter which is influenced by change in technology, x_a denotes the resource allocation to abatement. Emission of pollution represents B-A as:

$$E = [x - \emptyset A(x_a, x)] \tag{3.1}$$

Tayebi and Younespour (2012) suppose $A(x_a, x)$ is linearly consistent, concave and increasing in x_a and x , it can be written as

$$A(x_a, x) = x_a(\theta) \tag{3.2}$$

Hence θ= x_a/x is the fraction of X outcome decreases pollution and a(θ) A(θ,1). Tayebi and Younespour (2012) suppose without any input there will be no abatement, and pollution cannot be fully diminishes in production process as a(0) = 0 and $\emptyset_a(1)$ < 1.this shows the abatement cost in rising, from equation (3.1) of emission of pollution we decode in equation (3.2) as:

$$E = x[1 - \emptyset_a(\theta)] \tag{3.3}$$

Now Tayebi and Younespour (2012) stipulate the equilibrium for the manufacturing side of economy, so they suppose government impose the taxes on the goods which produces pollution (it is endogenous) to overcome pollution:

$$\Pi^x = px - c^x(w, r)x - \tau[1 - \emptyset_a(\theta)]x - p\theta x \tag{3.4}$$

Here, Π^xrepresents the profit, generated by producing the X commodity (px), less cost of production ($c^x(w, r)x$), tax on pollution ($\tau[1 - \emptyset_a(\theta)]x$), and cost of abatement($p\theta x$).

Firms selected the overall output of commodity X and abatement fraction to increase the profit, as shown:

$$\tilde{p} = p(1 - \theta) - \tau[1 - \emptyset_a(\theta)]$$

Then it turns as:

$$\Pi^x = \tilde{p}x - c^x(w, r)x$$

According to constant return to scale, the production level of individual firm is uncertain, so the first order condition for θ shows:

$$p = \emptyset \tau a'(\theta) \tag{3.5}$$

It shows the maximum abatement θ* as rising function of τ /p:

$$\theta^* = \theta(\emptyset \frac{\tau}{p}) \tag{3.6}$$

Therefore θ is greater than 0, as it is assumed that abatement cost is rising in terms of pollution tax with the lack of barriers and firms will enter so that the firms profit is zero, so the equation for industry X will be written as:

$$c^x(w, r) = \tilde{p} \tag{3.7}$$

and the industry Y will be written as:

$$c^y(w, r) = 1 \tag{3.8}$$

Therefore, Tayebi and Younespour (2012) suppose that Industry X and Industry Y are active, hence w and r from the above equation, are the factor prices as the function of price (p).factor price r and w shows the input coefficients for every sector, according to Shepherd Lemma the unit of labour L are required for the production of commodity X can be shown as:

$$c^x w \equiv \partial cx / \partial w$$

In case of full employment it can be written as:

$$L = c^x wx + c^y wy \tag{3.9}$$

$$k = c_r^x x + c_r^y y \tag{3.10}$$

Consumer maximize his utility assuming pollution as given, for instance consumer make preferences on goods and services that are homogeneous and marginal disutility of pollution is invariant, therefore the consumer's indirect utility function can be written as:

$$V\left(P, \frac{G}{N}, Z\right) = U\left(\frac{\frac{G}{N}}{P(p)}\right) - бz \tag{3.11}$$

Whereas G/N denotes the per capita income, p represents price, U represents increasing trend, б represents the marginal disutility of pollution, and however pollution is treated as harmful by-product of production and consumption. The real per capita income can be written as: $I = \left(\frac{\frac{G}{N}}{P(P)}\right)$, Then the indirect utility function can be written as:

$$u(I) - бz \tag{3.12}$$

Government has the authority to impose policy regarding pollution, but it can be change with economic growth condition. In our model we predicted the simple model by supposing the government impose the pollution tax, this shows that different countries have different policies and different government behavior, this pollution tax may effects the economic growth condition in an economy, whereas consumer behavior may be same, the optimum pollution tax increases the sum of utilities:

$MAX_{\tau}\{N[U(I) - бz]\}$

This can be shown as:

$$\tau^* = Nбλ[p, I] \tag{3.13}$$

as $\lambda = P(p)/u'$, and $\lambda I > 0$ thus u is concave. $б\lambda = [p, I]$, In this regards marginal damage per consumer, and hence eq (3.13) represents standard Samuelson rule. So the tax on pollution is combine marginal damage of all consumers and thus rises in income because natural environment is considered as normal good.

Scale, technique, composite and comparative advantage effect:

It is examined that the relationship between environment and economic growth is complicated; it is helpful to examine the relationship by decomposing the scale, technique, composite and comparative advantage effect. Scale effect of the economic output (S) is defined as the value of total output of economy at given price:

$$S = Px + Y \tag{3.14}$$

Composite effect is defined as the relative supply of X. It can be written as x/y and denoted with χ, from the above eq (3.9) and eq (3.10) we extract:

$$\frac{X}{Y} = C_w^y k - \frac{C_r^y}{C_r^x} - C_w^x k \equiv \chi[k, \tilde{p}] \qquad (3.15)$$

Whereas k represents (K/L) capital labour ratio, χ represents the increasing trend in k and $\tilde{p}$, thus rise in price will decrease the taxes τ. The output of an economy that changes $\chi\,[k, \tilde{p}]$can create the composite effect. The pollution tax rely on the size of population, per capita income, taste of consumers, then the pollution model can be written as:

$$\hat{E} = y_1\hat{S} + y_2\hat{K} - y_3\hat{I} - y_4\hat{N} - y_5\hat{6} - y_6\widehat{K.O} \qquad (3.16)$$

Whereas $\hat{E}$ represents pollution, $\hat{S}$ represents the scale effect, $\hat{K}$ represents capital labour ratio which is also known as composition effect. Capital intensive goods generate more pollution. The other terms$\hat{I}, \hat{N}, \hat{6}$, shows the effects of changes in the pollution emission and known as technique effect. $\widehat{K.O}$ represents comparative advantage effect. Government impose strict pollution policies when the per capita income rises and it will result in rise in the demand of environmental quality ε_{φ},I > 0), increase in the size of population ($\hat{N}$ >0) give rise to impose strict policies by government via Samuelson model[2]. Rise in pollution disutility ($\hat{6}$ > 0, it may rise from the more knowledge about emission of pollution). It results in increase in pollution tax and the demand for environmental quality. The last three effects of technique effect in the equation depends on ε_T, τ^* which represents the government response. Pollution emission increases due to scale of economy and the production of capital-intensive goods (Tayebi and Younespour, 2012).

The government imposes strict policies when there is rise in per income increases, pollution disutility and increase in the size of population in order to overcome pollution. The above

[2] Samuelson model explains the relationship between relative prices of output and relative factor rewards specifically, real wage and return to capital.

equation is not accurate for estimation so that Tayebi and Younespour (2012) add both the prices, domestic and fixed in the estimation. To investigate the problems that give rise to increase in pollution such as transportation cost or some other factors that acts as hurdle in trade. Given the fixed price Pw, the domestic price can be written as:

$$p = \beta p^w$$

Whereas, β represents the measure of trade friction.

