ECO-LABELING, SUSTAINABILITY AND TRADE: EVIDENCE FROM PAKISTAN

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DEDICATION

Dedicated to the everlasting memories of my Mother (Late)

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LIST OF ABBREVIATIONS

FSA	Financial Statement Analysis
PSX	Pakistan Stock Exchange
SBP	State Bank of Pakistan
WDI	World Bank Development Indicators
EPI	Environmental Performance Index
CP	Competitive Performance
FP	Financial Performance
3SLS	Three Stage Least Squares
GMM	Generalized Method of Moments

Abstract

Eco-labeling is recognized as an effective measure to control environmental pollution by the manufacturing firms. Given the increasing global demand for eco-labeled products, this study seeks to examine its implications for Pakistan. In the first part of this study, we analyze the existing pattern of eco-labeling schemes adopted by Pakistani textile firms and evaluate the effect of eco-labeling on their environmental and economic performance. We also identify the factors influencing a textile firm's decision to acquire an eco-label for its products. For these objectives, we use data for 128 firms from the textile industry listed on the Pakistan Stock Exchange from 2009 to 2015. The results show that, out of 128 textile firms in the sample, the firms with eco-labeled products are only 32%, which include 21% exporting firms and 11% non-exporting firms. Regression results from three stage least squares (3SLS) estimator show that the textile firms with an eco-label have higher environmental and economic performance. This indicates that the adoption of eco-labels promotes the sustainable growth of the textile firms. Regression results from logit model show that a large textile firm is more likely to adopt an eco-label relative to the medium or small firm, while an old textile firm is less likely to adopt an eco-label relative to a new textile firm. As expected, an exporting textile firm is more likely to adopt an eco-label. The environmental performance, as well as the financial performance of the textile firm, increases the likelihood of eco-label adoption.

Pakistan exports various products including textiles, apparel, food, fish, pulp, paper leather products, sports goods, cement, and other products. Pakistan's exports account for 8.5 percent of GDP while its imports account for 19.4 percent. The increasing global demand for eco-labeled products in the international markets poses a potential risk of the exports opportunities for Pakistan. Given the importance of exports in Pakistan economy and increasing demand for eco-labeled products, in the second part of this study, we investigate the potential impact of eco-labeling on the exports of Pakistan. For this part, we use panel data of 24 industrialized trading partners of the country from 2003 to 2014. Results of the Gravity model show that the number of eco-labels in the trading partner country has a negative and significant impact on the exports of fish, food and textiles products of Pakistan. The cost of acquiring eco-labels has a negative and significant impact on the fish, food, textiles, pulp, papers, and building materials exports of Pakistan.

The impressive environmental performance of the Blue Angel as a national eco-label scheme of Germany motivated other countries to introduce their own national eco-label schemes. However, there are various factors which determined a country government to introduce a national eco-label scheme. In the third part of this study, we identify the factors which determined the government to introduce a national eco-labeling scheme. For this part, we use panel data of 54 countries that are Pakistan's trade partners from 1994 to 2014. The results of the panel logit model show that a country with high economic growth and high government integrity is more likely to introduce a national eco-label scheme. A country with a reasonable number of environmentally conscious consumers is more likely to introduce a national eco-label scheme. A country which devoted a significant share of its expenditures for research and development (R&D) is more likely to introduce a national eco-label scheme, while a country which heavily depends on exports is less likely to introduce a national eco-label scheme. A country which

exports high technology products is more likely to introduce a national eco-label scheme. A country which faces a diverse range of eco-labels in its trade partner countries is more likely to introduce a national eco-label scheme, while an economically free country is less likely to introduce a national eco-label scheme.

CHAPTER 1: INTRODUCTION

1.1. Statement of the Problem

Concerns about industrial pollution are not new. In the late 1960s, various national and international environmental agencies identified the issue of increasingly negative impacts of industrial production on the quality of the natural environment. To address this issue and move towards more sustainable and environmentally friendly production, many researchers and policymakers have presented a wide range of policies and schemes including green taxes, defining property rights, strict bans, and other regulatory measures (Galarraga, 2002). Recently, voluntary actions for environmental protection have gained their importance and have been recognized as an effective measure to reduce environmental pollution. Eco-labeling is one of the most important schemes of voluntary environmental actions (Shen & Qin, 2011).

Eco-label is a seal of certification awarded to an environment-friendly product which meets the criteria specified by the eco-label awarding authority (UNOPS, 2009). Germany was the first country in the world to launch national eco-label scheme "Blue Angel". It has been awarded since 1978 by the Jury Umweltzeichen, a group of 13 people from environment and consumer protection groups, industry, unions, trade, media, and churches. It was formed on the proposal of the German Federal Minister of the Interior and approved by the Ministers of the Environment of the Federal Government (Edda, 2002). After the introduction of Germany's Blue Angel in 1978 as the first worldwide eco-label scheme, other European and non-European countries followed this example and introduced their own national eco-label schemes such as Nordic Swan by Nordic countries, EU Flower by European countries, Energy Star by USA, Eco-Mark by Japan, and Eco Material by Russia. Recently, Asian countries have also introduced their

own eco-label schemes, such as Eco Mark by Japan and India, and Green Label by Singapore and Thailand. The driving force behind the development of eco-labels was to increase green consumerism and production sustainability. Moreover, the multinational corporations in Europe wanted to improve their corporate social responsibility and to green their global supply chains that spanned the whole of Asia (Champalal, 2012).

In 1994, some countries collaborated in developing the Global Ecolabeling Network (GEN) a non-profit interest group composed of eco-label organizations all over the world. Currently, GEN has members represented from more than 50 territories and countries, with a particular focus in Europe and Asia. GEN functions to endorse cooperation and information exchange across members and eco-label schemes, services access to information on eco-label standards, engages with international organizations to endorse eco-labeling, and persuades demand for eco-label products through the endorsement of sustainable public procurement. GEN also supports its members in developing environmental leadership standards and criteria (Edda, 2002). In 2002, five eco-labeling organizations include the Forest Stewardship Alliance, the Marine Stewardship Council, Fair Trade International, the Rainforest Alliance, and the Alliance for Water Stewardship cooperated in developing the International Social and Environmental Accreditation and Labeling Alliance (ISEAL). ISEAL is set up to advance and develop sustainability standards for products across the globe. The goals of ISEAL Alliance are to get better the impacts of standards, define credibility for sustainability standards, increase the uptake of credible sustainability standards, and improve the effectiveness of standards (Edda, 2002).

The International Organization for Standardization (ISO) identified three types of eco-labels such as type I, type II, and type III (Champalal, 2012). Type I eco-labels (ISO-14024) are

a voluntary, multiple criteria based, government supported, and third-party schemes that awards a license that authorizes the use of environmental labels on products indicating overall environmental performance of a product within a particular product category based on life-cycle considerations (Ann & Cerasela, 2006; Galarraga, 2002). Type II eco-labels (ISO-14021) consisting of one-sided informative environmental claims made by manufacturers, importers or distributors and refer to specific attributes of products (Folmer, 2000). Type III eco-labels (ISO-14025) are voluntary schemes use pre-set indices and give quantified information about products based on independent verification, based on life cycle assessment and verified by qualified third-party organizations (Ann & Cerasela, 2006; Galarraga, 2002).

Eco-labeled products are notable in the global market, and thus the demand for eco-labeled products has been growing. According to the reports of Eco-labeling Network, in Germany, there were fewer than 100 products labeled by Blue Angel in 1979, but in 1994 there were 4,271 labeled products, and currently, there are about 12,000 Blue Angel products (Prieto-Sandoval et al, 2016). According to the latest report, the EU label has granted 2130 licenses to cover 54115 products and services from different sectors in 2017 (Ecolabel Facts and Figures, 2017). With the increase in demand for eco-labeled products, the number of eco-label schemes has also increased. Currently, 463 eco-label schemes in 25 types of industry sectors exist in 199 countries of the world (Ecolabel Index, 2016).

Eco-labeling has emerged as the main source of sustainable production in the manufacturing industries. However, the increasing use of eco-labels in international trade has raised a concern of developing countries that the developed countries use eco-labels to protect their national industries (Piotrowski & Kratz, 2005). The developed countries set the standards, criteria, and process of eco-labels according to their own domestic environmental regulations and

financial positions, and ignore the developing countries' environmental and financial positions (Joshi, 2004). Increasing demand for eco-labeled products from developed countries has adversely affected the volume of trade with developing countries (UNCTAD, 2004).

From the firms' perspective, the adoption of eco-label is based on evaluating its benefits and costs. The firms can use eco-labeling as a strategy to differentiate their products from other firms, to attract new customers from the market, and to put technological, environmental, economic and cultural barriers for new firm entry to the industry (Roy & Vezina, 2001). Furthermore, the adoption of eco-labels by firms provides a price premium in certain markets. Thus the existence of price premium motivates the firms to produce eco-labeled goods (Sedjo & Swallow, 2002). Eco-labeling tends to improve the environmental, social and economic performance of a firm (De Boer, 2003)[1]. On the other hand, adoption of eco-label by firms also involves the additional cost of its compliance, which may adversely affect their profitability (Atilgan, 2007)[2]. Furthermore, it is argued that most of the consumers are environmentally unconscious, therefore the firms with eco-labels find relatively few environmentally conscious consumers who are willing to pay a price premium for eco-labeled certified products (Atilgan, 2007).

Pakistan is one of the emerging nations of the Asia Pacific. The manufacturing sector of Pakistan accounts for 13.6 percent of its GDP. Pakistan is the 4th largest producer of cotton in the world (Pakistan Economic Survey, 2018). The textile sector is the largest manufacturing sector of Pakistan[3]. Furthermore, the textile sector is export-oriented, and the textile products account for 60 percent of national exports (Pakistan Economic Survey, 2018). The textile sector of

[1]Some examples of the benefits of the eco-labels are given in table A1 (Appendix A).
[2]In table A2 (Appendix A), we present the certification costs of obtaining the EU Flower as an example.
[3]The information on the ranking of textile industry among other major industries of Pakistan is given in table A3 (Appendix A).

Pakistan is one of the most polluting sectors of the economy, which directly affect the natural environment, human and animal health[4]. According to the Sustainable and Cleaner Production in the Manufacturing Industries of Pakistan survey of small and medium enterprises (SMEs) about 70% of the surveyed Pakistani textile and tannery firms have limited knowledge about the eco-labels while the remaining 30% know nothing about eco-labels (SCI-Pak, 2013)[5].

Given a continuous increase in the global demand for eco-labeled products, there is a need to examine the role of eco-labels in achieving production sustainability, the motivation behind the adoption and implementation of eco-labeling at the firm level and its eventual impact on the environmental and economic performance of the firms in the textile industry of Pakistan. Thus, the first part of this study addresses the following questions: What is the existing status and pattern of eco-labeling schemes adopted by Pakistani textile firms? Are the eco-labeling schemes adopted by the Pakistani textile firms promoting production sustainability? Does the adoption of an eco-label improve the environmental and economic performance of the textile firms? What are the factors which drive a textile firm to acquire an eco-label for its products? We address these questions using the firm level data from the textile industry in Pakistan. Previous studies (e.g.,Abbasi, 2012; Berghoef & Dodds, 2013; Blomquista et al, 2014; De Medeiros et al, 2014; Forlin, 2015; Triguero et al, 2013; Tsireme et al, 2012; Yusif et al, 2013) have given little attention to evaluate the motive behind the adoption and implementation of eco-labels at the firm level and its expected effects on the manufacturing firm's economic performance. Moreover, they evaluated the general structure of eco-labels and gave little attention to the role of eco-labels in promoting production sustainability.

[4]The list of environmental hazards associated with textile industry is given in Appendix A, table A4.
[5]The details of major eco-labels acquired by Pakistani textile firms are presented in table A5 (Appendix A).

Pakistan exports various products including fish, food, textile, pulp and paper, and building materials. Pakistan's exports account for 8.5 percent of GDP while its imports account for 19.4 percent (Pakistan Economic Survey, 2018). Given the trade deficit, the exports play an important role in Pakistan economy. However, the increasing global demand for eco-labeled products in the international markets poses a potential risk for the exports opportunities of Pakistan. For example, Pakistan's mango exports faced the risk of getting banned in the European Union for five years due to quality issues. Besides, Pakistan faced the ban on its mango by the United States (Mustafa & Hera, 2017). Recently, Australia, Germany, and Japan have banned imports of mango from Pakistan. Similarly, the country also faced a ban from Belgium on Pakistani peanut, from EU on Pakistani chickpeas/lentils, red chilies, apricot, mango, and kernels, from Sri Lanka on Pakistani onion and from the Philippines on citrus fruits during various years. Currently, the quality and standards issues reduce the volume of Pakistan's exports to China (Mustafa & Hera, 2017). Given the importance of exports in Pakistan economy and increasing demand for eco-labeled products, there is a need to investigate the potential impact of eco-labeling schemes on the export opportunities for Pakistan. Thus, in the second part of this study, we address the following question: Do the existing eco-labeling schemes in international markets of fish, food, textile, pulp and paper, and building materials affect the export opportunities of Pakistan?[6]

The impressive environmental performance of the Blue Angel as a national eco-label scheme of Germany forced other countries to introduce their own national eco-label schemes. Consequently, a number of developed and developing countries such that Nordic countries,

[6]The number of eco-labels faced by these five exports sectors of Pakistan in the international market is given in figure A1 (Appendix A). Moreover, the export performance of these sectors (except pulp and paper) over time is given in table A6 (Appendix A).

European Union (EU) Countries, United States, United Kingdom, Canada, Japan, Malaysia, and India also developed their own eco-labeling schemes (Grolleau & El Harbi, 2008). However, the factors which motivate a country's government to introduce a national eco-label scheme are still unknown. Therefore, in the third part of this study, we address the following questions: Which factors motivate a county government to introduce a national eco-label scheme? And how might a government evaluate whether national eco-label schemes are effective? The aim of the third part of this study is to identify the factors which motivate the government to introduce a national eco-labeling scheme. We address this research objective using panel data of 54 countries that are Pakistan's trade partners[7].

1.2. Objectives of the Study

Given a continuous increase in the global demand for eco-labeled products, this study seeks to examine its implications for Pakistani textile firms and exports of various products in Pakistan. The specific objectives of this study are as follows:

1. To evaluate the existing pattern of eco-labels adopted by Pakistani textile firms.
2. To analyze the effect of eco-label adoption by the textile firms on their environmental and economic performance.
3. To determine the factors influencing a textile firm's decision to acquire an eco-label for its products.
4. To evaluate the potential impact of eco-labeling on the export opportunities of Pakistan.
5. To determine the factors which motivate the government to introduce a national eco-labeling scheme.

[7]The information of national eco-labeling schemes in the trading partner of Pakistan is given in table A7 (Appendix A).

Findings of this study would help the textile firm managers in adopting and implementing various eco-labeling schemes and would help the authority in examining the existing eco-labeling schemes and taking some serious measures to promote the use of eco-labels in the textile and other manufacturing sectors of the country. Moreover, the results would also provide information to exporters about the importance of eco-labels in the international trade and would help policymakers to devise appropriate trade policy taking into account the role of eco-labeling in the international trade. Finally, the findings of this study would inform the policy makers of Pakistan about the effectiveness of a national eco-labeling scheme which in turn will enable them to introduce a national eco-labeling scheme.

1.3. Hypotheses to be Tested

The above objectives are accomplished in this study using various econometric models. Based on these objectives, the following hypotheses are tested in this study:

1. The existence of eco-label with a textile firm improves its environmental and economic performance.
2. The better economic performance of a textile firm increases its environmental performance conversely; the improvement in the environmental performance of a textile firm improves its economic performance.
3. The environmental, economic and supply-side indicators of a firm, regulatory pressure on it, it's export status and it's specific factors influence its decision to adopt an eco-label scheme.
4. The complex criteria, strict standard requirements and higher certification costs of the foreign eco-labeling schemes can reduce the export opportunities of Pakistan.

5. A country's economy stages of development, population effect, relative production cost advantage and strategic interaction with trading partners induce its government to introduce a national eco-labeling scheme.

CHAPTER 2: LITERATURE REVIEW

In this chapter, we review the literature on eco-labeling to identify the research gaps in the existing studies and the contributions of the current study. We review the literature on eco-labeling and its effects on the manufacturing firms' financial and competitive performance, influencing factors of adopting eco-label by a manufacturing firm, the possible impact of eco-labeling on international trade, and the influencing factor of government to introduce a national eco-labeling scheme.

2.1. The Effect of Eco-Label Adoption by the Manufacturing Firms on their Financial Performance

There are two main objectives of the eco-label schemes, the first one is to encourage environmentally friendly consumption and the second one is to persuade producers, governments and other agents to increase the environmental standards of the products and services in the economy. The adoption of voluntary environmental instruments improves the financial performance of the firm. In this regard, Sedjo & Swallow (2002) presented a theoretical model to analyze the effect of voluntary eco-labeling adoption on firm profits in a competitive industry and to distinguish the prices of labeled and unlabeled product. The study used the wood product as an example, the results of the model identified conditions under which the firms lose profits, with an eco-label and where existing production constraints may lead to a single price, for both the labeled and unlabeled product. In a similar fashion, Amacher et al (2004) developed a three-stage duopoly model of vertical product differentiation in order to analyze the impact of eco-labeling investment on firm profitability. The results of the model revealed that the firms' inducements to invest in eco-labeling scheme depend on their relative cost structure. When the

low-grade firm is more efficient in investing in eco-labeling then quality competition will stricter and vice versa.

For investigating the economic gains from eco-label empirically Yusif et al (2013) studied the impact of eco-labeling adoption by Indonesia's smallholder coffee farmers. The study used financial analysis to compare the profitability of eco-labeling and non-eco-labeling smallholder coffee farms. The logit model and descriptive statistical analysis were also used to present the stakeholders' and farmers' perceptions of eco-labels in the coffee sector. The study used primary data, collected through interviews with farmers. The results of the cash flow analysis are shown that eco-labeling in the coffee sector is profitable. Moreover, the farmers faced various problems in getting the certification, namely, limited support from the government, low educational level of farmers, lack of farmers' consciousness of eco-labels, the complexity of the certification scheme and financing problem of the certification.

Moreover, most of the firms adopt eco-labeling schemes because it promises a price premium. In this regard, Blomquista et al (2014) provide an answer to the question whether Swedish fishers received a price premium for participating in a marine swidership council (MSC) certified fishery by employing the hedonic price model. The study used individual-level data and found no evidence of a price premium for MSC-certified landing for the anglers engaged in the fishery.

2.2. The Effects of Eco-Label Adoption by the Manufacturing Firms on their Competitive Performance

Besides, the improvement in economic performance the eco-labels also improve the competitive performance of the firm. In order to investigate this fact, Grolleau et al (2007) used a Stackelberg

model to identify the conditions under which a domestic firm adopted eco-label in order to raise the costs of its foreign rivals. The results of the model showed ambiguous effects of the eco-labeling scheme on domestic social welfare. A one step forward Iraldo et al (2009) investigated this fact empirically. They analyzed the effect of the environmental management system (EMS) designed under the regulations of the eco-management and audit scheme (EMAS) on firm environmental and competitive performance. The study used the evaluation of EMAS and eco-label for their revision (EVER) project data consist of 101 observations, collected through a questionnaire in the year 2005. The results of the binary probit model showed the positive effect of the well-made EMS on environmental performance and on technological and managerial innovations. On the other hand, the results of the multivariate regression model are not strongly supported the impacts of EMS on other competitive variables such as market performance, resource productivity, and intangible assets. The study used a small sample size, which is definitely an important constraint of the empirical analysis of the study.

For the success of the eco-labeling scheme, competition among the firms on the basis of eco-label in the industry is important. In this regard, Forlin (2015) presented a model of vertical product differentiation with more than two firms. The model explored that the number of firms acquired eco-label not only depend on the cost of eco-label but also on the competition level between the eco-labeled and non-eco-labeled certified firms. The results of the model reviled that if the eco-label certifying authority imposes mild requirements than a larger number of firms will acquire eco-label but there will be no competition in the industry. On the other hand, if the authority imposed strict requirements that few firms will acquire eco-label which will lead to competition in the industry.

2.3. The Influencing Factors of Adopting Eco-Label by a Manufacturing Firm

A number of factors influence the firm decision to adopt voluntary environmental initiatives. In order to identify the determinants of adoption of voluntary environmental instruments, Grolleau et al (2007) empirically examined the factors determine voluntary adoption of Environmental Management System (EMS) certification namely, ISO 14001 and EMAS by agri-food industries in France. They applied logit model to a sample of 1,000 French agri-food firms and found that both the management related factors and economic incentives affect the decision of the firm to adopt the voluntary certification but the effect of management related factors was found to be stronger than the effect of economic incentives. However, the study did not determine the path of EMS certification adopted by the French firms. On the other hand, Berghoef & Dodds (2013) explored the interest of the Ontario wine industry members in an eco-labeling scheme and identified barriers and motivations to adopt such a scheme. The study used data collected through interviews with Ontario wine industry members in June and August 2009 and found that all industry members willing to participate in the eco-labeling scheme. The motivations behind the adoption of the schemes included environmental improvement, increased visibility, and improved public perception. The time and money are identified as the main constraint of participating in the scheme.

Triguero et al (2013) extend the issue to eco-innovation and investigated empirically the effect of supply-side, demand side and regulatory factors on the decision of small-manufacturing enterprises (SMEs) to adopt an eco-innovation. The study used a dataset of 27 European countries SMEs and for empirical estimations, it used a trivariate probit model and found that market share and cost-savings had a significant positive impact on eco-product innovations. On the other hand, existing environmental regulations, expected environmental regulations and

access to subsidies and fiscal incentives did not have any significant effect on the firm decision to eco-innovate. The study only provided information on eco-innovation activity by employing a binary variable and did not provide any information on eco-innovative intensity. On the other hand, De Medeiros et al (2014) carried out a literature review on environmentally sustainable product innovation and identified four sets of important factors for environmentally sustainable product innovation namely, market, law and regulation knowledge, inter-functional collaboration, innovation-oriented learning, and R&D investments. The factors recognized in this research provided a base for empirical researchers to conduct studies on the underlying issue.

Few researchers extended the analysis and tried to identify the determinants of green or suitable practices of the firm. In this regard, Tsireme et al (2012) explored the reasons that affect the decisions of managers of firms to adopt management practices in order to green their supply chain management (G-SCM). The data for the study was collected through questionnaires from small and medium-sized Greek firms. For empirical analysis, the study used Spearman statistical tests. The outcomes indicated that the environmental legislation of public authorities, market-based instruments, and self-regulated motivations affect the manager's decisions to take G-SCM practices. Similarly, Abbasi (2012) in his study firstly, analyzed the factors which affect the firm decision to adopt and implement green/sustainable practices, secondly, investigated the role of inter-firm knowledge sharing in encouraging and implementing green/sustainable practices, and thirdly, identified important gains the firm attained from green/sustainable practices. The study used primary data collected through questionnaire from 187 firm managers, in nine major industries of Pakistan, namely, electronic, automotive, chemical, leather, textile/fabrics, fertilizer/pesticide, pharmaceutical, shoes, and plastic producers. The study found environmental pressures, globalization, international demand and competitive pressures as the main factors,

which influence the firm decision to adopt green/sustainable practices in the manufacturing industry of Pakistan. Moreover, the study found effective involvement of original equipment manufacturers in knowledge distribution process within their suppliers' network. Furthermore, the study identified the scrap reduction, production optimization, and reduction in the use of packaging material, noticeable improvement in on-time deliveries, fundamental structural and technical changes as major gains attained from green/sustainable practices. However, the study used qualitative data and did not incorporate any econometric model for empirical estimations.

In the past, researchers gave little attention to evaluate the pattern of eco-labels adopted by a country manufacturing industry and the role of these eco-labels in promoting production sustainability at the firm level. Moreover, they paid little attention to the motives behind the adoption of eco-labels at the firm level and its expected implication on the firm's environmental and economic performance. Besides, the researchers carried out the analysis only for the firm in the developed countries; they did not try to extend their analysis to the firms in developing countries. In addition, most of these studies used to scale data and use ordinal probit and logit models for empirical estimations. Furthermore, their analyses are restricted to a few eco-labels and selected manufacturing industries. Therefore, in the first part of this study, we analyze the existing pattern of eco-labels adopted by Pakistani textile firms and its effects on their environmental and economic performance. We also identify the factors influencing a textile firm's decision to acquire an eco-label for its products. This study use data for 128 firms from the textile industry listed on the Pakistan Stock Exchange (PSX) from 2009 to 2015 and for empirical estimations, the study uses Three-Stage Least Squares (3SLS) and logit models.

2.4. The Possible Impact of Eco-Labeling on International Trade

The recent growth in the number of environmental standards and regulations in developed countries significantly affects the market access of developing states. The developing countries considered these stricter product standards as trade barriers for their exports. A wide range of literature available on the issue that developed countries uses the eco-labels as a nontariff trade barrier. For an instant, Verbruggen et al (1995) briefly examine these issues, paying attention to the most recent eco-labeling schemes for cut flowers in the Netherlands. The study concluded that eco-labels reduced the export opportunities of a number of developing countries. Bonsi et al (2008) also tried to provide the answer to the question whether or not the use of eco-labels is a barrier to international trade under the guidelines of the World Trade Organization (WTO) and International Standards Organization (ISO) principles. The study concluded that majority of eco-labeling schemes are based on life-cycle assessment (LCA) requiring both products related production processes and methods (PPMs), non-product related production processes and methods (NPR-PPMs) that make the eco-labeling a costly activity. Moreover, most of the eco-labeling schemes by developed countries are designed under their own environmental condition. Since the environmental conditions vary among countries and some of these programs are unjustified. On the basis of these results, the study declared eco-labeling schemes as trade barriers. Rotherham (2010) also investigated the same issue in his report with focusing on five famous eco-labeling schemes namely, the Blue Angel, the Forest Stewardship Council (FSC), the Marine Stewardship Council (MSC), Fair-trade Labeling Organizations International (FLO) and the International Federation of Organic Agriculture Movements (IFOAM). The results of the reports identified the cases where all the five eco-labeling schemes reduced the export

opportunities of developing countries. The report also stressed upon the collection of reliable data on all the available eco-labeling schemes.

Moreover, most of the researcher claimed that the developed world uses eco-labels for protectionist purposes, therefore, some researchers tried to establish a proper link between eco-labeling, environment, and trade. For an instant, Vossenaar (1997) tried to answer the question either eco-labeling schemes improve the natural environment or at the same time, it acts as a non-tariff barrier to trade. The study pointed out that eco-labeling is an effective environmental policy tool, if and only if it is non-discriminatory, transparent and based on an open process. If a particular eco-labeling scheme cannot fulfill these conditions then it acts as a non-tariff barrier to trade.

Eco-labeling on the one hand, provide useful information to the consumer regarding the environmental impacts of the product while on the other hand, there is concern that such schemes can indirectly raise trade barriers. In this regard, Abe et al (2002) constructed a simple theoretical model to analyze the environment and trade effects of eco-labeling schemes. The results revealed the possibilities that eco-labeling schemes may degrade the environment instead of improving it, while the same eco-labeling schemes may not hurt foreign firms, therefore it may not be a trade barrier. In addition, Jinji (2004) investigated the environmental and trade impacts of eco-labeling schemes in a vertically differentiated duopoly model where a domestic product is more environment-friendly then an imported product. The outcomes indicated that the complex criteria of the domestic eco-labeling scheme may not be necessary to hurt the foreign firm. Moreover, a foreign eco-labeling scheme may increase domestic welfare, but may not be beneficial to the foreign firm. Melser & Robertson (2005) limited their study only to the environmental benefits of eco-labeling. They evaluated the potential global environmental benefits of eco-labeling

schemes, paying attention in particular to internationally traded commodities. The outcomes of the survey proved that eco-labels can benefit consumers and producers, but in some instances, the eco-labeling cannot achieve its environmental targets. Moreover, most of the developing nations still considered eco-labeling as a trade barrier. Some researcher considered that eco-labeling schemes are the import barriers. In order to investigate this fact, Mason (2002) constructed a two-country model where some firms (called brown) use an environment-unfriendly production technology, while other firms (called green) use environment-friendly production techniques. The study concluded that the use of eco-labeling by the green firms reduced the volume of imported goods.

There are two types of environmental policy instrument in the international markets the first one is the environmental standards and the second one is the eco-labels schemes. Various governments introduced the eco-labeling scheme with the objective to increase global competition by providing environmentally sound products to their domestic and foreign consumers. In this regards, Greaker (2006) analyzed the choice of the domestic and foreign firm either to adopt an environmental standard or a voluntary eco-label scheme in a partial trade model. The results of the model showed that it may be optimal for the domestic government to introduce an eco-label and forced both firms to adopt the label, instead of setting an environmental standard. These results make it ambiguous that the developed countries use eco-labels for protectionist purposes. On the other hand, Podhorsky (2010) analyzed the potential impacts of eco-labeling schemes on consumer welfare and international trade in an open world economy by developing a two-country model with differentiated products and imperfect information. The study showed that if the home country set up the standard for its own eco-labeling scheme, then it would improve its term of trade while the volume of trade would be

reduced if the standard for the home country eco-labeling scheme set by the world authority. Moreover, the volume of trade in the home country with the eco-labeling scheme would be higher than the volume of trade without the eco-labeling scheme. The study concluded that the non-cooperative setting of environmental labels creates some serious global inefficiency.

From the review of the literature on the possible impact of eco-labeling on international trade, it is concluded that most of the emerging economies claimed that the extensive use of eco-labels in the international markets reduced their export opportunities to the markets of industrialized countries. Some researchers considered the eco-labeling as a non-tariff trade barrier while the other considers it a market-based instrument developed by industrialized countries in order to protect their domestic industries. In order to bridge the link between eco-labeling and trade opportunities of developing countries most of the researcher employed a conceptual or descriptive approach in their studies. We could not find hardly a study in developing countries which bridges this link empirically. Therefore, in the second part of this study, we evaluate the impact of eco-labeling on the export opportunities of Pakistan. This study uses the panel dataset of 24 industrialized trading partners of the country from 2003 to 2014. For empirical estimations, the study applies the standard gravity model for international trade.

2.5. The Influencing Factor of Government to Introduce a National Eco-Labeling Scheme

International voluntary environmental initiatives (VEIs) are growing as an effective environmental tool for corporate environmental self-regulation in the worldwide economic system. The number of both national and international VEIs increases rapidly. Christmann & Taylor (2002) analyzed the motivations behind the emergence of international VEIs and developed a strategic framework through which the firm managers can easily participate in the

VEIs. The study found that the consumer demand for environmentally friendly goods, pressure from non-governmental public organizations and from the government and environmental regulations are the main determinants of the emergence of international VEIs.

Jordan et al (2003) extended the analysis from VEIs to new environmental policy instrument (NEPIs) and examined the motivations behind the extensive use of new environmental policy instruments (NEPIs) such as eco-tax, voluntary environmental agreement, and eco-labels, in the European Union (EU). Specifically, the study tried to answer the question that either new idea put forward by member governments, EU institutions, expert groups and non-governmental organizations (NGOs) are the main motivation behind the EU adoption of NEPIs, or market and organization pressures are the main motivations. By utilizing the three different theoretical approaches, they concluded that both the ideas of the actors and market and organizations pressures are the main motivation behind the use of NEPIs. In the same year, Jordan et al (2003) also found that the NEPIs is the best option for environmental governance and the government can improve the performance of NEPIs with the help of its regulatory structure.

On the other hand, Grolleau & El Harbi (2008) extended the analysis by considering eco-labeling instead of NEPIs. They used the panel of 116 countries in order to examine the determinants of the adoption of eco-labeling schemes among countries. The results of the panel logit model showed that economic and political freedoms; innovation capacities and experience with other environmental voluntary initiatives play the main role in the diffusion of governmental eco-labeling schemes. Similarly, Monteiro (2010) analyzed the factors which influence the government decision to introduce an eco-labeling scheme by using a heteroskedastic Bayesian spatial probit model and cross-section data of 141 countries. This

model allowed the government's decision to introduce an eco-label to be influenced by the behavior of the neighboring countries. The results of the study identified economic development, innovation, experience, and potential scale effects as important determinants of the adoption of an eco-label scheme.

The government environmental regulation forced the firms to operate in an environmentally efficient way. In this regard, Tian (2003) developed an international duopoly model with both price and environmental competition and with the possible impacts of government policies. The results of the model showed that a regulatory increase in the form of the minimum required level of environmental friendliness of imported goods may harm the domestic firm and consequently, may increase imports. Moreover, the study showed the equilibrium conditions where the option of levels of environmental friendliness is socially optimal.

The economic theory of food labeling states that mandatory food labeling solve the issue of asymmetric information, but it is less effective in promoting sustainable consumption and production. Golan et al (2001) evaluated the economic theory behind food labeling and presented three case studies in which the government has intervened in food labeling program. The study found significant positive impacts of government intervention into the food labeling program and hence, proposed the government intervention into two other food sectors.

On the other hand, some researchers of the view that, the government intervention into the eco-labeling schemes is essential, therefore, they stressed upon the government intervention into the eco-labeling schemes. Grolleau et al (2004) addressed this issue in his study and concluded that, since governments are the major purchasers of goods, thus they can easily

intervene in eco-labeling through their purchasing decisions, consequently, benefit the environment directly/indirectly by influencing private purchasers through eco-labeling.

From the review of the literature on the influencing factor of government to introduce a national eco-labeling scheme, it is concluded that the intervention of government into the eco-labeling schemes is essential for the success and effectiveness of the schemes. Moreover, few studies identified the factors which motivate a country's government to introduce a national eco-label scheme by employing various datasets and different empirical models. However, these studies used a limited number of factors which motivate the government to introduce a national eco-label scheme. Moreover, their analyses are general to all countries included in the sample, and they did not extend the possible implication of the empirical results to a specific country's interest in establishing a national eco-labeling scheme. In addition, none of these studies give attention to the interest of a specific developing country in establishing its own eco-labeling scheme and the status of existing national eco-label schemes in its trade partner countries. Therefore, in the third part of this study, we identify a wide range of factors which motivate a country's government to introduce a national eco-labeling scheme. For this part, we use panel data of 54 countries that are Pakistan’s trade partners from 1994 to 2014 and for empirical estimations, we use panel logit model.

CHAPTER 3: DATA, MODELS, AND ESTIMATION METHODS

In this chapter, we provide complete information on data and its sources used in this study. We also discuss the theoretical models, empirical models, econometric models and estimation methods for various objectives such as eco-labeling and sustainability in the textile industry of Pakistan, influencing factors of adopting an eco-label by a textile firm, eco-labeling and its effect on the export opportunities of Pakistan, and the influencing factor of government to introduce a national eco-labeling scheme.

3.1. Data and its Sources

To evaluate the existing pattern of eco-labels adopted by Pakistani textile firms, to analyze the effect of eco-label adoption by the textile firms on their environmental and economic performance, and to determine the factors influencing a textile firm's decision to acquire an eco-label for its products, we use data of 128 firms from the textile industry listed on the Pakistan Stock Exchange from 2009 to 2015. We collect the required data from annual reports of textile firms listed in Pakistan Stock Exchange (PSX). Financial Statements Analysis (FSA) of non-financial companies listed in PSX for the year 2009-2015[8], published by the Statistics Department of State Bank of Pakistan (SBP). These data sources provide information on 152 textile firms listed in PSX. However, out of 152 firms, 24 firms' report negative economic performance and these firms are on the edges of bankruptcy therefore, we removed those textile firms who show the negative economic performance from our data and used the information of only the 128 textile firms who report positive economic performance. Additional information is

[8]This report provides information of 14 major industries listed in PSX; however, we used only the textile industry information. We selected this sector because of three reasons; the first reason is that this sector is closely linked with the environment. The second reason is that the products of this sector faced a huge number of eco-labels in the international market. The third reason is this is the largest exporting sector of Pakistan.

collected from personal communication with the firms[9] and from various published sources[10]. The annual reports of the textile firms, provide information on the firms, financial and competitive performance indicators, including net profit margin, return on capital employed, return on equity, market share, and assets turnover ratio. Besides, these reports also provide information on the firms' output, their tax expenses, their sales, their size, the number of machines they use and the textile manufacturing sub-sector they belonged. We took the information about the firms' labor cost, their material cost, their export status, and explanatory variables on the firms' financial performance form FSA. The information on the eco-label status of the firms, its age and the province where they operate are taken from personal communication with the firms. For the construction of the environmental performance index, we take the data on water consumption per liter of textile output, the wastewater discharge per unit of textile output and the number of water effluents per unit of textile output from various published sources.

