Exploring the Impact of Energy Consumption on Exports Using Simultaneous Equations: A Case Study of Pakistan

By

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International Institute of Islamic Economics

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Approval Sheet

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Accepted by the International Institute of Islamic Economics, International Islamic university, Islamabad, In partial fulfillment of the requirements for the award of the degree of MS in Economics and Finance.

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DEDICATED

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GRANDMOTHER

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ABSTRACT

There is a wide literature that provides information about the relationship between energy consumption and income as well as between income and trade. However, there is little literature that combines these two streams of relations to explore the relationship between energy consumption and exports. Keeping this in mind, in this study we have attempted to find the impact of energy consumption on manufactured exports of Pakistan for the period 1978 to 2014. Demand and supply equations are specified with relevant variables within a simultaneous equation framework. Demand side equations are specified with real effective exchange rate and world income while supply side equations are specified with relative prices, industry value added, energy consumption and total labor force. For this purpose, three types of energy sources are used, i.e oil (petroleum product), electricity and gas. Generalized methods of moments have been applied to estimate the simultaneous equations. The results revealed that in the demand side world income and real effective exchange rate have a positive and significant impact on manufactured exports of Pakistan. Whereas, export supply is positively related with relative prices, industry values added and energy consumption and negatively related with labor force.

FIGURES AND TABLES

ABBREVIATIONS

2SLS	Two Stage Least Squares
3SLS	Three Stage Least Squares
ADF	Augmented Dickey Fuller
ARDL	Autoregressive Distributed Lag
CFT	Cubic Feet
CNG	Compressed Natural Gas
CPI	Consumer Price Index
ECM	Error Correction Model
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GNP	Gross National Product
GWH	Giga Watt Hours
IEA	International Energy Agency
IFS	International Financial Statistics
ILO	International Labor Organization
IV	Instrumental Variable
IVA	Industry Value Added
LF	Labor Force

LPG	Liquefied Natural Gas
ML	Maximum Likelihood
MTOE	Million Tons of Oil Equivalent
MW	Mega Watt
NAFTA	North American Free Trade Agreement
OLS	Ordinary Least Square
REER	Real Effective Exchange Rate
RP	Relative Prices
TOE	Tons of Oil Equivalent
TOT	Term of Trade
UK	United Kingdom
UN	United Nations
USA	United States of America
SIC	Schwarz Information Criterion
WDI	World Development Indicator
WI	World Income
WPI	Wholesale Price Index

CONTENTS

CHAPTER 1

1 Introduction

Energy is considered to be a catalyst for the economic development of a country. It is a fundamental element in modern economies and it plays a vital role in the socioeconomic development. Industrialization in 20th century onward witnessed the increase in the demand for energy. The increase in the demand for energy and the dependency on energy reveals that in the next couple of years energy will be the main problem and burning issue in the world and oil will be used as a strategic weapon to play the international politics. Energy has a key role in the consumption as well as production process. Energy plays a fundamental role as compared to other variables incorporated in the production function for countries which are at middle stages of economic development[1].

Higher economic growth is a prerequisite for a developing country to move from a third world country to a developed nation (Gbadebo et.al. 2009). For a developing country like Pakistan the greater the economic growth the better its chances to become more developed. Exports are an important factor of economic growth. Firstly, it boosts investment opportunities, improves foreign exchange reserves and helps to create employment opportunities. Kemal et.al (2002) have explained that increase in exports assist more imports into country. If the imports include capital goods and raw materials, they will provide stimulus to more output growth. Secondly, export increases comprative

[1] International Energy Agency (IEA),(2005)

advantage in resourceful sectors of economy. Specialization in these sectors will improve productivity leading to increase in output growth. Thirdly, addition of international markets will provide economies of scale to export sector. This will also push up the output growth. Fourthly, growth in export increases aggregate demand resulting an increase in output.

Theoratically, it is possible to explain how energy consumption affects exports. For the production of exportable goods, energy is required to enhance the process of production of goods destined for exports. Similarly, exporting manufactured goods requires energy to fuel transportation. If there will be no sufficient energy to fuel transportation then expansion of exports will falter. Hence, energy is an important input to expand exports and appropriate amount of energy is required for export expansion (Sadrosky, 2011). Erkan et al (2009) have explained it in relation to economic growth while incorporating technology as a separate factor of production in the production function[2] They have pointed out that energy allows the practical usage of technology. If there will be no proper supply of energy, then the availability of technology will be of no use. Therefore, it is energy that enables the proper utilization of modern technology. It is worth mentioning here that in energy deficient and energy dependent country like Pakistan any sort of deficiency in energy can create hurdles, which will ultimately affect exports.

Pakistan`s exports are mainly composed of textile, leather, sports goods, cotton manufacturers and rice, contributing about 70.9% of total exports. Economic Survey of

[2] Romer`s production function.