When trade friction and the fixed price changes, then equation can be written as

$$\hat{\mathrm{p}} = \hat{\beta} + \widehat{p^w}$$

Rewrite the emission equation:

$$\hat{E} = y_1\hat{S} + y_2\hat{K} - y_3\hat{I} - y_4\hat{N} - y_5\hat{6} - y_6\widehat{K.O} + y_7\hat{\beta} + y_8\widehat{pw} \qquad (3.17)$$

According to Tayebi and Younespour (2012) Pollution in an economy may be rise because of trade friction and world fixed prices. It should not be supposed to examine the trade openness related in any organize way to pollution. This shows that value of β rises with trade openness for exporting the goods that produces more pollution and the value of β falls when importing the goods that are less polluted. Whereas β coefficient is positive, therefore the rise in trade allows $\hat{\beta} > 0$ for economy having comparative advantage in dirty commodity and $\widehat{\beta} > 0$ for an economy having comparative advantage in clean commodity. Tayebi and Younespour (2012) recapitulate the results as when an economy has comparative advantage in dirty goods or world price($\widehat{pw} > 0$), thus the price of pollution intensive commodity increases. By assuming the abatement intensity unchanged, the rise in relative price of good X enhances the output o X, thus pollution also increases. Given the pollution tax, rise in the price of good X increase the abatement cost thus pollution also rises. In opposite case where $\hat{\beta}$ <0 for an economy having comparative advantage in clean good or world price ($\widehat{pw} < 0$), the response of an economy toward trade depends on the comparative advantage. This theory explains the

technique to determine the composition effect derive by trade openness. Comparative advantage is examined by the interaction of factor endowment and distinguishes in pollution policies (due to discrepancy in income per capita). Pollution policies are affected by income per capita.

In order to examine the factors that affect the comparative advantage, Tayebi and Younespour (2012) interpret them separately. Factor endowment theory assumes that capital intensive goods are exported by capital intensive economies. In the above model it is not necessary because policies regarding pollution can alter the trade pattern, as capital intensive goods has vital role in the comparative advantage in the model. Hence X is capital intensive, when there is rise in k, keeping all other factors constant, increases the domestic supply of good X and decreases the autarky relative cost of good X. Other things remain constant; increases the factor of production used in pollution intensive good will increase the exports of the country of pollution intensive goods. Therefore if an economy is capital intensive, it must export the capital intensive good. Pollution haven hypothesis is the another theory of trade, according to this theory poor countries produce dirty goods and they have comparative advantage in dirty goods due to poor pollution policies, whereas rich countries have comparative advantage in clean goods and they have tight pollution policies. This shows that when country have same factor of production but different in real per capita income so there must be tight pollution policies in rich countries this will results in comparative advantage in clean good. In opposite case when country has different factor of production then there would be weak result. When country is rich, keeping other things constant, thus it must produce and export clean good. According to the autarky, the price of polluted goods increases with the real per capita income when we control the overabundance of relative factor. Therefore high income countries have the comparative advantage in clean goods furthermore it can be examined that when a country is rich, it exports clean (labour intensive) goods.

It has been shown that trade has an impact on the natural environment that changes with the comparative advantage of an economy. When we compare the economies that have identical per capita income and scale, we believe to find that trade openness related with greater pollution in economy with a comparative advantage in producing polluted goods and lower pollution in economy related with the clean goods. This measurement states that depending on country characteristics it is necessary when to separate composition effect from trade. As comparative advantage is determine by the complicated interaction of per income difference and factor abundance, these outcomes show that when a country is rich than the impureness motive for trade exceeds the factor endowment and thus the country will export the clean goods. Likewise, when a country is capital intensive than factor endowment for international trade will exceeds the pollution haven motive and thus the country exports dirty good. This theory is possibly weak because it does not explain either rich or capital abundant , but it explains that these concepts functions for the whole distribution of both real per capita income and factor abundant in the world (Tayebi and Younespour, 2012).

3.3 Econometric Model

In the light of above discussion, following model from equation (3.17) has been proposed:

$$\mathrm{E} = \mathrm{f}(\mathrm{S}, \mathrm{T.E}, \mathrm{K}, \mathrm{O}, \mathrm{K.O}, \mathrm{FDI}, \mathrm{N})$$

We have transformed all the variables into their natural logarithms following (Hui Ling *et al*. 2015). The regression equation can be written as:

$$lnE_{it} = \gamma_0 + \gamma_1 lnS_{it} + \gamma_2\, lnT.E_{it} + \gamma_3 lnK_{it} + \gamma_4 \mathrm{lnK}_{it}.\mathrm{O}_{it} + \gamma_5 lnO_{it} + \gamma_6 lnFDI_{\ it} + \gamma_7 lnN_{it} + \mathrm{U}_{it} \qquad (3.18)$$

Here, E represents carbon dioxide emission, S is the scale effect, T.E denotes Technique effect, K denotes composition effect, K.O represents the comparative advantage effect, O represents Trade openness. We have included some other control variable from the existing

literature in above model such as Population density (N), and Foreign Direct Investment (FDI). The data collected for our study from World Development Indicator (WDI) and International Monitory fund (IMF). Panel ARDL is used to check the relationship between International trade and environment.

3.4 Panel unit root

Panel Auto regressive distributed model (ARDL) is used to examine the long run relationship between variables. ARDL cointegration is applicable only when the regressors are mixture of I(0) , I(1). Panel Unit root test is therefore, required to confirm the absence of I(2) variable otherwise in the presence of I(2) variable, the critical values of ARDL bond test are no more applicable. In this study we applied commonly used Panel unit root test proposed by Levin, Lin & Chu (2002) and Im, Pesaran and Shin (2003). Levin, Lin & Chu (LLC) is mostly used on pooled data and solving the problem of sereal correlation by predicting heterogeneity among the units in panel series, whereas Im, Pesaran and Shin(IPS) is obtained by averaging the ADF statistics of each country in Panel . The auxiliary regression for panel unit root test of LLC follows the given equation:

$$y_{it} = \rho_i y_{i,t-1} + z_{it}^{'}\gamma + u_{it} \qquad i = 1, \dots N; t = 1, T \quad (3.19)$$

Whereas, z_{it} is the deterministic part including intercept and trend. u_{it} are the residual and according to LLC test the residuals are identical and independently distributed with the mean zero and varianceσ_u^2 . The parameter ρ_i indicates the existence or absence of unit root for all the values of i. When there is unit root in all the series of panel data, its null hypothesis can be constructed as $H_o : \rho = 1$, and the alternative hypothesis is $H_1 : \rho < 1$, reveals that there is no unit root.

The LLC supports the heterogeneity in intercept term, whereas, IPS supports the heterogeneity in both intercept and slope for cross sectional countries. The auxiliary equation of IPS for unit root test can be written as:

$$y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{\rho i} \emptyset_{ij} \Delta y_{i,t-j} + z_{it}^{'}\gamma + \varepsilon_{it} \quad (3.20)$$

When all the series in panel data have unit root, the null hypothesis can be constructed as $H_o: \rho_i = 1$ and alternative hypothesis is $H_1: \rho_i < 1$, shows that series have no unit root. It introduces the substitute tests that rely on averages of individual unit root test.

The IPS test is similar to the unit root test for all the series in cross sections. When $N \to \infty$ and $T \to \infty$, thus t-test for IPS is:

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - \frac{1}{N}E[t_{iT}|\rho_i=1]}{\sqrt{\frac{1}{N}var[t_{iT}|\rho_i=1]}} \quad (3.21)$$

3.5 Panel ARDL Cointegration

The ARDL technique for cointegration analysis in the single equation model suggested by Pesaran *et al.* (1997) and Pesaran *et al.* (2004), it deals with two steps for estimating the long run relationship. Firstly, it examines the existence of long run relationship (cointegration) between variables. If there is long run cointegration among variables, the next step is to investigate the long run coefficient through ARDL results.

According to Pesaran *et al*. (1999), Panel ARDL is the intermediate technique that enables the short run parameters to be distinguished among groups while applying equality on the coefficients of long run relationship among countries. The pooled mean group (PMG) has been proposed by Pesaran *et al*. (1999) in panel ARDL approach, it is best substitute to other estimations in panel data such as Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS).

The benefit of PMG is that, it can enable the dynamic of short run specification that vary from country to country by constructing the same coefficients of long run. Contrary, the

DOLS and FMOLS, the PMG estimator emphasize the adjustment dynamic among the long run and short run relationship. The purpose of supposing the short run dynamic and the error variance should be identical trend to be less compelling. While not applying the equality of short run slope coefficients enables the dynamic specification to be vary across countries. Therefore, the long-term relationship among international trade and environment is expected to be the same across countries but the short run coefficients are predicted to be country specific.