Moreover, for evaluating the impacts of eco-labeling on the export opportunities of Pakistan; we use the panel data of 24 trading partners of Pakistan. In addition, for the identification of motive behind introducing a national eco-label scheme by a country's government, we use the panel dataset of 54 trading partners of Pakistan. We collect the required data from UNCOMTRADE provided by the United Nations Trade and Statistics Division, World Bank Development Indicators (WDI) provided by the World Bank (WB), Economic Freedom Index, an annual guide published by "The Heritage Foundation, Washington", visiting Eco-label index website operated by Big Room Inc, a Certified B-Corporation based in Vancouver,

[9] We collect the information regarding, the eco-label adoption status of the firm, type of eco-label it adopts and type of other environmental or quality labels they adopt through directly visiting the website of the firm or through email/phone.

[10] Since, the data on the textile firms water consumption, wastewater discharge and water effluents per unit product is not available in a specific dataset, therefore, we took this data from various published sources.

Canada[11] and from the websites of various eco-label assigning organizations. The UNCOMTRADE dataset provides information on the export value of the five exporting sectors of Pakistan in developed countries. We compile information about the national income (nominal GDP), real per capita GDP, population, producer price index, trade costs, manufacturing tariff, exchange rate, research and development expenditures, export value index, high technology export, net trade, and per capita CO_2 emissions from WDI. The data on the number of eco-labels, national eco-labels and the number of private and third-party eco-labels are taken from eco-label index while the certification and labeling costs of eco-labels are received through personal communication with eco-labels assigning organizations. The Economic Freedom Index guide provides information on the economic freedom index and government integrity.

3.2. Eco-Labeling and Sustainability in the Textile Industry of Pakistan

3.2.1. Theoretical Model

In this part of the study, we use the vertical differentiation model presented by Youssef & Abderrazak (2009). In this model, they evaluate the economic and environmental impacts of the multiplication of eco-labels within a given economic sector. They considered two cases, in the first case, they assumed that information is complete such as the consumers know the true environmental qualities produced by the firms while for the second case, they assumed that the information is incomplete such as the consumers do not know the true environmental qualities produced by the firms. We extend the model under the two cases and evaluate the financial,

[11]Since 2007, Eco-label Index has been the supplier of information for the eco-label market. This distinctive platform collects and arranges data on eco-labels internationally, increasing transparency and helping buyers and sellers use them more efficiently. Eco-label Index is the biggest global directory of eco-labels, currently tracking 463 eco-labels in 199 countries, and 25 industry sectors.

competitive and environmental performance of the two textile firms, one with eco-label and the second with the national environmental standard. The basic assumptions of the models are given in Appendix B1. Let's start with the case of complete consumer information such that the entire consumer perfectly knows the high environmental quality q^H and the low environmental quality q^L. The profit of Firm H and Firm L is given by:

$$\pi^H(p^H, p^L, q^H, q^L) = p^H D^H(p^H, p^L, q^H, q^L) - \alpha {q^H}^2 \qquad (3.1)$$

$$\pi^H(p^L, p^H, q^L, q^H) = p^L D^L(p^L, p^H, q^L, q^H) - \gamma\alpha {q^L}^2 \qquad (3.2)$$

Substitute the demand functions into equation (3.1) and equation (3.2) and maximize equation (3.1) and equation (3.2) with respect to p^L and p^H, respectively.

$$\frac{\partial \pi^H}{\partial p^H} = 1 - \frac{p^H - p^L}{q^H - q^L} + p^H\left(-\frac{1}{q^H - q^L}\right) = 0 \qquad (3.3)$$

$$\frac{\partial \pi^L}{\partial p^L} = \frac{p^H - p^L}{q^H - q^L} - \frac{p^L}{q^L} + p^L\left(-\frac{1}{q^H - q^L} - \frac{1}{q^L}\right) = 0 \qquad (3.4)$$

The solution of the above first order conditions yields the equilibrium prices for Firm H and Firm L goods, respectively.

$$p^{HC} = \frac{2q^H(q^H - q^L)}{4q^H - q^L} \qquad (3.5)$$

$$p^{LC} = \frac{q^L(q^H - q^L)}{4q^H - q^L} \qquad (3.6)$$

where C represents the complete information case. Equation (3.5) and equation (3.6) implies that $p^{HC} > p^{LC}$. Substitute the equilibrium prices from equation (3.5) and equation (3.6) into the demand function given in equation (3.1) and equation (3.2) generate the following equilibrium demand functions:

$$D^{HC} = \frac{2q^H}{4q^H - q^L} \qquad (3.7)$$

$$D^{LC} = \frac{q^H}{4q^H - q^L} \qquad (3.8)$$

This implies that the quantity sold by firm L is equal to the half of the quantity sold by Firm H. Substitute the equilibrium prices from the equation (3.5) and equation (3.6) and the equilibrium demand functions from the equation (3.7) and equation (3.8) into the profit functions generate the equilibrium profits for the two firms:

$$\pi^{HC}(q^H, q^L) = \frac{4q^{H^2}(q^H - q^L)}{(4q^H - q^L)^2} - \alpha q^{H^2} \qquad (3.9)$$

$$\pi^{LC}(q^L, q^H) = \frac{q^L q^H (q^H - q^L)}{(4q^H - q^L)^2} - \gamma\alpha q^{L^2} \qquad (3.10)$$

From equation (3.9) and equation (3.10) one can observe the revenue of Firm H R^{HC} and Firm L R^{LC}, respectively:

$$R^{HC} = \frac{4q^{H^2}(q^H - q^L)}{(4q^H - q^L)^2} \qquad (3.11)$$

$$R^{LC} = \frac{q^L q^H (q^H - q^L)}{(4q^H - q^L)^2} \qquad (3.12)$$

By taking cross-derivatives of the revenue functions:

$$\frac{\partial R^{HC}}{\partial q^L} = -4\frac{q^{H^2}(4q^H - q^L)(2q^H - q^L)}{(4q^H - q^L)^4} < 0 \qquad (3.13)$$

$$\frac{\partial R^{LC}}{\partial q^H} = \frac{q^L(4q^H - q^L)(6q^H - 2q^L + 8q^{H^2}q^{L^2})}{(4q^H - q^L)^4} > 0 \qquad (3.14)$$

Equation (3.13) implies that a decrease in q^L increases firm's H revenue while equation (3.14) implies that an increase in q^H increases firm L revenue. This means that an increase in the product differentiation in a term of quality instead of price increases the firm revenue. This product quality competition through eco-label and national environmental standard improve the environmental performance of both the firms as well as improve the environmental performance

of the whole sector. In other words, in the case of complete consumer information, the existence of eco-label in the market increases the environmental qualities of both the firms and consequently improves the environmental quality of the whole sector.

Now suppose the incomplete consumer information case. Here, Youssef & Abderrazak (2009) put additional assumptions regarding consumer and firm behavior. The details of these assumptions are given in Appendix B2. The profit function of Firm L in the incomplete information case is given by:

$$\pi^{LI}(p^{HC}, p^{HC}, \mu^0) = p^{HC} D^I - \gamma \alpha {p^L}^2 \qquad (3.15)$$

The profit function of Firm H in the incomplete information case is given by:

$$\pi^{HI}(p^{LC}, p^{LC}, \mu^0) = p^{LC} D^I - \alpha {q^H}^2 \qquad (3.16)$$

The demand functions in the incomplete information case for the firm is given by:

$$D^H = \frac{\hat{p}^L - \bar{p}^H}{q^H - q^L} - \frac{\bar{p}^H}{q^L} \qquad (3.17)$$

Substitute the demand function into Firm H and Firm L profit functions:

$$\pi^{HI}(\hat{p}^H, \hat{p}^L, 0) = \hat{p}^H \left(\frac{\hat{p}^L - \bar{p}^H}{q^H - q^L} - \frac{\bar{p}^H}{q^L} \right) - \alpha {q^H}^2 \quad (3.18)$$

$$\pi^{HI}(\hat{p}^H, \hat{p}^L, 0) = \hat{p}^L \left(\frac{\hat{p}^L - \bar{p}^H}{q^H - q^L} - \frac{\bar{p}^H}{q^L} \right) - \gamma \alpha {p^L}^2 \quad (3.19)$$

Differentiate the profit function with respect to $\hat{p}^H$ and $\hat{p}^L$ gives:

$$\hat{p}^H = \frac{q^L}{2q^H} \hat{p}^L \qquad (3.21)$$

$$\hat{p}^H = \frac{q^L}{2q^H} \hat{p}^H \qquad (3.22)$$

Comparing the prices of both the firms in case of incomplete information and in case of complete information given in equation (3.5) and equation (3.6), respectively. It is observed that $\hat{p}^H > p^{HC}$

and $\hat{p}^L > p^{LC}$. This implies that the separating equilibrium prices in the case of incomplete information are always higher than the complete information equilibrium prices. The reason behind this is since, the consumer information is incomplete and therefore, they believe the higher price promise higher environmental quality. The firms take advantage of this belief of consumers and set higher prices for their products. Substitute separating equilibrium prices $\hat{p}^H$ and $\hat{p}^L$ into the profit function of Firm H and Firm L gives profit functions for both the firm:

$$\pi^{HI}(\hat{p}^H, \hat{p}^L, 1) = \left(1 - \frac{\hat{p}^H(2q^H - q^L)}{2q^H(q^H - q^L)}\right)\hat{p}^H - \alpha {q^H}^2 \qquad (3.23)$$

$$\pi^{LI}(\hat{p}^L, \hat{p}^H, 0) = \left(\frac{1}{4}\frac{q^L {\hat{p}^H}^2}{q^H(q^H - q^L)}\right) - \gamma\alpha {q^L}^2 \qquad (3.24)$$

Comparing equation (3.24) and equation (3.9) and equation (3.10) and equation (3.23) it is observed that $\pi^{LI}(p^{HC}, p^{HC}, \mu^0) > \pi^{LC}(q^L, q^H)$ and $\pi^{HI}(p^{HC}, p^{HC}, \mu^0) < \pi^{HC}(q^L, q^H)$. This implies that the profits of Firm H and Firm L in the case of incomplete information are higher than their profits in the case of complete information. Firm H revenue in incomplete and complete information cases are given by:

$$R^H(\hat{p}^H, \hat{p}^L, 1) = \left(1 - \frac{\hat{p}^H(2q^H - q^L)}{2q^H(q^H - q^L)}\right)\hat{p}^H \qquad (3.25)$$

$$R^H(p^{HC}, q^H, q^L) = \left(1 - \frac{p^{HC}(2q^H - q^L)}{2q^H(q^H - q^L)}\right)p^{HC} \qquad (3.26)$$

Firm F revenue in incomplete and complete information cases are given by:

$$R^L(\hat{p}^L, \hat{p}^H, 0) = \frac{1}{4}\frac{q^L}{q^H(q^H - q^L)}{\hat{p}^H}^2 \qquad (3.27)$$

$$R^L(p^{HC}, q^L, q^H) = \frac{1}{4}\frac{q^L}{q^H(q^H - q^L)}{p^{HC}}^2 \qquad (3.28)$$

By comparing the revenue function of both the firms in the two cases one conclude that:

$$-R^H(\hat{p}^H, \hat{p}^L, 1) > R^H(p^{HC}, q^H, q^L) \qquad (3.29)$$

$$-R^L(\hat{p}^L, \hat{p}^H, 0) > R^L(p^{HC}, q^L, q^H) \qquad (3.30)$$

This implies that in the case of incomplete information the firm revenue is always higher than the firm revenue in the complete information case. Since the prices in the incomplete information case are higher than prices of complete information case, therefore, the revenue is also higher in the former case and lower in the latter case. Now suppose, $\hat{q}^L$ and $\hat{q}^H$ are the environmental qualities of firm H and firm L in the incomplete information case while q^{HC} and q^{LC} are the environmental qualities of the same firms in the complete information case. Let both the firms want to charge higher prices by providing smallest environmental qualities. Since the revenue of both the firms in the case of incomplete information is higher than their revenue in the case of complete information, therefore, firm H decrease the environmental quality of its products to maximize its revenue while firm L choose an environmental quality for its products that minimize its fixed cost of production. Therefore, in the case of incomplete information, each firm produced environmental quality lower or equal to the case of complete information such as $q^{HC} \geqslant \hat{q}^H$ and $q^{LC} \geqslant \hat{q}^L$. From this result, we get two important points. First, this result points out that even if the products have eco-labels, their environmental qualities can be very low and do not match with the environmental quality expected or proclaimed by the eco-label. Second, this result indicates that the existence of eco-label in the industry reduced the environmental quality of the whole industry. Therefore, the eco-labels do not reflects the real level of the environmental qualities of the products. Thus, it is possible that the consumer will buy an eco-labeled product with a higher price but a lower environmental quality.

It can be concluded from this model that in the existence of eco-label with one textile firm increases the environmental qualities of both the textile firms and consequently improves

the environmental quality of the textile industry. Since we investigate the effect of eco-label adoption by the textile firms on their environmental performance; we devise two groups of textile firms, one with an eco-label and the second without an eco-label and analyzed the environmental performance of both the groups. For measuring the environmental performance of the textile firms, we construct an environmental performance index for each firm. On the relationship among the effect of eco-label adoption by the textile firms on their financial and competitive performance, this model provides information that in the existence of eco-label with one firm enable both the firms to charge higher prices and to generate higher revenue and profits. Instead of using price and net profit as financial performance indicators, we use three variables, net profit margin, return on equity and return on capital employed as financial performance indicators. Moreover, instead of using revenue as a competitive performance indicator we use two variables, market share and assets turnover ratio as competitive performance indicators.

3.2.2. Empirical Model

To model the effects of eco-label on the textile firms environmental and economic performance, we use four input production function consist of physical capital (C), labor inputs (L), material inputs (M) and knowledge capital (K). The Cobb–Douglas forms of the production function can be characterized as:

$$Q_{it} = AC_{it}^{\alpha} L_{it}^{\beta} M_{it}^{\lambda} K_{it}^{\gamma} \qquad (3.31)$$

$$i = 1, \dots\dots, N and t = 1, \dots\dots\dots T$$

$$\alpha + \beta + \lambda + \gamma = 1$$

Subject to the cost function

$$\tau C_{it} + wL_{it} + rM_{it} + \vartheta K_{it} \qquad (3.32)$$

where Q_{it} is the gross output of firm i in time t, A is the level of technology (which may be specific to each firm), τ, w, r, and ϑ are the prices of physical capital (C), labor inputs (L), material inputs (M) and knowledge capital (K), respectively. Taking log to both side of equation (3.31) we get:

$$logQ_{it} = logA + \alpha logC_{it} + \beta logL_{it} + \lambda logM_{it} + \gamma logK_{it}$$

OR

$$q_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma k_{it} \qquad (3.33)$$

$$\alpha + \beta + \lambda + \gamma = 1$$

Due to the non-availability of data on K, equation (3.33) is reformulated. Let,

$$\gamma k_{it} \approx \rho R_{it}$$

where R is the R&D stock or innovation capital $\rho = \partial Q / \partial K$ is the marginal product of innovation capital (constant), equation (3.33) implies that:

$$q_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \rho R_{it} \quad (3.34)$$

Due to the increase in the demand for environmentally friendly products, most of the firms diverted their innovation capital to discover different environmental instrument, through which they can easily produce environmentally sound products. Eco-label is one of the most important forms of environmental innovation, through the adoption of eco-label a firm can easily reduce its emissions and provide environmentally sound products to its customers. Therefore, we replace the innovation stock R_{it} in equation (3.34) by the firm investment to acquiring eco-labels; equation (3.34) is reformulated. Let

$$\rho R_{it} = \gamma ecolabel_{it}$$

where $ecolabel_{it}$ is the ith firm investment to acquire eco-labels for its product(s), equation (3.34) implies that:

$$q_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma ecolabel_{it} \quad (3.35)$$

Due to the non-availability of data on the firm investment to eco-labels, we introduced a Dummy for eco-label ($Decolabel_{it}$) assign value 1 if the ith firm acquired eco-label for its product and assign value 0 otherwise. Equation (4.35) implies that:

$$q_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} \quad (3.36)$$

Subject to the cost function

$$\tau c_{it} + w l_{it} + r m_{it} + \vartheta ecolabel_{it} \quad (3.37)$$

Let, the p_{it} is the price of the output of the ith firm, multiplying equation (3.36) by p_{it}:

$$p_{it} q_{it} = p_{it} (a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it}) \quad (3.38)$$

where $p_{it} q_{it}$ represents the revenue or sale of the ith firm, normalize the price to 1 to the left side of equation (3.38) we get:

$$p_{it} q_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} \quad (3.39)$$

Let introduce error term to equation (3.39) we get:

$$p_{it} q_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} + \mu_{it} \quad (3.40)$$

By subtracting the cost function of equation (3.37) from equation (3.39) we get:

$$p_{it} q_{it} - \tau c_{it} + w l_{it} - r m_{it} - \vartheta ecolabel_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} - \tau c_{it} + w l_{it} - r m_{it} - \vartheta ecolabel_{it} \quad (3.41)$$

Or

$$\pi_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} - \tau c_{it} + w l_{it} - r m_{it} - \vartheta ecolabel_{it} \quad (3.42)$$

Let introduce an error term to equation (3.42) we get:

$$\pi_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} - \tau c_{it} + wl_{it} - rm_{it} - \vartheta ecolabel_{it} + \mu_{it} \quad (3.43)$$

where π_{it} represents the net profit of the ith firm. Let from the production of each output the firm discharges k effluents such that Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Stipend Solid (TSS). By multiplying k effluent to equation (4.36), we get:

$$k * q_{it} = k(a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it}) \quad (3.44)$$

From multiplying the three different effluents to the ith firm output and following the procedure given in section 3.3.4, we formed environmental performance index (EPI). Normalize k to the right side, replace $k * q_{it}$ by EPI and introduce an error term to equation (3.44) we get:

$$EPI_{it} = a + \alpha c_{it} + \beta l_{it} + \lambda m_{it} + \gamma Decolabel_{it} + \mu_{it} \quad (3.45)$$

Through equation (3.40), equation (3.43) and equation (3.45) one can easily analyze the impact of eco-label on the financial, competitive and environmental performance of the ith firm.

3.2.3. Econometric Model

Our analysis on the impact of eco-label on the textile firms' environmental, financial and competitive performance involves an estimation procedure based on panel data models and a simultaneous equation system. In the first stage, we consider the environmental and financial performance and the environmental and competitive performance separately. In the second stage, we consider these variables endogenous and estimate the structural relationships describing the variation of endogenous variables.

3.2.3.1. Separated Equation System

In order to analyze the effect of eco-label on the textile firms environmental, financial, and competitive performance in a separate equation system, we follow the three error component panel data model of Azomahoua et al., (2001). The specification of the model is given by:

$$y_{it} = \alpha + x_{it}\beta + z_i\gamma + \mu_{it} \qquad (3.46)$$

$$\mu_{it} = \mu_i + \lambda_t + \varepsilon_{it}, \quad i = 1, \ldots\ldots, N, \quad t = 1, \ldots\ldots, T$$

where y_{it} is the dependent variable of the firm i in time t, that is the environmental performance of a given firm or its financial or competitive performance, x_{it} is the set of time-invariant explanatory variables, z_i is the set of time-invariant explanatory variables and μ_{it} is a normally distributed error term. Equation (3.46) can be estimated through a maximum likelihood procedure which is a complex procedure. It requires spectral decompositions of the covariance and the concentration of the likelihood function along with some parameters and Generalized Least Squares (GLS) implementation. In the specification of the model given in equation (3.46), we consider estimating separately parameters affecting environmental, financial, and competitive performance of the textile firms. Due to endogeneity among the firm environmental and financial performance and among its environmental and competitive performance, the empirical analysis of the mutual relationship between these variables can be completely precise through the estimation of a structural relationship in a simultaneous equations system (Azomahoua et al., 2001; Wagner et al., 2002). Therefore, we report different steps of the estimation procedure of a simultaneous equations system in the next section.

3.2.3.2. Simultaneous Equations System

Our model contains *G* theoretical relationships *(g = 1, G)* for endogeneity and *K* exogenous variables. Converse to the separated estimations, the data is pooled to comprise NT observations. The complete systems of simultaneous equations are given by:

$$\begin{bmatrix} y_1 \\ \vdots \\ y_G \end{bmatrix}_{GN\ T*1} = \begin{bmatrix} W_1 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & W_G \end{bmatrix}_{GNT\ *\sum_{g=1}^{G}(M_g+K_g)} \begin{bmatrix} \delta_1 \\ \vdots \\ \delta_G \end{bmatrix}_{\sum_{g=1}^{G}(M_g+K_g)*1} + \begin{bmatrix} \epsilon_1 \\ \vdots \\ \epsilon_G \end{bmatrix}_{GNT\ *1} \quad (3.47)$$

With $\epsilon \equiv [\epsilon_1, \dots, \epsilon_G]$ such that $\Omega = E(\epsilon\acute{\epsilon}) = A \otimes I_{NT}$ and elements of the matrix A are $\left(\sigma_{g,h}^2\right)_{g,h=1,\dots,G}$ the structure of A allows for a correlation between the disturbances of these equations. The elements of the $NT * \left(M_g + K_g\right)$ matrix W_g represented both the M_g endogenous variables and K_g exogenous variables included in the right-hnd side of equations.

3.2.4. Econometric Model Specification

Construction of Environmental Performance Index: There is evidence that the adoption of an environmental labeling scheme improves the environmental performance of the firm, and consequently, helps them to bring greater sustainability into their production process (King et al., 2005). Alanya et al., (2005) and Chettiyappan et al., (1999) introduced three types of environmental performance indicators for a textile firm. These indicators are the firm-specific energy consumption, its specific water consumption, and wastewater discharge and its specific pollutant load. The textile firms (involved in spinning, weaving, dyeing, finishing, printing or sizing) discharge wastewater comprises various pollutants. Among these pollutants, the major pollutant is Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended solids (TSS). We use the third environmental performance indicator, i.e. the firm

water pollutant such as BOD, COD, and TSS to measure the environmental performance of a textile firm. We construct the firm environmental performance index based on these three water pollutants released by a textile firm. For obtaining the information on the firm environmental performance indicators such as the Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS) emission, first, we take per product water consumption and per product wastewater discharge from various published sources (see Appendix E, Table E1). Once the wastewater consumption and wastewater discharge information for each textile product is obtained, we multiply it by the total category wise products of the textile firm. The data of each textile firm production are obtained from its annual reports. A textile firm may be engaged in producing one category of a product or engaged in producing a diverse range of products. Therefore, we sum the water consumption and wastewater discharge of all the textile product categories and obtain the yearly information on total water consumption and total wastewater discharge for each firm. The textile firms listed in PSX located in the four provinces of the country, therefore, in each province the textile firm discharges different amount of BOD, COD, and TSS (See Appendix E, Table E2).

We multiply the effluent liter per kg of products given in Table E2 to the total wastewater discharge of each firm without an eco-label in various provinces and got the yearly BOD, COD and TSS amount for each firm. Moreover, the eco-label acquired by Pakistani textile firms forced the firm to reduce the effluent level up to national or international standard (see Appendix E, Table E3). To find the effluent level of the firm with an eco-label we again multiply the effluent liter per kg of products given in table E3 to the total wastewater discharge of each firm with an eco-label and got the yearly BOD, COD and TSS amount for each firm. The descriptive statistics of these effluents of both the firms with an eco-label and the firms without an eco-label are given

in Appendix E, table E4. After getting information on BOD, COD, and TSS, we calculate the EPI for each firm for the year 2009 to 2015 with the following steps. Let the index is calculated for k different individual environmental performance indicators such as BOD, COD, and TSS. k thus designates the total number of individual variables/ indicators taken into consideration to evaluate the environmental performance. Therefore, the variable describing the specific emission V_k for the production unit (in our case a specific firm with a total of n firms) i is denoted as:

V_{it}^k = absolute emissions of variable k from firm i in period t/unit of production firm i in period t. This variable can be calculated for each of the n firms considered. Based on this, in the next step, the minimum value for this variable is identified, over the whole set of firms:

$$V_{min}^k = min_i \left\{ \frac{V_{it}^k}{i} \in 1 \dots n \right\}$$

Subsequently, for each firm, a new variable C_i^k is defined according to the following equation:

$$C_{it}^k = \frac{V_{min}^k}{V_{it}^k} \leq 1$$

The value taken by this ratio will be unity only for the firm performing best for the variable considered; for all other units, it will be strictly less than unity, but always larger than zero. Finally, the index is calculated as:

$$EPI_{it} = \frac{1}{k} [\sum_{j=1,t=1}^{k} C_{it}^k]$$

where EPI_{it} is environmental performance index of firm i in time t, i, j= 1, 2, n and t represents the time period, t=1, 2, T. The value of the index lies between 0 and 1 (Tyteca et al., 2002; Wagner et al., 2002). In the first regression in each system, we used the EPI as a dependent variable. On the other hand, the firm with higher environmental performance may have better financial and competitive performance (Iraldo et al., 2009). Therefore, the environmental

performance of the firm positively affects the financial and competitive performance of the firm (Wagner et al., 2002). Thus, in the second regression of each system, we use EPI as an independent variable.

Economic performance: The economic literature identified the positive and significant relationship among the firm ecological and economic performance. We consider two sets of factors to measure the economic performance of the textile firm namely, the financial performance of the firm and the competitive performance of the firm.

i. Financial performance: We consider three factors to measure the financial performance of the firm, namely, the firm's net profit margin, return on capital employed and return on equity. They are described briefly in the sections that follow. The net profit margin is defined as profit which is left for the owners from the rupee of sales after all expenses and taxes paid and indicates to what degree a firm was successful in achieving the maximum sales possible whilst simultaneously keeping costs low (Fraj-Andrés et al., 2009). Return on capital employed has measured a company's profitability and the efficiency with reference to the capital employed. Generally, return on capital employed measures the efficiency with which capital is employed in producing income (Wagner et al., 2002). Return on equity evaluates the efficiency of a company to utilize its shareholders' equity for looking profit. The return on equity is useful for comparing the profitability of a company to that of other firms in the same industry (Wagner et al., 2002). Moreover, for some firms' data about the financial performance variables are missing. We calculate these indicators by using their usual formulas from information provided by the annual reports of these firms. In the financial performance regression, we use these factors as dependent variables while in environmental performance regressions we use these variables as explanatory variables.

ii. Competitive performance: The economic literature identified an expected positive relationship between the firm environmental and competitive performance. Such the strong competitive position of the firm positively affects its environmental performance. The firm competitiveness depends on its market share and its assets turnover ratio (Iraldo et al., 2009). In the competitive performance regression, we use these two indicators as dependent variables while in the environmental performance regression we use these variables as explanatory variables.

Eco-label Characteristics: With the help of eco-label a textile firm can improve its environmental and economic performance (Iraldo et al., 2009). By visiting the eco-label index website, we found that there are ninety-one types of eco-labels used in the global textile industry. However, the textile firms in Pakistan acquired only ten types of eco-labels for their products. We compile the information regarding, the eco-label adoption status of the firm and type of eco-label it adopts through personal communication with the firms such as directly visiting the website of the firms or through email/phone. With the positive response of the firms' management, we easily obtain data on the eco-label adoption status of the firms and type of eco-label they adopted. Once we collect the eco-label information of the firms, then we introduce dummy assigning value 1, if the firm adopts at least one eco-label scheme and 0 otherwise (Doran & Ryan, 2012). Such as:

$$Decolabel = \begin{cases} 1 \;\; if\ a\ firm\ acquired\ eco-label\ for\ its\ products \\ 0 \;\; Otherwise \end{cases}$$

Firm environmental factors/ Supply-side factors: During the production process the use of machinery, raw materials, and labor inputs causes emissions and significantly affect the firm environmental performance (Iraldo et al., 2009). For the purpose, we use all these variables as independent variables in the environmental performance models. For the machinery, we use the

total number of machinery with the firm (both electrical and non-electrical). On the other hand, for raw materials and labor costs, we use their actual values (De Medeiros et al., 2014; Triguero et al., 2013). Moreover, we use only the variable machinery as an independent variable in financial performance models. In the environmental performance model, we expect a positive sign of labor and material cost while a negative sign for machinery.

Firm-specific factors: The firm-specific factor also affects its environmental and economic performance (Iraldo et al., 2009). We introduce four specific factors for each firm namely, the firm size, the textile sub-sector it belongs (Wagner et al., 2002), its age (Iraldo et al., 2009) and the region where the firm is located (Iraldo et al., 2009). For the firm size, we use the total number of employees in the firm. We introduce dummies for firm sub-sector and the region where the firm operates. There are three textile sub-sectors in our sample namely, yarn manufacturing, textile composites manufacturing, and fabrics manufacturing. For the three sub-sectors, we introduce two dummies, assigning value 1, if the firm has a specific sub-sector and 0, otherwise (Wagner et al., 2002). For firm age, we used the number of years since the firm operates (Horbach, 2008; Rehfeld et al., 2007; Tsireme et al., 2012). The manufacturing industries located in the four provinces of Pakistan. For the four provinces we use three dummies, assigning value 1 if the firm belongs to a specific province and 0, otherwise (Horbach, 2008).

Explanatory variables of the textile firms' financial performance: The firm capital intensity ratio significantly affects its financial performance. The capital intensity may help a firm be financially efficient from its already devoted costs for fixed assets that contribute to the firm's production during the life of those assets. The capital intensity ratio of a firm is a measure of the amount of capital needed per dollar of revenue. It is calculated by dividing the total assets

of a firm by its sales or just by taking the reciprocal of the total asset turnover ratio. This ratio shows the extent to which a firm used its assets more efficiently to generate revenue. Instead of capital intensity ratio Russo & Fouts (1997) and Wagner et al., (2002) included assets turnover ratio as a proxy of capital intensity ratio when carrying out economic performance regressions. The annual reports of the firms and the FSA of non-financial companies listed in PSX for the year 2010-2015 could not provide information about the textile firm's capital intensity ratio. However, these data sources provide information of the firm's assets turnover ratio. For obtaining the capital intensity ratio we take the reciprocal of the assets turnover ratio. Besides, the firm financial leverage also significantly affects its financial performance. Financial leverage shows the extent to which a firm uses the borrowed money. It measures how much a firm uses equity and debt to finance its assets.

For controlling financial leverage Hart & Ahuja (1996) and Wagner et al., (2002) used the debt-equity ratio in their financial performance regressions. The debt-equity ratio measures the firm's financial leverage and calculated by dividing its total liabilities by stockholders' equity. Moreover, it shows how much debt a firm is using to finance its assets relative to the amount of value represented in the shareholders' equity. On the other hand, the dividend policy of a stock market listed firm is very important because it indicates on how much funds held by the firm for investment and how much funds it gives to the shareholder as a dividend. Furthermore, the dividend policy of the firm informs the shareholders about the firm financial performance. Controlling for the dividend policy of a textile firm, we use the dividend cover ratio in our financial performance regressions. Dividend cover ratio measures the ability of a firm to pay dividends to ordinary shareholders from after-tax income and calculated by dividing the firm's net profit after tax by the total amount of dividend it pays to stockholders. In addition,

we also include the interest cover ratio in our financial performance regressions because it measures the efficiency of a firm to pay interest payment on an outstanding debt from its operating profit. It is achieved by dividing the firm's earnings before interest and taxes (EBIT) during a given period by the amount a firm must pay in interest on its debts during the same period. Due to a great fit of dividend cover ratio and interest cover ratio in the net profit margin model, we introduce both these variables only in a net profit margin model while could not include these variables into return on capital employed and return on equity models.

3.2.5. Estimation Method

For analyzing the effect of eco-label adoption by the textile firms on their environmental and financial performance, we use one environmental performance variable, environmental performance index (EPI), and three financial performance (FP) variables, net profit margin, return on capital employed, and return on equity. Therefore, the system of equations consists of M = 2 equations, the first one for environmental performance variable (EPI) and the second one for the financial performance variables (net profit margin, return on capital employed, and return on equity). In total, we estimate three independent systems of equations[12]:

$$EPI_{it} = \alpha + \beta FP_{it} + \gamma DL_{it} + \delta S_{it} + \theta F_{it} + \mu_{it} \qquad (3.48)$$

$$FP_{it} = \vartheta + \pi EPI_{it} + \varphi DL_{it} + \tau S_{it} + \sigma F_{it} + \rho X_{it} + \epsilon_{it} \qquad (3.49)$$

where EPI_{it} is the environmental performance index of the *ith* firm, FP_{it} is the set of the *ith* firm financial performance indicators, DL_{it} is the eco-label dummy represents the eco-label adoption status of the *ith* firm, S_{it} is the vector of *ith* firm environmental or supply side factors, F_{it} is the vector of *ith* firm specific variables, X_{it} is the vector of explanatory variables of the *ith* textile

[12]Wagner et al., (2002) also used a similar model but did not incorporate eco-label characteristics.

firms financial performance, μ_{it} and ϵ_{it} are the error term, $\alpha, \ldots\ldots, \rho$ are parameters to be estimated and i = 1, 2, 3,……., N (represents the firm), t = 1, 2, 3,……., T (represents the time period). Similarly, for analyzing the effect of eco-label adoption by the textile firms on their environmental and competitive performance, we use EPI and two competitive performance (CP) variables market share and assets turnover ratio. In this situation, we estimate two independent system of equation:

$$EPI_{it} = \alpha + \beta CP_{it} + \gamma DL_{it} + \delta S_{it} + \theta F_{it} + \varepsilon_{it} \qquad (3.50)$$

$$CP_{it} = \vartheta + \pi EPI_{it} + \varphi DL_{it} + \tau S_{it} + \sigma F_{it} + \omega_{it} \qquad (3.51)$$

where CP_{it} is the vector of the ith firm competitive performance indicators and ε_{it} and ω_{it} are the error term and $\alpha, \ldots\ldots, \sigma$ are parameters to be estimated. The system of the equation from (3.48) to (3.49) and form (3.50) to (3.51) is our empirical models. Due to the simultaneous nature of the model, we use Three-Stage Least Square (3SLS) estimation procedures. The important issue of the estimation of a simultaneous equation system is the identification problem. One can estimate the simultaneous equation system with 3SLS if the system is over-identified. For the system identification, the econometric literature helped to frame the method of order condition. For over-identification of each equation in the model, the order condition requires that the number of exogenous variables (K) excluded from the single equation must be at least as large as the number of endogenous variables (M) included in the model (Wagner et al., 2002). Each independent system of equation we use comprise two endogenous variables (M = 2), such that in the first system of simultaneous equations it is EPI and net profit margin, in the second system it is EPI and return on capital employed, in the third system it is EPI and return on equity, in the fourth system it is EPI and market share, and in the last system it is EPI and assets turnover ratio. In order to over-identify the first equation in each system, we exclude three provincial dummies.

For identification of the second equation in the environmental and financial performance system, we exclude two textile sub-sector dummies and two exogenous variables MC and LC. On the other hand, for the identification of the second equation in the environmental and competitive performance system, we exclude two textile sub-sector dummies and one exogenous variables machinery. Once, the order condition satisfies we estimate the model with 3SLS estimation procedure. Moreover, we do not use the panel structure of the data, but instead the pooled model on the data. The reason behind this is that due to the small time period of nine years when accounting for the panel structure, the general condition of panel estimations are lost (Wagner et al., 2002). Moreover, for estimation of the environmental, financial, and competitive performance models, we use data for 128 firms from the textile industry listed on the Pakistan Stock Exchange from 2009 to 2015.