In panel ARDL the long run relationship among variables can be describe through standard log-linear function of ARDL-UECM model.

$$\begin{aligned}\Delta lnE_{it} = {} & \delta_0 + \delta_1 lnE_{it-1} + \delta_2 lnS_{it-1} + \delta_3 lnT.E_{it-1} + \delta_4 lnK_{it-1} + \delta_5 lnO_{it-1} \\ & + \gamma_6 lnk_{it-1}.O_{it-1} + \gamma_7 lnFDl_{it-1} + \gamma_8 lnN_{it-1} + \sum_{l=1}^{n1} \gamma_1 \Delta lnE_{it-l} \\ & + \sum_{l=0}^{n2} \gamma_2 \Delta lnS_{it-l} + \sum_{l=0}^{n3} \gamma_3 \Delta lnT.E_{it-l} + \sum_{l=0}^{n4} \gamma_4 \Delta lnK_{it-l} \\ & + \sum_{l=0}^{n5} \gamma_5 \Delta lnO_{it-l} + \sum_{l=0}^{n6} \gamma_6 \Delta lnK_{it-l}.O_{it-l} + \sum_{l=0}^{n7} \gamma_7 \Delta lnFDl_{it-l} \\ & + \sum_{l=0}^{n8} \gamma_8 \Delta lnN_{it-l} + v_{it}\end{aligned} \tag{3.22}$$

Hence $i = 1, \ldots . N$ represents the units of cross section, $t = 1, \ldots T$ denotes the time span, δ_0 denotes the specific group intercept. The null hypothesis from the above equation is $H_o: \delta_i = 0$, means there is no cointegration between variables and the alternative hypothesis $H_o: \delta_i \neq 0$, means there is cointegration between variable. When we have large value F-statistics thus we reject the null hypothesis in case of individual country analysis. When null hypothesis is rejected, means that there is cointegration. The long run relationship among the variables can be written as:

$$lnE_{it} = \emptyset_i + \sum_{l=1}^{n1} \gamma_1 lnE_{it-l} + \sum_{l=0}^{n2} \gamma_2 lnS_{it-l} + \sum_{l=0}^{n3} \gamma_3 lnT.E_{it-l} + \sum_{l=0}^{n4} \gamma_4 lnK_{it-l} + \sum_{l=0}^{n5} \gamma_5 lnO_{it-l} + \sum_{l=0}^{n6} \gamma_6 lnK_{it-l}.O_{it-1} + \sum_{l=0}^{n7} \gamma_7 lnFDl_{it-l} + \sum_{l=0}^{n8} \gamma_8 lnN_{it-l} + v_{it}$$

(3.23)

The PMG approach imposes the assumption that the coefficient in the long run relationship are same for all the countries whereas the coefficient in short run varies. Likewise the hypothesis of cointegration is related with the specified assumption of PMG. Moreover the Error Correction Term (ECT) is derived consequently from the given the long run relationship of the variables and the error correction model is used to examine the short run relationship among the variables. It can be written as:

$$\Delta lnE_{it} = \emptyset_i + \sum_{l=1}^{n1} \gamma_{1l} \Delta lnE_{it-l} + \sum_{l=0}^{n2} \gamma_{2l} \Delta lnS_{it-l} + \sum_{l=0}^{n3} \gamma_{3l} \Delta lnT.E_{it-l} + \sum_{l=0}^{n4} \gamma_{4l} \Delta lnK_{it-l} + \sum_{l=0}^{n5} \gamma_{5l} \Delta lnO_{it-l} + \sum_{l=0}^{n6} \gamma_{6l} \Delta lnK_{it-l}.O_{it-l} + \sum_{l=0}^{n7} \gamma_{7l} \Delta lnFDl_{it-l} + \sum_{l=0}^{n8} \gamma_{8l} \Delta lnN_{it-l} + \varphi ECT_{t-l} + v_{it}$$

(3.24)

The coefficient of Error Correction Term (ECT) should have negative sign for the existence of cointegration. If the magnitude of ECT lies between 0 and 1, indicates the convergence toward the Long run equilibrium path which disturb due to the last period shocks. The parameter φ represents the speed of adjustment towards equilibrium. It tells how fast the variable converged towards the mean position and its value must be significant statistically and coefficient should have negative sign. This parameter of ECT is taken from PMG

approach. Whereas the residual term v_{it} is independently and normally distributed with mean zero and variance constant. Furthermore PMG is the mediate method including both the averaging and pooling, it allows the long run coefficient that is same for all the countries awhile short run coefficient are different for each countries.

3.6 Data description and data source

To analyze the impact of international trade on environment by decomposing scale, composition, technique, and comparative advantage effect, other components that increase Co2 emission are: Population density, trade openness, and foreign direct investment. Panel data set has been used for selected South Asian countries in our study from the time duration 1980-2016.

We have collected 37 years data of Carbon dioxide emission E, real GDP, real GNP, trade openness, capital-labor ratio (K/L), Gross fixed capital formation is used as a proxy for capital and total labor force is used for labor, FDI, Population density, Area per square km, from the time duration 1980 to 2016 for country Pakistan, India, Bangladesh, Sri lanka. The data collected for our study from the website of World development indicator and the variables used in our study are explained below:

Table 3.1: Description of Variables:

Variable name	**Proxy**	**Description**	**Unit**
Environmental degradation	(E)	Emission of carbon dioxide	Metric ton per capita
Scale effect	S	Real GDP per square kilometer is proxy for scale effect	US$
Technique effect	TE	We observe the scale of economy within the country i-e GDP whereas the income related to technique effect indicate the income of a nation wherever it is attained i-e GNP. Hence we can	US$

		use the difference between GDP and GNP measure to distinct technique effect from scale effect. The income variable I_t is the lag of three year average of y_t=GDP-GNP per capita . three year moving average is taken to smooth the business cycle variation. For year t, that is $I_t = (y_t + y_t + y_t)/3$, it captures technique effect.	
Composite effect (capital/labour ratio)	K	Capital-labor (K/L) ratio is composite effect. (Gross fixed capital formation is used as a proxy for capital and total labor force is used for labor).	__
Comparative advantage effect.	KO	Capital-Labor ratio and trade openness is comparative advantage effect. When there is reduction in trade barrier, the developed economies having tight environmental policies exchange the dirty goods to the developing economies with having not severe environmental policies, thus the production of these goods enhances pollution in the developing economies.	__
Foreign direct investment	FDI	Foreign Direct Investment relative to GDP.	Net inflows, percentage to GDP
Population density	N	Population density	Per square km of land area
Trade openness effect (export+import)	O	Real trade openness (export + import) is trade effect relative to GDP.	Percentage to GDP

3.7 Descriptive statistics

Table 3.2 represents statistical statistics of the data. The central values of the data set are mean and median. The mean value of E for selected South Asian countries is -0.725 respectively whereas mean value of scale effect, Technique effect, trade openness effect, population density, comparative advantage effect , composition effect and foreign direct investment for selected South Asian countries are -6.056, 6.754, 3.569, 5.863, -11.227, -14.625 and -0.934 respectively. The Median values of E, scale effect. Technique effect, trade openness effect, population density, comparative advantage effect, composition effect and foreign direct investment for selected South Asian countries are -0.557, -6.199, 6.712, 3.564, 5.729, -11.364, -14.574 and -0.370 respectively. E, Scale effect, Technique effect, Trade openness effect, Population density, Comparative advantage effect, Composition effect seems normally distributed, because the mean and median values are approximately same. Moreover, table 3.2 represents maximum values of South Asian countries that is largest value in the data set whereas minimum represents the smallest values in data set for the variables of South Asian countries. Standard deviation indicates the spread of data from its central value. E, Scale effect, Technique effect, Trade openness effect, Population density, Comparative advantage effect, Composition effect and foreign direct investment are scattered 0.707, 1.766, 0.546, 0.499, 0.657, 1.790, 1.392 and 1.718 standard units from the mean values. Skewness shows the symmetry position of the data and it should be close to zero. E, Scale effect, technique effect, trade openness effect, population density, comparative advantage effect and composition effect have almost zero skewness, while, foreign direct investment is negatively skewed. Kurtosis measures the peak of the data set. The value of kurtosis must lies around 3, except scale effect, composition effect and foreign direct investment. All the remaining variables have kurtosis close to 3.

Table 3.2: Descriptive statistics

Variables/ Des-stats	LNE	LNS	LNTE	LNO	LNN	LNKO	LNK	LNFDI
Mean	-0.725	-6.056	6.754	3.569	5.863	-11.227	-14.625	-0.934
Median	-0.557	-6.199	6.712	3.564	5.729	-11.364	-14.574	-0.370
Maximum	0.548	-2.812	8.176	4.485	7.132	-8.006	-12.351	1.299
Minimum	-2.373	-8.939	5.864	2.514	4.618	-14.212	-16.755	-7.057
Std. Dev.	0.707	1.766	0.546	0.499	0.657	1.790	1.392	1.718
Skewness	-0.533	0.164	0.505	-0.106	0.422	0.189	0.089	-1.394
Kurtosis	2.531	1.947	2.824	2.271	2.365	2.089	1.958	4.286

Chapter 4

Results and Discussion

4.1 Introduction

This chapter includes the empirical results of impact of trade on environment by using macro Panel approach. The first step is to check the stationarity of data by applying Im, Pesaran and Shin (2003) and Levin, Lin and Chu (2002) Panel unit root test. If all the variables are integrated at different order, we use Panel ARDL cointgration approach. The next step is to choose the appropriate lag length of the explanatory variables. Akaike Information Criterion (AIC) has been used for optimal lag length in long run coefficient of Panel ARDL (1, 2, 2, 2, 2, 2, 2, 2) Model. This lag length seems optimal in macro Panel approach. Expected signs and significance of parameters are correlated with the existing literature. This study deals with the macro panel, thus in the first step panel unit root should be analyzed.

4.2 Panel unit root

The absence of I(2) variable is confirmed by using Im, Pesaran and Shin IPS test (2003) and Levin, Lin and Chu t* LLC test (2002). From the given table 4.1, it can be observed that the null hypothesis of panel unit root can be rejected at level for foreign direct investment whereas other variables such as carbon dioxide mission (E), scale effect (S), technique effect (TE), composition effect (K), comparative advantage effect (K.O) and trade openness effect (O) are stationary at the first difference. So the data set comprises of mixture of I(1) and I(0) and there is no I(2) variable thus Panel ARDL cointegration technique is used.

Table 4.1 Results of Panel unit root test with individual intercept and trend

Variable	Im, Pesaran and Shin (2003)		Levin, Lin & Chu t*a(2002)		Order of Integration I(0)/I(1)
	At Level	At First Difference	At Level	At First Difference	
E	0.794	0.001*	0.756	0.009*	I(1)
S	0.975	0.000*	0.518	0.010***	I(1)
TE	0.992	0.000*	0.373	0.037***	I(1)
K	0.690	0.000*	0.619	0.032***	I(1)
K.O	0.780	0.000*	0.991	0.014***	I(1)
FDI	0.004*	0.000	0.032***	0.000	I(0)
N	0.001*	0.000	0.000*	0.000	I(0)
O	0.889	0.000*	0.993	0.009*	I(1)

Note:* and *** indicate the significance at 1% and 5% level.

4.3 Panel ARDL and PMG results

Table 4.2 shows the long run results of ARDL. Based on Akaike Information Criterion (AIC) findings confirm that scale effect has significant and positive relation with pollution emission whereas technique effect has significant and negative relationship with pollution. The result reveals that while acquiring the economies of scale, 1% increase in scale effect will increase Carbon dioxide emission by 2.48%. When there is shift in economic transitions due to change in technology, the positive effect change into the negative effect, where 1% increase in technology will decrease the pollution emission by 2.29%. The results suggest that increase in the economic activity will increase the pollution emission and it can be overcome through income effect encourage modern technology to decrease pollution emission. The results are closer to Grossman (1991), Dinda (2005) and Copeland and Tylor (1994). Population density has significantly positive relation with pollution. Comparative advantage has positive and significant relation with the pollution emission, 1% increase in comparative advantage effect

will increase emission by 0.99%. The result suggests that comparative advantage affects the environmental quality, because of lacking technical competitiveness in directed markets due to outward shift of human capital and physical capital. Foreign direct investment has significantly positive relationship with pollution emission, 1% increase in FDI will increase pollution emission by 0.02%. When net inflow in the economy increases it will also increase the pollution emission. These results are similar to Copeland and Taylor (1994) and He (2006). Composition effect has significantly negative relation with carbon dioxide emission. If we increase composition effect by 1%, it will decrease pollution emission by 0.80%. The result suggests that change in composition effect by using less capital abundant goods in the existence of technique effect decreases the pollution emission. These findings are consistent with Tsurumi and Managi (2010). Trade openness has significantly negative relation with carbon dioxide emission, 1% increase in trade openness will decrease pollution emission by 0.97%. Trade openness sufficiently supports change in technology, capital formation and economic development in South Asian countries. The long run policies are required to enhance the trade volume to enhance environmental quality. The results are similar to Ling (2015). Parenthesis represents the optimal lags in the model

Table 4.2: Long run coefficients of Panel ARDL model

Dependent variable: carbon dioxide emission (E)		
Variables	**Coefficient**	**t-statistics**
LNS	2.487	2.901
LNTE	-2.294	-2.861
LNN	1.170	7.483
LNKO	0.993	8.240
LNK	-0.802	-5.076
LNFDI	0.020	3.118
LNO	-0.974	-9.094

Note: All the variables are significant at 5% level of significant in long run relationship.

Table 4.3: Short run results for overall panel

Dependent variable: E		
Variables	**Coefficient**	**t-statistics**
ECM	-0.525	-3.014
D(LNS)	-1.988	-3.276*
D(LNS(-1))	-0.611	-0.582
D(LNTE)	0.556	0.456
D(LNTE(-1))	0.414	3.242*
D(LNN)	-33.415	-0.951
D(LNN(-1))	24.255	0.746
D(LNKO)	-0.659	-3.127*
D(LNKO(-1))	-0.595	-1.584
D(LNK)	0.924	-3.727*
D(LNK(-1))	0.729	1.970**
D(LNFDI)	0.004	0.260
D(LNFDI(-1))	-0.003	-0.383
D(LNO)	0.775	2.802*
D(LNO(-1))	0.580	1.509
C	14.925	2.621

Note:* and ** indicate the significance at 1% and 5% level.

The above table 4.3 shows the short run relationship between the variables. Result shows that current scale effect has significant and negative relation with the carbon dioxide emission, If we increase 1% in scale effect, it will decrease the carbon dioxide emission by 1.98%, it shows that increase in economic activity will not degrades the natural environment in short run, whereas the scale effect of the previous year has insignificant relation with carbon dioxide emission. Technique effect of the current year has insignificant relation with carbon dioxide emission, whereas, the technique effect of the previous year has significantly positive relation with carbon dioxide, when we increase 1% in technique effect of the previous year, it will increase carbon dioxide by 0.41%. The results suggest that technological change enhances the pollution emission in short run. Population density has insignificant relation

with carbon dioxide emission. Comparative advantage effect of the current year has significant and negative relation with carbon dioxide emission, if we increase 1% in comparative advantage, it will decrease carbon dioxide emission by 0.65%, it shows that comparative advantage in clean goods may not affect the natural environment, whereas the comparative advantage of the previous year has insignificant relation with carbon dioxide emission. Composition effect of the current year and previous year has significantly positive relation with carbon dioxide, if we increase 1% in composition effect, it will increase carbon dioxide emission by 0.92 and if we increase 1% in composition effect of previous year, it increased carbon dioxide emission by 0.72%. The results explain that adoption of more capital abundant means of production in the absence of modern technologies may enhances the pollution emission. These results are similar to Cole (2006). Foreign direct investment has insignificant relation with carbon dioxide in short run. Trade openness of the current year has significantly positive relation with carbon dioxide emission, when there is 1% increase in Trade openness, it will increase carbon dioxide by 0.77%, the short run results reveal that trade openness do not supports the change in technology and capital formation, the trade policies in the short run enhances the trade volume may increases the pollution emission. These results are similar to Shahbaz *et al*. (2013) for Malaysia and Bangladesh, whereas trade openness for the previous year has insignificant relation with carbon dioxide. Furthermore the coefficient of Error Correction Term ECM is -0.525, that shows the adjustment speed towards equilibrium and it has negative sign and significant at 5% level. Therefore the coefficient of ECM ascertained the adjustment speed is low, thus after a shock in economy, the adjustment speed that shows the deviation from long run equilibrium to short run is corrected by 52%.