3.3. Factors Influencing a Textile Firm's Decision to Acquire a Certified Eco-Label for its Products

3.3.1. Theoretical Model

For this part of the study, we use the model presented by Pavlinovic (2013). The basic objectives of Pavlinovic (2013) were to analyze the effect of eco-labeling on the manufacturing firm decision to adopt an environmentally friendly technology and alternatively, to analyze the effect of eco-friendly technology on the manufacturing firm decision to adopt an eco-labeling scheme. Since we are interested to analyze the factors which influence a textile firm decision to adopt an eco-label, therefore, we evaluate the model presented by Pavlinovic (2013) for the support of secondary objectives. The basic assumptions of the model are given in Appendix C1. Let $\bar{p}$ is the maximum price the consumer willing to buy an eco-label good:

$$\bar{p} = \mu g + (1-\mu)b \qquad b \leq \bar{p} \leq g \quad (3.52)$$

where μ is the updated probability that the firm is green if it holds an eco-label. The value of μ is given by:

$$\mu = \frac{\beta_G}{\beta_G - \beta_B} \qquad (3.53)$$

Substitute equation (3.53) into equation (3.52) we get the price of the eco-labeled certified product:

$$\bar{p} = \frac{\beta_G}{\beta_G + \beta_B} g + \frac{\beta_B}{\beta_G + \beta_B} b \qquad (3.54)$$

The price of the non-labeled product is given by:

$$\bar{q} = \frac{\alpha_N}{1 - \beta_G - \beta_B} g + \frac{1 - \alpha_N - \beta_G - \beta_B}{1 - \beta_G - \beta_B} b \quad (3.55)$$

The profits of the four subgroups firms are given by:

$$\pi_{GC} = \bar{p} - e - c_g \qquad (3.56)$$

$$\pi_{GN} = \bar{q} - e \qquad (3.57)$$

$$\pi_{BC} = \bar{p} - c_b \qquad (3.58)$$

$$\pi_{BN} = \bar{q} \qquad (3.59)$$

where π_{GC} is the profit of a green-certified firm, π_{GN} is the profit of the green non-certified firm, π_{BC} is the profit of brown certified firm and π_{BN} is the profit of the brown non-certified firm. Let, assume all the green firms are eco-label certified, therefore, the focus is given to the decision by brown firms to adopt the eco-label scheme. The decision of the brown firms to adopt an eco-label scheme affects the price and profit of green firms with an eco-label. The dynamics of the brown firm is given by:

$$\dot{\beta}_B = \beta_B(1 - \beta_B - \beta_G)(\pi_{BC} - \pi_{BN}) \qquad (3.60)$$

where $\dot{\beta}_B$ represents the change in the fraction of the certified brown firm. Equation (3.60) implies that changes in the fraction of certified brown firms depend upon the probability that an eco-label certified brown firm is matched with a non-certified brown firm and by the divergence in their profits. The stationary state exists when:

$$\beta_B = 0 \; and \; 1 - \beta_B - \beta_G = 0 \qquad (3.61)$$

Under certain conditions, there is an interior stationary state $0 < \beta_B^* < 1$, if it satisfies the following condition:

$$\pi_{BC} = \pi_{BN} \qquad (3.62)$$

$$\bar{p} - \bar{q} = c_b \qquad (3.63)$$

Let $\alpha_N = 0$ equation (3.55) becomes:

$$\bar{q} = \frac{0}{1 - \beta_G - \beta_B} g + \frac{1 - 0 - \beta_G - \beta_B}{1 - \beta_G - \beta_B} b \qquad (3.64)$$

$$\bar{q} = b$$

Substitute $\bar{q} = b$ and equation (3.54) into equation (3.63) yields:

$$\frac{\beta_G}{\beta_G + \beta_B} g + \frac{\beta_B}{\beta_G + \beta_B} b - b = c_b \qquad (3.65)$$

The simplification yields the following interior stationary state.

$$\beta_B^* = \frac{\beta_G (g - b - c_b)}{c_b} \qquad (3.66)$$

Since $0 < \beta_B^* < 1$, therefore, for the value of several parameters the interior stationary state does not exist and all the brown firms either decide to acquire eco-label for their products or decide to not acquire the eco-label for their products. The stability of the interior stationary state can be derived:

$$\pi_{BC} - \pi_{BN} = \bar{p} - c_b - \bar{q} \qquad (3.67)$$

Substitute $\bar{q} = b$ and equation (3.53) into the equation the above equation yields:

$$\pi_{BC} - \pi_{BN} = \bar{p} - c_b - b \qquad (3.68)$$

The simplification yields the following expression:

$$\pi_{BC} - \pi_{BN} = \frac{\beta_G}{\beta_G + \beta_B}(g + b) - c_b \qquad (3.69)$$

Differentiate equation (3.69) with respect to β_B yields:

$$\partial\beta_B(\pi_{BC} - \pi_{BN}) = \frac{-\beta_B(g - b)}{\beta_G - \beta_B} < 0 \qquad (3.70)$$

Equation (3.67) implies that the derivative of the difference in the profit of brown certified and brown non-certified firms with respect to β_B are negative indicates to the fact that the interior stationary state is stable. Small divergence from this interior stationary state are corrected automatically and converges again to the interior stable state. For an instant, when $\beta_B < \beta_B^*$ then the profit of eco-label certified brown firm is higher than the profit of non-eco-label certified brown firm, therefore, when these two firms match, the non-eco-label certified firm converts to eco-label certified. Thus, the fraction of certified brown firms increases and the system again converges to β_B^*. On the other hand, when $\beta_B > \beta_B^*$ then the profit of the non-certified brown firm is higher than the profit of the certified brown firm, therefore, when these two firms match; the eco-label certified firm converts to non-eco-label certified. Thus, the fraction of certified brown firms decreases and the system again converges to β_B^*. Moreover, the interior stationary state increases if the consumer willingness to pay for green products increases. This green premium motivates the brown firms to follow the eco-label strategy of the green firms.

This model identified three factors price, profit and green premium which influence a manufacturing firm decision to adopt an eco-label. Following Triguero et al., (2013), Grolleau et al., (2007), De Medeiros et al., (2014), Horbach (2008), Shen & Qin (2011), Rehfeld et al.,

(2007), Hanim et al., (2012), and Tsareme et al., (2012) we identify eleven factors which induce a textile firm decision to adopt an eco-label. These factors include taxes, machinery, raw material, labor cost, environmental performance, financial performance, competitive performance, the export status of the firm, firm size, and firm age. After the identification of the factors, we empirically investigate the effect of these factors on a textile firm decision to acquire an eco-label for its product.

3.3.2. Empirical Model

Here we present a simple empirical model that allows us to examine the factors that induce a textile firm's decision to adopt an eco-label. Let assume that the main aim of the textile firms is to maximize profit. Therefore, they adopt an eco-label if and only if their expected long-run profits with an eco-label adoption (π^A) is higher than their expected long-run profit without eco-label adoption (π^{NA}). Expected long-term profits are also called latent variables because they are not observed directly in the data by the econometrician. Let assume that the profits of the firms are the linear function of latent variables. The profits of the firms in both the cases are given as:

$$\pi^A = X\beta^A + \mu^A \qquad (3.71)$$

And

$$\pi^A = X\beta^{NA} + \mu^{NA} \qquad (3.72)$$

where X represents a matrix of explanatory variables capturing the factors that may affect the eco-label adoption decision of the firms, β^A and β^{NA} are the coefficients matrix of X and μ^A and μ^{NA} are the error terms. A firm adopts an eco-label if the following conditions hold:

$\pi^A > \pi^{NA}$ or $X\beta + \mu > 0$, where $\beta \equiv \beta^A - \beta^{NA}$ and $\mu \equiv \mu^A - \mu^{NA}$. By incorporating the probabilities we get:

$$prob(eco-label\ adoption) = prob(\pi^A > \pi^{NA}) = prob(X\beta + \mu > 0$$

$$= prob(\mu > -X\beta) \qquad (3.73)$$

And

$$prob(eco-label\ non-adoption) = prob(\pi^A < \pi^{NA}) = prob(X\beta + \mu < 0$$

$$= prob(\mu < -X\beta) \qquad (3.74)$$

Let μ is normally distributed with mean 0 and variance σ^2, we get:

$$prob(eco-label\ adoption) = prob(\mu > -X\beta) = F(X\beta) \qquad (3.75)$$

where F is the cumulative standard logistic distribution function and σ^2 has been normalized to 1. With the help of equation (3.75), one can easily find the influencing factors which induce a firm's decision to adopt an eco-label.

3.3.3. Econometric Model

For the purpose of describing the textile firm's decision to acquire an eco-label for its products, we follow the econometric model developed by Shen & Qin (2011). We examine the linkages among the dependent variable eco-label and explanatory variables using a binary regression model specified in equation (3.76) below:

$$Ecolabel_i = X_i\beta + \mu_i \qquad (3.76)$$

where $Ecolabel_i$ represents the eco-label status of the *ith* firm, X_i represents a matrix of explanatory variables capturing the factors that may affect the eco-certification decision of the *ith* firm, β is the coefficients matrix of X_i, μ_i is the error term and i represents the firm. The $Ecolabel_i$ is binary in nature; it is linked to the observed variables in the following way:

$$Ecolabel_i = \begin{cases} 1 \ \ if\ the\ ith\ firm\ acquired\ eco-label\ for\ its\ products \\ 0\ Otherwise \end{cases}$$

Shen & Qin (2011) specified the above model as a binary probit model. Since we use a pooled dataset, therefore; we specify the above model as a binary logit model. For converting the above model for the estimation of pooled data we include only the time subscript t to the above equations such that:

$$Ecolabel_{it} = X_{it}\beta + \mu_{it} \qquad (3.77)$$

$$Ecolabel_{it} = \begin{cases} 1 \;\; if\ the\ ith\ firm\ acquired\ eco-label\ for\ its\ products\ in\ time\ t \\ 0 \;\; Otherwise \end{cases}$$

The marginal effect can be computed from the above model in the following way.

$$\frac{\partial E(Ecolabel_{it}/X_{it})}{\partial X_{it}} = F(X_{it}\beta)\beta \qquad (3.78)$$

where F is the cumulative standard logistic distribution function. Here, the marginal effects are usually calculated at the sample means of the data. In addition, during the computation of a binary logit model, a problem arises because X sometime includes dummy variables. The marginal effect (ME) of a dummy variable can be computed in the following way.

$$ME = P(Ecolabel_{it} = \frac{1}{\overline{x_{(d=1)}}} - P\left(Ecolabel_{it} = \frac{1}{\overline{x_{(d=0)}}}\right) \qquad (3.79)$$

where d is a dummy variable and $\overline{x_{(d)}}$ represents the mean of all other variables in the model.

3.3.4. Econometric Model Specification

With the help of eco-label, it has been shown that a textile firm can improve the environmental performance of its product (Shen & Qin, 2011). We introduce dummy assigning value 1 if the firm adopts at least one eco-label scheme and 0 otherwise. We use this binary variable as a dependent variable.

Regulatory pressure: Basically, there are two sets of regulatory measures through which the public authorities pressure the manufacturing units or industries to improve their

environmental performance. The first set comprises laws, regulation, and policies, and these hold a direct or indirect impact on the firm environmental performance. The second set consists of environmental taxes. The government of Pakistan formed several environmental protection laws, regulation and policies for the industrial sector under the guideline of Pakistan Environmental Protection Ordinance (PEPO) of 1983 and Pakistan Environmental Protection Act (PEP-Act) 1997 (Aftab et al., 2000). Since the environmental regulations exist in the textile sector of Pakistan; compliance with this regulation has already forced the firm to improve its environmental performance. Therefore, instead of the first set of regulations, we use the second set of regulations that comprise environmental taxes (De Medeiros et al., 2014; Horbach, 2008; Shen & Qin, 2011; Triguero et al., 2013; Tsireme et al., 2012). Environmental taxes have the ability to force the firm to adopt a voluntary environmental scheme such as eco-label (Grolleau et al., 2007). The dataset we employ does not provide information on environmental taxation. Therefore, we use the total income tax expenses (for current year) of the firm as a proxy for environmental taxation. We expect a positive sign for this variable.

Firm environmental factors/ Supply-side factors: The supply side factors significantly contribute to the firm decision to adopt a certified voluntary environmental scheme (Triguero et al., 2013). For machinery, we use the number of machines with the firm. For raw materials and labor costs, we use their actual values (De Medeiros et al., 2014; Triguero et al., 2013). For labor and material costs we expect a negative sign while we expect a positive sign for machinery.

Environmental performance: A firm with better environmental performance is can more easily adopt an environmental labeling scheme compared to the firm with lower environmental performance. Therefore, we include the environmental performance index as a factor which influences the firm decision to adopt an eco-label scheme and expect a positive sign for it.

Economic performance: A firm with better economic performance is can more easily adopt an eco-labeling scheme compared to the firm with weak economic performance. The economic performance of a textile firm is composed of its financial and competitive performance.

i. Financial performance: The better financial position of a firm forced him to improve its environmental performance through the adoption of an eco-label. Moreover, the firm with a stronger financial position can bear the cost of eco-label certification easily. To evaluate the impact of financial performance on the firm decision to adopt an eco-label scheme, we use three financial performance indicators namely, the textile firm net profit margin, its return on capital employed and its return on asset (Grolleau et al., 2007). We expect a positive sign for these three variables.

ii. Competitive performance: The environmental leadership provides the opportunity for a firm to differentiate its products from those firms' products, which use environmentally harmful technologies in their production process. Through, this environmental product differentiation strategy, the firms can attract new customers from the market as well as it can put technological, environmental, economic and cultural barriers for a new firm enters to the industry. This environmental product differentiation increases the rivals cost and consequently, improve the competitive position of the environmental leader firm in the market and in the industry. In order to evaluate the impact of competitive performance on the firm decision to adopt an eco-label, we use two competitive performance indicators namely, market share and assets turnover ratio (Grolleau et al., 2007). We expect a positive sign for these two variables.

Export status of the firm: The pressure from the firm's foreign consumers and foreign environmental regulation and standard may force the firm to adopt eco-label scheme (Grolleau et

al., 2007). For the purpose, we introduce a dummy for export assigning value 1, if the firm export its commodities and assign value 0, otherwise (Horbach, 2008; Shen & Qin, 2011). Moreover, we expect a positive sign for this dummy variable.

Firm-specific factors: We introduce two specific factors for each firm namely, the firm size and its age (Iraldo et al., 2009). For the firm size, we use the total number of employees in the firm (Grolleau et al., 2007; Hanim et al., 2012; Horbach, 2008; Rehfeld et al., 2007; Shen & Qin, 2011). For the firm age, we use the number of years since the firm operates (Horbach, 2008; Rehfeld et al., 2007; Tsireme et al., 2012). We expect a positive sign for these two variables.

3.3.5. Estimation Method

The specific version of the model (3.76) is given[13]:

$$Pr(DL_{it} = 1/R_{it}, \dots\dots, DE_{it}) = F(\alpha + \beta_1 R_{it} + \beta_2 S_{it} + \beta_3 EPI_{it} + \beta_4 FP_{it} + \beta_5 CP_{it} + \beta_6 F_{it} + \beta_7 DE_{it} + \mu_{it}) \quad (3.80)$$

where DL_{it} is a dummy, and its value will be 1 if the *ith* firm adopted an eco-label and its value will be 0 otherwise, R_{it} is the regulatory pressures on the *ith* firm, S_{it} is the vector of *ith* firm environmental or supply side factors, EPI_{it} is the environmental performance index of the *ith* firm, FP_{it} is the vector of financial performance indicators of the *ith* firm, CP_{it} is the vector of competitive performance indicators of the *ith* firm, F_{it} is the vector of *ith* firm specific variables, and DE_{it} is a dummy indicating the exports status of the *ith* firm. μ_{it} is the error term, α and β_j are parameters to be estimated, i = 1, 2, 3,…….., N, and t = 1, 2, 3,…….., T. Equation (3.80) is

[13]Similar model is used by Grolleau et al., (2007) in order to identified determinants of environmental management system while Horbach (2008) and Kammerer (2009) used a similar model in order to identified determinants of environmental innovation.

our empirical model with a binary dependent variable. Due to the binary nature of the dependent variable, we cannot estimate the parameters of this model through ordinary least square and (OLS) and generalized least square (GLS) because it produces biased and inconsistent estimates. For the solution of these problems, the econometric literature proposed logit regression model (Greene, 2003; Gujarati, 2009). With the help of this model, we estimate the parameters of the model and the marginal effects for each explanatory variable. For estimation of the model, we use data of 128 firms from the textile industry listed on the Pakistan Stock Exchange from 2009 to 2015.

3.4. Eco-Labeling and the Export Opportunities of Pakistan

3.4.1. Theoretical Model

In this part of the study, we use the model presented by Greaker (2006). This model comprises a three-stage game between three actors, a domestic government, a domestic firm and a foreign firm exporting to the domestic market. For simplicity, he assumed that the production process generates local pollution. At the first stage of the game, the domestic government chooses whether to regulate pollution with a national environmental standard $\bar{r_s}$ or with an eco-label scheme $\bar{r_c}$. At the second stage of the game, the domestic and the foreign firm choose whether to adopt the eco-label if it is offered. Finally, in the third stage of the game, the two firms compete in prices on the domestic country market. Moreover, the domestic government and the firms have perfect information and domestic consumers cannot observe the environmental performance of the firms. Since we are interested in evaluating the effect of eco-labeling on trade; therefore, we discuses only the second stage of the model. The firms' cost function is given as:

$$c_0 q_i + a_i \qquad i = d, f \qquad (3.81)$$

where a_i is the level of pollution abatement cost (in US$), q_i is the level of output, c_0 is the marginal cost and $i = d, f$ represents domestic and the foreign country, respectively. The production of q_i release emissions e_i such as:

$$e_i = q_i - \alpha_i a_i \qquad i = d, f \qquad (3.82)$$

where α_i is the parameter represents the efficiency of pollution abatement. The domestic government targets emissions per unit of output $\frac{e_i}{q_i}$. The government wants to reduce the pollution through eco-label scheme $(1 - \bar{r_c})$ with $\bar{r_c} \in [0,1]$. Therefore, if the government introduces an eco-labeling scheme and firms choose to adopt this eco-labeling scheme if and only if, $\frac{e_i}{q_i} \leq (1 - \bar{r_c})$ or $\alpha_i a_i \geq \bar{r_s} q_i$. Normalize c_0 to 0 α_d to 1 and let $\alpha_f \in [2/3,1]$ (We use α instead of α_f). The unit cost c_d of the domestic firm and c_f of the foreign firm is given by:

$$c_d \begin{cases} \bar{r_c} & if\ adoption\ of\ eco-label \\ 0 & if\ no\ regulation \end{cases} \qquad (3.83)$$

$$c_f \begin{cases} \dfrac{\bar{r_c}}{\alpha_f} & if\ adoption\ of\ eco-label \\ 0 & if\ no\ regulation \end{cases} \qquad (3.84)$$

The profits of the firms are given as:

$$\pi_i(p_d, p_f) = [p_i - c_i] q_i(p_d, p_f) \qquad i = d, f \quad (3.85)$$

where p_i is the price of product i, $i = d, f$ and $q_i(p_d,\ p_f)$ is domestic demand for product i. For regulating the market, let the government introduce an eco-labeling scheme and set the criteria $\bar{r_c}$ for the scheme. The foreign firm is indifferent to the adoption of the eco-label scheme. Greaker (2006) specified four cases such as; (1) if only the domestic firm adopt an eco-label, (2) if only the foreign firm adopt an eco-label, (3) if both the firm adopts an eco-label, and (4) if no firm adopt an eco-label. If only the domestic firm adopts the eco-labeling scheme, then the Nash

equilibrium outputs, profits, and prices of the two firms can be derived in the following way. The linear demand function for the domestic good facing by the domestic firm is given as:

$$q_d(p_d, p_f) = \frac{m(\bar{r_c}) - 2(p_d - p_f - 1)}{4} \qquad (3.86)$$

Where the following conditions must hold:

$$m(\bar{r_c}) + p_f - 1 < p_d < p_f + 1 \qquad (3.87)$$

Then the domestic firm solves the profit maximization problem:

$$max_{p_d r_d}\, \pi_d = [p_d - r_d] \frac{2(p_f - p_d + 1) + m(\bar{r_c})}{4} \qquad (3.88)$$

Subject to

$$r_d \geq \bar{r_c} \qquad (3.89)$$

For the solution of the maximization problem, the domestic firm sets $r_d = \bar{r_c}$. The foreign firm solves the profit maximization problem:

$$max_{p_f, r_f} = [p_f - r_f] \frac{2(p_d - p_f - m(\bar{r_c}))}{4} \qquad (3.90)$$

Subject to

$$r_f \geq 0 \qquad (3.91)$$

For the solution of the maximization problem, the foreign firm sets $r_f = 0$. The first order condition for equation (3.88) and equation (3.90) produce the Nash equilibrium prices for the output of the two firms:

$$p_d = \frac{6 + 4\bar{r_c} + m(\bar{r_c})}{6} \qquad (3.92)$$

$$p_f = \frac{6 + 2\bar{r_c} - m(\bar{r_c})}{6} \qquad (3.93)$$

Substitute equation (3.83) and equation (3.93) into equation (3.87) provides:

$$m(\bar{r_c}) \leq \left\{3 - \bar{r_c}, \frac{3 + \bar{r_c}}{2}\right\} \qquad (3.94)$$

Substitute equation (3.92) and equation (3.93) into the demand function given in equation (3.86) and solving for both the domestic and foreign firm. The Nash equilibrium output of both the domestic and foreign firm is given as:

$$q_d = \frac{6 - 2\bar{r_c} + m(\bar{r_c})}{12} \qquad (3.95)$$

$$q_f = \frac{6 + 2\bar{r_c} - m(\bar{r_c})}{12} \qquad (3.96)$$

Substitute the values in the profit functions; provided the reduced form of profit function for the domestic and foreign firm, one can find:

$$\pi_d = 2[q_d]^2 = 2\left[\frac{6 - 2\bar{r_c} + m(\bar{r_c})}{12}\right]^2 \qquad (3.97)$$

$$\pi_f = 2[q_f]^2 = 2\left[\frac{6 + 2\bar{r_c} - m(\bar{r_c})}{12}\right]^2 \qquad (3.98)$$

If only the foreign firm adopts eco-label then its marginal cost will be $\bar{r_c}/\alpha$. Replace $\bar{r_c}/\alpha$ by $\bar{r_c}$ in equation (3.97) and equation (3.98), and one can get the profit of both the firms. If both the firms adopt eco-label, then the domestic firm solves the following problem:

$$max_{p_d}\pi_d = [p_d - \bar{r_c}]\frac{(p_f - p_d + 1)}{2} \qquad (3.99)$$

The foreign firm solves the profit maximization problem:

$$max_{p_f}\pi_f = \left[p_f - \frac{\bar{r_c}}{\alpha}\right]\frac{(p_d - p_f + 1)}{2} \qquad (3.100)$$

The first order condition for equation (3.99) and equation (3.100) produce the Nash equilibrium prices for the output of the two firms:

$$p_d = 1 + \frac{\frac{\bar{r_c}}{\alpha} + 2\bar{r_c}}{3} \qquad (3.101)$$

$$p_f = 1 + \frac{2\frac{\bar{r_c}}{\alpha} - \bar{r_c}}{3} \qquad (3.102)$$

The Nash equilibrium output of both the domestic and foreign firm is given as:

$$q_d = \frac{3 + \frac{\bar{r_c}}{\alpha} + \bar{\bar{r_c}}}{6} \qquad (3.103)$$

$$q_f = \frac{3 - \frac{\bar{r_c}}{\alpha} + \bar{r_c}}{12} \qquad (3.104)$$

Substitute the values in the profit functions; provide the reduced form of profit function for the domestic and foreign firm:

$$\pi_d = 2[q_d]^2 = 2\left[\frac{3 + \frac{\bar{r_c}}{\alpha} + \bar{r_c}}{6}\right]^2 \qquad (3.105)$$

If no firm adopts the eco-label, then they both earn a profit, $\pi_d = \pi_d = \frac{1}{2}$ and produce $q_d = q_f = \frac{1}{2}$ as long as the market is covered. Table 3.1 summarizes the details of all these conditions. If there are two pure strategies for the domestic and foreign firm, for example, if either the firms adopt eco-label or not then three Nash equilibriums are generated. Every equilibrium is distinctive and depends exclusively on the values of the function $m(\bar{r_c})$, the eco-label criterion $\bar{r_c}$, and the parameter α. Therefore, a firm can adopt the eco-label if the average willingness to pay for the eco-label $\frac{m(\bar{r_c})}{2}$ has to be equal to or greater than the increase in per unit abatement cost. Table 3.2 summarizes the results of all these equilibria. The first Nash equilibrium shows that the domestic firm adopts eco-label if per unit cost of pollution abatement $\bar{r_c}$ is less than or equal to the average willingness to pay for the eco-label and the average willingness to pay for the eco-label has to be less than the marginal cost of pollution abatement via eco-label $\frac{\bar{r_c}}{\alpha}$. Both the firms adopt eco-label if the average willingness to pay for the eco-label has to be equal to or

Table 3.1: The Market Game

Outcomes	Domestic firm profit	Foreign firm profit
Domestic eco-label	$2\left[\frac{6-2\bar{r_c}+m(\bar{r_c})}{12}\right]^2$	$2\left[\frac{6+2\bar{r_c}-m(\bar{r_c})}{12}\right]^2$
Foreign eco-label	$2\left[\frac{6+2\frac{\bar{r_c}}{\alpha}-m(\bar{r_c})}{12}\right]^2$	$2\left[\frac{6-2\frac{\bar{r_c}}{\alpha}+m(\bar{r_c})}{12}\right]^2$
Both eco-label	$\frac{1}{2}\left[\frac{3+\frac{\bar{r_c}}{\alpha}-\bar{r_c}}{3}\right]^2$	$\frac{1}{2}\left[\frac{3-\frac{\bar{r_c}}{\alpha}+\bar{r_c}}{3}\right]^2$
No eco-label	$\frac{1}{2}$	$\frac{1}{2}$

greater than the marginal cost of pollution abatement via eco-label. Finally, no firm adopts eco-label if the average willingness to pay for the eco-label has to be less than the unit cost of pollution abatement via eco-label. Moreover, if only the foreign firm adopts eco-label then there will be no equilibrium because the foreign firm has either higher or the same per unit abatement cost as the domestic firm. Furthermore, if the firms are symmetric i.e. $\alpha = 1$, there exist only two equilibria; either both firms adopt eco-label, or neither of both the firms adopts eco-label. This means that if the eco-label scheme criteria $\bar{r_c}$ implies that $\bar{r_c} \leq \frac{m(\bar{r_c})}{2} < \frac{\bar{r_c}}{\alpha}$ then:

i. Only the domestic firm will adopt the eco-label.

ii. Domestic firm profits will increase.

iii. Foreign firm profits will decrease.

iv. Imports of the foreign good will decrease.

If the eco-label scheme criteria $\bar{r_c}$ implies that $\frac{m(\bar{r_c})}{2} \geq \frac{\bar{r_c}}{\alpha}$ then:

i. Both firms will adopt the eco-label.

ii. Domestic profits will increase as long as $\alpha < 1$.

iii. Foreign profits will decrease as long as $\alpha < 1$.

iv. Imports of the foreign product will decrease as long as $\alpha < 1$.

Table 3.2: The Adoption Game

Equilibrium	Sufficient and necessary conditions
Domestic eco-label	$\bar{r_c} \leq \frac{m(\bar{r_c})}{2} < \frac{\bar{r_c}}{\alpha}$
Both eco-label	$\frac{m(\bar{r_c})}{2} \geq \frac{\bar{r_c}}{\alpha}$
No eco-label	$\frac{m(\bar{r_c})}{2} < \bar{r_c}$

This model shows that if the eco-label scheme is established on the basis of each of the two stated criteria, then the imports of the foreign/exporting country will decrease, regardless of the fact that only the domestic/importing country firms will adopt the eco-label or both the foreign and domestic countries' firms adopt the eco-label. We investigate that the developed countries established eco-label schemes reduced the export opportunities of a developing country like Pakistan. Therefore, this result of the model enables us to analyze the potential effect of eco-labeling on the export opportunities of Pakistan. Moreover, to analyze this fact empirically, we select five major export sectors of Pakistan, namely, fish, food, textiles, pulp and paper, and building materials.

3.4.2. Econometric Model

One of the possible ways to model the potential effects of the foreign/importing country eco-label schemes on the export opportunities of a domestic/exporting country, the econometric literature provides the standard gravity model for international trade. The gravity model has been used in the social sciences since the latter half of the nineteenth century. Due to its empirical consistency, it has been used to explain various flows such as migration, commuting, tourism, and commodity shipping. Pöyhönen (1963); Tinbergen & Hekscher (1962) were the first authors who used the gravity model for international trade. The most simple form of the gravity model for international trade shows a positive association among the volume of exports between any

two trading partners and their national incomes and shows a negative association among their volume of exports and the distance between them (Wall, 1999). Geraci & Wilfreid (1977); Koysti (1963); Pöyhönen (1963); Prewo (1978); Tinbergen & Hekscher (1962) used the following specification of the gravity model:

$$PX_{ij} = \beta_0 (Y_i)^{\beta_1} (Y_j)^{\beta_2} (D_{ij})^{\beta_3} (A_{ij})^{\beta_4} \mu_{ij} \qquad (3.106)$$

where PX_{ij} is the US$ value of trade flow from country i to country j, Y_i and Y_j is the US$ value of nominal GDP in country i and country j, D_{ij} is the distance between the economic centers of country i and country j, A_{ij} is the other varables which either restricts or promote the trade among country i and country j and μ_{ij} is the log-normally distributed error term. The log-linear form of the gravity model of equation (3.106) is given by:

$$ln(PX_{ij}) = \beta_0 + \beta_1 ln(Y_i) + \beta_2 ln(Y_j) + \beta_3 \ln(D_{ij}) + \beta_4 ln(A_{ij}) + \varepsilon_{ij} \quad (3.107)$$

Most of the researchers used the above gravity model to estimate the bilateral trade relations among the partners. Moreover, this model estimates only the main effects of bilateral trade relations among the partner, consequently, the projection of bilateral trade relations may mislead and give inaccurate forecasts with unnecessary large confidence intervals (Breuss & Egger, 1999). Egger & Pfaffermayr (2003) presented the proper and general specification of the gravity model which capture the three effects namely, the random effect, fixed effect and bilateral trade effects simultaneously. The more general specification of the model is given as:

$$ln(PX_{ijt}) = \alpha_i + \gamma_j + \lambda_t + \beta_1 ln(Y_{it}) + \beta_2 ln(Y_{jt}) + \beta_3 ln(D_{ij}) + \beta_4 ln(A_{ijt}) + \varepsilon_{ijt} \qquad (3.108)$$

where α_i is the domestic country effect, $i = 1, \ldots\ldots, N$, γ_j is the partner country effect, $j = 1, \ldots\ldots, N+1$ and λ_t is the time effect, $t = 1, \ldots\ldots\ldots, T$. Equation (3.108) is the generalized form of the two-way fixed effect panel data model. This model has three restrictions, $\sum_i \alpha_i =$

$0, \sum_i \gamma_j = 0$ and $\sum_t \lambda_t = 0$ (Egger & Pfaffermayr, 2003). When cross-sectional data is used, then T=1 and implicitly restriction $\sum_t \lambda_t = 0$ is imposed on the model. When time series data is used, then N=1 implicitly restriction $\sum_i \alpha_i = 0$ is used on the model. On the other hand, when panel data is used then no such restrictions are imposed on the model (Matys, 2005).

3.4.3. Econometric Model Specification

One of our objectives is to analyze the potential impacts of eco-labeling on the export opportunities of Pakistan. Therefore in this study, we use the export value in US$ of Pakistan as the dependent variable (Baier & Bergstrand, 2007; Bergstrand, 1985). The analysis is carried out for five exports sectors of Pakistan faced the eco-labels in the markets of partners developed countries namely, fish and fish products, food, textiles, pulp and paper, and building materials. Therefore, we use five dependents variables.

National income: The national income of the importing countries positively and significantly affect the value of exports from the exporting country (Egger & Pfaffermayr, 2003). For the purpose, we use the US$ value of nominal Gross domestic products (GDP) of the trade partner countries as an explanatory variable (Baier & Bergstrand, 2007; Bergstrand, 1985).

Trade cost: To measure the distance effect most of the international trade studies include transportation cost to the gravity model (Baltagi et al, 2003; Narayan & Nguyen, 2016; Victor & Macphee, 2006). However, instead of transportation cost, we include the trade cost in our analysis. The trade cost varying among the trading partners and negatively affects the exports of the countries. Moreover, we use the cost to export per container as a proxy for trade cost.

Eco-label characteristics: Most of the developing countries considered that industrialized nations introduce eco-labeling schemes for protecting their domestic industries (Greaker, 2006), while others argue that it increases the costs of international trade (Daniel & Peter, 2005).

Similarly, some researcher identified eco-labeling as a non-tariff trade barrier to international trade. The existing eco-labeling schemes in the international market requiring high standards in the chain of custody (COC), process and production methods (PPMs) and life cycle assessment (LCA) may subsequently increase the cost of production of several developing countries' firms. Other problems with the use of eco-labels faced by developing countries include technical barriers, certification costs and low credibility (Bonsi et al., 2008). To investigate the impact of developed countries eco-labeling scheme on the export opportunities of Pakistan, we introduce two characteristics of eco-labels, namely the number of eco-labels in the importing country and the certification and labeling costs of acquiring these eco-labels. Moreover, the variable number of eco-label is used to capture the effect of the complex procedure and strict standard requirements of the eco-labels and the diversity of eco-labels exist in the developed trading partners of Pakistan. Further, we expect negative signs for these two variables. Names and product categories of some eco-label schemes exist in the developed trade partners of Pakistan are given in Appendix G, table G1.

Wholesale price index: The economic literature shows a negative association between exports and its prices. When the price of the exported commodity rises in the exporting country, then the importing country reduced the import of this good, thus the exporting country loses its competitive position in the importing country market. Conversely, when the price of the exported commodity is raised in the importing country, then the exporting country increases its exports and earns more revenue from exports. But the rise in the price of exporting commodity reduces the purchasing power of the consumer in the importing country. Therefore, they divert their consumption from importing commodity to domestic substitute commodity. This diversification again reduces the export earning of the exporting country (Victor & Macphee, 2006). In order to

capture the effect of price on the export opportunity of Pakistan, we use the wholesale price index (Victor & Macphee, 2006).

Population size: The country with a high population and small domestic markets encourage the demand for imports consequently, the country imports a wide range of goods from exporting countries. This suggests a positive impact of population on bilateral trade (Oguledo & MacPhee, 1994). On the other hand, total GDP and per capita GDP are the good measures of imports demand and exports supply, this suggests a negative impact of population on bilateral trade (Richard, 1994). Due to the importance of the population size, we use it as an explanatory variable (Egger & Pfaffermayr, 2003; Lewer & Van den Berg, 2008).

Manufacturing tariff: The theoretical and empirical economic literature on the relationship between exports and non-tariff trade barriers shows a significant negative association between the two variables. Such that the reduction in the non-tariff trade barriers make it possible for various countries to increase its exports and vice versa (Chaney, 2008). To analyze the trade barriers impact on the export opportunities of Pakistan, we use the manufacturing tariff rate as a proxy for non-tariff trade barriers.

Exchange rate: The exchange rate shows the volatility in the value of a currency (Bergstrand, 1985; Egger & Pfaffermayr, 2003). When exchange rate increases then the domestic currency depreciates domestic goods become cheaper in the importing country consequently, foreign demand for domestic goods increases and vice versa. Therefore, we expected both the positive and negative impact of exchange rate on the value of domestic export (Bergstrand, 1985; Egger & Pfaffermayr, 2003). In this study, we use the exchange rate as an explanatory variable (Bergstrand, 1985; Narayan & Nguyen, 2016).

3.4.4. Estimation Method

Since our main aim is to analyze the potential effect of eco-labeling on the export opportunities of Pakistan; therefore, we introduce only the developed countries explanatory variables into the model while ignoring the explanatory variable of the domestic country Pakistan. Moreover, we introduce additional variables into the gravity model. The resulting model is given as[14]:

$$ln(PX_{ijt}) = \alpha_i + \gamma_j + \lambda_t + \beta_1 ln(Y_{jt}) + \beta_2 ln(C_{jt}) + \beta_3 ln(EL_{jt}) + \beta_4 ln(ELC_{jt}) + \beta_5 ln(P_{jt}) + \beta_6 ln(POP_{jt}) + \beta_7 ln(MT_{jt}) + \beta_8 ln(ER_{jt}) + \varepsilon_{ijt} \quad (3.110)$$

where PX_{ijt} is the export from country i to country j, Y_{jt} is the US$ value of nominal GDP of country j, C_{jt} is the cost of export per container in country j, EL_{jt} is the number of eco-labels in country j, ELC_{jt} is the certification and labeling cost of eco-labels in country j, P_{jt} is the producer price index of country j, POP_{jt} is the population of country j, MT_{jt} is the manufacturing tariff in country j, ER_{jt} is the exchange rate in country j, ε_{ijt} is the error term, i represents the domestic/exporting country, j represents the partner/importing countries, $j = 1, \ldots\ldots, N+1$, t represents the time period where $t = 1, \ldots\ldots, T$, and ln represents the natural log. The panel gravity model of equation (3.110) is our final model.