4.4 Country wise short run results

The short run results of panel ARDL cointegration for each country are presented below:

4.4.1 Short run results for Pakistan

Table 4.4 indicates the short run relationship between the variables in case of Pakistan. Result shows that scale effect of the current year and previous year has negative and significant relation with the carbon dioxide emission, If we increase 1% in scale effect of current year, it will decrease the carbon dioxide emission by 0.92%, if scale effect of previous year increased by 1%, it will decrease the carbon dioxide emission by 2.03%, it shows that increase in economic activity does not degrades the natural environment in case of Pakistan. Technique effect of current and previous year has significant and positive relationship with carbon dioxide emission, when we increase 1% in technique effect of the current year it will increase carbon dioxide by 1.68%, if we increase 1% in technique effect of previous year, it will increase carbon dioxide emission by 0.45%. The results suggest that technological change enhances the pollution emission in short run in case of Pakistan. These results are contradict to Ling (2015), who finds that scale effect has positive and technique effect has negative relation with pollution emission. Population density has insignificant relation with carbon dioxide emission. Comparative advantage of current year and the previous year has significant and negative relationship with carbon dioxide emission. If comparative advantage of the current year is increased by 1%, it will decrease carbon dioxide emission by 0.41% and when the comparative advantage of the previous year is increase by 1%, it will decrease carbon dioxide emission by 0.33%, it shows that comparative advantage may not affect the natural environment, due to inward shift of human capital and physical. Composition effect of current and previous year has significant and positive relationship with carbon dioxide emission. If we increase composition effect by 1%, it will increase carbon dioxide emission by 0.50% and when we increase 1% in the previous year composition effect, it will increase

carbon dioxide emission by 0.34%. The result explains that adoption of more capital abundant means of production in the absence of modern technologies may enhances the pollution emission. These results are similar to Cole (2006). Foreign direct investment of the current year has significant and negative relationship with carbon dioxide emission. If we increase FDI by 1%, it will decrease carbon dioxide emission by 0.003%, it shows that increase in the inflows in economy, it may reduces the economic activity in home country thus pollution emission is reduced, Whereas FDI of the previous year has significantly positive relationship with the carbon dioxide. When there is increase 1% in FDI, it will increase carbon dioxide emission by 0.01%. When net inflow in the economy increases it will also increase the pollution emission due to poor institutional functions in Pakistan, for making strict environmental policies. These results are similar to Duy (2012). Trade openness has significantly positive relation with carbon dioxide emission at, when there is 1% increase in trade openness of current year, it will increase carbon dioxide by 0.43%, if there is increase in trade openness for the previous year, it will increase carbon dioxide by 0.34%. The short run results for Pakistan reveal that trade openness do not supports the change in technology and capital formation, the trade policies in the short run enhances the trade volume may increases the pollution emission. These results are similar to Shahbaz *et al*. (2013). Furthermore the coefficient of Error Correction Term ECM is -0.588, it shows adjustment speed towards equilibrium and it has negative sign and significant at 5% level. Therefore the coefficient of ECM ascertained the adjustment speed is low, thus after a shock in economy, the adjustment speed that shows the deviation from long run equilibrium to short run is corrected by 58%.

Table 4.4: short run results for Pakistan

Variables	Coefficient	t-statistics
ECM	-0.588	-20.052
D(LNS)	-0.924	-3.392**
D(LNS(-1))	-2.037	-6.421*
D(LNTE)	1.689	9.626*
D(LNTE(-1))	0.458	11.364*
D(LNN)	32.604	0.1182
D(LNN(-1))	-12.852	-0.066
D(LNKO)	-0.4141	-29.037*
D(LNKO(-1))	-0.339	-63.375*
D(LNK)	0.508	26.483*
D(LNK(-1))	0.345	31.898*
D(LNFDI)	-0.003	-31.783*
D(LNFDI(-1))	0.013	142.315*
D(LNO)	0.434	26.051*
D(LNO(-1))	0.348	45.800*
C	16.572	0.707

Note:* and ** indicate the significance at 1% and 5% level.

Summary of results:

The overall results for short run relationship between international trade and environmental quality pointed out the negative relation between scale effect and carbon dioxide, comparative advantage effect and carbon dioxide emission, our short run results for Pakistan also shows the same negative relationship. Literature pointed the positive relation between technique effect and carbon dioxide, composition effect and carbon dioxide, trade openness and carbon dioxide, our results also confirm the same positive relation.

4.4.2 Short run results for India

Table 4.5 indicates the short run relationship between the variables in case of India. Result shows that scale effect of the current year has negative and significant relation with carbon dioxide emission, if we increase scale effect by 1%, it will decrease carbon dioxide emission by 1.99%, the results shows that increase in economic activity do not detoriates the natural

environment, Whereas, scale effect of the previous year has insignificant relationship with carbon dioxide emission. Technique effect of the current year has insignificant relationship with carbon dioxide emission, whereas, in previous year it has significantly positive relationship with carbon dioxide emission, if we increase technique effect by 1%, it will increase carbon dioxide emission by 0.09%. The results suggest that technological change enhances the pollution emission in short run in case of India. These results are contrast to Hui Ling (2015). Population density has insignificant relationship with carbon dioxide emission. Comparative advantage of current year and the previous year has significant and negative relationship with carbon dioxide emission. If comparative advantage of the current year is increased by 1% it will decrease carbon dioxide emission by 0.06% and when the comparative advantage of the previous year is increase by 1%, it will decrease carbon dioxide emission by 0.19%.These result explains that comparative advantage may not affect the natural environment, due to inward shift of human capital and physical in India. Composition effect of current year has statistically significant and positive relationship with carbon dioxide emission. If we increase composition effect by 1%, it will increase carbon dioxide emission by 0.48%. The result suggested that adoption of capital abundant means of production in the absence of modern technologies may enhance the pollution emission. These results are related to Cole (2006), whereas, composition effect of the previous year has insignificant relationship with carbon dioxide emission. Foreign direct investment of current year and previous year has significant and negative relationship with carbon dioxide emission. If we increase FDI by 1%, it will decrease carbon dioxide emission by 0.01%, whereas in previous year, if there is increase 1% in FDI, it will decrease carbon dioxide emission by 0.005%. The results suggested that increase in the inflows in economy, it may reduces the economic activity in home country thus pollution emission is reduced. Trade openness has significantly positive relation with carbon dioxide emission, when there is 1% increase in trade openness

of current year, it will increase carbon dioxide by 0.71%, if there is increase in trade openness for the previous year, it will increase carbon dioxide by 0.34%. The findings reveals that trade openness do not supports the change in technology and capital formation, the trade policies in the short run enhances the trade volume may increases the pollution emission in India. These results are similar to Shahbaz *et al*. (2013). Furthermore the coefficient of Error Correction Term ECM is -0.892, it shows adjustment speed towards equilibrium and it has negative sign and significant at 5% level. Therefore the coefficient of ECM ascertained the adjustment speed is low, thus after a shock in economy, the adjustment speed that shows the deviation from long run equilibrium to short run is corrected by 89%.