We estimate this model for the five major export sectors of Pakistan, which face a reasonable number of eco-labels in the developed partner countries, namely, fish and fish products, food, textiles, pulp and paper, and building materials. We estimate total five equations for each exporting sector. For estimation of the model, we use panel data, therefore; the estimation of the model is carried out using the standard Panel Random effect (RE), Fixed effect

[14]Wall (1999) and Narayan & Nguyen (2016) used a similar model but did not incorporate eco-label characteristics.

(FE) and System Generalized method of moments (System GMM) estimation procedures. For estimation of the model, we use the panel data of 24 trading partner countries of Pakistan for 2003 to 2014.

3.5. Government and National Eco-Labeling Schemes

3.5.1. Theoretical Model

In this part of the study, we use the model presented by Basu et al., (2004). They started with a basic model where N countries produced two goods namely, a numeraire good Y^j, $j = 1, \dots \dots, N$ and agriculture good X^j. The numeraire good produced by using the input L_y^j with $Y_j = w^j L_y^j$, where w^j (equal to marginal or average product) is the price of input L_y^j. The production of agriculture good X^j can be carried out either by an environmentally friendly production process X_e^j or a baseline production process X_o^j. Let there be M^j number of competitive agriculture firms in country j. For producing the agriculture good X^j the firms employed L_x^j input. The agriculture good production function through the two techniques (environmentally friendly and environmentally unfriendly) is given by:

$$X_e^j = \left(L_x^j/\alpha\right)^{\alpha}, X_o^j = \left(L_x^j\right)^{\alpha} \qquad (3.111)$$

where $\alpha \in (1,\infty)$ is the cost of environmentally friendly production technology adopted by a firm. The cumulative distribution function $X_e^j F^j(\acute{\alpha})$ represents the fraction of producers in country j with and $\alpha \leq \acute{\alpha} \in (1,\infty)$. The decision of the jth country firms to adopt environmental friendly production techniques depends on the extent to which eco-labeling allows firms to internalize consumers' willingness to pay for environmentally friendly production techniques. Let p_u be the price of unlabeled agricultural good produce with

environmental unfriendly technology and p_j^l be the price of eco-labeled agricultural good produce with environmentally friendly technology. The green premium $(p_j^l - p_u)$ may differ across countries due to differences in consumers' perception about the country-specific environmental benefits, and hence, their willingness to pay for implementing green production techniques.

The agriculture good producer solves two problems, the first one is to adopt voluntarily environmental friendly technology or not and the second one is the amount of L_x^j to use. The maximum profit the producer earns from the use of environmentally friendly technology and the environmentally unfriendly technology are:

$$\pi_e^j(\alpha, p_l^j) = max_{L_x^j}\, p_l^j \left(\frac{L_x^j}{\alpha}\right)^{\alpha} - w^j L_x^j \qquad (3.112)$$

$$\pi_o^j(p_u) = max_{L_x^j}\, p_u \left(L_x^j\right)^{\alpha} - w^j L_x^j \qquad (3.113)$$

The first order conditions for equation (3.112) and equation (3.113) provide the profit-maximizing output level from the use of the two technologies (see Appendix D.1):

$$X_e^j(\alpha, p_l^j) \qquad (3.114)$$

$$X_o^j(\alpha, p_u) \qquad (3.115)$$

The producer in country j gain advantages from the adoption of environmentally friendly production techniques if and only if the following condition hold:

$$\pi_e^j(\alpha, p_l^j) \geq \pi_o(p_u) \leftrightarrow \alpha \left(\frac{p_l^j}{p_u}\right)^{\alpha} \equiv \bar{\alpha}^j \qquad (3.116)$$

where $\bar{\alpha}^j$ is the fraction of marginal producers who are indifferent to choose among the two techniques of production. The above expression implies that the higher the green premium

$\left(\frac{p_l^j}{p_u}\right) - 1$ the higher will be the fraction of producers $F^j(\bar{\alpha}^j)$ who gain benefit from the green production. The value of aggregate production in the jth country is given by:

$$M^j \left[p_l^j \int_1^{\bar{\alpha}^j} X_e^j(\alpha, p_l^j) dF_j(\alpha) + p_u \int_{\bar{\alpha}^j}^{\infty} X_o^j(p_u) dF_j(\alpha) \right]$$

$$= M^j \left[(p_u \left(\frac{\alpha}{w^j}\right)^{\alpha})^{\frac{1}{1-\alpha}} \right] \left[(1 - F^j(\bar{\alpha}^j) + (\frac{p_l^j}{p_u})^{\frac{1}{1-\alpha}} \int_1^{\bar{\alpha}^j} \left(\frac{1}{\alpha}\right)^{\frac{1}{1-\alpha}} dF^j(\alpha) \right] \quad (3.117)$$

Equation (3.117) decomposes the international differences the producer revenue into two parts. The first one is pure international input cost w^j differences identified in the first square brackets $(p_u \left(\frac{\alpha}{w^j}\right)^{\alpha})^{\frac{1}{1-\alpha}})$ and the second one is the self-selection among producers in employing the two production technologies $(\bar{\alpha}^j)$ and the green premium, identified in the second square brackets $(\frac{p_l^j}{p_u})^{\frac{1}{1-\alpha}}$. By extending equation (3.117) for countries without the eco-label scheme by replacing p_l^j by p_u and no green premium for the unlabeled goods such as:

$$\bar{\alpha}^j = (\frac{p_l^j}{p_u})^{\alpha} = 1 \quad (3.118)$$

Profit of the average producer in a country j without eco-label depends on w^j with:

$$\bar{\pi}^j = (1-\alpha)(p_u \left(\frac{\alpha}{w^j}\right)^{\alpha})^{\frac{1}{1-\alpha}} \quad (3.119)$$

Let d_y^j is the consumption of identical numeraire good in country j and D_x^j is the index of agriculture good consumption in country j. The log linear utility function of the representative consumer in country j is given as:

$$logU^j\left(D_x^j, d_y^j\right) = \beta^j logD_x^j + \left(1 - \beta^j\right) logd_y^j \quad (3.120)$$

where β^j is the expenditure share of the agriculture good in the total consumption of the representative consumer in country j and $(1-\beta^j)$ is the expenditure share of numeraire good in the total consumption of the representative consumer in country j. Let d_e^{ji} is the quantity demand for the environmentally friendly product of country j in country i and d_o^j is the quantity demand for the base-line good in country j. The effective consumption D_x^j in country j is given as:

$$D_x^j = \sum_{i=1}^{N}\left(1+g^i\right)d_e^{ji} + \sum_{i=1}^{N} d_o^j \qquad (3.121)$$

The effective consumption D_x^j in country j consists of two components such as on physical quantities of x consumed and on green consumption index $\sum_{i=1}^{N} g^i d_e^{ji}$. The marginal rate of substitution (MRS) between d_e^{ji} and d_e^{jk} is given by the ratio $(1+g^i)/(1+g^k)$ and reflect the consumer relative valuation for eco-friendly goods originating from countries i and k, respectively. Moreover, $(1+g^i)$ represents the MRS between one unit of the eco-labeled good and one unit of unlabeled good in country i. For the positive demand of both labeled and unlabeled products the following equilibrium conditions must be held:

$$\frac{p_l^i}{p_l^k} = \frac{1+g^i}{1+g^k}, \frac{p_l^i}{p_u} = 1+g^i, \quad i,k = 1, \ldots\ldots, N \quad (3.122)$$

The aggregate agriculture producer revenue in the presence of eco-labeling in country j is given by:

$$Q_e^j(p_u) = \left(p_u M^j \left(\frac{\alpha}{w^j}\right)^{\alpha}\right)^{\frac{1}{1-\alpha}} \left(\left[1 - F^j\left(\frac{p_l^j}{p_u}\right)\right] + \left(\frac{p_l^j}{p_u}\right)^{\frac{1}{1-\alpha}} \int_1^{\left(\frac{p_l^j}{p_u}\right)} \left(\frac{1}{\alpha}\right)^{\frac{1}{1-\alpha}} dF^j(\alpha) \right)$$

$$= \left(p_u M^j \left(\frac{\alpha}{w^j}\right)^{\alpha}\right)^{\frac{1}{1-\alpha}} \left(1 \right.$$

$$\left. + (1+g^i)^{\frac{1}{1-\alpha}} \int_1^{(1+g^j)^{1/\alpha}} \left[\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{1-\alpha}} - \left(\frac{1}{1+g^j}\right)^{\frac{1}{1-\alpha}}\right] dF^j(\alpha) \right)$$

$$\equiv p_u^{\frac{1}{1-\alpha}} \gamma^j \left(1 + G^j\right) \qquad (3.123)$$

The aggregate producer revenue in the absence of eco-label in country j is given by:

$$Q_o^j(p_u) = p_u^{\frac{1}{1-\alpha}} \gamma^j \qquad (3.124)$$

where the parameter $\gamma^j \equiv M^j (\frac{\alpha}{w^j})^{\frac{\alpha}{1-\alpha}}$ measures the production cost of the country j. Holding p_u constant $p_u G^j$ is the green premium in the industry for the eco-labeled product. The green premium has a positive impact on revenue; as the green premium increases the revenue increases and vice versa. Moreover, the size of G^j depends on both the demand and supply side factors. On the demand side, the higher the country j unit green premium $1 + g^j$ the higher will be the revenue gain in the presence of eco-labeling. On the supply side, it depends directly on the cost distribution among producers in country j. The countries where the producers are interested to distribute their production cost are more likely to benefit from eco-labeling.

Now, turning to bring the equilibrium price for eco-labeled and non-eco-labeled goods in the general equilibrium framework. Let I is the set of countries with eco-label scheme and I_{-j} is the set of countries with eco-label scheme but country j. With consumer income $w^j \mathrm{L}^j$ in country

j, the total world demand for agriculture good is equal to the producer revenue if and only if the following condition hold:

$$\sum_{j=1}^{N} \beta^j w L^j = \sum_{j \in I} \left(p_u(I)\right)^{\frac{1}{1-\alpha}} \gamma^j \left(1 + G^j\right) + \sum_{j \ni I} \left(p_u(I)\right)^{\frac{1}{1-\alpha}} \gamma^j \qquad (3.125)$$

Therefore, the price of a non-eco-labeled product is given by:

$$p_u(I) = \left(\frac{\sum_{j=1}^{N} \beta^j w^j L^j}{\sum_{j \in I} \gamma^j G^j + \sum_{j=1}^{N} \gamma^j} \right)^{1-\alpha} \qquad (3.126)$$

The above expression implies that when $G^j > 0$ for $j \in I$ then the price of a non-eco-labeled good is strictly decreasing in the number of countries adopted an eco-label scheme. The same situation hold for the price of the eco-labeled good, since $p_l^j\left(I, g^j\right) = p_u(I)(1 + g^j)$. This term of trade effects highlights the negative externality that one country's decision to implement eco-labeling scheme imposes on the welfare of producers in other countries. This means that the decision of a country to adopt an eco-labeling scheme depends on the eco-labeling schemes in other countries. For investigating this fact, let $W \equiv \sum_{j=1}^{N} \beta^j w^j L^j$ be the total expenditure of consumers devoted to the consumption of agriculture good in the N countries. The aggregate producer profit in country j with eco-label as given by:

$$\pi_e^j\left(I_{-j}, G^j\right) = \frac{(1-\alpha) W \gamma^j (1 + G^j)}{\sum_{i \in I_{-j}} \gamma^j G^j + \gamma^i G^i + \sum_{i=1}^{N} \gamma^i} \qquad (3.127)$$

On the other hand, the aggregate producer profit in country j without eco-label as given by:

$$\pi_o^j\left(I_{-j}\right) = \frac{(1-\alpha) W \gamma^j}{\sum_{i \in I_{-j}} \gamma^j G^j + \sum_{i=1}^{N} \gamma^i} \qquad (3.128)$$

Let c^j is the fixed cost of acquiring an eco-labeling scheme in country j, the adoption of the eco-labeling scheme would raise the aggregate producer profits, taking the eco-labeling adoption of the rest of the $N - 1$ countries, if and only if:

$$\pi_e^j\left(I_{-j}, G^j\right) - \pi_o^j\left(I_{-j}\right) \geq c^j \, log G^j$$

$$\geq \ln\left(\frac{\frac{c}{1-\alpha}}{Q_o^j\left(p_u\left(I_{-j}\right)\right)}\right) - \ln\left(1 - \frac{\frac{c}{1-\alpha}}{W - Q_o^j\left(p_u\left(I_{-j}\right)\right)}\right)$$

$$+ \ln\left(1 + \frac{\gamma^j}{\sum_{i \in I_{-j}} \gamma^j G^j + \sum_{i \neq j} \gamma^j}\right) \qquad (3.129)$$

It is concluded from the above expression that the decision of a country to adopt an eco-labeling scheme depends on many factors such as the industry level green premium G^j, aggregate output level $Q_o^j\left(p_u\left(I_{-j}\right)\right.$ in country j. The larger the output level in the absence of eco-labeling scheme in country j, the more able producers are to bear the fixed cost of eco-labeling. Moreover, the country with a larger share of non-labeled good gain little from the eco-labeling schemes. To see this, if country j is large enough so that $W - Q_o^j\left(p_u\left(I_{-j}\right)\right)$ is close to zero then $\pi_e^j\left(I_{-j}, G^j\right) - \pi_o^j\left(I_{-j}\right) - c^j$ is always less then zero for $c^j > 0$. The third term in equation (4.112) represents the magnitude and the nature of peer effects between the N countries. By linearizing the third term in equation (3.112) with respect to $\sum_{i \in I_{-j}} \gamma^i G^i$ provide:

$$\ln\left(1 + \frac{\gamma^j}{\sum_{i \in I_{-j}} \gamma^i G^i + \sum_{i \neq j} \gamma^i}\right) \approx \ln\left(1 + \frac{\gamma^j}{\sum_{i \neq j} \gamma^i}\right) - \frac{\gamma^j}{\sum_{i \neq j} \gamma^i}\left(\sum_{i \neq j} \frac{\gamma^i}{\sum_{i=1}^N \gamma^i} G^i\right) \qquad (3.130)$$

The above expression shows that the strategic incentives for country j to adopt an eco-labeling scheme depends upon the three effects, specifically, country j will be more likely to adopt an eco-labeling scheme:

i. If it has a larger production cost advantage in the production of agriculture good $(\gamma^j / \sum_{i \neq j} \gamma^i)$.

ii. If the cumulative number of countries with eco-labeling schemes increases.

iii. If the industry-level green premium $\gamma^i G^i$ is higher in countries who adopt an eco-labeling scheme.

The most important point to be noted here is that the cumulative number of countries plays an important role in the decision of the country to adopt an eco-labeling scheme if and only if the industry-level green premium in these countries are strictly positive. Moreover, it is also observed that the adoption of eco-labeling by developing countries promise less premium in the international market. One possible reason for that is the consumers in developed countries pay a little premium for the eco-labeled product of developing countries. Another possible reason is that the producers in developing countries have an inherent disadvantage in producing environmental sound goods. In a nutshell, the incentives to adopt an eco-labeling scheme in country j depends on:

i. The fixed cost of the eco-labeling scheme.

ii. The scale effect.

iii. The relative production cost advantage of country j in producing the agriculture good via the baseline technique.

iv. The number of countries that have already implemented an eco-labeling scheme at any given time period and the industry level green premium of these countries.

This model provides six factors which induce a country's government to adopt an eco-label scheme, namely, the fixed cost of eco-labeling scheme, the scale effect, the relative production cost advantage, the number of countries that have already implemented an eco-labeling scheme at any given time period and the industry level green premium of these countries. However, we investigate the factors which motivate a government to introduce a national eco-label scheme. Therefore, along with some of these factors, we use many others

additional factors suggested by Monteiro (2010). On the basis of the above model, Monteiro (2010) identified four sets of factors which induce a country's government to introduce a national eco-labeling scheme. These set of factors comprising a country's economy stages of development, scale effect, relative production cost advantage and strategic interaction with trading partners. For measuring the economy stages of development, we use three factors such that real per capita gross domestic products (GDP), economic freedom and government integrity. For measuring the population effect, we use the total population. For measuring the relative production cost advantage we use two factors such as research and development (R&D) expenditures and export dependency. For measuring strategic interaction with trade competitor we use five factors such as the number of eco-label schemes in the trade partner countries, high technology exports, net trade in goods and services, manufacturing tariff and Per capita CO_2 emission. After the identification of the factors, we empirically investigate the extent of these factors in motivating a country's government to introduce its own national eco-label scheme.

3.5.2. Empirical Model

In this section, we present a simple empirical model that permits us to examine the factors that induce a country's government to introduce a national eco-label scheme. Let assume that the main motive of the firms in country j is to maximize profit. Therefore, the government of country j introduces a national eco-label scheme if and only if the expected long-run aggregate producer profit with a national eco-label scheme (π_e^j) is higher than expected long-run aggregate producer profit without a national eco-label scheme (π_o^j). Expected long-term aggregate producer profit is also known as a latent variable because they are not observed by the econometrician. Let assume that the aggregate producers' profit in country j is the linear

function of latent variables. The aggregate producers' profit in country j in both the cases is given as:

$$\pi_e^j = X\beta_e^j + \mu_e^j \qquad (3.131)$$

And

$$\pi_o^j = X\beta_o^j + \mu_o^j \qquad (3.132)$$

where X represents a matrix of explanatory variables capturing the factors that may affect a government to introduce a national eco-label scheme, β_e^j and β_o^j are the coefficients matrix of X and μ_e^j and μ_o^j are the error terms. The government of country j introduces a national eco-label scheme if the following conditions hold:

$\pi_e^j > \pi_o^j$ or $X\beta + \mu > 0$, where $\beta \equiv \beta_e^j - \beta_o^j$ and $\mu \equiv \mu_e^j - \mu_o^j$. By incorporating the probabilities we get:

$$prob(introducing\ a\ national\ eco-label\ scheme) = prob\left(\pi_e^j > \pi_o^j\right) = prob(X\beta + \mu > 0$$

$$= prob(\mu > -X\beta) \qquad (3.133)$$

And

$$prob(not\ introducing\ a\ national\ eco-label\ scheme) = prob\left(\pi_e^j < \pi_o^j\right) = prob(X\beta + \mu$$

$$< 0 = prob(\mu < -X\beta) \qquad (3.134)$$

Let μ is normally distributed with mean 0 and variance σ^2, we get:

$$prob(introducing\ a\ national\ eco-label\ scheme) = prob(\mu > -X\beta)$$

$$= F(X\beta) \qquad (3.135)$$

where F is the cumulative standard logistic distribution function and σ^2 has been normalized to 1. With the help of equation (3.135), one can easily find the influencing factors which induce a government to introduce a national eco-label scheme.

3.5.3. Econometric Model

For the purpose of identifying the determinants of a national eco-label scheme by the government, we follow the econometric model developed by Grolleau & El Harbi (2008). We use a linear binary regression model specified in equation (3.136) for the underlying latent variable that motivates the government to introduce a national eco-labeling scheme:

$$Y_i = \alpha_i + \sum_{\substack{i=1 \\ j=1}}^{12} \beta_j X_{it} + \mu_{it} \qquad i = 1, \dots \dots . N, t = 1, \dots \dots \dots, T \qquad (3.136)$$

where Y_i is a binary variable its value 1 if the government already introduced at least one national eco-label scheme and its value 0 otherwise, X_{it} is the vector of explanatory variables, α_i, and β_j are intercept and slope coefficient to be estimated, μ_{it} is the error term and i represent the country and t represents the time. The latent variables in this model represent the total gain that a country achieves by introducing the eco-labeling scheme. The positive signs of the latent variable indicate that the gains from introducing the eco-labeling scheme are greater than its costs. The dependent variable is binary in nature in such a case one cannot estimate the parameters of the model through ordinary least square and (OLS) and generalized least square (GLS) because it produced biased and inconsistent estimates. For the solution of this problem, the standard econometric literature proposed panel logit model with log-likelihood estimation. Arellano & Honoré (2001) specified the log-likelihood estimation for the logit models. Let, suppose two time periods:

$$Pr(Y_{it} = 1 |\ X_{i1}, X_{i2}, \alpha_i) = \frac{\exp(\beta_j X_{it} + \alpha_i)}{1 + \exp(\beta_j X_{it} + \alpha_i)} \qquad (3.137)$$

The conditional likelihood method eliminates the individual specific effect. Let, define the set of two events, A and B by $A = \{Y_{i1} = 0, Y_{i2} = 1\}$ and $B = \{Y_{i1} = 1, Y_{i2} = 2\}$. The expression in (3.137) becomes:

$$\Pr(Y_{i1} = 0, Y_{i2} = 1 |\ Y_{i1} + Y_{i2} = 1, X_{i1}, X_{i1}, \alpha_i) = \Pr(A |\ AUB, X_{i1}, X_{i1}, \alpha_i)$$

$$= \frac{1}{1 + \exp((X_{i1} - X_{i1})\beta_j} \qquad (3.138)$$

Equation (3.138) shows that if one restricts the sample to the observations for which Y_{i1} changes over time, then β_j can be estimated by estimating a logit in the restricted sample without having to specify the distribution of individual specific effect. In general case, if there is more than $T > 2$ observation for each individual in the sample, the conditional distribution of $(Y_{i1}, \ldots\ldots\ldots, Y_{it})$ is given by:

$$P\left(Y_{i1}, \ldots\ldots\ldots Y_{it} \middle| \sum_{t=1}^{T} Y_{it}, X_{i1}, \ldots\ldots., X_{it}, \alpha_i\right) = \frac{\exp\left(\sum_{t=1}^{T} Y_{it} X_{it} \beta_j\right)}{\sum_{(d_1, \ldots.. d_t) \in B} exp\left(\sum_{t=1}^{T} d_t X_{it} \beta_j\right)} \qquad (3.139)$$

where $\sum_{t=1}^{T} d_{it} = \sum_{t=1}^{T} Y_{it}$ and it is a sufficient statistic for α_i and one can easily use equation (3.139) to estimate the β_j parameters. The estimation of equation (3.139) is carried out using conditional maximum log-likelihood estimation. In other words, actually one can maximize:

$$\sum_{1=1}^{n} \left(\sum_{s<1} log\left(\frac{\exp(Y_{it}(X_{it} - X_{is})}{1 + \exp((X_{it} - X_{is})\beta_j} \right) \right) \qquad (3.140)$$

The maximum log-likelihood estimators obtain from these estimations is consistence and unbiased.

3.5.4. Econometric Model Specification

By visiting the eco-label index website, we found that out of 54 countries half of the countries established their own national eco-label schemes while the remaining half countries did not

establish their own national eco-label scheme. Once we collect the information on national eco-label schemes, we introduce dummy assigning value 1, if the country has already introduced at least one national eco-label and assign value 0, if the country yet not introduce its own national eco-label scheme (Grolleau & El Harbi, 2008; Monteiro, 2010). Such as:

$$Decolabel = \begin{cases} 1 \;\; if\ the\ country\ already\ introduced\ at\ least\ one\ national\ eco-label\ scheme \\ 0 \;\; Otherwise \end{cases}$$

Economy's stages of development: The environmental Kuznets curve shows that countries with higher income provide more attention to environmental improvement as compared to the poor countries. This suggests that the economy on the top stage of development would be more sensitive for the improvement of its natural environment as compared to the economy on the lower or medium stages of development (Magnani, 2000). Therefore, the economy's stages of development have the ability to influence the government to introduce a national eco-label scheme. We include three variable to measure the economy's stages of development namely, real per capita GDP (Grolleau & El Harbi, 2008), economic freedom (Grolleau & El Harbi, 2008) and government integrity (Monteiro, 2010). We expect positive signs for these three variables.

Population effect: A country with a huge population size but less environmental regulations put the lives of more people at risk. Moreover, an increase in the number of environmentally conscious consumers with an increase in population may induce a government to introduce a national eco-label scheme. The existence of eco-consumers generates a significant amount of green premium for eco-label products. Again, the producer collects a significant premium from the market, which has favorable effects on his firm economies of scale. In this study, we use the population size (Monteiro, 2010) to capture the population effect on the government interest to introduce a national eco-label scheme and expect a positive sign for it.

Relative production cost advantage: The opponents of the eco-labeling argue that the existing eco-labeling schemes reduced the export opportunities of developing countries. Most of the developing countries heavily dependent on exports, so to maintain the volume of their exports; these countries may introduce a national eco-label scheme. If the country is a net exporter then, it will easily restore the cost of eco-labeling. This improves the relative production cost advantage of an economy depend heavily on exports. In addition, introducing an eco-label to the economy with comparative cost advantage leads to the diffusion of innovations among private firms, which ultimately enhance the R&D activities of the firms. Again the diffusion of eco-innovations eventually improves the relative production cost advantage of an economy in producing different products (Monteiro, 2010; Porter & Van der Linde, 1995). In this study, we use the export value index as a proxy for export dependency. The R&D investment data for most of the developing countries are not available, therefore; we use the education expenditure as a proxy for R&D activities. We expect positive signs for these two variables.

Strategic interaction with trade competitor: Various researchers in economics considered national eco-labeling as a strategic environmental policy. Thus, they suggest a negative link between the government's interests to introduce a national eco-label with the number of eco-labels schemes in other states. Moreover, the increasing interdependence among the nation's economies due to eco-labeling schemes strengthens their economic relationships and reduced their trade cost. In addition, if a country wants to increase its export share in the international market it would be more interested to introduce an eco-labeling scheme (Ralph & Stefan, 1999). While the eco-label schemes are designed with the aim to reduce global environmental problems, such that, to reduce CO_2 emissions and provide safety to biodiversity. These environmental features affect a country's government to introduce an eco-labeling scheme (Daniel & Peter,

2005). A domestic national eco-label scheme will effective when in the market, there are few countries having the same standard requiring eco-labeling schemes. When the number of eco-labels similar to domestic eco-labels increase, then the domestic eco-label lost its value. In this situation, the government may decide to abandon the idea of an eco-label scheme (Monteiro, 2010). To analyze the impact of the number of eco-labels on the government decision to introduce a national eco-label scheme, in this study, we use the number of eco-labels schemes persist in all trade partner countries as an explanatory variable.

Moreover, in this study, we use high technology exports as a proxy for exports. In addition, there are two processes through which a country can improve its economic relations with the rest of the world namely, the trade and foreign investment. In this study, we consider only the trade variable and use net trade in goods and services as a proxy for this variable. The economist treats manufacturing tariff as a non-tariff trade barrier. However, cretin evidence shows that it significantly increases the trade cost. Referable to the importance of manufacturing tariff, we employ it as a proxy for trade cost. Lastly, for valuing the effects of environmental characteristics on the government's interest in eco-labeling, we use the per capita CO_2 emission as an explanatory variable. We expect a negative sign for manufacturing tariff while we expect positive signs for the remaining variables.

3.5.5. Estimation Method

The specific version of the model (3.136) is given as:

$$DEL_{it} = \alpha_i + \beta_1 ln(E_{it}) + \beta_2 ln(POP_{it}) + \beta_3 ln(C_{it}) + \beta_4 ln(S_{it}) + \mu_{it} \qquad i = 1, \ldots\ldots N, t = 1, \ldots\ldots, T \qquad (3.141)$$

where DEL_{it} is a binary variable taking value 1 if the *ith* country's government already introduced at least one national eco-label scheme and 0 otherwise, E_{it} is the vector of economic

development indicators of the *ith* country, POP_{it} is the population of the *ith* country, C_{it} is the vector of relative production cost advantage of the *ith* country, and S_{it} is the vector of the strategic variables of the *ith* country, a. Equation (3.141) is our empirical model with a binary dependent variable. For estimation of this model we use panel data, therefore; we require a panel procedure for empirical estimation. Due to the binary nature of the dependent variable, we cannot estimate the parameters of this model through Panel Random effect (RE), Fixed effect (FE) and Generalized method of moments (GMM) because it produces biased and inconsistent estimates. For the solution of this problem, the econometric literature proposed panel logit regression model (Greene, 2003; Gujarati, 2009). With the help of this model, we estimate the parameters of the model and the marginal effects for each explanatory variable. For estimation of the model, we use panel data of 54 countries that are Pakistan's trade partners from 1994 to 2014. Names of these countries are given in Appendix H, table H1.

CHAPTER 4: ECO-LABELING AND SUSTAINABILITY IN THE TEXTILE INDUSTRY OF PAKISTAN

In this chapter, we present the empirical results on eco-labeling and sustainability in the textile industry of Pakistan. The chapter consists of four sections. The first section provides information on the pattern of existing eco-labels adopted by Pakistani textile firms. The second section deals with descriptive statistics of dependent and explanatory variables. The third section of this chapter deals with the results of the estimated simultaneous equation system and the last section deals with the estimated results of the influencing factors of a textile firm's decision to adopt an eco-label.

4.1. Existing Pattern of Eco-Labels Adopted by Pakistani Textile Firms

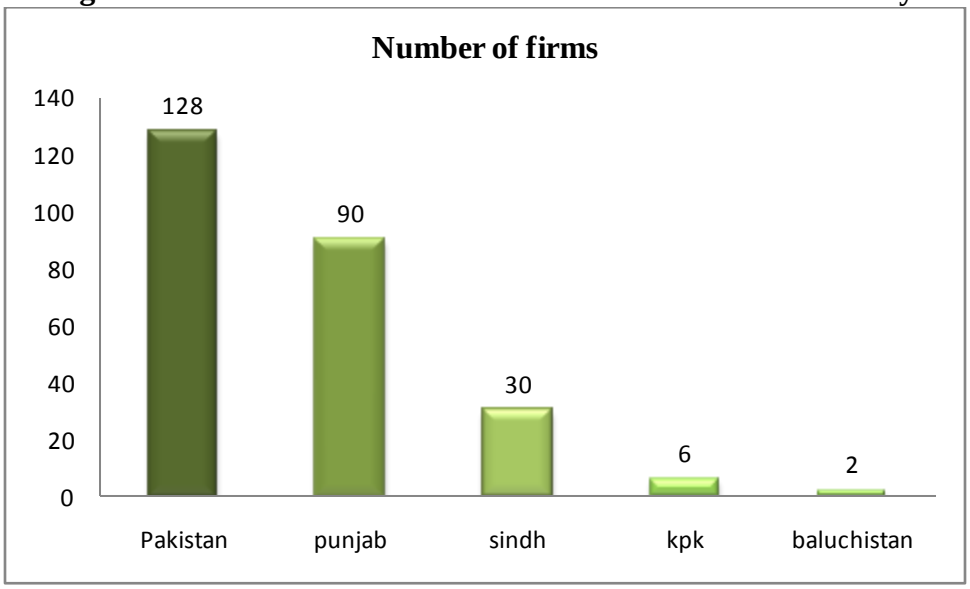
To evaluate the existing pattern of eco-labels adopted by Pakistani textile firms for the year 2016, we use the data of 128 textile firms listed in Pakistan Stock Exchange (PSX). Out of 128 textile firms 90 firms operate in Punjab, 30 firms operate in Sindh, 6 firms operate in Khyber-Pakhtunkhwa and only 2 firms operate in Baluchistan. For more details see figure 4.1.

4.1.1. The Current State of Eco-Labeling in the Textile Industry of Pakistan

The current state of eco-labeling in the textile industry of Pakistan is given in figure 4.2. It is observed that out of 128 textile firms in the textile industry of Pakistan, only 32% of the firms acquired eco-labels for their products while the remaining 68% of the firms did not acquire eco-labels for their products. The Sustainable and Cleaner Production in the Manufacturing industry of Pakistan (SCI-Pak) survey for the year 2013 identified three reasons behind the non-adoption of eco-labels by the Pakistani textile firms. The first reason is that most of the textile firms have limited knowledge and information about the eco-labels while some of them know nothing about

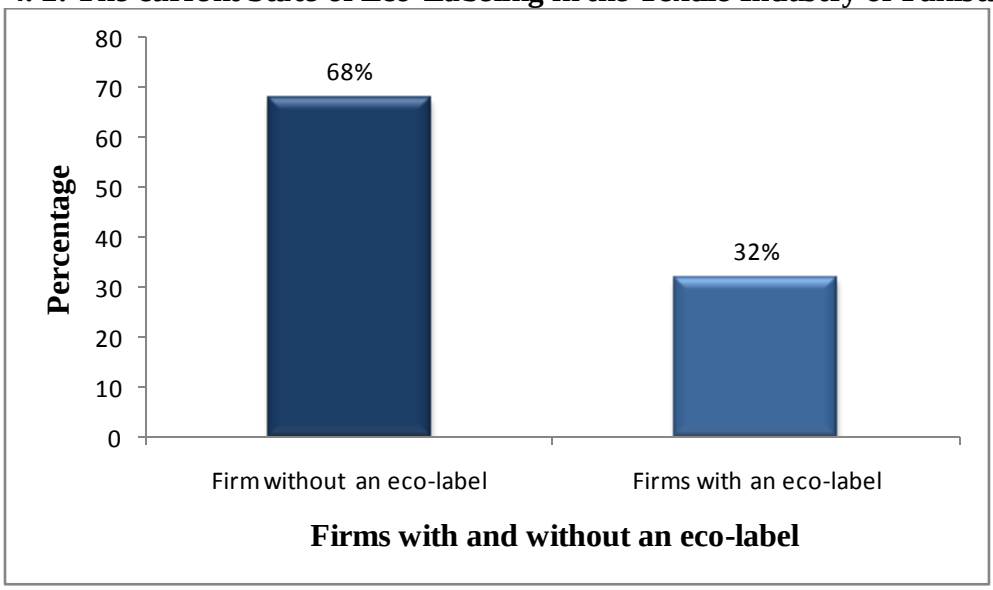
eco-labels. The second reason is that they provide less importance to the eco-labels. The third reason is related to the barriers of acquiring these eco-labels, such as the higher costs associated with eco-labels and the higher standard requirements of the eco-label (SCI-Pak, 2013).

Figure 4. 1: Number of the Textile Firms Selected for the Study



Source: Based on data obtained through personal communication with the firms in the year 2016.

Figure 4. 2: The current State of Eco-Labeling in the Textile Industry of Pakistan (%)

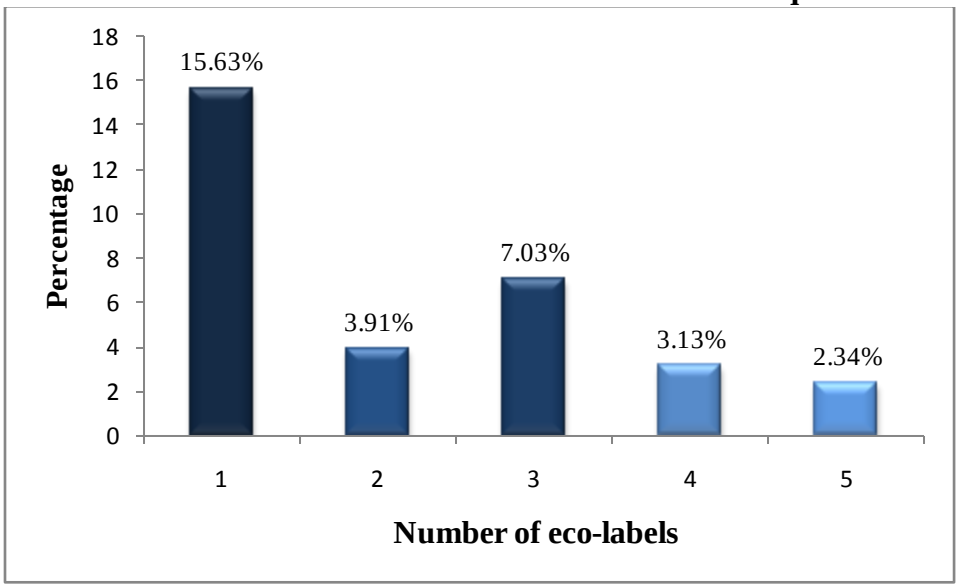


Source: Based on data obtained through personal communication with the firms in the year 2016.

4.1.2. Number of Eco-Labels with those Textile Firms who Acquired Eco-Labels

The information on the number of eco-labels with those textile firms who acquired eco-labels is given in figure 4.3. From this figure we observe that in the textile industry of Pakistan, the textile firms who acquired eco-labels about 16% of them acquired single eco-label, about 7% of them acquired three eco-labels, 4% of them acquired two eco-labels, 3% of them acquired four eco-labels and approximately 2% of them acquired five eco-labels, respectively.

Figure 4. 3: Number of Eco-Labels with those Textile firms who Acquired Eco-Labels (%)



Source: Based on data obtained through personal communication with the firms in the year 2016.

4.1.3. Name and Types of Eco-Label Acquired by Pakistani Textile Firms

The details on the name and type of eco-labels acquired by Pakistani textile firms are given in table 4.1. It is observed that in the textile industry of the country, the textile firms who acquired eco-label 25% of them acquired Oeko-Tax Standard 100, about 16% of them acquired Global Organic Textile Standard (GOTS), and 6% of them acquired Better Cotton Initiative (BCI). Moreover, the textile firms who acquired eco-labels most of them use type III eco-label schemes.

4.1.4. The current State of Eco-Labeling in the Sub-Sectors of Pakistan Textile Industry

The current states of eco-labeling in the sub-sectors of Pakistan textile industry are given in figure 4.4. It is observed from the figure that the textile firms who acquired eco-labels 22% of them belong to yarn manufacturing sector, 8% of them belongs to the textile composites manufacturing sector, and 2% of the belongs to fabrics manufacturing sector.

Table 4. 1: Name and Types of Eco-Label Acquired by Pakistani Textile Firms

No	Name of Eco-label	Type	Number of firms	Percentage
1	Oeko-Tax Standard 100	III	32	25
2	Oeko-Tax Standard 1000	III	3	2.34
3	Global Organic Textile Standard (GOTS)	III	20	15.63
4	Better Cotton Initiative (BCI)	III	8	6.25
5	Organic Exchange Standard 100 (OE 100)	III	5	3.91
6	Organic Exchange Standard Blended (OE Blended)	III	4	3.13
7	Organic Content Standard (OCS)	III	4	3.13
8	Organic Content Standard 100 (OCS 100)	III	4	3.13
9	Organic Content Standard Blended (OCS Blended)	III	3	2.34
10	Fair Trade Production Fair Choice (FTPFC)	III	1	0.78
11	Fair Trade (FT)	III	2	1.56
12	EU Ecolabel (EU)	III	1	0.78
13	TUV Rheinland Certified	II	1	0.78
14	Eco-Friendly/Environmental Friendly Products	I	1	0.78

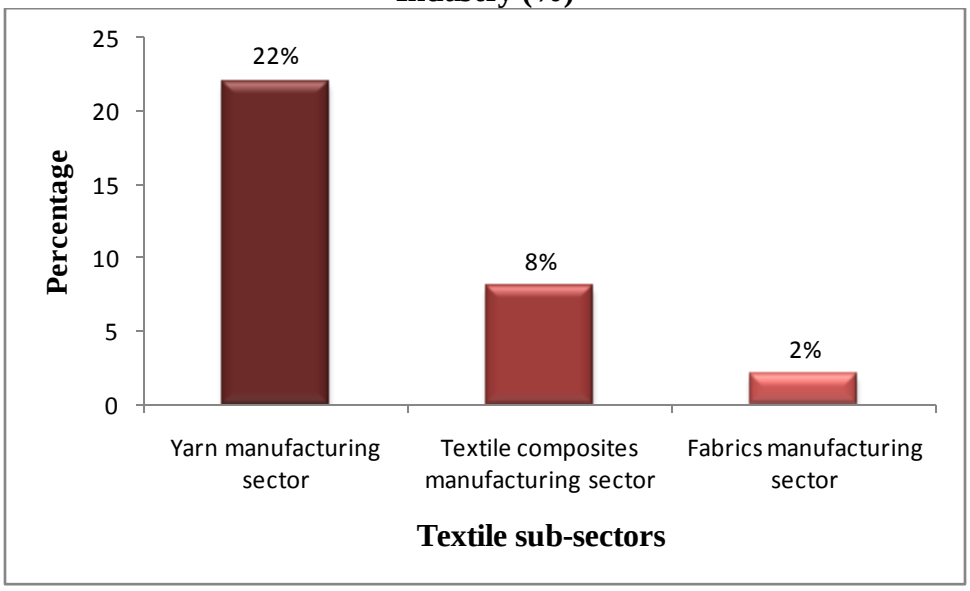
Source: Author's computation based on data obtained through personal communication with the firms in the year 2016.

4.1.5. Current State of Eco-Labeling of the Exporting Firms in the Textile Industry of Pakistan

The information for the exporting and non-exporting textile firms with and without eco-labels is given in figure 4.5. It is clear from the figure that in the textile industry of Pakistan, the textile

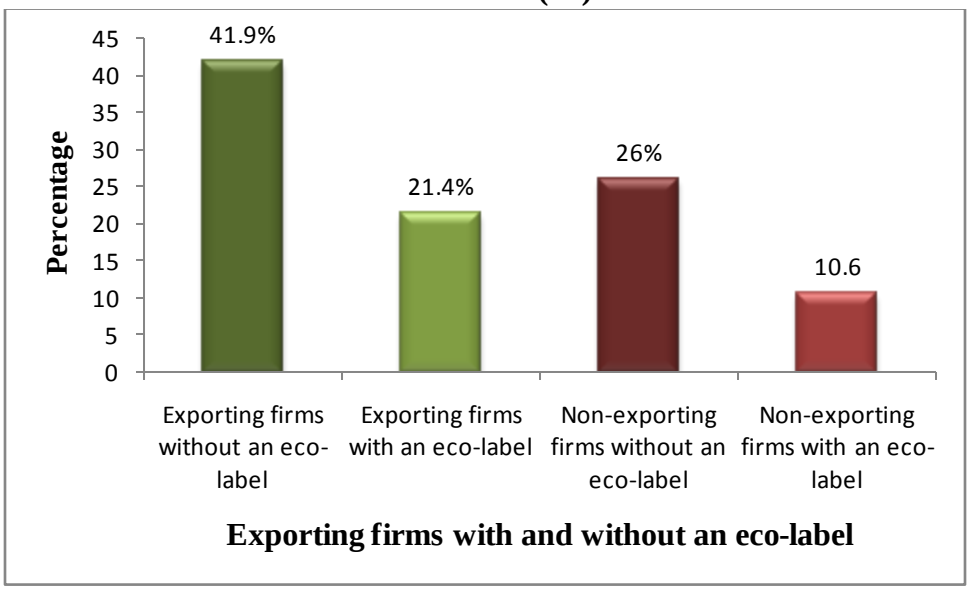
firms who acquired eco-labels about 21% of them are exporting firms and about 11% of them are non-exporting firms. The SCI survey of Pakistan for the year 2013 provided the main reason for the adoption of eco-labels by the export-oriented textile firms that are most of the surveyed textile firms reported that they acquired eco-labels for fulfilling their foreign buyers demand for eco-labeled products. Moreover, the textile sector of Pakistan is the leading exporting sector of the country and it has the comparative advantage in this sector (Khan et al., 2002). However, this sector facing the risk of rejecting its textile products in the international market on the basis of eco-labeling. Therefore, for keeping the strong position of the country in the international textile market and for reducing the risk of rejecting the products most of the exporting textile firms acquired eco-labels for their products.

Figure 4. 4: The current State of Eco-Labeling in the Sub-Sectors of Pakistan Textile Industry (%)



Source: Based on data obtained through personal communication with the firms in the year 2016.

Figure 4. 5: Current State of Eco-Labeling of the Exporting Firms in the Textile Industry of Pakistan (%)



Source: Based on data obtained through personal communication with the firms in the year 2016.

4.2. Descriptive Statistics

Descriptive statistics about the important variables used in this part of the study is given in table 4.2. It is observed that the environmental performance of the textile firms with an eco-label is much higher than the environmental performance of the firms without an eco-label. This indicates that the eco-label has the potential to improve the environmental performance of the textile firms. In this study, we use two sets of factors to measure the economic performance of the textile firms namely, the financial performance of the firms and the competitive performance of the firms. Comparing the financial performance variables of the textile firms (i.e. net profit margin, return on capital employed and return on equity) we observe that the financial performance of the firms with an eco-label is much higher than the financial performance of the firms without an eco-label. On the comparison of the firms competitive performance variables (i.e. market share and assets turnover ratio), it is observed that the competitive performance of the firms with an eco-label is much higher than the competitive performance of the firms without

an eco-label. This reflects the situation where the firms with an eco-label occupied the major share of the Pakistani textile market.

Contrasting the explanatory variables of the firms, it is observed that those textile firms who acquired eco-label bear more labor and materials costs and use more machines as compared to the firms who did not acquire eco-label. It is because the eco-label requirements forced the firm to use more educated and skilled labor as well as using environmentally friendly raw materials and machinery in their production process, all of which increase their costs. Evaluating the firm-specific variables, it is observed that large size and aged textile firms acquired eco-labels. Besides, the average tax expenses of the textile firms with an eco-label are also higher than the average tax expenses of the firms without an eco-label. Comparing the explanatory variables of the financial performance indicators of the textile firms, we observe relatively higher capital intensity ratio, debt-equity ratio, and dividend cover ratio while a relatively lower interest cover ratio for the textile firms who adopted eco-label as compared to the textile firms who did not adopt eco-label.

4.3. Results of the Estimated Simultaneous Equation System

The system of simultaneous equations of the textile firms environmental and financial performance and the textile firms environmental and competitive performance is first estimated through Pooled Ordinary Least square (Pooled OLS) but due to the existence of strong endogeneity among the textile firms environmental and financial performance and among the textile firms environmental and competitive performance, we observe biased parameter estimates for the models, therefore we cannot interpret these results. The results of the Pooled OLS are given in Appendix F, table F1, and table F2, respectively. To find the extent of endogeneity

Table 4. 2: Descriptive Statistics

Variables	Definition	Firm with an eco-label	Firm without an eco-label	Overall mean
		Mean & SD	Mean & SD	Mean & SD
Dependent				
Environmental Performance				
Environmental Performance Index (EPI)	It is the index measure the firm's environmental performance (%).	20.1340 (3.6828)	4.1119 (10.7143)	9.2440 (11.7587)
Economic Performance				
i. Financial Performance (FP) Indicators				
Net Profit Margin	This ratio is achieved as a ratio of profit earned by a firm from its sale (%).	9.7496 (15.0296)	9.3145 (15.4173)	9.4539 (15.2872)
Return on Capital Employed	This is the ratio of the firm's earnings before interest and tax to capital employed (%).	16.3873 (15.8387)	13.3569 (13.5244)	14.3276 (14.36739)
Return on Equity	It is the ratio of a firm's net income to average shareholders' equity (%).	22.6074 (19.3486)	20.5729 (24.6575)	21.2246 (23.0989)
ii. Competitive Performance (CP) Indicators				
Market Share	It is the ratio of the ith firm sale to the total industry sale (%).	0.1788 (0.1903)	0.0755 (0.1178)	0.1086 (0.1528)
Assets Turnover Ratio	This ratio is achieved by dividing the firm's annual earnings by its total assets (%).	1.4556 (5.4027)	1.3756 (1.1135)	1.4011 (3.1893)
Explanatory				
Firm Environmental Factors/ Supply-Side Factors (S)				
Labor Cost	The total labor cost of the firm (Million Rs).	422.8761 (900.3866)	235.6267 (391.5423)	295.605 (608.9723)
Material Cost	Total materials cost comprised the cost of all raw and other processing materials incurred in the production of finished goods (Million Rs)	3366.7 (4316.435)	2259.9 (2904.372)	2614.422 (3457.049)

Continue……

Variables	Definition	Firm with an eco-label	Firm without an eco-label	Overall mean
		Mean & SD	Mean & SD	Mean & SD
Machinery	Total number of machinery with a firm both (electrical and non-electrical) (Number)	50654.56 (47534.55)	46264.47 (42016.55)	47670.67 (43880.79)
Firm-Specific Factors (F)				
Firm Size	Total number of employees in the firm	1920.186 (3005.597)	1348.489 (2130.815)	1531.611 (2458.122)
Firm Age	Age of the firm since it operates (years)	34.5017 (18.2195)	33.1724 (13.4914)	33.5982 (15.1694)
Regulatory Pressure (R)				
Tax	Total income tax expenses of the firm (Million Rs).	74584.26 (92155.62)	29792.2 (59284.68)	44139.66 (74422.89)
Explanatory Variables of the Textile Firms Financial Performance (X)				
Capital Intensity Ratio (CIR)	This ratio is achieved by dividing the firm's average total assets by its sales (%).	3.1169 (10.9931)	1.2863 (1.9274)	2.4468 (8.8712)
Debt Equity Ratio (DER)	It is the ratio of firm's total liabilities by stockholders' equity (%).	8.5642 (10.2287)	7.5525 (7.7703)	7.8765 (8.6413)
Dividend Cover Ratio (DCR)	This is the ratio of the firm's net profit after tax to the total amount of dividend (%).	8.8910 (9.7263)	8.0810 (9.9039)	8.3405 (9.8492)
Interest Cover Ratio (ICR)	This is the ratio of a firm's earnings before interest and tax to its interest expenses (%).	4.6123 (8.8555)	5.0938 (9.6488)	4.9395 (9.3997)

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.
Note: SD represents Standard Deviation given in the parenthesis.

among the textile firms environmental and financial performance, we perform a Hausman endogeneity test. The results of the Hausman endogeneity test are given in section C (Diagnostic Tests) of table 4.3. In model 2 and in model 3, we find statistically significant coefficients for Hausman endogeneity test. These results show that there is strong endogeneity among the textile firms' environmental performance index and their return on capital employed and among their environmental performance index and their return on equity. From these significant results, we concluded strong endogeneity among the textile firms environmental and financial performance. The results of the LR test for the three models are also given in the in section C of table 4.3. On the basis of the statistically significant value of the LR test, we can reject the null hypotheses stating that structural equation models are statistically better than simultaneous equation models.

On the other hand, to find the extent of endogeneity among the textile firms' environmental and competitive performance, we again perform a Hausman endogeneity test. The results of the Hausman endogeneity test are given in section C (Diagnostic Tests) of table 4.4. In model 1; we find statistically significant coefficients for Hausman endogeneity test which shows strong endogeneity among the textile firms' environmental performance index and their market share. From these result, we concluded strong endogeneity among the textile firms environmental and competitive performance. The results of the LR test for the two models are also given in the in section C of table 4.4. On the basis of the statistically significant value of the LR test, we can reject the null hypotheses stating that structural equation models are statistically better than simultaneous equation models.

Due to strong endogeneity among the textile firms environmental and financial performance and among their environmental and competitive performance, we estimate the simultaneous system of equations with the help of Three-Stage Least Squares (3SLS) estimation

procedure. The results and discussion of the estimated simultaneous equation system of the textile firms by 3SLS are given in subsequent sections.

4.3.1. The Effects of Eco-Label Adoption by the Textile Firms on their Environmental and Financial Performance

The results of the estimated simultaneous equation system for the effect of eco-label adoption by the textile firms on their environmental and financial performance are given in section A of table 4.3. Let us consider first the estimated results of the environmental performance regressions. Focusing on the core variable, it is observed that in all the three estimated environmental performance regressions the dummy variable eco-label positively and significantly affects the environmental performance of those textile firms who acquired eco-label. Iraldo et al., (2009) also find similar results but instead of eco-label, he used an environmental management system (EMS). The results of the SCI-Pakistan survey carried out in the year 2013 also confirmed this result; in this survey, most of the textile firms claimed out that the adoption of eco-label improves their environmental performance. The possible explanation for this result is that the standard requirements of eco-labels used in the textile industry obligated the eco-label holder firms to take several environmental improvement measures such as the use of environmentally friendly materials and machinery, use less water and discharge less effluent to the water etc. Consequently, these measures improve the environmental performance of the textile firms.

It is observed that financial performance indicators net profit margin, return on capital employed and return on equity positively and significantly affect the firms environmental performance index. Wagner et al., (2002) also find similar but insignificant results. The possible explanation for this positive relationship is that investment in the firms environmental

performance improvement activities cause extra cost which further raises the firms cost of production; therefore, the firms with weak financial position cannot easily bear the costs of such expensive activities. On the other hand, the firms with a strong financial position can easily bear the extra cost of these activities. Therefore, when the financial position of the firms improves, they adopt various environmental strategies for improving their environmental performance. The small coefficients of the financial performance indicators show that any significant change in the financial performance of the textile firms brings small changes in their environmental performance.

By evaluating the impact of firm environmental factors/supply-side variables, it is observed that machinery is negative but significantly affect the firms environmental performance index. To capture the effect of machinery, we use the number of machinery with the textile firms. When the number of machines with the textile firms increases their pollution level also increases. According to Aftab et al., (2000) and Khan et al., (2002) in the textile industry of Pakistan, most of the firms use conventional machinery or environmental unfriendly machinery which put higher pollution load on the firms and ultimately reduce their environmental performance. Moreover, the positive and significant coefficient of the materials cost indicates that when the material cost of the textile firms increases, then the environmental performance of the firms also increases. It is reasonable on the ground that when the firms use environmentally harmless raw materials than it increases the material cost of the firms but alternatively improve their environmental performance. In addition, we observe positive, but the insignificant coefficient of the labor cost.

Evaluating the impact of firm-specific variables, we observe a negative and significant impact of firm size on the environmental performance of the textile firms. Wagner et al., (2002)

also find a positive but insignificant result for firm size. This result implies that larger the size of the firms the lower their environmental performance. The possible reason for this negative relationship is that larger size textile firms can produce more and hence, can pollute more. In other words, a large size textile firms produce a larger amount of output. For producing such a large amount of output, the firms employed a huge number of labors, capital and raw materials which consequently, increase the pollution load of the firms. Resultantly, large size textile firms experience lower environmental performance. The variable age has a positive and significant impact on the textile firm environmental performance. With the passage of time, the firms gain more experience about the shifts in the demand of consumers from conventional to green products (environmentally friendly products) and therefore, they find various ways to improve their environmental performance. Furthermore, we find a negative, but an insignificant impact of textile sub-sectors dummies on the environmental performance of the firms. Wagner et al., (2002) also found similar results for industrial sub-sector dummies.

Concerning the results of the estimated financial performance regressions, it is observed that the dummy variable eco-label positively and significantly affects the financial performance of those textile firms who acquired eco-label. This result is in line with the point of view of supporters of eco-labels such as Sedjo & Swallow (2002), Chen (2005) and De Boer (2003). Sedjo & Swallow (2002) pointed out that the eco-label promise a price premium consequently; improve the financial position of the eco-labeled certified manufacturing firms. On the other hand, Chen (2005) stated that the adoption of the eco-label scheme improves the financial performance of the firms. Moreover, De Boer (2003) stated that eco-labeling has the ability to improve the financial performance of the firms. The adoption of eco-label enables the firms to capture the huge amount of environmentally conscious consumers and earned a price premium

which ultimately improves their financial position (Porter & Van der Linde, 1995). In the developing country like Pakistan, most of the consumers provide less importance to the environmental attributes of the products; and therefore, they cannot evaluate the true value of eco-label certified textile products. Therefore, in the domestic textile market, the Pakistani textile firms find fewer environmentally conscious consumers who are willing to pay a price premium for eco-labeled certified products.

However, the textile industry of Pakistan is the leading exporting sector of the country and the firms in this industry export their products to international markets (Aftab et al., 2000). In international markets, the Pakistani textile firms find a notable number of environmentally conscious consumers who are willing to pay a price premium for eco-labeled certified products. The existence of a huge number of eco-consumers in the international market generates a high amount of a price premium for Pakistani eco-label certified textile products. Consequently, a sufficient market for Pakistani eco-labeled textile products can generate. Thus, the Pakistani textile firms with an eco-label can get the desired price premium for eco-label products which improve their financial performance.

It is observed that environmental performance index negatively and significantly affects the textile firms' net profit margin, return on capital employed, and return on equity. Wagner et al., (2002) found a positive impact of environmental performance on return on capital employed while insignificant results for other financial performance indicators. These results support the traditionalist view which states that there is a negative relationship between the firms environmental and financial performance (Boons & Wagner, 2009; Wagner et al., 2002). Traditionalists point out that investment in the firms environmental performance improving

activates causes extra cost which further raises the cost of production. The increase in the cost of production adversely affects the firms' financial performance.

By evaluating the impact of other firm environmental factors/supply-side variables, we find a negative and significant impact of machinery on return on capital employed and return on equity while finding an insignificant impact of machinery on net profit margin. We can justify this result on the ground that when the number of machines with the textile firms increase, but the number of expert workers who run the machines cannot increases in the same proportion than their production, as well as their profit, cannot significantly increase.

Evaluating the impact of the textile firms' specific variables on their financial performance, there is evidence of a negative and significant relationship between the firm size and net profit margin and a positive and significant relationship between the firm size and return on equity. These results make the impact of firm size on the textile firms' financial performance ambiguous. Wagner et al., (2002) find insignificant results for firm size. The relationship between the firms' age and their financial performance is found to be insignificant.

Assessing the impact of explanatory variables of firms' financial performance there is evidence of a positive and significant impact of capital intensity ratio only on net profit margin while for remaining two financial performance indicators its impact is insignificant. Russo & Fouts, (1997) and Wagner et al., (2002) also found similar results but instead of capital intensity ratio, they used assets turnover ratio. We can justify this result on the ground that the capital-intensive firms can enjoy cost savings from having already devoted a major portion of their capital to real or fixed assets. This benefit may be more important during the economic recession, during recession periods, cost savings become more significant for the firms because it

reduces negative impacts on their profitability. Moreover, we find a positive and statistically significant relationship between the firms' debt-equity ratio and their financial performance. Hart & Ahuja, (1996) and Wagner et al., (2002) also found the similar result. This result implies that the financial leverage of the textile firms positively affects their financial performance. This outcome is reasonable since the debt-equity ratio of the textile firms listed in PSX is very low (i.e. on average 7.9% against a significant level 33%) such a lower financial leverage cannot adversely affect the financial performance of the firms. Consequently, the textile firms listed in Pakistan Stock Exchange (PSX) can improve their financial performance by increasing leverage up to a substantial degree.

Furthermore, we observe the positive and significant impact of dividend cover ratio and interest cover ratio on the firms' net profit margin. This implies that increase in the ability of the textile firms to pay dividends regularly to ordinary shareholders from after-tax income and an increase in the efficiency of that firms to pay interest payment on an outstanding debt from their operating profit then their net profit margin will rise. In addition, we observe a negative, but the insignificant impact of provincial dummies on net profit margin and return on equity. The significant and negative impact of provincial dummies on return on capital employed indicates that the return on capital employed of the textile firms decreases if the firms operate in the province Punjab, Sindh, and KP. Wagner et al., (2002) also found similar but insignificant results for countries dummies. The economic downturns and peace less situation in the country may be the possible reason for this negative relationship.

The Diagnostic Cheeks of the three models are given in section B (Diagnostic Cheek) of table 4.3. On the Diagnostic Cheek, we observe reasonable R-Squared and reasonable root-mean-square error (Root MSE) of regressions for estimated environmental and financial

performance models. On the basis of highly significant values of the Wald chi^2 statistics, we can reject the null hypothesis stating that coefficients for all variables in all the models are zero.

4.3.2. The Effects of Eco-Label Adoption by the Textile Firms on their Environmental and Competitive Performance

The results of the estimated simultaneous equation system for the effects of eco-label adoption by the textile firms on their environmental and competitive performance are given in section A of table 4.4. Let us consider first the estimated results of the two environmental performance regressions. In both regressions, there is a positive and significant impact of the dummy variable eco-label on the environmental performance of the textile firms. The variable machinery negatively and significantly affects the environmental performance of the textile firms. On the other hand, we observe a positive and significant coefficient for age in both the environmental performance regressions. We already discuss the impact of these variables on the environmental performance of the textile firms in the previous section, therefore, for simplicity; we cannot replicate those discussions in this section.

Further, it is observed that in two competitive performance indicator (market share and assets turnover ratio) only assets turnover ratio positively and significantly affects the textile firms' environmental performance index. The possible explanations for this positive relationship are that the investment of the firms to environmentally sound production practices leads extra costs, which further raises the cost of production; therefore, the firms with a weak competitive position cannot easily bear the costs of such expensive production practices. On the other hand, the firms with a strong competitive position can easily bear the extra cost of these production practices.

Table 4. 3: 3SLS Estimation Results for the Effect of Eco-Label on the Textile Firms Environmental and Financial Performance

Model:	(1)		(2)		(3)	
A. Dependent Variables	Environmental Performance Index (ln)	Net Profit Margin (ln)	Environmental Performance Index (ln)	Return on Capital Employed (ln)	Environmental Performance Index (ln)	Return on Equity (ln)
Net Profit Margin (ln)	0.00537***					
	(0.00133)					
Return on Capital Employed (ln)			0.00642***			
			(0.00122)			
Return on Equity (ln)					0.00825***	
					(0.00152)	
Environmental Performance Index (ln)		-0.445**		-0.468***		-0.914***
		(0.198)		(0.165)		(0.180)
Eco-Label (Dummy)	2.103***	1.120***	2.105***	1.223***	2.105***	2.085***
	(0.0374)	(0.427)	(0.0376)	(0.357)	(0.0376)	(0.389)
Machinery (ln)	-0.172***	-0.0561	-0.172***	-0.0935***	-0.172***	-0.150***
	(0.0137)	(0.0353)	(0.0138)	(0.0314)	(0.0138)	(0.0340)
Material Cost (ln)	0.0811***		0.0794***		0.0800***	
	(0.0122)		(0.0123)		(0.0123)	
Labor Cost (ln)	0.00412		0.00190		0.00260	
	(0.0124)		(0.0125)		(0.0125)	
Firm Size (ln)	-0.0422**	-0.110***	-0.0407**	0.0195	-0.0417**	0.0318*
	(0.0168)	(0.0169)	(0.0169)	(0.0170)	(0.0169)	(0.0181)
Firm Age (ln)	0.139***	-0.0130	0.139***	0.0465	0.141***	-0.0950
	(0.0382)	(0.0595)	(0.0384)	(0.0580)	(0.0384)	(0.0623)
Capital Intensity Ratio (ln)		0.905***		-0.0202		-0.00153
		(0.0240)		(0.0213)		(0.0225)
Debt Equity Ratio (ln)		0.831***		0.945***		0.763***
		(0.0175)		(0.0167)		(0.0184)
Dividend Cover Ratio (ln)		0.0379**				

		(0.0156)				
Interest Cover Ratio (ln)		0.0990***				
		(0.0163)				
Yarn Manufacturing Sector (Dummy)	-0.0849		-0.0861		-0.0879	
	(0.0618)		(0.0623)		(0.0623)	
Textile Composites Manufacturing Sectors (Dummy)	-0.0531		-0.0517		-0.0520	
	(0.0648)		(0.0653)		(0.0652)	
Punjab (Dummy)		0.154		-0.407***		-0.178
		(0.153)		(0.145)		(0.157)
Sindh (Dummy)		0.0195		-0.318**		-0.0949
		(0.156)		(0.148)		(0.160)
Khyber-Pakhtunkhwa (Dummy)		-0.0561		-0.520***		-0.285
		(0.170)		(0.161)		(0.175)
Constant	-3.198***	-0.316	-3.168***	-0.000189	-3.187***	-0.204
	(0.222)	(0.610)	(0.223)	(0.531)	(0.223)	(0.576)
B. Diagnostic Cheek						
Observations	896	896	896	896	896	896
R-Squared	0.810	0.792	0.810	0.775	0.809	0.576
Root MSE	0.4734	0.6863	0.4741	0.6489	0.4744	0.7803
Chi^2 Statistics	3883.89***	3958.32***	3855.95***	3412.48***	3884.53***	1797.13***
C. Diagnostic Tests						
Hausman Endogeneity Test	0.07030		0.1868***		0.3414**	
	(0.0677)		(0.0692)		(0.1977)	
LR Test of Model	31.26***		13.54**		42.17***	

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.

- Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Therefore, when the competitive position of the firms improves, they adopt various environmentally sound production practices for improving their environmental performance.

Moreover, when we replace the financial performance indicators by competitive performance indicators in the environmental performance models, then we observe the ambiguous impact of the firm size on the textile firms' environmental performance. The negative and significant impact of Dummy variable yarn manufacturing sector on environmental performance index indicates that the environmental performance of the textile firms decreases if the firms operate in the yarn manufacturing sectors. Wagner et al., (2002) also found similar but insignificant results for industrial sub-sector dummies. The economic downfall and peace less situation in the country may be the possible reasons for this negative relationship.

About the results of the estimated competitive performance models, it is observed that the dummy variable eco-label positively and significantly affects the competitive performance of those textile firms who acquired eco-label. Iraldo et al., (2009) explore that eco-labels are effective environmental instruments which have the ability to improve the environmental performance of the firms and consequently their competitiveness. Therefore, the eco-label provides the opportunity for the textile firms to compete in the market by producing environmentally sound products if and only if, the environmentally conscious consumers are ready to buy and willing to pay a positive price a premium for these products. Since the textile industry of Pakistan mostly exports their products to the international market where they experience a tough competition from their rivals. However, the increasing demand for the eco-labeled product in the international market open ways of exporting textile firms of Pakistan to produce eco-labeled certified products. By exporting eco-labeled certified textile products, the Pakistani textile firms increase their market share of eco-labeled textile products and can

improve their competitive performance in the international market. Moreover, eco-labeling has the potential to reduce the cost of production of textile firms through resource conservation, which provides the opportunity for the textile firms to increase the rivals cost by producing environmentally sound products with lower costs. With these lower costs of production, the textile firms can easily improve their competitive position in the industry as well as in the domestic and international textile markets.

It is observed that environmental performance index negatively and significantly affects the textile firms' competitive performance indicators market share and assets turnover ratio. Iraldo et al., (2009) found a positive impact of environmental performance on market share and intangible assets while found an insignificant impact of environmental performance on other competitive performance indicators. This result is against the revisionist view which states that the continuous improvement in the environmental performance of the firms, positively affect their competitive position (Iraldo et al., 2009). According to revisionist, the continuous improvement in the environmental performance of the firms is the main source of their competitive advantage, because it leads to more efficient production practices, improves the productivity of the firms, reduces the costs of compliance and opens new market opportunities for the firms. Since Pakistan is a developing country, the firms in the textile industry of the country with weak financial resources and weak technological capabilities cannot easily keep the continuous improvement in their environmental performances which leads to inefficient production practices, a reduction in their productivity and close new market opportunities for them.

Furthermore, we observe a positive and significant impact of firm size on both market share and assets turnover ratio. These results indicate that the firm size positively affects the

competitive performance of the textile firms. According to Triebswetter & Wackerbauer (2008), not only the market share and assets turnover ratio make the competitive position of the firms but their large size also makes their competitive position in the market. Thus, the larger the firms' size the higher will be their production and the better will be their competitive position. The variable age shows a negative and significant relationship only with assets turnover ratio. This indicates the fact that with the passage of time the firms in the textile industry of Pakistan observed a reduction in their competitive performance. Again, the economic downfall and peace less situation in the country may be the possible reasons for this negative relationship.

Except for the positive and significant impact of the dummy variable Sindh on market share, we observe the insignificant impact of all other provincial dummies on market share and assets turnover ratio. This indicates that the competitive performance of the textile firms is good if they operate in the Sindh province. According to Khan et al (2002), the textile industry of Pakistan is the important and leading export industry of the country. Its higher export potential provides the comparative advantage in the international textile market. Due to this comparative advantage, the textile firms operate in the Sindh province experience higher competitive performance.

The Diagnostic Cheek of the two models is given in section B of table 4.4. On the Diagnostic Cheek, we observed high R-Squared for the estimated environmental performance models, while relatively low R-Squared for competitive performance models, it is reasonable because we use pooled dataset with a large number of observations. Moreover, we observe reasonable root-mean-square error (Root MSE) of the regression for estimated environmental and competitive performance models. On the basis of highly significant values of the Wald chi^2

statistics, we can reject the null hypotheses stating that coefficients for all variables in all the models are zero.

In short, from this empirical analysis, we observe that in the textile industry of Pakistan the adoption of eco-label by the textile firms positively and significantly affect their environmental, financial, and competitive performance. In other words, in the textile industry of Pakistan, the adoption of eco-labels by the textile firms improves their environmental and economic performance. Since, in this study, we consider the environmental and economic dimensions of sustainability, therefore, on the basis of these results we conclude that eco-label contribute to the sustainable growth of the textile firms as well as it has the potential to bring production sustainability in the textile industry of Pakistan.

4.4. Influencing Factors of a Textile Firm's Decision to Adopt an Eco-Label

The results of the estimated binary logit model which shows the impact of influencing factors of a firm's decision to adopt an eco-label is given in table 4.5. Along with the coefficient estimates of the logit model we also report its corresponding marginal effect[15] in the same table. We observe a negative, but the significant impact for variable tax expenses which indicates that the existing environmental taxation program for the textile industry of Pakistan negatively affects the textile firm decision to adopt an eco-label. In other words, the environmental regulatory pressure from governmental authorities diverts the textile firm decision to adopt an eco-label. Halkos & Evangelinos (2011) and Nakamura et al., (2001) found the similar result for Greek and Japanese firms but instead of eco-label, they used Environmental Management System Standard (EMSS)

[15]For continuous explanatory variables, marginal effects measure the change in the estimated probability, following an increase in the explanatory variable by 1 unit; for discrete variables, however, the marginal effect is calculated as the difference between the probabilities estimated at the sample means when the dummy variable takes the values 1 and 0, respectively (Grolleau et al., 2007).

Table 4. 4: 3SLS Estimation Results for the Effect of Eco-Label on the Textile Firms Environmental and Competitive Performance

Model:	(1)		(2)	
A. Dependent Variables	Environmental Performance Index (ln)	Market Share (ln)	Environmental Performance Index (ln)	Assets Turnover Ratio (ln)
Market Share (ln)	0.00171			
	(0.0300)			
Assets Turnover Ratio (ln)			0.000017***	
			(0.0422)	
Environmental Performance Index (ln)		-1.555***		-0.463***
		(0.283)		(0.169)
Eco-Label (Dummy)	2.138***	3.748***	2.139***	0.765**
	(0.0391)	(0.595)	(0.0385)	(0.356)
Machinery (ln)	-0.157***		-0.157***	
	(0.0152)		(0.0139)	
Firm Size (ln)	0.00729	0.612***	0.00833	0.156***
	(0.0215)	(0.0379)	(0.0137)	(0.0226)
Firm Age (ln)	0.124***	-0.152	0.124***	-0.266***
	(0.0394)	(0.124)	(0.0409)	(0.0741)
Yarn Manufacturing Sector (Dummy)	-0.0944*		-0.0848	
	(0.0550)		(0.0518)	
Textile Composites Manufacturing Sectors (Dummy)	-0.0532		-0.0482	
	(0.0573)		(0.0541)	
Punjab (Dummy)		0.0312		-0.128
		(0.192)		(0.228)
Sindh (Dummy)		0.344*		0.102
		(0.197)		(0.233)

Khyber-Pakhtunkhwa (Dummy)		0.0855		0.0577
		(0.100)		(0.248)
Constant	-2.423***	-17.24***	-2.451***	-1.706**
	(0.433)	(1.202)	(0.192)	(0.738)
B. Diagnostic Cheek				
Observations	896	896	896	896
R-Squared	0.803	0.079	0.802	0.004
Root MSE	0.483	1.531	0.483	0.911
Chi^2 Statistics	3775.50***	436.36***	3651.49***	33.70***
C. Diagnostic Tests				
Hausman Endogeneity Test	0.4262**		0.1102	
	(0.2019)		(0.1341)	
LR Test of Model	14.92**		12.89*	

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.

- Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

and ISO 14001 certification system, respectively. According to Ali (2017) at present, there are no specific environmental or green taxes imposed by the Pakistani government on industries pollution. However, certain other taxes are imposed on the industries that may align with environmental outcomes including fuels, power, energy, machinery, water, and raw materials consumption, etc.