Table 4.5: Short run results for India

Variables	Coefficient	t-statistics
ECM	-0.892	-47.648
D(LNS)	-1.990	-2.701***
D(LNS(-1))	-2.775	-0.531
D(LNTE)	3.360	0.629
D(LNTE(-1))	0.097	2.588***
D(LNN)	-115.592	-0.065
D(LNN(-1))	10.345	0.060
D(LNKO)	-0.669	-22.012*
D(LNKO(-1))	-0.191	-12.958*
D(LNK)	0.489	12.362*
D(LNK(-1))	-0.008	-0.411
D(LNFDI)	-0.0178	-601.959*
D(LNFDI(-1))	-0.005	-153.176*
D(LNO)	0.715	19.311*
D(LNO(-1))	0.349	12.643*
C	28.963	0.224

Note:* and *** indicate the significance at 1% and 10% level.

Summary of results:

The overall results for short run relationship between international trade and environmental quality pointed out the negative relation between scale effect and carbon dioxide, comparative advantage effect and carbon dioxide emission, our short run results for India also shows the same negative relationship. Literature pointed the positive relation between technique effect and carbon dioxide, composition effect and carbon dioxide, trade openness and carbon dioxide, our results also confirm the same positive relation.

4.4.3 Short run results for Srilanka

Table 4.6 indicates the short run relationship between the variables in case of Sri Lanka. Result shows that scale effect of the current year has negative and significant relation with carbon dioxide emission at, if we increase scale effect by 1%, it will decrease carbon dioxide emission by 1.35%, findings confirms that increase in economies of scale do not detoriates the natural environment, whereas, scale effect of the previous year has insignificant relationship with carbon dioxide emission. Technique effect of the current year has insignificant relationship with carbon dioxide emission whereas, in previous year it has significantly positive relationship with carbon dioxide emission at, if we increase technique effect by 1%, it will increase carbon dioxide emission by 0.71%. Findings explain that change in technological process may decrease the pollution emission in case of Srilanka. Population density has insignificant relationship with carbon dioxide emission. Comparative advantage of current year and the previous year has significant and negative relationship with carbon dioxide emission. If comparative advantage of the current year is increased by 1% it will decrease carbon dioxide emission by 1.24 % and when the comparative advantage of the previous year is increase by 1%, it will decrease carbon dioxide emission by 1.71 %. Result explains that comparative advantage may not affect the natural environment, due to inward shift of human capital and physical in Srilanka. Composition

effect of current year and previous year has statistically significant and positive relationship with carbon dioxide emission. If we increase composition effect of current year by 1%, it will increase carbon dioxide emission by 1.43 %. When we increase 1% in the previous year composition effect, it will increase carbon dioxide emission by 1.69%. Findings suggested that adoption of capital abundant means of production in the absence of modern technologies may enhance the pollution emission. Foreign direct investment of current and previous year has significantly positive relationship with carbon dioxide emission. If we increase FDI of current year by 1%, it will increase carbon dioxide emission by 0.05%, whereas in previous year, if there is increase 1% in FDI, it will increase carbon dioxide emission by 0.004%. The result explains that when net inflow in the economy increases it will also increase the pollution emission. Trade openness has significantly positive relation with carbon dioxide emission, when there is 1% increase in trade openness of current year, it will increase carbon dioxide by 1.57%, if there is increase in trade openness for the previous year, it will increase carbon dioxide by 1.69 %. The trade regulations in the short run enhances the trade volume may increases the pollution emission in Srilanka. Moreover, the coefficient of Error Correction Term ECM is -0.051, it shows adjustment speed towards equilibrium and it has negative sign and significant at 5% level. Therefore the coefficient of ECM ascertained the adjustment speed is low, thus after a shock in economy, the adjustment speed that shows the deviation from long run equilibrium to short run is corrected by 5%.

Table 4.6: Short run results for Srilanka

Variables	Coefficient	t-statistics
ECM	-0.051	-10.624
D(LNS)	-1.352	-2.013**
D(LNS(-1))	1.049	0.367
D(LNTE)	-2.098	-0.683
D(LNTE(-1))	0.718	1.988*
D(LNN)	-67.567	-0.106
D(LNN(-1))	50.501	0.071
D(LNKO)	-1.247	-3.561**
D(LNKO(-1))	-1.715	-5.869*
D(LNK)	1.434	5.890*
D(LNK(-1))	1.693	7.223*
D(LNFDI)	0.050	83.965*
D(LNFDI(-1))	0.004	7.866*
D(LNO)	1.574	3.201**
D(LNO(-1))	1.695	4.454**
C	1.326	0.544

Note:* and ** indicate the significance at 1% and 5% level.

Summary of results:

The overall results for short run relationship between international trade and environmental quality pointed out the negative relation between scale effect and carbon dioxide, comparative advantage effect and carbon dioxide emission, our short run results for Srilanka also shows the same negative relationship. Literature also pointed the positive relation between composition effect and carbon dioxide, trade openness and carbon dioxide, our results also confirm the same positive relation. As far as relationship between technique effect and carbon dioxide is concerned, literature shows positive relation between the international trade and environmental quality but our results shows that technique effect is negatively affects carbon dioxide in the current year.

4.4.4 Short run results for Bangladesh

Table 4.7 indicates the short run relationship between the variables in case of Bangladesh. Result shows that scale effect of the current year and previous year has insignificant relation with carbon dioxide emission. Technique effect of the current year and previous year has insignificant relationship with carbon dioxide emission. Population density has insignificant relationship with carbon dioxide emission. Comparative advantage of current year and the previous year has significant and negative relationship with carbon dioxide emission. If comparative advantage of the current year is increased by 1% it will decrease carbon dioxide emission by 0.30 % and when the comparative advantage of the previous year is increase by 1%, it will decrease carbon dioxide emission by 0.13 %. Result explains that comparative advantage in Bangladesh may not affect the natural environment, due to inward shift of human capital and physical. Composition effect of current year and previous year has statistically significant and positive relationship with carbon dioxide emission at. If we increase composition effect of current year by 1%, it will increase carbon dioxide emission by 1.26 %. When we increase 1% in the previous year composition effect, it will increase carbon dioxide emission by 0.88 %. Findings confirmed that adoption of capital abundant means of production in the absence of modern technologies may enhance the pollution emission. Foreign direct investment of current and previous year has significant and negative relationship with carbon dioxide emission. If we increase FDI of current year by 1%, it will decrease carbon dioxide emission by 0.01%, whereas in previous year, if there is increase 1% in FDI, it will decrease carbon dioxide emission by 0.02%. Findings suggested that increase in the inflows in Bangladesh economy, may reduce the economic activity thus pollution emission is reduced. Trade openness of current year has significantly positive relation with carbon dioxide emission, when there is 1% increase in trade openness of current year, it will increase carbon dioxide by 0.37 %, results explains that trade regulations in the short run

enhances the trade volume that may increases the pollution emission , whereas trade openness in previous year has significant and negative relationship with carbon dioxide emission, when we increase trade openness by 1% it will decrease carbon dioxide by 0.07 %. Trade openness sufficiently supports change in technology, capital formation and economic development in Bangladesh. The long run policies are required to enhance the trade volume to enhance environmental quality. Furthermore the coefficient of Error Correction Term ECM is -0.569, it shows adjustment speed towards equilibrium and it has negative sign and significant at 5% level. Therefore the coefficient of ECM ascertained the adjustment speed is low, thus after a shock in economy, the adjustment speed that shows the deviation from long run equilibrium to short run is corrected by 56%.

Table 4.7: Short run results for Bangladesh

Variables	Coefficient	t-statistics
ECM	-0.569	-38.577
D(LNS)	-3.686	-1.563
D(LNS(-1))	1.319	0.244
D(LNTE)	-0.728	-0.215
D(LNTE(-1))	0.383	0.564
D(LNN)	16.891	0.061
D(LNN(-1))	-42.969	-0.115
D(LNKO)	-0.303	-15.547*
D(LNKO(-1))	-0.135	-11.647*
D(LNK)	1.262	5.596**
D(LNK(-1))	0.889	4.588**
D(LNFDI)	-0.013	-192.86*
D(LNFDI(-1))	-0.025	-324.463*
D(LNO)	0.376	17.775*
D(LNO(-1))	-0.070	-5.277**
C	12.836	0.329

Note:* and ** indicate the significance at 1% and 5% level

Summary of results:

The overall results for short run relationship between international trade and environmental quality pointed out the negative relation between scale effect and carbon dioxide, comparative advantage effect and carbon dioxide emission, our short run results for Bangladesh also shows the same negative relationship. Literature also pointed the positive relation between composition effect and carbon dioxide, trade openness and carbon dioxide, our results also confirm the same positive relation. As far as relationship between technique effect and carbon dioxide is concerned, literature shows positive relation between the international trade an environmental quality but our results shows that technique effect is negatively affects carbon dioxide in the current year, whereas it has same positive relationship in the previous year.

4.5 Comparative analysis of South Asian countries

The scale effect has negative relationship with carbon dioxide in case of all selected South Asian countries; Pakistan, India, Srilanka and Bangladesh. When scale is increased, the pollution generated from that production, do not damages the environmental quality. It will be beneficial for the economy.

Technique effect has positive relationship with carbon dioxide emission in Pakistan and India as when modern technology is used and it produces the commodities which are toxic for environment creates more pollution in the country thus it has perverse impact on the natural environment. Moreover, there is negative relationship in case of Srilanka and Bangladesh as the modern technology produces less pollution while manufacturing of goods thus it would be beneficial for the economic development and do not degrades the environmental quality.

Composition effect has positive relationship with carbon dioxide emission in case of all selected South Asian countries; Pakistan, India, Srilanka and Bangladesh. This shows that adoption of capital abundant means of production in the absence of modern methods may enhances the carbon dioxide emission.

Comparative advantage effect has negative relationship with carbon dioxide emission in case of all selected South Asian countries including; Pakistan, India, Srilanka and Bangladesh. It shows that comparative advantage may not affect the environmental quality due to inward shift of human and physical capital.

The results indicate that selected South Asian countries are developing countries so there short run results are much related to each other.

Chapter 5

Conclusion and Policy Implication

5.1 Conclusion

The purpose of this study is to examine the effect of international trade on natural environment in selected South Asian Countries: Pakistan, India, Srilanka and bangladesh over the time period from 1980 to 2016. This study focused in the first step on theoretical framework and later on development of trade and environment nexus that explains the decomposition of the international trade impact on pollution emission by decomposing scale, composition, technique effect and comparative advantage effect. The theoretical model which is used in the study is pollution model of Anthonyn, Copeland & Taylor (1994).

The panel ARDL results evaluated that international trade significantly impacts the environmental quality in the long run. The scale effect increases the carbon dioxide emission but the technique effect reduces the carbon dioxide emission. The composition effect lowers the carbon dioxide emission but the comparative advantage adds in carbon dioxide emission.

The coefficient of variables in short run of overall panel data set is negative and the error correction term is statistically significant. ECT determines the adjustment speed that shows the deviation from long run equilibrium to short run is corrected by 52%. In short run results for overall panel reveals that scale effect reduces the carbon dioxide emission whereas technique effect increases the carbon dioxide emission. The composition effect decreases the carbon dioxide emission but comparative advantage effect adds in carbon dioxide emission.

The country wise short run results are much related to each other as scale effect decreases the carbon dioxide emission in all the selected South Asian countries; Pakistan, India, Srilanka and Bangladesh but the technique effect increases the carbon dioxide emission in Pakistan and India whereas technique effect reduces carbon dioxide emission in Srilanka and Bangladesh. The composition effect adds in the carbon dioxide emission in all selected South

Asian countries whereas comparative advantage effect reduces the carbon dioxide emission in all selected South Asian countries. The selected South Asian countries have approximate same results because all selected countries are developing countries.

5.2 Policies implications

This study provides the useful intuitions relating to international trade-environment nexus. The estimated model determines some policy applicability for policy makers.

In context of policy implications, the findings of this study suggest that environmental quality lost due to technique effect and composition effect in South Asian countries. However, the policy makers should focus on such policies which promote the use of environmental friendly technologies and efficient use of natural resources in the production; on both the effect, composition and technique effect have better consequence on carbon dioxide emission.

The other channel shows the negative and favorable impact of trade on environmental quality comprises of scale effect and comparative advantage effect. This points out the issues, such as significance and constructive role of acknowledgment as well as economical and governance in boosting the environmental quality. Such features are required to be developed through policy formulations.

References

- Antweiler, W., Copeland, B. R., & Taylor, M. S. (2001). Is free trade good for the environment?. American Economic Review, 91(4), 877-908.
- Adamowicz, V. (2006). The effects of trade liberalization on the environment: An Empirical study.
- Azhar, U., Khalil, S., & Ahmed, M. H. (2007). Environmental effects of trade liberalisation: a case study of Pakistan. The Pakistan Development Review, 645-655.
- Amanat Ali, Nigah Abbas, Faiz-ur-Rehman and Zain-ul-Abedin(2017),” Trade Liberalization and Environmental Quality: A Case Study of Pakistan”,
- Baldwin, R. E., &Seghezza, E. (1996). Testing for trade-induced investment-led growth (No. w5416). National Bureau of Economic Research.
- Binder, M., & Offermanns, C. (2007). International investment positions and exchange rate dynamics: a dynamic panel analysis.
- Baek, J., Cho, Y., & Koo, W. W. (2009). The environmental consequences of globalization: A country-specific time-series analysis. Ecological economics, 68(8-9), 2255-2264.
- Bildirici, M., & Kayıkçı, F. (2012). Energy consumption and growth in Eastern Europa: ARDL approach. Economic Research, 25(3), 538-559.
- Bildirici, M. E., & Kayıkçı, F. (2013). Effects of oil production on economic growth in Eurasian countries: Panel ARDL approach. Energy, 49, 156-161.
- Copeland, B. R., & Taylor, M. S. (1994). North-South trade and the environment. The quarterly journal of Economics, 109(3), 755-787.
- Cole, M. A. (2006). Does trade liberalization increase national energy use?. Economics Letters, 92(1), 108-112.
- Dean, J. M. (2002). Does trade liberalization harm the environment? A new test. Canadian Journal of Economics/Revue canadienned' économique, 35(4), 819-842.
- Dinda, S., & Coondoo, D. (2006). Income and emission: a panel data-based cointegration analysis. Ecological Economics, 57(2), 167-181.
- Eskeland, G. S., & Harrison, A. E. (2003). Moving to greener pastures? Multinationals and the pollution haven hypothesis. Journal of development economics, 70(1), 1-23.

- Ferrantino, M. J., & Linkins, L. A. (1999). The effect of global trade liberalization on toxic emissions in industry. Weltwirtschaftliches Archiv, 135(1), 128-155.
- Frankel, J. A., & Rose, A. K. (2005). Is trade good or bad for the environment? Sorting out the causality. Review of economics and statistics, 87(1), 85-91.
- Faiz-Ur-Rehman, Ali, A., & Nasir, M. (2007). Corruption, trade openness, and environmental quality: A panel data analysis of selected South Asian countries. The Pakistan Development Review, 673-688.
- Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American free trade agreement (No. w3914). National Bureau of Economic Research.
- Gale, L. R., & Mendez, J. A. (1998). The empirical relationship between trade, growth and the environment. International Review of Economics & Finance, 7(1), 53-61.
- Grimaud, A. (1999). Pollution permits and sustainable growth in a Schumpeterian model. Journal of Environmental Economics and Management, 38(3), 249-266.
- Gallagher, K., & Taylor, R. (2003). International trade and air pollution: The economic costs of air emissions from waterborne commerce vessels in the United States. Tufts University.
- Gamper-Rabindran, S., &Jha, S. (2004). Environmental impact of India's trade liberalization.
- Hettich, F. (1998). Growth effects of a revenue-neutral environmental tax reform. Journal of Economics, 67(3), 287-316.
- Halicioglu, F. (2009). An econometric study of CO2 emissions, energy consumption, income and foreign trade in Turkey. Energy Policy, 37(3), 1156-1164.
- Halicioglu, F., &Ketenci, N. (2015). The impact of international trade on environmental quality in transition countries: evidence from time series data during 1991-2013.
- Iwami, T. (2001). Economic development and environment in Southeast Asia: an introductory note. International Journal of Social Economics, 28(8), 605-622.
- Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of econometrics, 115(1), 53-74.
- Iwata, H., Okada, K., & Samreth, S. (2012). Empirical study on the determinants of CO2 emissions: evidence from OECD countries. Applied Economics, 44(27), 3513-3519.