On the basis of this argument, we provide two possible explanations for this negative relationship. The first one is the absence of specific environmental or green taxes on the textile industry pollution. Due to the absence of a clear green tax, the governmental environmental authorities cannot force a firm in the textile industry of the country to adopt a voluntary environmental scheme such as eco-label. The second one is the existence of various other taxes, on the firm in the textile industry of the country, which increases the cost of production of the textile firm and consequently, reduces its ability to adopt the expensive environmental standard such as eco-label.

A positive and significant coefficient is observed for machinery, indicating that in the textile industry of Pakistan any increase in the number of machines with a firm influences its decision to adopt eco-label. According to Darnall et al (2000) and Halkos & Evangelinos (2002), a firm may adopt voluntary environmental scheme i.e. eco-label for the improvement of its machinery. Since, in the textile industry of Pakistan, most of the firms use higher polluting machinery (Aftab et al., 2000; Khan et al., 2002). Therefore, in order to reduce the higher pollution load of machinery, the firm wants to acquire eco-label because it obligated him to use environmental friendly machinery.

The negative and significant coefficient of material cost shows that the increase in the material cost reduces the possibility of the textile firm to adopt an eco-label. The possible reason for this negative relationship may be the low purchasing power of the consumers. Since the prerequisites of the eco-label scheme obligated the firm to use environmentally friendly raw materials. However, environmentally friendly raw materials are more expensive than the environmental unfriendly raw materials. Therefore, the use of environmentally friendly raw materials causes extra cost which further raises the cost of production. One possible way for the firm to restore this extra cost is to charge a higher price for the consumers. The Pakistani consumers with low purchasing power cannot pay a higher price for the eco-label textile product. Resultantly, they purchase non-eco-labeled textile products at lower prices.

The coefficient of the labor cost is positive and significant, indicating that any increment in the labor cost increases the probability of the textile firm adopt an eco-label. This result is reasonable on the ground that the firm invests into its labor force in the form of environmental training and education improves their environmental consciousness. With such an environmentally conscious labor force a firm can easily adopt and implement an eco-label.

We observe a positive and significant relationship between the environmental performance of a textile firm and its decision to adopt an eco-label. According to the findings of the SCI survey of Pakistan for the year 2013, one of the driving forces to acquire eco-labels is the firm's own willingness to be more responsible in producing eco-friendly products. This is the need of the day which the textile firm recognizing now. The textile industry of Pakistan is the most polluting industry of the country (Khan et al., 2002), in order to lower down the pollution load of the firm operating in the textile industry of Pakistan, the adoption of eco-label is the best option.

For the financial performance indicators, a positive and significant coefficient is observed only for return on equity while insignificant coefficients are observed for the net profit margin and return on capital employed. This means that the return on equity positively influences the firm decision to adopt an eco-label. Grolleau et al., (2007) found a positive impact of financial incentives on the firm decision to adopt the ISO 14001 certification. There are two ways under which the eco-label certification raises the firm's profitability. First, the adoption of eco-label enables the firm to capture the huge amount of environmentally conscious consumers and earned a price premium which ultimately increases its profit (Porter & Van der Linde, 1995). In the domestic textile market, the Pakistani textile firm hardly can find environmentally conscious consumers who are willing to pay a price premium for eco-labeled certified products. However, the textile industry of Pakistan is the leading exporting sector of the country and the firms in this industry export their products to international markets (Khan et al., 2002). In international markets, Pakistani textile firms can find a huge number of environmentally conscious consumers who are willing to pay a price premium for eco-labeled certified products. The desire of a textile firm to capture this notable amount of environmentally conscious consumers, to earn a price premium and to increase its profit positively affects its decision to adopt an eco-label.

Besides, Porter & Van der Linde (1995) stated that pollution leads to the waste of resources, increase the cost of production and reduced the financial opportunities of a firm. The only way that firm follows to efficiently use its resources, reduce its cost of production and to improve its financial position is that the firm reduced its pollution by adopting eco-label schemes. The adoption of an eco-label may help the firm to use its resource efficiently, reducing its cost of production and improve its financial position (Halkos & Evangelinos, 2002). In the textile industry of Pakistan, most of the firms use its resources inefficiently which increase their

cost of production and lower down their financial position (Aftab et al., 2000; Khan et al., 2002). The desire of a textile firm to efficiently use its resources, reduce its cost of production and to improve its financial position positively effects its decision to adopt an eco-label.

Insignificant coefficients are observed for both the competitive performance indicators market share and assets turnover ratio. This means that the desire of a textile firm to occupy the major share of the textile market has no effect on its decision to adopt the eco-label scheme. This finding is contradicted with the findings of Tsireme et al., (2012) and Abbasi (2012) who found that market share positively and significantly affects the firm decision to adopt green sustainable management (G-SCM) practices. However, we expect positive signs of these variables but due to data deficiencies; we get insignificant results for them.

We observed a positive and significant impact of firm size on its decision to adopt eco-label. Grolleau et al., (2007) and Nakamura et al., (2001) was found similar results by analyzing the determinants for EMS and ISO 14001, respectively. This result is reasonable because the larger firm has more resources to adopt an eco-label. Moreover, the costs of maintaining such labels as a share of corporate budgets are also smaller for the larger firm, so he is more likely to adopt an eco-label scheme. On the other hand, we find a negative, but significant coefficient for age, indicating that the old textile firm is less likely to adopt an eco-label scheme. This is reasonable because the old firm may less likely to adopt an advance environmental certifications and schemes which may be more beneficial for the improvement of its environmental performance.

The positive and significant parameter estimate of the dummy variable export indicates that the export status of the firm positively affects its decision to adopt an eco-label. This finding

is in line with Grolleau et al., (2007) they pointed out that the pressure from firm foreign consumers and foreign environmental regulation and standard may force the firm to adopt environmental management system. The results of the SCI-Pakistan survey for the year 2013 also confirmed this finding which reported that 24% of the surveyed textile firms of the view that eco-labels are important for the satisfaction of the foreign consumers' demands for eco-labeled products. The global increase in the demand for eco-labeled textile products in the international markets, increasing the risk of rejection the textile products on the basis of eco-label of the country in the international market. Therefore, this makes it essential for Pakistani textile firm to adopt eco-label schemes. Since the textile industry of Pakistan is the leading export industry of the country; the firms in this industry export their product to various countries where they faced a diverse range of environmental regulations.

Besides, the environmental regulations in these countries the Pakistani textile firms also faced environmental regulations proposed by international organizations such as the World Trade Organization (WTO), negotiations on Multilateral Environmental Agreements (MEAs) and International Standard setting bodies. Compliance with these regulations forced the Pakistani textile firm to adopt eco-label schemes. In addition, the adoption of eco-label schemes by the Pakistani textile firm also enables him to comply better with the expected strict environmental regulations (both country-specific and international).

The positive and significant value of the marginal effect of machinery indicates that by installing additional machinery a textile firm increases the probability that it will adopt eco-label. This result is reasonable on the ground because in the textile industry of Pakistan installing additional units of machinery (traditional) means increasing pollution loads of the firm. To reduce the possible pollution load of the firm by installing additional machinery units, a textile

firm may be more willing to eco-labeling. Because the eco-labeling providing the opportunity for a firm to use environmentally friendly machinery instead of traditional machinery.

Moreover, the positive and significant value of the marginal effect of labor cost indicates that the increase in the textile firm's labor cost increase the probability that it will adopt an eco-label. However, a textile firm investment into its labor force in the form of environmental training and education on one side, increase its labor costs, but, on the other side, it increases the environmental consciousness labor force with the firm. These environmental conscious labors will force the top management of the firm to start environmental protection measures for its production processes. Moreover, environmental conscious labors may better follow the guideline and criteria of various environmental schemes such as eco-labeling. These two options may increase the probability of a textile firm to adopt eco-label.

Furthermore, the positive and significant value of the marginal effect for environmental performance index indicates that improvement in a textile firm's environmental performance increase the probability that it will adopt eco-label. The eco-labels are assigned to those textile firms who have improved their environmental performance up to the eco-label criteria. Therefore, continuous improvements in a textile firm environmental performance increase the possibility that the firm will qualify for eco-labeling. Thus, a continuous improvement in a textile firm's environmental performance increases the probability that it will adopt eco-labels.

Besides, the positive and significant value of the marginal effect for return on equity indicates that improvement in a textile firm's financial performance increases the probability that it will adopt eco-label. Eco-labeling is considered as a costly activity; consequently, the firm with a weak financial position cannot easily adopt eco-labels. On the other, the textile firm with

strong financial position can easily bear the costs of eco-labeling and hence, can easily adopt various eco-labeling schemes. Therefore, a continuous improvement in a textile firm's financial performance increases the probability that it will adopt eco-label. The positive and significant value of the marginal effect of firm size indicates that larger a textile firm's size the more probable that it will adopt eco-label. A larger textile firm has enough resources for acquiring and maintaining the costs of eco-labeling. So, the larger the firm size the higher will be the possibility that it will adopt eco-labels.

On the other hand, the negative and significant value of the marginal effect of tax expenses shows that increases in the tax burden on a textile firm reduce the probability that it will adopt eco-label. The existence of various taxes on the firm in the textile industry of Pakistan, increase the tax burden on the textile firm and consequently, reduced its ability to adopt the expensive environmental standard such as eco-label. Thus, an increase in further taxation puts away a textile firm in the country from adopting eco-labels.

In addition, the negative and significant value of the marginal effect for material cost shows that the increase in the material cost of a textile firm reducing the probability that it will adopt eco-label. The higher materials costs of a textile firm lead to higher costs of production and resultantly, higher prices for its outputs. However, the low purchasing power of the Pakistani consumers' forbids them not to purchase textile products with higher prices. Consequently, the firm faces a reduction in sales. This fair of increase in prices and reductions in sales, reduce the probability that a textile firm adopt an eco-labeling scheme.

Also, the negative and significant value of the marginal effect of age shows that one year increase in the age of the textile firm's reducing the probability that it will adopt eco-label. The

old textile firm is less likely to adopt environmental labeling which may be more beneficial for the improvement of their environmental performance. Moreover, the positive and significant value of the marginal effect of the dummy variable export indicates that the export status of a textile firm increases the probability that it will adopt eco-label. Being a leading exporting sector of the country, the textile industry of Pakistan faced a diverse range of environmental regulations in importing countries as well as the environmental regulations proposed by various international organizations. The exporting textile firm in the country can easily fulfill these regulations by just adopting eco-label. Therefore, compliance with foreign and international environmental regulations increases the probability of exporting textile firm of Pakistan to adopt various eco-labeling schemes. On the diagnostic cheek of the model, higher Pseudo R squared and significant Wald chi^2 statistic is observed for the model which also valid the model estimated.

Table 4. 5: Results of the Estimated Logit Regression for the Influencing Factors of the Textile Firm Decision to Adopt an Eco-Labeling Scheme

Dependent Variable Eco-Label (Dummy)	Coefficients	Marginal Effect
Regulatory Pressure		
Tax Expenses (ln)	-0.822***	-0.011*
	(0.305)	(0.008)
Firm Environmental Factors/ Supply-Side Factors		
Machinery (ln)	1.255***	0.017*
	(0.176)	(0.007)
Material Cost (ln)	-0.941***	-0.012*
	(0.239)	(0.005)
Labor Cost (ln)	1.345***	0.018*
	(0.302)	(0.008)
Environmental Performance		
Environmental Performance Index (ln)	4.871***	0.064*
	(0.537)	(0.027)
Financial Performance Indicators		
Net Profit Margin (ln)	-0.550	-0.007
	(0.397)	(0.005)
Return on Capital Employed (ln)	0.292	0.004
	(0.347)	(0.004)
Return on Equity (ln)	0.481*	0.006*
	(0.246)	(0.005)
Competitive Performance Indicators		
Market Share (ln)	-0.319	-0.004
	(0.404)	(0.005)
Assets Turn Over Ratio (ln)	-0.293	-0.004

	(0.458)	(0.007)
Firm-Specific Factors		
Firm Size (ln)	0.892***	0.012*
	(0.238)	(0.007)
Firm Age (ln)	-1.388***	-0.018*
	(0.346)	(0.008)
Export Status of the Firm		
Export Status (Dummy)	1.148**	0.014*
	(0.514)	(0.006)
Constant	-1.805	
	(7.665)	
Diagnostic Cheek		
Observations	896	
Pseudo R Squared	0.853	
Wald Chi^2 Statistics	275.06***	

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.

- Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

CHAPTER 5: INTERNATIONAL ECO-LABELING SCHEMES AND THE EXPORT OPPORTUNITIES OF PAKISTAN

In this chapter, we evaluate the potential impact of eco-labeling on the export opportunities of Pakistan. This chapter has two sections the first section provides information on descriptive statistics and the second section deals with the results of the estimated gravity model.

5.1. Descriptive Statistics

Descriptive statistics about the exports of fish and fish products, food and food products, textiles, pulp and paper and building materials of Pakistan to developed countries, the number of eco-labels faced by Pakistan exporters in the developed countries' markets, the certification and labeling costs of these eco-labels and other control variables used in this part of the study are given in table 5.1. Evaluating overall means, it is observed that regarding exports to developed countries, the textile is the leading export sector of the country, followed by food sector, fish sector, building materials sector, and pulp and paper sector, respectively. Moreover, the food exporting sector of Pakistan faced the highest number of eco-labels in the markets of developed countries, followed by building materials sector, textile sector, pulp, and paper sector, and fish sector, respectively. In addition, in these developed countries we observe the highest certification and labeling costs for building materials eco-labels, followed by pulp and paper eco-labels, textiles eco-labels, food eco-labels, and fish eco-labels, respectively. This indicates that the lower exporting sectors of the country such as building materials and pulp and paper sectors face a diverse range of eco-labels and relatively high certification and labeling costs of eco-labels in the developed countries' markets.

Comparing the medium exporting sectors food and fish sectors we observe the highest number of eco-labels in the food sector, while the lowest number of eco-labels for the fisheries sector. On the other hand, we observe comparatively lower certification and labeling costs of eco-labels for these two sectors as compared to the remaining three export sectors. The leading export textile sector of the country faced a lower number of eco-labels as compared to the food and building sectors while lower certification and labeling costs of eco-labels as compared to the lower exporting pulp and paper and building sectors. Regarding other explanatory variables, we observe high GDP, medium size population, relatively high wholesale price index, higher trade cost, high exchange rate while lower manufacturing tariff for twenty-four developed trading partners of Pakistan. Comparing yearly means, it is observed that from the year 2003 to 2012 the exports of fish and fish products continuously falls while in the year 2014 it raises again. On the other hand, from the year 2003 to 2009, the number of eco-labels faced by the Pakistani fish exporting sector in developed countries' markets and the certification and labeling costs of these eco-label increases continuously.

Moreover, from the year 2003 to 2014 we observe a positive improvement in food exports of the country, regardless of the fact that within the same time period this sector observed an increase in the number of eco-labels and their certification and labeling costs. Further, the export of the textile sector increases from the year 2003 to 2006, it decreases in the year 2009 and increases again from the year 2012 to 2014. In the course of the same time period, the number of eco-labels faced by this sector and their corresponding certification and labeling costs increases gradually. The exports of the pulp and paper increase from the year 2003 to 2009 while decreases after the year 2009. The number of eco-labels faces in this sector and their corresponding certification and labeling costs increases within the same period. The exports of

building material increases from the year 2003 to 2006, decreases in the year 2009 and increases again from the year 2012 to 2014. On the other hand, the number of eco-labels and their certification and labeling costs for building material increase continuously from the year 2009 to 2010. From the year 2003 to 2009, for developed countries, we observe an increase in GDP, population, wholesale price index, and trade cost while an observed reduction in manufacturing tariff and fluctuations in their exchange rates.

5.2. Results of the Estimated Gravity Model

The gravity model is first estimated through Pooled OLS, Panel RE, and Panel FE estimation procedures, but due to the existence of strong endogeneity and reverse causality among the export volume of Pakistan (PX_{ijt}) and the Gross Domestic Product (GDP) or national income of developed trading partner countries (Y_{jt}), we observe biased coefficients for the model, therefore we are not interpreting these results. The estimated results of the Pooled OLS, RE and FE are given in Appendix G, table G2. For checking causality among PX_{ijt} and Y_{jt} we perform Granger Causality test. The results of the test are given in part C (Diagnostic Test) of table 5.2. From the result of the test, we find bi-directional causality (reverse) among textiles exports and GDP, among pulp and paper exports and GDP and among building materials exports and GDP. On the other hand, we observe uni-directional causality among fish exports and GDP and among GDP and textile exports. From these results, we concluded strong causality among the export volume of Pakistan and the national income of its developed trading partners.

To find endogeneity between PX_{ijt} and Y_{jt}, we perform the Durbin and Wu-Hausman endogeneity tests. The results of the test are given in part C of table 5.2. In all the five models, we find statistically significant coefficients of Durbin and Wu-Hausman endogeneity tests. These

Table 5. 1: Descriptive Statistics

Variables	Definition	Overall	2003	2006	2009	2012	2014
Dependent		Mean & SD	Mean & SD	Mean & SD	Mean & SD	Mean & SD	Mean & SD
Exports (PX)	*Average exports of the leading five export sectors of Pakistan to Developed partner countries (Million US$)*						
Fish	Exports of fish and fish products (i.e. fish and crustaceans, fish and crustaceans products etc)	4.1673 (9.4179)	4.6957 (7.4888)	4.2141 (7.0065)	4.0559 (10.6430)	4.1662 (10.3510)	4.7401 (12.4254)
Food	Exports of food and food products (i.e. cereals, sugar, fruits, vegetables, dry fruits, meat, dairy products etc)	21.1011 (34.3207)	9.3032 (14.149)	13.1131 (21.0781)	16.8453 (22.2625)	29.7869 (57.8562)	40.0301 (50.8894)
Textile	Exports of textile products (i.e. raw cotton, cotton yarn, cotton cloth, knitwear, bed wear, towels, readymade garments, carpets, silk, woven fabrics etc)	317.6601 (672.244)	219.53 (505.06)	314.7488 (799.4504)	272.1259 (583.2248)	371.2781 (721.6196)	399.5088 (711.3135)
Pulp and Paper	Exports of pulp and paper products (i.e. wood, pulp of wood, paper and paperboard etc)	0.2449 (0.5062)	0.1338 (0.2029)	0.3358 0.6944	0.4537 (0.8790)	0.2412 (0.4254)	0.1743 (0.2836)
Building Materials	Exports of building materials (i.e. cement, ceramic products, varnishes, paints etc)	1.2992 (3.1909)	0.3587 (0.7679)	1.1693 (2.1996)	0.8185 (1.4018)	1.9532 (4.9524)	2.3549 (4.7701)
Explanatory							
Number of Eco-Label (EL)	*Average number of eco-labels faced by Pakistani exporters in developed countries' markets*						
Fish	Number of eco-labels for fish and fish products	3.0278 (1.8344)	2.6667 (1.2394)	3.0416 (1.8052)	3.1667 (2.0571)	3.1667 (2.0571)	3.1667 (2.0571)
Food	Number of eco-labels for food and food products	12.8646 (10.1008)	10.25 (7.3853)	12.1667 (8.6359)	13.625 (11.0956)	13.75 (11.4027)	13.75 (11.4027)
Textile	Number of eco-labels for textile products	10.1146 (6.9366)	8.0416 (4.3487)	9.5 (5.6568)	10.7916 (7.4657)	11 (8.0487)	11.0416 (8.2011)
Pulp and Paper	Number of eco-labels for pulp and	9.2743	7.9583	8.4583	9.7083	9.9583	10.0833

	paper products	(4.8329)	(2.8049)	(3.3097)	(5.2210)	(5.8568)	(5.8303)
Building Materials	Number of eco-labels for building materials	11.1111 (8.0066)	8.75 (4.0459)	9.6667 (6.0048)	11.5833 (8.5613)	12.5833 (9.6949)	12.5833 (9.6949)
Cost of Eco-Label (ELC)	*Average certification and labeling costs of eco-labels (Million US$)*						
Fish	Cost of eco-labels for fish and fish products	0.0223 (0.0302)	0.0186 (0.0278)	0.0197 0.0278	0.0232 (0.0321)	0.0241 (0.0319)	(0.0241) (0.0319)
Food	Cost of eco-labels for food and food products	0.0795 (0.0787)	0.0542 (0.0487)	0.0714 (0.0674)	0.0875 (0.0870)	0.0875 (0.0871)	0.0875 (0.0871)
Textile	Cost of eco-labels for textile products	0.0894 (0.0555)	0.0747 (0.0374)	0.0783 (0.0446)	0.0957 (0.0599)	0.0966 (0.0628)	0.0968 (0.0636)
Pulp and Paper	Cost of eco-labels for pulp and paper products	0.0910 (0.0509)	0.0754 (0.0274)	0.0779 (0.0309)	0.0981 (0.0586)	0.0989 (0.0604)	0.1004 (0.0605)
Building Materials	Cost of eco-labels for building materials	0.1108 (0.0685)	0.0862 (0.0395)	0.0961 (0.0439)	0.0981 (0.0586)	0.1246 (0.0809)	0.1248 (0.0809)
Other Explanatory Variables	*Other explanatory variables which can affect the export opportunities of Pakistan*						
GDP (Y)	Nominal Gross domestic products (Million US$)	1862059 (3111792)	1279341 (2404405)	1613547 (2848971)	1836545 (3051676)	2213711 (3584451)	2334969 (3907126)
The Trade Cost (C)	Cost to export per container (US$ per container)	1024.318 (361.1781)	943.9 (317.3)	934.5417 (309.5357)	1061 (352.8813)	1092.542 (425.1997)	1120.283 (397.52)
Wholesale Price Index (P)	Use to measure the price volatility (Index)	96.2634 (12.3071)	79.434 (12.402)	89.3781 (7.8650)	96.1427 (3.2422)	108.1981 (4.5667)	108.6461 (6.4271)
Population (POP)	Number of people living in the country (Million)	100.6874 (264.5379)	98.02 (261.65)	99.5008 (266.3307)	100.9586 (270.5458)	102.2951 (274.5723)	103.3138 (277.3658)
Manufacturing Tariff (MT)	Manufacturing tariff rate (%)	2.2956 (1.8352)	3.0958 (2.2533)	2.7487 (2.1775)	2.2962 (1.8595)	1.6369 (1.6509)	1.8041 (1.0931)
Exchange Rate (ER)	The rate of exchange between two currencies (Relative to US$)	124.4506 (356.7601)	123.6 (384.8)	108.543 (303.9136)	136.615 (401.7005)	129.0469 (379.3153)	135.7982 (403.6454)

Source: Computed by authors based on UNCOMTRADE, WDI dataset for the year 2003-14, Eco-label index website and visiting websites of eco-labels providing organization for the year 2016.

- Note: SD represents Standard Deviation given in the parenthesis.

results show that there is strong endogeneity of fish, food, textile, pulp and paper, and building materials exports to GDP. From these results, we concluded strong endogeneity among the Pakistani exports and the national income of its developed trading partners.

To avoid the problem of endogeneity and reverse causality, this study prefers to use the System GMM technique. Because System GMM deals with the problem of endogeneity, reverse causality, autocorrelation and also handle the non-stationary process in the data. The System GMM removes endogeneity by "internally transforming the data". Transformation refers to a statistical process where a variable's past value is subtracted from its present value. In this way, the number of observations is reduced and this process (internal transformation) enhances the efficiency of the system GMM technique (Ullah et al., 2018). System GMM estimates a set of two equations, one in a level form which uses suitable lag level as an instrument and the other one is difference form that utilizes lag first difference as an instrument. System GMM combines both sets of moment conditions as a linear GMM estimator which cover both level and difference equations (Mileva, 2007). In this study System GMM is applicable because the basic condition for applying GMM is that the number of the cross-section (N) should be greater than the number time series (T), and in our case number of the cross section is twenty-four (N=24) while the number of time series is twelve (T=12).

The results of the estimated gravity model through System GMM for the five export sectors, namely, fish and fish products, food and food products, textile products, pulp and paper products, and building materials are given in part A of table 5.2. Focusing on the core variable, we observe a negative and significant impact of the number of eco-labels on the exports of fish, food and textiles products of Pakistan. This indicates that the complex procedure and strict standard requirements of the eco-labels exist in the developed partner countries can reduce the

fish, food and textiles exports of Pakistan. This result is in line with the findings of Bonsi et al., (2008) and Joshi (2004). Since the eco-label scheme is a complex and strict standard; include on criteria satisfaction, chain of custody (COC), the process of production method (PPMS), life cycle assessment (LCA) and other requirements. Therefore, it may be too difficult for Pakistani exporters to acquire such a complex and strict standard for their products. The fish, food, and textile exporting firms in Pakistan with low financial resources and low technical expertise may be the other reasons for restricting them to fulfill the complex PPMS, COC, LCA and other requirements of eco-label schemes exist in the developed partner countries. Consequently, they can observe a reduction in exports of fish, food and textiles products. The existence of more than one eco-label standard in the developed countries is another main factor which may reduce the export opportunities of the country. The existence of a diverse range of eco-labels for fish, food and textile products in the developed countries may make it harder for Pakistani exporters to comply with a unique eco-label standard. In the remaining two models we observe a positive and significant impact of the number of eco-labels on the exports of Pakistani pulp and paper products and building materials. Since, the share of pulp and paper products and building materials in the total exports of Pakistan to developed countries is very low such as 0.07 and 0.4 percent, respectively. Therefore, the existence of a diverse range of eco-label with the complex procedure and strict standard requirements in the developed countries may not reduce the volume of exports of these sectors.

A negative and significant coefficient of the eco-label cost in all the five estimated models indicates that the higher certification and labeling costs of eco-labels can reduce the exports of Pakistan to partner developed countries. This finding is in line with the findings of Kiekens (2000) Wessells et al (2001) and Piotrowski & Kratz (2005). Eco-label has considered a

costly activity includes costs of COC, costs of LCA, the cost of acquiring and monitoring, costs of its material requirements and cost of its expensive environmental technologies. Since Pakistan is a developing country, the exporting firms in the country with weak financial resources and weak technological capabilities cannot easily bear the high cost of acquiring and monitoring of eco-labels, the high costs of its material requirements and the high costs of its other requirements. These costs can reduce the ability of the exporting firms of the country to adopt eco-label schemes. This ultimately can reduce the country's exports to developed countries where consumers demand eco-label certified products. Moreover, the adoption of the foreign eco-labels obligated the domestic exporting firms to improve the environmental performance of their production process as well as to improve the environmental quality of their products. Therefore, any exporting firm in Pakistan belongs to the stated sectors, when acquired a foreign eco-label can bear the extra cost of environmental protection which can further increase its total cost of production. The increase in the total cost of production can reduce the competitive advantage of the country in fish, food, textiles, pulp and paper, and building materials exports and consequently, can reduce its export opportunities.

Regarding other explanatory variables, we observe a positive and significant coefficient for GDP in all the five estimated models. Egger & Pfaffermayr (2003), Baier & Bergstrand (2007) Bergstrand (1985) and Narayan & Nguyen (2016) also found a positive and significant coefficient for the importing country GDP. This result indicates that the increase in the national income of the importing developed countries can increase the exports of the five product categories from Pakistan. This result also fits with the theory which states that the volume of export from a country is an increasing function of the national income of their importing countries (Wall, 1999).

In the estimated fish and pulp and paper models, we observe an insignificant coefficient for trade cost. On the other hand, in the estimated food model we observe a positive and significant coefficient for trade cost while in the estimated textiles and building materials models, we observe a negative and significant coefficient for trade cost. These findings indicate that the food exporting sector of Pakistan may easily restore the trade cost put by its developed trading partner countries, while the textile and building materials sector of the country may not easily restore this trade cost and consequently, face a reduction in exports. Moreover, a country may raise its trade cost in order to discourage the demand for imports. Therefore, we can say the trade cost put by the developed countries can reduce their imports demand for Pakistani textile products and building materials while it cannot reduce their import demand for Pakistani food products.

In the estimated food, textiles, and building materials models, we observe an insignificant coefficient for the wholesale price index. On the other hand, in the estimated fish model we observe a positive and significant coefficient for wholesale price index while in the estimated model for pulp and paper we observe a negative and significant coefficient for the wholesale price index. Victor & Macphee (2006) found positive parameter estimates for wholesale price index. These findings indicate that an increase in the price of fish products in the markets of developed partner countries can increase the fish exports of Pakistan while decreasing the pulp and paper exports of the country. The rise in the wholesale price of fish products in the markets of developed countries shows that their domestically produced fish products are expensive relative to the importing fish products. Therefore, they can reduce the production of domestic fish while increasing the import of Pakistani fish products. However, due to higher environmental awareness of the developed countries regarding the pulp and paper products (such

that they introduced 11 types of eco-labels for pulp and paper products), the increase in the wholesale price of pulp and paper products in the markets of these countries cannot increase their imports of the same products (less environmental friendly pulp and paper products) from Pakistan.

In the estimated fish, textile and pulp and paper models we observe an insignificant coefficient for the population. On the other hand, in the estimated food model we observe a negative and significant coefficient for the population, while in the estimated building materials model we observe a positive and significant coefficient for the population. Egger & Pfaffermayr (2003) and Lewer & Van den Berg (2008) found a positive coefficient for the population. These findings indicate that an increase in the population of developed partner countries can reduce the food exports of Pakistan while can increase the exports of building materials of the country. The developed countries are characterized by a larger domestic market for food products while a relatively small domestic market for building materials (Oguledo & MacPhee, 1994). An increase in the population in the developed countries encourage the introduction of advanced technologies and the division of labor, consequently, these countries produce a wide range of food and food products for domestic consumption. This increase in the domestic production of food and food products in the developed partner countries can discourage the demand for Pakistani food and food products. On the other hand, an increase in the population of developed countries with a relatively small domestic market of building materials can encourage the demand for Pakistani building materials.

In the estimated textiles, pulp and paper, and building materials models, we observe an insignificant coefficient for manufacturing tariff. On the other hand, in the estimated fish and food models, we observe a positive and significant coefficient for manufacturing tariff. Victor &

Macphee (2006) found a negative coefficient for manufacturing tariff. This finding indicates that an increase in the manufacturing tariff in the developed partner countries cannot decrease the export volume of the fish and food sector of Pakistan. This outcome is reasonable since the developed countries put lower manufacturing tariff rates (i.e. On average 2.3%) such a lower manufacturing tariff cannot reduce the exports of the fish and food of Pakistan to these countries. Moreover, a lower manufacturing tariff put by the developed countries makes it possible for the exporting firms in Pakistan to increase their exports to these countries.

In the estimated pulp and paper model we observe the insignificant impact of the exchange rate on the export volume of this exporting sector of Pakistan. On the other hand, in the remaining four estimated models, we observe a negative and significant coefficient for the exchange rate. Bergstrand (1985), Egger & Pfaffermayr (2003) and Narayan & Nguyen (2016) found a positive and significant coefficient for the exchange rate. These findings indicate that an increase in the exchange rate in the developed partner countries can decrease the export of the fish, food, textile, and building materials sectors of Pakistan. The increase in the exchange rate in the developed countries means depreciation in their domestic currencies, which reduce the purchasing power of the domestic consumer. The low purchasing power of the developed countries consumers can force them to reduce their demand for imported Pakistani fish, food, textiles, and building materials. The positive and significant coefficient of lagged variables in all the five models shows a positive impact on the previous export performance of the five exports sectors of Pakistan on their current export performance. The possible reason for this positive relationship is that in each year a country can increase or decrease its exports of certain commodities on the basis of its previous year's export performance.

In short, from this empirical analysis, it is observed that the complex procedure, strict standards requirements and a diverse range of eco-labels exist in the developed countries and the high labeling and certification costs of acquiring these eco-labels can reduce the export opportunities of Pakistan to these countries. Besides, the eco-labels the higher exchange rate in the developed countries can also reduce the export opportunities of the country. On the other hand, the higher national income and the lower tariff rates in the developed countries can increase the export opportunities of Pakistan in these countries. Moreover, we observe an ambiguous effect of other explanatory variables such as population, wholesale price index, and trade cost on the export opportunities of Pakistan.

The Diagnostic Cheeks of the five models are given in section B (Diagnostic Cheek) of table 5.2. On the basis of highly significant values of the Wald chi^2 statistics, we can reject the null hypothesis stating that coefficients for all variables in the model are zero. The diagnostic tests of the five models are given in section C of table 5.2. On the basis of the insignificant values of Arellano-Bond test for AR(2), we observe the evidence of second-order serial correlation in the estimated fish, food and pulp and paper models, which is additional support of the correct instrument specification of the models. Since we use the second lag operator in the estimated textile and building materials models, therefore; we observe significant values of the Arellano-Bond test for AR (2). The estimations cannot provide an Arellano-Bond test for AR (3) however; we expect an insignificant value of the Arellano-Bond test for AR (3). Moreover, the problem of endogeneity is tackled by using the instrumental variable technique. On the basis of insignificant values of the Sargen and Hansen test for over-identified restrictions, we cannot reject the null hypothesis that instruments as a group are exogenous; this shows that we use valid instruments.

Table 5. 2: Results of the System GMM Gravity Model Estimations

Model:	1	2	3	4	5
A. Dependent Variables	Exports of Fish and Fish Products (ln)	Exports of Food and Food Products (ln)	Exports of Textile Products (ln)	Exports of Pulp and Paper Products	Exports of Building Materials (ln)
GDP (ln)	0.0950*	0.987***	0.316***	0.515***	0.612***
	(0.0567)	(0.155)	(0.0653)	(0.176)	(0.233)
Trade Cost (ln)	0.0674	0.620***	-0.282***	0.111	-0.851***
	(0.130)	(0.134)	(0.0588)	(0.208)	(0.285)
Number of Eco-Labels (ln)	-0.144**	-0.621*	-0.162**	1.309***	0.632***
	(0.0730)	(0.337)	(0.0652)	(0.247)	(0.234)
Cost of Eco-Labels (ln)	-0.0385***	-0.184**	-0.0785*	-0.786***	-0.593***
	(0.0118)	(0.0917)	(0.0463)	(0.173)	(0.202)
Wholesale Price Index (ln)	0.658***	0.517	-0.269	-1.506***	1.218
	(0.194)	(0.370)	(0.177)	(0.446)	(0.876)
Population (ln)	-0.0785	-0.171***	0.0383	-0.0393	0.349***
	(0.0640)	(0.0644)	(0.0310)	(0.0861)	(0.110)
Manufacturing Tariff (ln)	0.107**	0.233**	-0.0574	0.0673	0.156
	(0.0479)	(0.118)	(0.0413)	(0.123)	(0.190)
Exchange Rate (ln)	-0.0395***	-0.154***	-0.0390***	-0.0750	-0.102***
	(0.0148)	(0.0384)	(0.00823)	(0.0543)	(0.0337)
First Lag of Exports of Fish and Fish Products (ln)	1.027***				
	(0.0325)				
First Lag of Exports of Food and Food Products (ln)		0.514***			
		(0.0749)			
Second Lag of Exports of Textile Products (ln)			0.736***		
			(0.0410)		
First Lag of Exports of Pulp and Paper Products (ln)				0.430***	
				(0.105)	
Second Lag of Exports of Building Materials (ln)					0.354**
					(0.154)

Constant	-4.586** (2.078)	-19.45*** (4.187)	0.130 (1.149)	4.935** (1.968)	-9.351* (5.151)
B. Diagnostic Cheek					
Wald Chi^2 Statistics	2286.32 ***	1044.60 ***	1013.59 ***	6848.58***	1262.45***
C. Diagnostic Test					
Granger Causality	0.241	7.890***	6.107***	11.054***	16.171***
	27.944***	0.018	4.776***	3.248**	3.703**
Durbin Endogeneity Test	8.202**	27.754***	8.570**	6.953**	5.396*
Wu-Hausman Endogeneity Test	8.144**	29.839***	8.522**	6.870**	5.299*
Arellano-Bond Test for AR(2)	-0.03	1.24	-6.01***	-0.35	-2.12*
Sargan Test for Over-Identified Restrictions	38.80	9.01	1.55		35.83
Hansen Test for Over-Identified Restrictions				20.22	

Source: Computed by authors based on UNCOMTRADE, WDI dataset for the year 2003-14, Eco-label index website and websites of eco-labels providing organization for the year 2016.

- Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

CHAPTER 6: GOVERNMENT AND NATIONAL ECO-LABEL SCHEMES

In this chapter, we identify a wide range of factors which motivate the government to introduce a national eco-labeling scheme and also investigated the degree of interest of a country to introduce a national eco-label scheme keeping into account the number of eco-labels adopted by its trading partner countries. This chapter consists of three sections; the first section deals with the current state of national eco-labeling schemes in the trade partner countries of Pakistan. The second section deals with the descriptive statistic of influencing factors induce a country's government to introduce a national eco-labeling scheme. In the last section, we provide information on the estimated results of the panel logit model.

6.1. The Current State of National Eco-Labeling Schemes in the Trade Partner Countries of Pakistan

The details of the current state of national eco-labeling schemes of the countries included in this study are given in figure 6.1. From this table, we observe that out of 54 countries half of the countries established their own national eco-label schemes while the remaining half countries did not establish their own national eco-label scheme. The information of national eco-labeling schemes of the countries that are Pakistan's trading partners and who established their own national eco-labeling schemes is given in Appendix H, table H1.

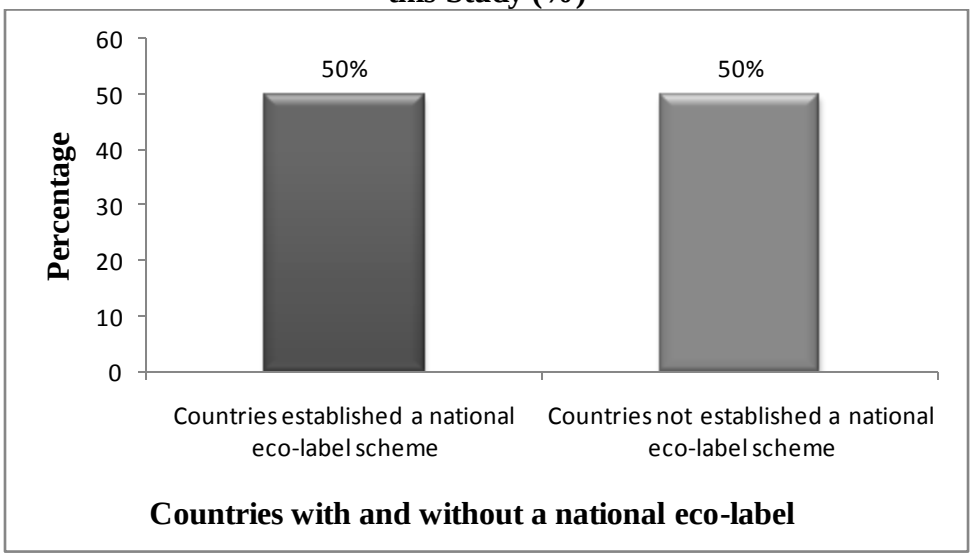
6.2. Descriptive Statistics

The descriptive statistics of possible factors which motivate a government to introduce a national eco-labeling scheme are given in table 6.1. It is evident from the table that the trade partner of Pakistan with high per capita income, high research and development (R&D) expenditures, high technology exports, high per capita CO_2 emissions, a larger population, a greater number of eco-

labels, less dependence on exports, a lower rate of manufacturing tariffs, trade deficit, reasonable economic freedom, and government integrity already introduced their own national eco-labeling schemes.

In other words, the trade partner countries of Pakistan which have economies on the top development stages, with a large population, who have the relative production cost advantage in the production of certain goods and who have strong relations with their trade partners already introduced their own national eco-labeling schemes. As a whole we observe high real per capita GDP, reasonable economic freedom and government integrity, medium size population, high R&D expenses, high export value index, high technology exports, lower net trade, lower manufacturing tariff, a high number of eco-labels, and high per capita CO_2 emissions for the fifty-four trading partner countries of Pakistan (see last column of table 6.1).

Figure 6. 1: Current State of National Eco-Labeling Schemes of the Countries Included in this Study (%)



Source: Based on data obtained from Eco-label Index, 2016.

Table 6. 1: Descriptive Statistic

Variables	Definitions	Countries with a national eco-labeling scheme	Countries without a national eco-labeling scheme	Overall mean
		Mean & SD	Mean & SD	Mean & SD
Explanatory				
Economy's Stages of Development (E)				
Real Per Capita GDP	Real GDP divided by the total population of the country) (Constant 2005 US$).	27023.2 (15690.9)	18956.5 (78861.6)	22989.9 (56974.6)
Economic Freedom Index	Used to measure economic freedom in a country.	67.6598 (8.1622)	60.0266 (10.8323)	63.8432 (10.4999)
Government Integrity Index	Used to measure the status of government integrity in a country.	66.8635 (22.4688)	40.4451 (23.6320)	53.6543 (26.5674)
Population Effect (POP)				
Population	The number of peoples living in the country (Million).	128.4721 (312.1663)	34.1910 (39.8890)	81.3014 (227.3816)
Relative Production Cost Advantage (C)				
R&D Expenses	Research & Development expenses (current US$ million).	59535.8 (117957.3)	4152.4 (7400.1)	31844.1 (88009.6)
Export Value Index	Index to measure the country's exports performance 2000=100).	183.4864 (135.6292)	301.9437 (960.3302)	242.6628 (687.7581)

Continue…..

Variables	Definitions	Countries with a national eco-labeling scheme	Countries without a national eco-labeling scheme	Total
		Mean & SD	Mean & SD	Mean & SD
Strategic Interaction with Trade Competitors (S)				
High Technology Exports	High-technology exports are the exports of products with high R&D intensity (current US$ million).	41509.9 (69395.1)	4088.2 (13986.1)	22799.1 (53421.3)
Net Trade	The difference between exports and imports (BOP, current US$ million).	-1898.5 (105742.3)	7918.9 (27157.9)	3010.2 (77319.8)
Manufacturing Tariff	Manufacturing tariff rate (%).	3.7662 (4.3915)	9.9293 (8.8889)	6.8477 (7.6557)
Number of Eco-labels	The number of type I, II and III eco-labels in a country (Number).	30.3774 (23.1409)	7.6949 (8.1001)	19.0361 (20.7131)
Per Capita CO_2 Emissions	The ratio of total CO_2 emissions to total population (Metric tons).	11.1178 (12.6282)	7.5290 (12.2627)	9.3234 (12.5702)

Source: Computed by authors based on WDI 1994-2014, Economic freedom index, 2017 and eco-label index 2016.
Note: SD represents Standard Deviation given in the parenthesis.

6.3. Results of the Estimated Panel Logit Model

Due to the binary dependent variable and panel structure of the model first, we estimate the Random Effect (RE) logit regression. However, the RE panel logit regression coefficients perform relatively poorly, most of the variables are insignificant. Therefore, we are not interpreting these results. The estimated results of the RE logit regression are presented in Appendix H, table H2. Since the outcome does not vary in any group, therefore; we do not estimate the fixed effect (FE) panel logit regression. Due to the problems that persist in RE and FE logit regression, we estimate Mixed Effect Panel logit model. The results of the estimated mixed effect panel logit model of influencing factors induce a government to introduce a national eco-labeling scheme are given in table 6.3. Along with the coefficients of the panel logit model, we also reported its corresponding marginal effect in the same table.

We observe a significant coefficient for the variable real per capita GDP, which indicates that the economic growth in a country motivates its government to introduce a national eco-label scheme. Monteiro (2010) found the similar result by analyzing the decision of a country to introduce an eco-label. An explanation for this result is that, as the economy grows, the government has the incentive and the means to introduce a national eco-labeling scheme.

A negative and significant coefficient is observed for the economic freedom index, indicating that economic freedom reduces the probability of a country's government to introduce a national eco-label scheme. Grolleau & El Harbi (2008) also found the similar result by analyzing the determinants of the adoption of eco-labeling schemes among countries. The possible reason for this negative relationship is that the higher economic freedom in a country may provide the right to producers to adopt private or third party eco-labeling schemes. The

preference of the producers toward private and third-party eco-labels in a country may reduce the probability that its government introduces a national eco-label scheme.

The positive and significant coefficient of the government integrity index shows that increase in government integrity, in a country increase the probability that its government introduces a national eco-label scheme. The highest moral and ethical standard of a government provides him the opportunity to introduce and implement environmental instruments because the consumers, producers and third-party organizations trust on those environmental instruments which are introduced by a government with high integrity. From the above results, we conclude that countries which have reached a high stage of economic development are more likely to introduce its own national eco-label scheme.

The coefficient on population is positive and statistically significant indicates that an increase in the population of environmentally conscious consumers induces a government to introduce a national eco-label scheme. Monteiro (2010) found insignificant coefficient for the population but instead of the total population he used the population below 45 years. Since we used the population size as a proxy for the existence of eco-consumers, therefore; the increase in the population of a country may increase the number of eco-consumers, who may demand eco-label products. This increasing demand from the increasing number of eco-consumers for eco-labeled products may force a government to introduce a national eco-label scheme.

The negative and significant coefficient on the export value index shows that an increase in the export dependency of a country reduces the motivation of its government to introduce a national eco-label scheme. This result is against the statement of Monteiro (2010) and Porter & Van der Linde (1995), they state that those countries which heavily depend on exports, introduce

a national eco-label scheme, to maintain the volume of their exports. If the country is a net exporter then, it will easily restore the cost of eco-labeling. This improves the relative production cost advantage of an economy depend heavily on exports. Several countries in the sample are the net exporters of certain commodities. However, the existences of various financial and technical barriers in these countries reduce their relative production cost advantage and they cannot easily restore the cost of a proposed national eco-labeling scheme. Therefore, the relative production cost disadvantage in these countries stops them to introduce their own national eco-labeling scheme.

On the other hand, we observe the positive and significant impact of the research and development expenditure (R&D) on a government motivation to introduce a national eco-labeling scheme. This result is a line with Monteiro (2010) and Porter & Van der Linde (1995) they pointed out that, the increase in the R&D expenditures in a country leads to the diffusion of eco-innovation, which ultimately increase the probability that the environmental authorities of the country introduce a national eco-label scheme. Introducing an eco-label scheme eventually improves the relative production cost advantage of an economy in producing different products. From these results, we conclude the ambiguous impact of a country's relative production cost advantage on its government motivation to introduce a national eco-label scheme.

The positive and significant coefficient for high technology exports indicates that if a country wants to increase its high technology export share in the international market, it would be more interested to introduce a national eco-labeling scheme. This result is in line with Monteiro (2010) and Grolleau & El Harbi (2008) who found that economies with higher technological exports capacities use the national eco-labeling scheme as a tool to enhance and reinforce their high technological potential in the international market.

We observe negative and significant coefficient for the net trade show that if a country wants to improve its economic relations with the rest of the world through trade, then it will not introduce a national eco-label scheme. The opponents of the eco-labeling such that Ralph & Stefan (1999), Hollingsworth (2000), Wessells et al (2001) and Joshi (2004) argued that the existing eco-labeling schemes reduced the export opportunities of developing countries. Since the developing countries depend heavily on their exports, therefore; introducing a national eco-labeling scheme, by the developed countries may reduce the exports of developing countries and weaken down their economic relations. Therefore, in a lodge to sustain strong economic relations with trading partners, the governments may not stick in its own national eco-label scheme.

The positive and significant coefficient for the manufacturing tariff indicates that the desire of a country to reduce the trade cost for its partners motivate its government to introduce a national eco-labeling scheme. This result is in line with Piotrowski & Kratz (2005) who stated that the increasing interdependence among the nation's economies due to eco-labeling schemes reduce their trade costs. The economist treats manufacturing tariff as a non-tariff trade barrier, however, Monteiro (2010) pointed out it significantly increases the trade cost. Therefore, introducing a national eco-label scheme may help the countries who want to reduce the trade cost for its trading partners.

The positive and significant coefficient for the number of other eco-labels indicating, that the existence of other eco-label schemes (type II, and Type III) in the trading partner countries induces a government to introduce its own national eco-label scheme. This result is against the statement of Monteiro (2010) who stated that a domestic national eco-labeling scheme will be effective when there are few trading partner countries having the same standard requiring eco-labeling schemes. When the number of eco-labels similar to the domestic eco-label increases

then the domestic eco-label lost its value. In this situation, the government may decide to abandon the idea of an eco-label scheme. However, this statement is criticized on the ground based on the observation that the national, international and private eco-label schemes persist in the trade partners are different in procedure, requirements, and standard, therefore, it cannot discourage a country to introduce a national eco-label scheme. Moreover, most of the countries under consideration face the risk of rejecting their products in the developed partner countries' markets. On the other hand, due to the complex procedure, the strict standard requirement and high costs of acquiring eco-labels, it is very hard for a country to adopt a foreign eco-label scheme. In this situation, it is quite easy for a country to introduce its own national eco-label scheme, according to their domestic and foreign market requirements. Thus, the availability of the other eco-label schemes in the trading partner countries encourages a country's government to devise its own national eco-label scheme. This result confirmed the fact that the interest of a country in introducing a national eco-label scheme increases if its trade partners introduced and adopt a diverse range of eco-labels.

For the last variable per capita CO_2 emissions we observe positive and significant coefficient indicate that the desire of a country to reduce its pollution or per capita CO_2 emissions motivate its government to introduce a national eco-label scheme. This result is in line with the statement of Daniel & Peter (2005) who stated that the eco-labeling schemes are designed under the aim to reduce global environmental problems such as to reduce CO_2 emissions and provide safety to biodiversity. These environmental features motivate a country's government to introduce a national eco-labeling scheme. From these results, we conclude that the desire of a country to strengthen their relations with their trading partners increase the probability of its government to introduce a national eco-label scheme.

According to Grolleau & El Harbi (2008), the panel logit model treats the explanatory variables as latent variables. The positive and significant coefficient of the latent variable indicates the situation where a country gains from introducing a national eco-labeling scheme. Moreover, the positive signs of the latent variable indicate that the gains from introducing the national eco-labeling scheme are greater than its costs. Therefore, the positive signs on real per capita GDP, government integrity, population, R&D expenditure, high technology exports, manufacturing tariff and per capita CO_2 emissions shows that from introducing a national eco-label scheme, a country can improve its economic growth, increase its government integrity, increase demand for eco-labeled products, increase its R&D expenditure, increase its high technology exports, reduces its trade cost and per capita CO_2 emissions ceteris paribus. On the other hand, the negative signs on economic freedom index, export value index and net trade show that introducing a national eco-label scheme can reduce the economic freedom, dependency on primary products exports and net trade of the country. From these results, we concluded that the gains from introducing the national eco-labeling scheme are greater than its costs.

The positive and significant value of the marginal effect of the variables real per capita GDP, government integrity, the number of eco-consumers, R&D expenditures, high technology exports, manufacturing tariff, the number of other eco-labels and per capita CO_2 emissions indicating that one unit increase in these variables increases the probability that a country's government introduced a national eco-label scheme. On the other hand, the negative and significant value of the marginal effect of economic freedom, export value index and net trade shows that one unit increase in these variables reduces the probability that a government

introduces a national eco-label scheme. A significant Wald chi^2 statistic suggests rejecting the null hypothesis that coefficients for all variables in the model are zero.

Table 6. 2: Panel Logit Regression Results for Estimating the Impact of Influencing Factors of Introduction of National Eco-Labeling Scheme

Dependent Variable National Eco-Label (Dummy)	Coefficients	Marginal Effect
Economy's Stages of Development		
Real Per Capita GDP (ln)	0.986*** (0.170)	0.237*** (0.040)
Economic Freedom Index (ln)	-2.852*** (1.091)	-0.686** (0.264)
Government Integrity Index (ln)	0.751* (0.413)	0.181* (0.099)
Population Effect		
Population (ln)	0.851*** (0.208)	0.205*** (0.049)
Relative Production Cost Advantage		
R&D Expenses (ln)	0.415** (0.165)	0.099* (0.040)
Export Value Index (ln)	-0.788*** (0.184)	-0.189*** (0.044)
Strategic Interaction with Trade Competitors		
High Technology Exports (ln)	0.205*** (0.0252)	0.049*** (0.005)

Net Trade (ln)	-0.485***	-0.116***
	(0.101)	(0.024)
Manufacturing Tariff (ln)	0.373**	0.089*
	(0.164)	(0.039)
Number of Eco-Labels (ln)	1.261***	0.304***
	(0.196)	(0.048)
Per Capita CO_2 Emissions (ln)	0.846***	0.204***
	(0.198)	(0.045)
Constant	-17.71***	
	(5.005)	
Diagnostic Cheek		
Observations	1,134	
Wald Chi^2 Statistics	235.73***	
Log-Likelihood	-290.67	

Source: Computed by authors based on WDI 1994-2014, Economic freedom index, 2017 and eco-label index 2016.

- Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

In this chapter, we draw the conclusions based on the findings of this study and provide recommendations for policymakers. Finally, we present the limitations of the study and recommendations for future research.

7.1. Conclusions

This study has three parts, the first part of the study deals with eco-labeling and sustainability in the textile industry of Pakistan. The second part deals with international eco-labeling schemes and the export opportunities of Pakistan and the third part discusses government and national eco-label schemes. In the first part of this study, we analyze the existing pattern of eco-labeling schemes adopted by Pakistani textile firms and evaluate the effect of eco-labeling on their environmental and economic performance. We also identify the factors influencing a textile firm's decision to acquire an eco-label for its products. For these objectives, we use data for 128 firms from the textile industry listed on the Pakistan Stock Exchange from 2009 to 2015. In addition, for empirical estimations, the study uses Three-Stage Least Squares (3SLS) and logit models.

The results show that, out of 128 textile firms in the sample, the firms with eco-labeled products are only 32%, which include 21% exporting firms and 11% non-exporting firms. Out of 32% textile firms with eco-labeled products, 22% of them belong to the yarn manufacturing textile sector. Moreover, most of the firms acquired type III eco-label schemes. In addition, the firms in the textile industry of Pakistan acquired only ten types of eco-label schemes. Regression results from three stage least squares (3SLS) estimator show that the textile firms with an eco-label have higher environmental and economic performance. This indicates that the adoption of

eco-labels promotes the sustainable growth of the textile firms. Besides, eco-labeling has the potential to bring production sustainability in the textile industry of Pakistan. In addition, we observe the evidence of a negative and significant relationship between the environmental and financial performance of the textile firms. This confirms that our findings consistent with the traditionalist school of thoughts. Further, we observe the evidence of a negative and significant relationship between the environmental and competitive performance of the textile firms. This confirms that our findings are against the revisionist school of thoughts.

Regression results from logit model show that a large textile firm is more likely to adopt an eco-label relative to the medium or small firm, while an old textile firm is less likely to adopt an eco-label relative to a new textile firm. As expected, an exporting textile firm is more likely to adopt an eco-label. The environmental performance, as well as the financial performance of the textile firm, increases the likelihood of eco-label adoption. An increase in the number of machinery with a textile firm and increase in its labor costs increases the likelihood of eco-label adoption, while an increase in the tax expenses of the textile firm and its material costs decreases the likelihood of eco-label adoption.

In the second part of this study, we investigate the potential impact of eco-labeling on the export opportunities of Pakistan. For this part, we use a panel dataset of 24 industrialized trading partners of the country from 2003 to 2014. For empirical estimations, in this part of the study, we apply the standard gravity model for international trade. Results of the Gravity model show that the number of eco-labels has a negative and significant impact on the fish, food and textiles exports of Pakistan. This indicates that the complex procedure, strict standard requirements and a diverse range of eco-labels exist in the developed partner countries can reduce the exports opportunities of Pakistan. The cost of eco-labels has a negative and significant impact on the

fish, food, textile, pulp and papers, and building materials exports of Pakistan. This indicates that the higher certification and labeling costs of acquiring eco-labels can reduce the exports of Pakistan to developed countries. Besides, the eco-labels the higher exchange rate in the developed countries can also reduce the export opportunities of the country. On the other hand, the higher national income and the lower tariff rates in the developed countries can increase the export opportunities of Pakistan in these countries. Moreover, we observe an ambiguous effect of other explanatory variables such as population, wholesale price index, and trade cost on the export opportunities of Pakistan.

The aim of the third part of this study is to identify the factors which motivate the government to introduce a national eco-labeling scheme. For this part, we use panel data of 54 countries that are Pakistan's trade partners from 1994 to 2014. For empirical estimations, we use panel logit model. We generalize the results of the study to Pakistan. The results of the panel logit model show that a country with high economic growth and high government integrity is more likely to introduce a national eco-label scheme. A country with a reasonable number of environmentally conscious consumers is more likely to introduce a national eco-label scheme. A country which devoted a larger share of its expenditures for research and development (R&D) is more likely to introduce a national eco-label scheme, while a country which heavily depends on exports is less likely to introduce a national eco-label scheme. A country which exports high technology products is more likely to introduce a national eco-label scheme. A country which faces a diverse range of eco-labels in its trade partner countries is more likely to introduce a national eco-label scheme. This indicates that the interest of a country in introducing a national eco-label scheme depends on the eco-label schemes exists in its trading partner countries. An economically free country is less likely to introduce a national eco-label scheme. The high CO_2

emissions/pollution load of a country increases the likelihood of a national eco-label introduction. A country with a high manufacturing tariff is more likely to introduce a national eco-labeling scheme, while a country with a positive net trade is less likely to introduce a national eco-label scheme.

7.2. Recommendations/Policy Implications

The results derived from this research have great policy relevance. The results of the first part of the study show that in the textile industry of Pakistan only 32% of textile firms acquired eco-labels. One reason for this narrow adoption of eco-labels by the firms may be either limited information about these firms about the eco-labels or they are unaware of the importance of eco-labels. This laid responsibility for the ministry of industries, the ministry of environment and textile organization of the country and also on the eco-labels assigning organizations such as Global Ecolabeling Network (GEN) and International Social and Environmental Accreditation and Labeling Alliance (ISEAL) to provide full information about the characteristics and importance of eco-labels to textile firms. In this regard, the arrangement of seminars and workshop will be a good option. The second reason for perceiving barriers to acquiring eco-labels such as the higher costs associated with eco-labels and the strict standard requirements of the eco-labels. It laid the responsibility on the GEN and ISEAL to keep the cost of eco-labels in limits and to put reasonable standard requirements for the eco-labels. This will enable the textile firms in the developing country like Pakistan to acquire eco-labels easily. The provision of subsidies from governmental organizations on the eco-label adoption will also beneficial in this regard. With the help of government subsidies on adoption of eco-label, the textile firms will easily fulfill the strict standard requirements of eco-labels and will easily bear the cost of eco-labels.

Another important result is that compared to the non-exporting textile firms, 21% of the exporting textile firms acquired eco-labels. The increasing demand for eco-label products from the foreign consumer may force the firms in the textile industry of Pakistan to acquire an eco-label or the firms may acquire eco-label to comply better with foreign environmental regulations and policies. On the basis of this result, we can provide two policy options, one for the management of the firms and the second for the environmental agencies of Pakistan. Through the provision of eco-labeled certified products, the textile firms of Pakistan can attract new consumer from the international market and can be occupied a major share of the international textile market. Moreover, the firms who did not export their products due to the strict foreign environmental regulations and policies can easily comply with these regulations just by adopting eco-label. This will increase the export efficiency of the textile industry. Therefore, if the management of the textile firms wants to attract international consumers and want to export or increase the export of their products to the international market, then they must be acquired eco-labels. In addition, the environmental protection agencies of Pakistan may not treat eco-label as an environmental policy instrument. Therefore, it is the need of the day that the environmental protection agencies of Pakistan, include an eco-label as an environmental policy instrument to their existing set of environmental policy instruments. This will force the domestic textile firms to acquire eco-labels.

Moreover, we find evidence that the adoption of eco-label improves the environmental performance of the firms. Currently, the management of a textile firms struggles continually to search different environmental instruments for the reduction of their pollution load. In this regard, the adoption of eco-label will be a good option because it obligated the textile firms to use environmental efficient raw materials and technologies, use less water, and discharge less

effluent into the water. Comply with the requirements of eco-label quickly improve the environmental performance of the textile firms. This laid responsibility for the management of the Pakistani textile firms to acquire eco-labels for their products. The adoption of eco-labels will improve the environmental performance of the textile firms as well as it will likely reduce the pollution load of the textile industry.

Further, in the textile industry of Pakistan, the adoption of eco-label improves the financial performance of the textile firms. Since the eco-consumers are ready to pay a high price premium for environmentally sound products. The increasing demand for environmentally sound products forced the management of the textile firms to search different environmental instruments for their products to fulfill the demand of eco-consumers and to gain a huge amount of green premium from them. In this regard, the adoption of eco-label will be a good option because it enables the firms to provide environmentally sound products and resultantly earn a high price premium for them. This laid responsibility for the management of the firms to acquire eco-labels for their product because it promises green premium and improvement in profitability. This also laid responsibility for the ministry of industries, the ministry of environment and textile organization in the country to force the non-eco-labeled textile firms to acquire eco-label. The adopting of eco-label by more textile firms will improve the financial position of the textile industry of Pakistan.

The adoption of eco-label also improves the competitive performance of the textile firms in the market. This is an impetus for the management of the firms to acquire eco-labels for their products. Through the adoption of eco-label, the firms can easily differentiate its environmentally sound products from conventional products. This will increase the market share of the firms and consequently will improve their competitive performance. Moreover, the

adoption of eco-labels by textile firms leads to competition among the firms on the basis of eco-label in the textile industry of Pakistan. Resultantly, the textile firms who acquired eco-label observe improvement in competitive performance. This laid responsibility for the ministry of industries, the ministry of environment and textile organization in the country to force the non-eco-labeled textile firms to acquire eco-labels. The adoption of eco-labels by more textile firms will increase the competition in the industry. Consequently, the textile firms with an eco-label will feel a positive improvement in their competitive performance.

In addition, the adoption of eco-labels promotes the sustainable growth of the textile firms. This laid responsibility for the management of the textile firms to acquire an eco-label for their product because it promises sustainable growth which is the need of the day. Furthermore, the adoption of eco-labels has the potential to bring production sustainability in the textile industry of Pakistan. This laid responsibility for the ministry of industries, the ministry of environment and textile organization in the country to force the non-eco-labeled textile firms to acquire eco-labels. The adoption of eco-labels by more textile firms will strengthen the production sustainability as well as it will increase sustainability awareness in the textile industry of the country. From this empirical analysis, eco-label emerged as a tool of production sustainability. This laid the responsibility on the international environmental organization and agencies to spread the information on the role of eco-labels in production sustainability throughout the globe that will enable different industries of different countries to come under the net of sustainability just by adopting eco-labels. We hope that, if once all the industries of the world adopt eco-labels, then we will move a one step forward toward a sustainable world.

The positive impact of environmental and financial performance of a textile firm decision to adopt an eco-label provides an impetus for the management of the firms, ministry of

industries, the ministry of environment and textile organization of the country, to take serious measures for the improvement of environmental and financial performance of the textile firms. Once the environmental and economic performance of the firms improves, they will be easily acquired eco-label for their products. Due to the absence of specific environmental or green taxes and the existence of various other taxes (i.e. Taxes on fuels, power, energy, machinery, water and raw materials consumption, etc.) in the textile industry of the country we find a negative impact of tax expenses or regulatory pressure on the firm's decision to acquire an eco-label. This laid responsibility for the environmental authorities and the ministry of industries to design a green tax policy for the textile industry of the country, which forces a firm in this industry to adopt a voluntary environmental scheme such as eco-label. At the same time, it is necessary that the authorities reduce other taxes from the textile firms, which will further decrease their cost of production and, consequently, increase their ability to adopt the expensive environmental standard such as eco-label.

The significant and positive impact of machinery and labor cost laid responsibility for the management of the textile firms to use environmentally friendly machinery and employ environmental conscious labor force if they want to acquire an eco-label for their products. The positive impact of firm size on its decision to adopt an eco-label indicates to the fact that larger firms have more resources and budget to adopt an eco-label scheme. This also laid responsibility for the management of the large textile firms to acquire an eco-label for their products. Moreover, we found a positive impact of the dummy variable export on the textile firm decision to adopt an eco-label. This result also laid responsibility for the management of the exporting textile firms in the country to acquire eco-labels. The adoption of eco-labels by the exporting textile firms will enable them to fulfill the demand of foreign consumers for environmentally

friendly product and will comply better to foreign environmental regulation and standard and to expected strict environmental regulations (both country-specific and international). In addition, the global increase in the demand for eco-labeled textile products in the international markets, increasing the risk of rejecting the domestic textile products on the basis of eco-label in the international market; therefore, this makes it essential for exporting textile firms to adopt eco-label schemes. In this regard, the formation and implementation of the strict regulations of governmental authorities on the exporting textile firms to adopt the eco-labels will be beneficial.

The results of the second part of the study show a potential adverse impact of the complex procedure, the strict standard requirement and high certification cost of eco-labels on the export opportunities of Pakistan. This result provides evidence to the World Trade Organization (WTO), International Standard Setting Organization (ISO), Global Ecolabeling Network (GEN), and International Social and Environmental Accreditation and Labeling Alliance (ISEAL) to find ways of making the eco-label process, standard, and cost, simpler, feasible and affordable that the developing country like Pakistan also participates in these eco-label schemes. In this regard, one policy option is to avoid complex procedure and strict standard requirements in the case of product groups that are largely produced by Pakistan. Another policy option is to exempt Pakistani producers from the eco-labels requirements and to limit them to comply with their domestic environmental standard. Another possibility is to develop an internationally accepted procedure and standard for eco-labeling schemes. The involvement of Pakistan in the eco-label procedure and standard-setting process will be also beneficial in this regard. The joint efforts from Pakistan and its developed partner countries in setting the eco-label procedure and standard will reduce the adverse impact of these eco-labels on the export opportunities in the country. The provision of technical and financial assistance on behalf of the

WTO, ISO, GEN, ISEAL, and developed countries will be also useful because it will provide help to the Pakistani producers to fulfill the process and standard requirements of various eco-label schemes.

Moreover, the exporting firms in Pakistan with weak financial position cannot bear the costs of eco-label schemes, therefore; it makes it essentials for Pakistan to establish their own eco-label schemes. In this regard, the technical and financial assistance will be useful; it will support the country to establish its own eco-labeling scheme. The shifts of the testing requirements of eco-labels from developed countries to Pakistan will be also beneficial in reducing the associated costs of acquiring eco-labels. Further, for spreading information on eco-labeling among the countries of the globe, there is the need for an international center. The exchange of information on eco-label through this center will be reducing the information costs of Pakistani producers. In this regard, the GEN, ISEAL, and International Trade Center (ITC) will play an important role.

The diversity in the number of eco-labels in the developed countries' markets is another important factor which can reduce the export opportunities of Pakistan. Mutual recognition between two or more than two eco-labeling schemes will be beneficial in this regard, such that if a product receives an eco-label from one scheme, it will automatically be eligible for another eco-labeling scheme if the product category exists in both schemes. We expect that if the concerned departments and organizations follow the above-mentioned suggestions, then it will enable the producers in Pakistan to take advantages of trading opportunities that may arise for eco-labeled products.

The results of the third part of the study show that the influencing factors which induce a government to introduce a national eco-label scheme are very important for policymakers in Pakistan. Pakistan is a growing economy which felt a positive improvement in its economic growth. Moreover, the country wants to increase its share of high technology export in the international market and want to reduce the trade cost for its partners. The country has also relative production cost advantage in the production of certain commodities. In addition, being a signatory to Kyoto Protocol the environmental agencies of the country desire to reduce its pollution level. In these circumstances, it is essential for the Pakistani government to introduce a national eco-label scheme.

The result that the interest of a country in introducing a national eco-label scheme depends on the eco-label schemes exists in its trading partner countries is especially relevant for policy makers of Pakistan. The existence of a wide range of eco-label schemes for different categories of products in the trade partner countries of Pakistan increases the risk of losing the competitive position of certain exporting commodities of Pakistan. Moreover, the increasing demand for eco-label products in these countries also increases the risk of rejecting Pakistani products in these countries on the basis of eco-labels. Therefore, it is essentials for the Pakistani government to establish its own eco-label scheme. In addition, due to the complex procedure, the strict standard requirement and high costs of foreign eco-label schemes, it is very hard for Pakistani producers to adopt a foreign eco-label scheme. In this situation, it is quite easy for the Pakistani government to introduce its own national eco-label scheme according to its domestic and foreign market requirements.

Treating the coefficient of the logit model as latent variables we can say that, if a country without a national eco-labeling scheme want to improve its economic development, increase

demand for eco-labeled products, increase its R&D expenditure, increase its high technology exports, while if it wants to reduce its per capita CO_2 emissions, trade cost and dependency on primary products exports ceteris paribus then it must introduce its own national eco-label scheme. This shows that introducing a national eco-labeling scheme improves the likelihood of economic, trade and environmental benefits. Therefore, if the government of Pakistan wants to take these benefits, then it must introduce its own national eco-labeling scheme.

For introducing a transparent, credible and an effective national eco-labeling scheme we propose a complete pathway for the government of Pakistan. For introducing a national eco-labeling scheme the government of Pakistan must follow the following steps: Follow guiding principles of ISO on eco-labeling. Clarify that who is responsible for defining criteria, certifying products, and usually administering the eco-labeling scheme. Choose the product categories and decide the certification criteria for these product categories. For this purpose, collect proposals on certification criteria and product categories from industry, trade organizations, consumers, and environmental protection organizations. Create criteria for the eco-labeling scheme. Opinion and comments from interested stakeholders should be included before finalizing the list of criteria. This list should be periodically revised. Make a list of producers, service providers, suppliers, retailers, distributors, importers, and institutions who can apply for the eco-labeling scheme. Set up an awarding process for the eco-label, consisting of testing and compliance verification, applicant licensing, and monitoring. Fix an application fee, the cost of verification, and an annual fee for use of the eco-label. These fees must depend on annual product turnover.

Moreover, for the establishment, implementation, and success of an effective national eco-labeling scheme, the government of Pakistan must form the following organizational structure: State Environmental Protection Administration; the government establishes this

administration to offer policy support for eco-labeling products and technology development, to issue guidelines and requirements for the proposed eco-labeling products, to conduct research on technology and policies related to eco-labeling, and to supervise the eco-certification. Certification Committee for Environmental Labeling; the government establishes this committee to advertise the national eco-labeling scheme and promote its products, to honor the outstanding units and individuals in the field of eco-labeling; and to advocate for related international communication. Environmental United Certification Center; the government establishes this center to enforce the requirement for improving the technique and quality of certification issued by State Environmental Protection Administration, to make sure the national eco-label is honored, managed, and supervised properly, and to cooperate with Certification Committee for Environmental Labeling in advertising and honoring the national eco-labeling scheme.

7.3. Limitations of the Study and Future Research

The analysis of eco-labeling and sustainability at the firm level is carried out only for the textile industry of the country. Other possibilities are to carry out the analysis for other important industries of Pakistan, namely footwear, food, fish, building materials and pulp and paper industries. The researcher can extend the study to other developing countries. In order to identify the influencing factors of a textile firm decision to adopt an eco-label, we use internal factors of the firm while ignoring the external factors. The possibility for other researchers is to use the external factors such that the environmental policies of the government, market demand for an environmentally sound product, the market price of the product, the increase in the number of eco-consumers, etc. Moreover, we do not find any proper dataset in the country which deals about the eco-label adoption status of the textile firms, the name of these eco-labels, and the role of these eco-labels on the textile firms' environmental and economic performance. Therefore, it

puts a great responsibility on the Pakistan Bureau of Statistic (PBS) to collect country-wide data on eco-labels at the firm level. It is quite easy for PBS if it just puts additional questions regarding eco-labels in the questioner of the next round of the Census of Manufacturing Industries (CMI).

The analysis of eco-labeling and the export opportunities of Pakistan is carried out only for the five exporting sectors of the country, namely fish, food, textiles, pulp and paper, and building materials. Other possibilities are to carry out the analysis for other important exporting sectors of Pakistan, namely footwear, beverages, pharmaceutical products, detergents, plastics and articles thereof, raw hides, skins, and leather. Moreover, we carry out the analysis only for one developing country Pakistan. The researcher can extend the study to other developing countries. In addition, we did not find the data on the exports and imports of eco-labeled products. In order to obtain accurate results on the impact of eco-labeling on the export opportunities of developing countries, data on the eco-labeled product is needed from both the exporting and importing countries. The collection of data on the exports and imports of eco-labeled products may be a complex and expensive process. There is a need for consultation and collaboration between the countries, WTO, ISO, GEN, and ISEAL to find ways to collect such type of data.