- Jabeen, N. (2011). Impact of trade liberalizations on environmental quality (A case study of selected South Asian countries) (Doctoral dissertation, AIOU).
- Jardón, A., Kuik, O., &Tol, R. S. (2017). Economic growth and carbon dioxide emissions: An analysis of Latin America and the Caribbean. Atmósfera, 30(2), 87-100.
- Kukla-Gryz, A. (2009). Economic growth, international trade and air pollution: A decomposition analysis. Ecological economics, 68(5), 1329-1339.
- Kim, H. S., &Baek, J. (2011). The environmental consequences of economic growth revisited. Economics Bulletin, 31(2), 1-13.
- Kakakhel, S. (2012). Environmental Challenges in South Asia. Institute of South Asian Studies, National University of Singapore.
- Karsalari, A. R., Mehrara, M., Musai, M., &Mohammadi, M. (2014). Relationship between economic growth, trade and environment: evidence from D8 countries. IJARAFMS, 4, 320-326.
- KEHO, Y. (2016). Trade Openness and the Environment: A Time Series Study of ECOWAS Countries. Journal of Economics, 4(4), 61-69.
- Lucas Jr, R. E. (1988). On the mechanics of economic development. Journal of monetary economics, 22(1), 3-42.
- Lucas, R. E., Wheeler, D., & Hettige, H. (1992). Economic Development, Environmental Regulation, and the International Migration of Toxic Industrial Pollution, 1960-88 (Vol. 1062). World Bank Publications.
- Low, P., & Yeats, A. (1992). Do" dirty" industries migrate?. World Bank Discussion Papers[WORLD BANK DISCUSSION PAPER.]. 1992.
- Lopez, R. (1994). The environment as a factor of production: the effects of economic growth and trade liberalization. Journal of Environmental Economics and management, 27(2), 163-184.
- Lee, H., & Roland-Holst, D. (1997). The environment and welfare implications of trade and tax policy. Journal of Development Economics, 52(1), 65-82.
- Lopez, R. (1997). Environmental externalities in traditional agriculture and the impact of trade liberalization: the case of Ghana. Journal of Development Economics, 53(1), 17-39.
- Liddle, H. A. (2002). Advances in family-based therapy for adolescent substance abuse. In LS Harris (red.). Problems of drug dependence 2001: proceedings of the

63rd annual scientific meeting: the College on Problems of Drug Dependence (pp. 113-115).

- Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. Journal of econometrics, 108(1), 1-24.
- Lee, C. C., & Chang, C. P. (2008). Energy consumption and economic growth in Asian economies: a more comprehensive analysis using panel data. Resource and energy Economics, 30(1), 50-65.
- Loi, N. (2012). The impact of trade liberalization on the environment in some East Asian countries: an empirical study.
- Ling, C. H., Ahmed, K., Muhamad, R. B., & Shahbaz, M. (2015). Decomposing the trade-environment nexus for Malaysia: what do the technique, scale, composition, and comparative advantage effect indicate?. Environmental Science and Pollution Research, 22(24), 20131-20142.
- Mani, M., & Wheeler, D. (1998). In search of pollution havens? Dirty industry in the world economy, 1960 to 1995. The Journal of Environment & Development, 7(3), 215-247.
- Managi, S., Hibiki, A., & Tsurumi, T. (2009). Does trade openness improve environmental quality?. Journal of environmental economics and management, 58(3), 346-363.
- Muhammad, J., &Qayyum, A. (2011). Foreign aid-growth nexus in pakistan: role of macroeconomic policies.
- Mahidin, M. U. B. (2013). Trade and the environment: an empirical analysis-the case of Malaysia (Doctoral dissertation, University of Sheffield).
- Pethig, R. (1976). Pollution, welfare, and environmental policy in the theory of comparative advantage. Journal of environmental economics and management, 2(3), 160-169.
- Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. Journal of economic perspectives, 9(4), 97-118.
- Pirotte, A. (1999). Convergence of the static estimation toward the long run effects of dynamic panel data models. Economics Letters, 63(2), 151-158.

- Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. Journal of the American Statistical Association, 94(446), 621-634.
- Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. Oxford Bulletin of Economics and statistics, 61(S1), 653-670.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics, 16(3), 289-326.
- Parikh, A., &Stirbu, C. (2004). Relationship between trade liberalisation, economic growth and trade balance: an econometric investigation.
- Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. Econometric theory, 20(3), 597-625.
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. Journal of applied econometrics, 22(2), 265-312.
- Rebelo, S. (1991). Long-run policy analysis and long-run growth. Journal of political Economy, 99(3), 500-521.
- Romer, P. (1994). New goods, old theory, and the welfare costs of trade restrictions. Journal of development Economics, 43(1), 5-38.
- Soytas, U., Sari, R., & Ewing, B. T. (2007). Energy consumption, income, and carbon emissions in the United States. Ecological Economics, 62(3-4), 482-489.
- Saboori, B., &Soleymani, A. (2011). CO2 emissions, economic growth and energy consumption in Iran: A co-integration approach. International Journal of Environmental Sciences, 2(1), 44.
- Shahbaz, M., Mallick, H., Mahalik, M. K., &Loganathan, N. (2015). Does globalization impede environmental quality in India?. Ecological Indicators, 52, 379-393.
- Taylor, M. S., & Copeland, B. R. (2001). Trade and transboundary pollution. In The Economics of International Trade and the Environment (pp. 125-148). CRC Press.
- Takeda, F., & Matsuura, K. (2006). Trade and the Environment in East Asia: Examining the Linkages with Japan and the USA. The Journal of the Korean Economy, 7(1), 33-56.
- Temurshoev, U. (2006). Pollution haven hypothesis or factor endowment hypothesis: theory and empirical examination for the US and China.

- Tayebi, S. K., & Younespour, S. (2012). The Effect of Trade Openness on Environmental Quality: Evidence from Iran's Trade Relations with the Selected Countries of the Different Blocks. Iranian Economic Review, 16(32), 19-40.
- Van Beers, C., & Van Den Bergh, J. C. (1997). An empirical multi-country analysis of the impact of environmental regulations on foreign trade flows. Kyklos, 50(1), 29-46.
- Wacziarg, R. (2001). Measuring the dynamic gains from trade. The world bank economic review, 15(3), 393-429.
- Wu, J., Li, S., & Samsell, D. (2012). Why some countries trade more, some trade less, some trade almost nothing: The effect of the governance environment on trade flows. International Business Review, 21(2), 225-238.
- Wijesinghe, W. P. A. S. (2014). Effects of environmental regulations on South Asian food and agricultural exports: A gravity analysis (No. 139). ARTNeT Working Paper Series.
- Zaman, R. (2012). CO2 Emissions, Trade Openness and GDP Percapita: Bangladesh Perspective.
- Zamfir, P. B. (2014). What Is The Impact Of International Trade On Natural Environement. *Annals-Economy Series*, 458-462.
- ZohaibAli ,ZakirZaman and Mowadat Ali (2015),” The Effect of International Trade on Carbon Emissions: Evidence from Pakistan”, Journal of Economics and Sustainable Development ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online) Vol.6, No.9, 2015.