In the analysis of government and national eco-label schemes, we focus on introducing a national eco-labeling scheme, however; we cannot discuss the implementation and success of a national eco-label scheme. Other researchers can investigate the implementation and success of a national eco-label scheme. Moreover, during the introduction and implementation phase of a national eco-labeling scheme, a government faces several problems. We cannot identify these problems and the potential impact of these problems on the government decision to introduce a

national eco-label scheme. The researcher can extend the study for the identification of the problems associated with a national eco-labeling scheme and the potential impact of these problems on a government decision to introduce a national eco-labeling scheme. In addition, we carry out the analysis only for the trade partner countries of Pakistan. The researcher can extend the study to other developing countries. However, it is expected that results and general arguments advanced here would be quite robust and despite the limitations of the present study, it should positively contribute to the discussions on issues concerning eco-labeling and its possible impact on production sustainably, international trade and government.

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APPENDICES

Appendix A: Important Tables of Chapter 1

Table A1: Benefits from the Eco-Labeling Scheme

Types of benefits	Principle theme	Illustrative examples
Environmental benefits	Environmental improvement	In the year 1990, the environmental departments of Germany claimed that the Blue Angel for paints had reduced volatile organic compound emissions by 40000 tons.
	Easier compliance with environmental regulation	In the year 2003, the United States (US) Department of Army's Aberdeen Proving Ground claimed that by using eco-label paints they saved the cost of reporting, handling, storing and disposing of paints with hazardous substances.
Economic benefits	Cost saving	In the year 2003, the United States (US) Department of Army's Aberdeen Proving Ground claimed that they saved US$ 1.76 per gallon by using eco-label paints.
Competitive benefits	Greater market competitiveness	The ISO estimated around US$500 million premium for environmentally friendly products exports. By adopting various eco-label schemes a firm can earn a huge amount of this green premium and easily improve its competitive position in the international market.
Social benefits	Health and safety	Eco-labeled products are comparatively less harmful to human beings then non-eco-labeled products.

Source: Grolleau et al (2004).

Table A2: Certification Cost of EU Eco-Labeling Scheme

Fee	Minimum	Maximum	Concession
The application fee covers the costs of processing the application	ERU 300	EUR 1300	25 percent reduction for Small and Medium-size Enterprises (SMEs) and applicant from developing countries.
The annual fee for the use of the label = 0.15 percent of the annual volume of sales of the product	ERU 500 per product group per applicant	ERU 25000 per product group per applicant	25 percent reduction for SMEs and applicant from developing countries and 15 percent reduction for firms registered under ISO 14001 certification program.

Source: Eco-label index, 2016.

Table A3: Ranking of Textile Industry among other Industries

Components	Industry					
	Textile	Leather	Carpets	Sports Goods	Surgical instruments	Fish/ fish products
Environmental impact	5	5	4	1	1	2
Pollution charges	4	5	4	0	1	0
Export potential	5	2	3	3	4	2
Employment	5	3	2	2	2	N/A
Total	19	15	13	6	9	4
Ranking by importance	1st	2nd	3rd	5th	4th	6th

Source: Khan et al (2002).

Note: score (5= very high, 4= high, 3= middle, 2= low, 1= very low, 0= none). The score constructed on the basis of Census of manufacturing industries (CMI) data set for the year 1990-91, collected by the Federal Bureau of statistic (FBS), Government of Pakistan.

Table A4: Environmental Hazards Associated with the Textile Industry

Process	Source	Major impacts
Fiber cultivation	Pesticide use	Occupational health problems, reduction in soil fertility, harm to soil structure, soil aeration. And soil erosion, reduce genetic biodiversity.
Spinning	Spinning operation	Cause respiratory disease.
Washing	Detergents, soap, alkalis, wetting agents, foamers, and defoamers	Carcinogenic, depilation of ozone layer, potentially bio-accumulative, obnoxious odor, water turbidity, reduce light penetration,
Sizing/desizing	Sizing materials	Low biodegradability.
Bleaching	Bleaching materials	Low biodegradability, air pollutants emission.
Mercerizing		High pH value.
Dyeing	Dyestuff and chemicals	Carcinogenic, high allergy risk, high BOD, and COD, obnoxious odor, threatens fish spawning grounds, water system corrosion.
Finishing	Finishing materials	Extremely persistent effluent pollutants, high toxicity, occupational health hazards.

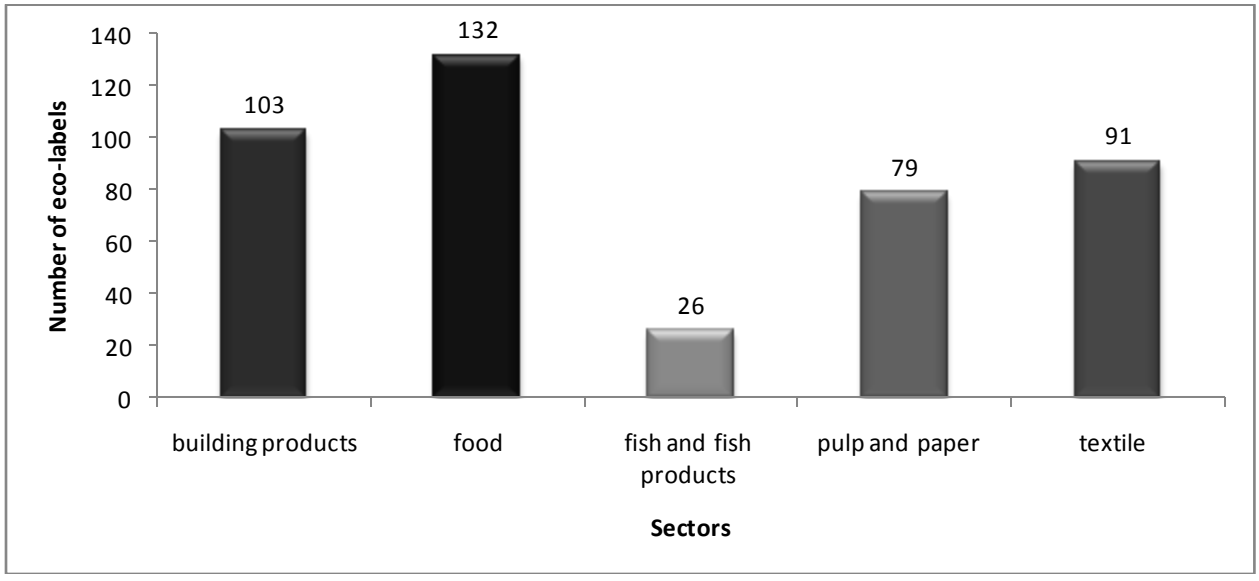
Source: Khan et al (2002).

Table A5: Details of Major Eco-Labels Acquired by Pakistani Textile Firms

Name	Verified by/verification body	Nature	Year of introduction
1. Oeko-Tax Standard 100	An independent organization (third party)	International	1992
2. Oeko-Tax Standard 1000	An independent organization (third party)	International	1995
3. Environmentally Friendly Product	It varies depending on the standard	National	1994
4. Fair-trade	An independent organization (third party)	International	1997
5. Organic Exchange Standard (OE) OE-100 & OE-Blended	An independent organization (third party)	International	2004
6. Better Cotton Initiatives (BCI)	An independent organization (third party)	International	2005
7. Global Organic Textile Standard (GOTS)	An independent organization (third party)	International	2006
8. Organic Content Standard (OCS) 100 and Blended	An independent organization (third party)	International	2013
9. TUV Rheinland Certified	Our own organization (second party)	Private	
10. EU Ecolabel	An independent organization (third party)	National	1992

Source: Visiting the website of textile firms or through email/phone listed in PSX.

Figure A1: The Number of Eco-Labels Faced by Five Exports Sectors of Pakistan in International Markets



Source: Eco-label Index, 2016.

Table A6: Export Performance of Fish and Fish Products, Food, Building Products and Textile Sectors of Pakistan

Export category	Value of exports per year (Rs. Millions)				
	2007-08	2009-10	2011-12	2013-14	2014-15
Fish and fish products	13329	19051	28590	37918	35462
Building products	27274	41652	47274	55443	48214
Textiles	517333	644877	804362	1055251	1030934
Food	135428	211845	245749	322122	308341
Total	693364	917425	1125975	1470734	1422951

Source: Economic survey of Pakistan, 2015-16.

Appendix B: Eco-Labeling and the Firm Environmental, Financial and Competitive Performance

Appendix B1: Assumptions of the Model

A. Firms' Behavior

For analyzing the firm's behavior, Youssef & Abderrazak (2009) put the following assumptions:

1. There are two firms in the market, Firm H who produce high environmental quality good (q^H) and firm L who produced low environmental quality good (q^L).
2. There is one eco-label and one national environmental standard in the market and each firm adopt at least one of the two alternatives. Let Firm H adopt eco-label L_H and Firm L adopt national environmental standard L_L. Moreover, the environmental characteristics of eco-labels are higher than the environmental characteristics of the national environmental standard.
3. Both the firms producing the same good.
4. Firm H charge price p^H against the provision of q^H while firm L charge p^L against the provision of q^L.
5. $q^H > q^L$ and $q^i \in [0, \infty]$, where $i = H, L$.
6. Firm H investment cost is $F(q^H) = \alpha {q^H}^2$ where $\alpha > 0$ to obtain the label L_H. Firm L investment cost is $F(q^L) = \gamma\alpha {q^L}^2$ where $\gamma > 0$ to obtain the national environmental standard L_L. These investment costs are consisting of the adoption, implementation and maintenance cost of eco-labels and environmental standard, respectively.
7. γ indicates to the investment efficiency of Firm L in environmental quality. If $\gamma \leq 1$ then Firm L is efficient in investment and invests more to improve its product environmental quality. On the other hand, if $\gamma > 1$ then Firm L is not efficient in investment and invests

less to improve its product environmental quality. Since, Firm L produced low environmental quality good, therefore, its investment to environmental quality improvement is low, so, $\gamma > 1$.

8. The marginal cost of quality of both the firms are constant, therefore, the marginal costs are normalized to zero $c_H = c_L = 0$.

B. Consumers' Behavior

1. The environmental awareness of the consumers is given such as they prefer most environmental sound good if several environmental qualities goods are available to them at the same price.
2. All consumers purchase one unit of the good.
3. For choosing among the environmental sound good the consumers have the test parameter $\theta \in [0,1]$.
4. The consumers purchase the environmental quantity $q^i (i = H, L)$ at price p^i.
5. The indirect utility function of the consumer is given by:

$$U(q^i, p^i; \theta) = \theta q^i - p^i$$

where $i = H, L$.

6. Let $\tilde{\theta}$ is the test parameter characterizes the marginal consumer who is indifferent to purchase high or low environmental quality good. Let $\tilde{\theta} = \left[\frac{p^H - p^L}{q^H - q^L}\right]$, the consumers whose $\theta \in \left[\frac{p^H}{q^H}, \tilde{\theta}\right]$ purchase the low environmental quality q^L, the consumers whose $\theta \in [\tilde{\theta}, 1]$ purchase high environmental quality q^H and the consumers whose $\theta \in [0, p^L]$ do not purchase the good.
7. The demand function for low and high environmental quality good are given by:

$$D^L(p^L, p^H, q^L, q^H) = \tilde{\theta} - \frac{p^L}{q^L} = \frac{p^H - p^L}{q^H - q^L} - \frac{p^L}{q^L}$$

$$D^H(p^H, p^L, q^H, q^L) = 1 - \tilde{\theta} = 1 - \frac{p^H - p^L}{q^H - q^L}$$

Appendix B2: Additional Assumptions

1. A consumer has no information regarding the qualities the firm provided under eco-label L_H and national environmental standard L_L. They did not know either the eco-label or the national environmental standard provide the higher environmental quality.

2. Although the consumer did not observe the true environmental qualities of the eco-label and the environmental standard, they believe that among the two alternatives one provide the highest environmental quality.
3. For analyzing the performance of the two environmental tools they observed the price of the good produced under the two alternative schemes. They consider the higher price of a good with eco-label or environmental standard is more environmentally friendly.
4. They observe the price p^L of Firm L good with national environmental standard L_L and price p^L of Firm H good with eco-label L_H.
5. They observed the price vector (p^H, p^L) and on the basis of this price vector they analyze the environmental qualities provided by the two firms.
6. The initial belief of the consumer is that both the Firms H and Firm L is a fifty percent chances to provide a higher environmental quality good such as $\mu^0 = \frac{1}{2}$. Where, μ^0 represents the priori consumers beliefs.
7. The profit function of Firm H is given by:

$$\pi^H(p^H, p^L, \mu(p^H, p^L))$$

where $\mu(p^H, p^L)$ is the consumer's posterior belief that the firm which offers the price p^H offers a high environmental quality product while the firm which offers the price p^L offers the low environmental quality good. Moreover, $\mu(p^H, p^L) = 1 - \mu(p^L, p^H)$.

8. Both the firms know the behavior of the consumers in the sense that no firm has a reputation advantage on the other, this implies that $\mu(p^i, p^i) = \frac{1}{2},\ 1 = L, H$. This means that if the two firms set the same price then the consumer posterior beliefs remain the same.
9. If $\mu(p^H, p^L) = 1$, then consumer believe that the firm which offers price p^H is a high environmental quality firm. If $\mu(p^H, p^L) = 1/2$, then they believe that there are fifty-fifty chances that both the firm are the higher environmental quality firms. If $\mu(p^H, p^L) = 0$ then they believe that the firm which offers p^L is a low environmental quality firm.
10. The expected quality of the consumer to obtain is given by:

$$\rho(\mu) = \mu q^H + (1 - \mu) q^L$$

where $\rho^0 = \frac{q^H + q^L}{2} = \rho(\mu^0)$.

11. If the price vector does not give any information on the environmental quality demand then the demand function for the firm is identical.

$$D^I(p,p) = \frac{1}{2}\left(1 - \frac{p}{\rho^0}\right) = \frac{1}{2}\left(1 - \frac{2p}{q^H + q^L}\right)$$

where I represent the incomplete information case.

Appendix C: Influencing Factors of Adopting Eco-Label by Firm

Appendix C.1: Assumptions

Pavlinovic (2013) put the following assumptions:

1. There are two types of firms, green (non-polluting) and brown (polluting) operating in the market. The green firms take into account the environmental impact of their production and therefore, take necessary measures for its reduction. On the other hand, the brown firms do nothing for the reduction of their emissions.
2. The environmental impact is global.
3. The green firm uses environmentally friendly technology and pays extra cost $e > 0$ for it while the brown firm does not use such technology and avoid the extra cost e.
4. There are four subgroups of green and brown firms such as green certified, green non-certified, brown certified, brown non-certified. The fraction of these firms is given by:

$$\alpha = \alpha_C + \alpha_N$$
$$\beta = \beta_G + \beta_B$$

   where α is the fraction of green firms ($1 - \alpha$ is the faction of brown firms), α_C is the faction of green certified firms, α_N is the fraction of green non-certified firms, β is the fraction of certified firms ($1 - \beta$) is the fraction of non-certified firms, β_G is the fraction of green certified firms and β_B is the fraction of brown certified firms. Moreover, $\alpha_C = \beta_G$, therefore, in the analysis only β_G is used.
5. There is a third party eco-labeling scheme in the market. However, the eco-labeling criteria are imperfect; therefore, a brown (polluting firm) can also acquire eco-label for its good, but with a higher cost.
6. c_g is the eco-label cost of the green firm while c_b is the eco-label cost of brown firm, where $c_g < c_b$.

7. The green firms bear the burden of double cost, such as the cost they bear against the use of environmentally friendly technology ye and the cost of eco-labeling c_g. On the other hand, the brown firm faces only the cost of eco-labeling c_b.
8. Besides, the environmental sound technology and eco-labeling costs, other production costs are normalized to zero.
9. The firm supply is infinite.
10. Consumer incomplete information, such as the consumer not knows the actual environmental performance of the good while the firms know the true environmental quality of the good they produce. Moreover, the consumer does not know about the firm technology but know about the eco-label status of the firm.
11. The consumer unit money metric utility function s given by:

$$m = \theta - p$$

where $\theta \in \{g, b\}$ and $g > b$, g green good, b brown good.

12. The producer is the price maker; it set the price equal to or lowers then consumer expected quality, therefore, the firm act like a monopolist.

Appendix D: Eco-Labeling and Government

Appendix D.1: Profit-Maximizing Output Level from the Use of the Two Technologies

$$(1-\alpha)\left(p_l^j \frac{\alpha}{\alpha w^j}\right)^{\frac{1}{1-\alpha}}$$

$$(1-\alpha)\left(p_u \frac{\alpha}{w^j}\right)^{\frac{1}{1-\alpha}}$$

$$X_e^j(\alpha, p_l^j)$$

$$X_o^j(\alpha, p_u)$$

Appendix E:

Table E1: Water Consumption and Waste Water Discharge from Per Unit of Textile Product

Category	Water consumption (l/kg of product)	Wastewater discharge (l/kg of product)
Yarn manufacturing	198.416	182.984
Fabric manufacturing	160	154.324
Dyeing and finishing	184.086	184.086
Printing	68.8945	68.8944
Sizing	3.9	3
Natural fiber manufacturing	120	115
Garments manufacturing	201.723	201.723
Knitting fabrics	120	115
Manmade fiber	33.8409	30.2033
Textile processing	166	160

Source: Chettiyappan et al (1999) and Alanya et al (2005).

Table E2: Effluent Discharge Level of BOD, COD, and TSS from Textile Industry of Pakistan

Province	Effluent (mg/l)		
	BOD	COD	TSS
Punjab	391.26	598.68	475
Sindh	273.8	400.1	1261
KP	475	160	2100
Baluchistan	475	160	2100

Source: Sial et al (2006), Nasir et al (2012), Nosheen et al (2000) and Imtiazuddin et al (2012).

Table E3: Pakistan and World Bank Effluent Discharge Standard for Textile Industry

Country/international organization	Effluent (mg/l)		
	BOD	COD	TSS
Pakistan	80	150	150
World Bank (WB)	30	160	50

Source: Dey & Islam (2015) and Zafar (2015).

Table E4: Descriptive Statistics of Amount of Effluent from Pakistani Textile Firms

Firm	Effluent (Million mg/l)		
	BOD	COD	TSS
Firm with eco-label	249844.6	1249223	416407.6
	(749981.4)	(3749907)	(1249969)
Firm without eco-label	5774696	3022091	2.32e+07
	(5.05e+07)	(1.71e+07)	(2.23e+08)
Total	4284440	2543883	1.70e+07
	(4.32e+07)	(1.48e+07)	(1.91e+08)

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.

Appendix F: Pooled OLS Estimation Results for the Effect of Eco-Label on the Textile Firms Environmental, Financial and Competitive Performance

Table F1: Pooled OLS Estimation Results for the Effect of Eco-Label on the Textile Firms Environmental and Financial Performance

Model:	(1)		(2)		(3)	
A. Dependent Variables	Environmental Performance Index (ln)	Net Profit Margin (ln)	Environmental Performance Index (ln)	Return on Capital Employed (ln)	Environmental Performance Index (ln)	Return on Equity (ln)
Net Profit Margin (ln)	0.0342***					
	(0.00905)					
Return on Capital Employed (ln)			0.00821			
			(0.00970)			
Return on Equity (ln)					-0.00636	
					(0.0110)	
Environmental Performance Index (ln)		0.0472		-0.0791**		-0.140***
		(0.0348)		(0.0339)		(0.0337)
Eco-Label (Dummy)	2.085***	0.0639	2.101***	0.384***	2.106***	0.433***
	(0.0350)	(0.0876)	(0.0344)	(0.0812)	(0.0339)	(0.0817)
Machinery (ln)	-0.174***	0.0195	-0.172***	-0.0342	-0.171***	-0.0330
	(0.0457)	(0.0176)	(0.0457)	(0.0231)	(0.0456)	(0.0228)
Material Cost (ln)	0.0802***		0.0693***		0.0686***	
	(0.0135)		(0.0128)		(0.0127)	
Labor Cost (ln)	0.0156*		0.0165*		0.0170*	
	(0.00933)		(0.00936)		(0.00951)	
Firm Size (ln)	-0.0439***	-0.108***	-0.0476***	0.0209	-0.0475***	0.0282
	(0.0149)	(0.0284)	(0.0152)	(0.0184)	(0.0151)	(0.0211)
Firm Age (ln)	0.141***	-0.0892*	0.143***	-0.0133	0.140***	-0.194***
	(0.0231)	(0.0464)	(0.0230)	(0.0420)	(0.0232)	(0.0604)
Capital Intensity Ratio (ln)		0.950***		0.0111		0.0114
		(0.0390)		(0.0416)		(0.0372)
Debt Equity Ratio (ln)		0.814***		0.946***		0.760***

		(0.0383)		(0.0253)		(0.0291)
Dividend Cover Ratio (ln)		0.0378**				
		(0.0177)				
Interest Cover Ratio (ln)		0.0863***				
		(0.0264)				
Yarn Manufacturing Sector (Dummy)	-0.144*		-0.153*		-0.157*	
	(0.0789)		(0.0811)		(0.0812)	
Textile Composites Manufacturing Sectors (Dummy)	-0.0816		-0.0983		-0.104	
	(0.0871)		(0.0897)		(0.0894)	
Punjab (Dummy)		0.149**		-0.456		-0.165
		(0.0734)		(0.325)		(0.208)
Sindh (Dummy)		-0.00245		-0.384		-0.0744
		(0.0815)		(0.328)		(0.213)
Khyber-Pakhtunkhwa (Dummy)		-0.0660		-0.524		-0.274
		(0.159)		(0.339)		(0.244)
Constant	-3.284***	1.001***	-3.112***	1.057***	-3.064***	1.774***
	(0.411)	(0.241)	(0.413)	(0.386)	(0.416)	(0.335)
B. Diagnostic Cheek						
Observations	896	896	896	896	896	896
R-Squared	0.812	0.817	0.810	0.795	0.810	0.674

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.

- Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table F2: Pooled OLS Estimation Results for the Effect of Eco-Label on the Textile Firms Environmental and Competitive Performance

Model:	(1)		(2)	
A. Dependent Variables	Environmental Performance Index (ln)	Market Share (ln)	Environmental Performance Index (ln)	Assets Turnover Ratio (ln)
Market Share (ln)	0.0843***			
	(0.0140)			
Assets Turnover Ratio (ln)			0.0203	
			(0.0127)	
Environmental Performance Index (ln)		0.257***		0.00226
		(0.0790)		(0.0389)
Eco-Label (Dummy)	2.103***	0.0241	2.143***	-0.190*
	(0.0321)	(0.188)	(0.0312)	(0.0972)
Machinery (ln)	-0.174***		-0.156***	
	(0.0455)		(0.0460)	
Firm Size (ln)	-0.0424***	0.634***	0.00481	0.162***
	(0.0132)	(0.0301)	(0.0127)	(0.0297)
Firm Age (ln)	0.151***	-0.282***	0.128***	-0.300***
	(0.0231)	(0.0981)	(0.0238)	(0.114)
Yarn Manufacturing Sector (Dummy)	-0.159*		-0.164*	
	(0.0810)		(0.0856)	
Textile Composites Manufacturing Sectors (Dummy)	-0.0969		-0.0961	
	(0.0889)		(0.0930)	
Punjab (Dummy)		0.208		-0.0856
		(0.335)		(0.0921)
Sindh (Dummy)		0.388		0.110
		(0.342)		(0.0987)

Khyber-Pakhtunkhwa (Dummy)		0.212		0.0892
		(0.375)		(0.152)
Constant	-1.303**	-10.44***	-2.390***	0.0416
	(0.523)	(0.564)	(0.433)	(0.359)
B. Diagnostic Cheek				
Observations	896	896	896	896
R-Squared	0.803	0.079	0.802	0.004

Source: Computed by authors based on annual reports and FSA data of Pakistani textile firms listed in PSX for the year 2009-15.

- Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix G: International Eco-Labeling Schemes and the Export Opportunities of Pakistan

Table G1: Names and Product Categories of Some Eco-Labels Schemes Exist in Trade Partner Countries of Pakistan

	Products Categories				
Name of eco-label	Fish and fish product	Food and food products	Textile	Pulp and paper	Building materials
AMA Biozeichen		Yes			
American Grass-fed		Yes			
Austrian Eco-label				Yes	
Best Aquaculture Practices	Yes	Yes			
Better Cotton Initiatives (BCI)			Yes		
BioGro New Zealand		Yes			
Bio-Siegel		Yes			
Bio Quebec		Yes			
Blue Angel			Yes	Yes	Yes
Canada Organic		Yes			
Carbon Neutral Product Certification					Yes
Carbon Reduction Label		Yes		Yes	Yes
Carbon Free Certified		Yes		Yes	Yes
Certified Wildlife Friendly		Yes	Yes	Yes	
China Environmental labeling			Yes	Yes	Yes
China Organic Food Certification		Yes			
China Water Conservation Certification					Yes
Danish Ø-mark		Yes			
Dolphin Safe/Dolphin friendly	Yes	Yes			
Eco-Leaf	Yes	Yes	Yes	Yes	Yes
Ecomark: Japan			Yes		Yes
EcoMaterial					Yes
Eco-Rail Mark					Yes
ENERGY STAR: USA					Yes
Environmental Product Declaration	Yes	Yes		Yes	Yes
Environmentally Friendly Product			Yes	Yes	
EU Eco-label			Yes	Yes	Yes
Fair Trade Certified	Yes	Yes	Yes		
Fairtrade		Yes	Yes		

Food Alliance Certified		Yes			
Global Organic Textile Standard (GOTS)			Yes		
Green Tick	Yes	Yes		Yes	Yes
Hungarian Eco-label				Yes	Yes
IMO Certified		Yes	Yes	Yes	
Indoor air PLUS					Yes
Japanese Agriculture Organic Standard (JAS)		Yes			
Korean Eco-label			Yes	Yes	Yes
LowCO2 Certification	Yes				Yes
Luomu Sun Singapore		Yes			
Marine Stewardship Council	Yes	Yes			
NPEHOV			Yes	Yes	Yes
Nordic Eco-label or Swan		Yes	Yes	Yes	Yes
Ocean Wise	Yes	Yes			Yes
Oeko-Tax Standard 100 &1000			Yes		
Ø-label Norway	Yes	Yes	Yes	Yes	
Organic Exchange Standard (OE) 100 & OE-Blended			Yes		
Organic Content Standard (OCS) 100 and Blended			Yes		
Organic Food Federation		Yes			
Rain Forest Alliance Certified		Yes		Yes	
Recycled Content				Yes	
Rhode Island Certified Organic		Yes			
Safe Agri-Food Product		Yes			
Sea Choice	Yes	Yes			
SEE What You Are Buying Into	Yes	Yes		Yes	Yes
Soil Association Organic Standard	Yes	Yes	Yes	Yes	
SustentaX			Yes		Yes
Texas Certified Organically Produced		Yes	Yes		
USDA Certified Bio-Based		Yes	Yes	Yes	Yes
USDA Organic		Yes			
Water Efficiency Labeling & Standard (WELS) Scheme					Yes
Water Sense					Yes

Source: Eco-label index, 2016.

Table G2: Results of the Gravity Model

Independent Variables	Estimation Method														
	RE					FE					Pooled OLS				
	Dependent Variables					Dependent Variables					Dependent Variables				
	Export of Fish & Fish Products (ln)	Export of Food & Food Products (ln)	Export of Textile Products (ln)	Export of Pulp & Paper Products (ln)	Export of Building Materials (ln)	Export of Fish & Fish Products (ln)	Export of Food & Food Products (ln)	Export of Textile Products (ln)	Export of Pulp & Paper Products (ln)	Export of Building Materials (ln)	Export of Fish & Fish Products (ln)	Export of Food & Food Products (ln)	Export of Textile Products (ln)	Export of Pulp & Paper Products (ln)	Export of Building Materials (ln)
GDP (ln)	0.308	1.18***	1.21***	1.21***	1.72***	0.307	2.26***	1.41***	1.014	2.31***	-0.885***	1.590***	1.248***	1.384***	1.314***
	(0.443)	(0.254)	(0.118)	(0.359)	(0.329)	(0.629)	(0.340)	(0.139)	(0.627)	(0.574)	(0.258)	(0.178)	(0.121)	(0.197)	(0.181)
Trade Cost (ln)	0.827	0.497	-0.46**	0.120	-0.957	1.550	0.304	-0.245	0.973	-1.693*	-2.025***	1.226***	-0.769***	-0.241	-0.578*
	(0.824)	(0.457)	(0.208)	(0.638)	(0.629)	(0.972)	(0.522)	(0.215)	(0.966)	(0.889)	(0.465)	(0.247)	(0.162)	(0.334)	(0.322)
Number of Eco-Label (ln)	-0.905	-0.949	-0.8***	0.838	-0.361	-0.176	-1.162	-0.69***	1.500	-0.615**	-0.939**	-0.957**	-0.247	0.187	0.691***
	(0.847)	(0.727)	(0.212)	(1.003)	(0.258)	(1.119)	(0.844)	(0.238)	(2.038)	(0.302)	(0.414)	(0.401)	(0.194)	(0.611)	(0.228)
Cost of Eco-Labels (ln)	0.394	0.637*	-0.0573	-0.450	0.113	0.278	0.980**	0.00845	-0.322	0.546	0.491***	-0.0324	-0.00147	-0.0862	-0.594***
	(0.262)	(0.356)	(0.107)	(0.813)	(0.291)	(0.476)	(0.404)	(0.106)	(1.516)	(0.354)	(0.0866)	(0.252)	(0.123)	(0.424)	(0.143)
Wholesale Price Index (ln)	-1.585	1.57***	0.65***	-1.99**	0.780	-1.98*	-0.091	0.350	-1.804	0.705	1.423	1.511**	0.561*	-2.180***	1.426**
	(0.965)	(0.519)	(0.231)	(0.842)	(0.803)	(1.155)	(0.609)	(0.254)	(1.148)	(1.068)	(1.345)	(0.681)	(0.325)	(0.769)	(0.683)
Population (ln)	0.515	-0.0869	-0.140	-0.475	-0.245	2.833	0.341	-3.51***	-9.18*	-7.94**	1.612***	-0.263*	-0.193***	-0.483***	0.0696
	(0.497)	(0.283)	(0.174)	(0.324)	(0.327)	(4.248)	(2.282)	(1.020)	(4.669)	(3.953)	(0.224)	(0.136)	(0.0636)	(0.138)	(0.157)
Manufacturing Tariff (ln)	0.0217	0.270	0.121	0.677**	0.186	0.286	0.0538	0.00151	0.631*	-0.0223	-1.561***	0.745***	0.0318	0.121	0.232
	(0.332)	(0.179)	(0.076)	(0.307)	(0.290)	(0.357)	(0.185)	(0.0775)	(0.358)	(0.323)	(0.430)	(0.186)	(0.100)	(0.232)	(0.214)
Exchange Rate (ln)	0.315	-0.0124	0.0599	-0.186	-0.115	-0.317	2.942***	0.772***	-0.157	1.198	0.490***	-0.30***	-0.0638**	-0.182***	-0.104**
	(0.251)	(0.151)	(0.098)	(0.138)	(0.140)	(1.102)	(0.576)	(0.241)	(1.091)	(1.002)	(0.0817)	(0.0639)	(0.0287)	(0.0654)	(0.0526)
Constant	-6.828	-31***	-9.9***	-2.763	-28.6**	-47.88	-67.57*	39.38**	140.9*	84.48	12.80*	-36.1***	-9.196***	-6.503	-22.76***

	(7.940)	(5.778)	(2.959)	(9.641)	(5.826)	(70.71)	(38.03)	(17.16)	(80.03)	(65.83)	(7.306)	(4.122)	(2.423)	(5.404)	(4.006)
Observations	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288
R-Squared	0.232	0.567	0.628	0.431	0.594	0.035	0.408	0.545	0.068	0.156	0.390	0.640	0.742	0.447	0.645
Number Of Id	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24

Source: Computed by authors based on UNCOMTRADE, WDI dataset for the year 2003-14, Eco-label index website and websites of eco-labels providing organization for the year 2016.
Standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Appendix H: Government and National Eco-Label Schemes

Table H1: National Eco-Labeling Scheme in the Trading Partner of Pakistan

Country	Eco-labeling scheme	Date of introduction
Germany	Blue Angel	1978
Canada	R-2000 Certificate	1981
United States	Texas Certified Organically Produced	1988
Denmark	Danish Ø-mark	1989
Finland	Nordic Ecolabel or Swan	1989
Japan	Eco Mark	1989
Norway	Nordic Ecolabel or Swan	1989
Sweden	Nordic Ecolabel or Swan	1989
Austria	Austrian Ecolabel	1991
India	Ecomark	1991
Australia	Energy Rating Programme: Australia	1992
Belgium	EU Ecolabel	1992
France	EU Ecolabel	1992
Greece	European Ecolabel	1992
Italy	EU Ecolabel	1992
Korea Republic of	Ecomark (Korean Eco-label)	1992
Netherlands	EU Ecolabel	1992
Poland	EU Ecolabel	1992
Portugal	EU Ecolabel	1992
Romania	EU Ecolabel	1992
Singapore	Green label Singapore	1992
United Kingdom	EU Ecolabel	1992
China	China Environmental Labeling	1993
Hungary	Hungarian Ecolabel	1993
Czech Republic	Environmentally Friendly Product	1994
Spain	Emblem of Guarantee of Environmental Quality	1994
Thailand	Thai Green Label	1994
New Zealand	Enviro-Mark	2001
Malta	ECO Certification	2002
Russian Federation	EcoMaterial,	2010

Source: Eco-label index, 2016.

Table H2: Names of the Countries Included in this Study

S. No	Country Name	S. No	Country Name
1	Netherland	28	Sierra Leone
2	Australia	29	Switzerland
3	Australia	30	Philippines
4	Portugal	31	Malaysia
5	Japan	32	Tanzania
6	United States	33	Ghana
7	Spain	34	Malawi
8	Italy	35	Kenya
9	Norway	36	Hong Kong
10	Greece	37	Myanmar
11	Sweden	38	Saudi Arabia
12	Belgium	39	Turkey
13	Canada	40	Bahrain
14	Germany	41	Egypt
15	Finland	42	Kuwait
16	Denmark	43	Cameroon
17	United Kingdom	44	Oman
18	France	45	Algeria
19	Romania	46	Qatar
20	Hungary	47	Jordan
21	Poland	48	Yemen
22	Czech Republic	49	Iran
23	Thailand	50	United Arab Emirates
24	Singapore	51	Lebanon
25	Korea Republic	52	Bangladesh
26	China	53	Sri Lanka
27	India	54	Pakistan

Table H3: Results of the Estimated Random Effect Panel Logit Regression

Dependent variable National Eco-label (Dummy)	Coefficients	Marginal Effect
Economy's Stages of Development		
Real Per Capita GDP (ln)	5.040*** (1.929)	5.040*** (1.929)
Economic Freedom Index (ln)	-13.57 (13.92)	-13.57 (13.92)
Government Integrity Index (ln)	2.785 (5.008)	2.785 (5.008)
Population Effect		
Population (ln)	3.604 (2.267)	3.604 (2.267)
Relative Production Cost Advantage		
R&D Expenses (ln)	3.031* (1.788)	3.031* (1.788)
Export Value Index (ln)	-6.009*** (1.775)	-6.009*** (1.775)
Strategic Interaction with Trade Competitors (S)		
High Technology Exports (ln)	1.222*** (0.306)	1.222*** (0.306)
Net Trade (ln)	-0.158	-0.158

	(1.142)	(1.142)
Manufacturing Tariff (ln)	0.839	0.839
	(1.608)	(1.608)
Number of Eco-Labels (ln)	3.750*	3.750*
	(1.917)	(1.917)
Per Capita CO_2 Emissions (ln)	4.728**	4.728**
	(2.056)	(2.056)
Constant	-138.5*	
	(71.23)	
Diagnostic Cheek		
Observations	1,134	
Wald chi^2 Statistics	62.01***	
Log-Likelihood	-22.8985	

Source: Computed by authors based on WDI 1994-2014, Economic freedom index, 2017 and eco-label index 2016.

- Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.