Pakistan (2009-10) shows that one of the main factors in the 21.7% decline of the exports in the leather manufacturers and 8.1% and 7.4% decline in knitwear and readymade garments is due to energy crises faced by the export sector in Pakistan. According to Asif (2011), export sector is paying a huge price due to energy crises in Pakistan because exporters are missing their deadlines and losing their jobs. He argues that the textile sector, which is backbone of Pakistan`s economy, contributes more than 60% to total exports. But energy crises induced a large number of textile groups to shift their manufecturing base to other courtiers.

The demand for energy in Pakistan is increasing rapidly while the supply of energy is more or less stagnant. As a result the gap between energy demand and supply has widened. Asif (2011) has pointed out that the gap between commercial energy demand and supply has risen from three Million tones of oil equalient (MTOE) in 1971-1972 to eighteen Million Tones of Oil Equalient (MTOE) in 2007-08. In the meantime frequent load shedding in energy subsectors, i.e. electricity and gas, has added further fuel to fire. As a result, factories have been forced to lock their gates and over 400,000 workers have become unemployed due to that very reason inflicting a huge loss to the country.

Keeping in view the above-mentioned situation, now the issue arises is that whether there exists any relationship between energy consumption and exports in Pakistan? This study will analyze the impact of energy consumption on manufactured exports in case of Pakistan. In order to further enrich our study, we will check the sectoral

impact, .i.e. impact of oil, gas and electricity consumption on exports. Furthermore, this study will also investigate the factors that are affecting the export performance because besides energy there are other factors that can affect exports. This requires to incorporate both the demand and supply side factors that are affecting the exports in one way or other. The demand side factors generally include the world demand for exports, the price of competing goods and exchange rate, while the supply side factors include relative prices, gross domestic product, labor force and industry value added. In this way, we will be able to analyze the role of energy for exports while controlling the changes in other factors viz., demand and supply side factors.

To the best of our knowledge, such study has never been conducted for Pakistan. Though some studies (Aqeel and Butt, 2002; Siddiqi, 2004) have been carried out to check the relationship between energy consumption and economic growth but they did not address the issue of exports in context of energy. Keeping in mind the existing energy crises in Pakistan, there is pressing need to conduct a study on this burning issue.

1.1 Problem Statement

Economies of the world are dependent on energy and Pakistan is not an exception. Pakistan is facing the worst energy crisis in its history making it inevitable for the investors and manufacturers to shift their manufacturing base to the neighbouring countries[3]. For a developing and energy hungry country like Pakistan, energy conumption bears a great importance for its correct forcasting to fullfill the future requirments,

[3] See Asif (2011)

because shortage in energy can create severe economic crisis. Studies have found that exports boost economic growth. This brings an intresting question here; whether there is any impact of energy consumption on exports of Pakistan? Which sector of energy contributes more to boost exports in Pakistan? What are the other factors that are affecting the export performance of Pakistan? Whether energy consumption can be considered as a stimulus to exports in Pakistan because energy is an indispensable input for export expansion. There are some indications that energy consumption can affect export sector, however, there is no worthwile study conducted to answer the above mentioned questions. We have accepted the challenge to answer these question in detail.

1.2 Purpose Statement

The purpose of the study is to

- Identify the impact of main energy consumption sectors, namely crude oil, gas and electricity, on the exports of Pakistan viz., the major determinants of exports.
- Assess whether other demand and supply side factors affecting exports are equally important in explaining the export behaviour of Pakistan.

1.3 Significance of the Study

The relationship between energy consumption and exports is an important topic to study. For example, if energy consumption is found to have a statistically significant impact on exports, then the reduction in energy consumption, say through energy crises, or through energy conservation policies, will reduce trade viz., exports. The reduction in the exports may ultimately affect economic growth. No study has been carried out to

measure the effects of energy consumption on exports by considering both supply as well as demand side determinants of exports. It is expected that by including the determinants of exports one can find better picture of the connection between energy consumption and exports. So this study is a unique in its own and thus a good contribution to the existing literature. By estimating the demand as well as supply side determinants of exports, we will be able to mention policy implications for Pakistan.

1.4 Limitations of the Study

In this study we have taken exports at aggregate level (i.e. total exports of Pakistan) while energy consumption is taken at disaggregate level (i.e. oil/petroleum consumption, gas consumption and electricity consumption). There are other sectors of energy like wind energy, thermal energy, atomic energy etc but we are not considering these sectors.

1.5 Organization of the Study

This study has been organized in the subsequent sequential order. Chapter one is attributed to the introduction. Chapter two provides an overview of energy consumption and exports of Pakistan. Chapter three reviewes the relevant literature. Chapter four portrays research methodology and the plan to estimate the econometric model. This chapter also provides the description of variables and data used in this study. Chapter five presents emperical results and analysis. Chapter six provides the conclusion and policy implications.

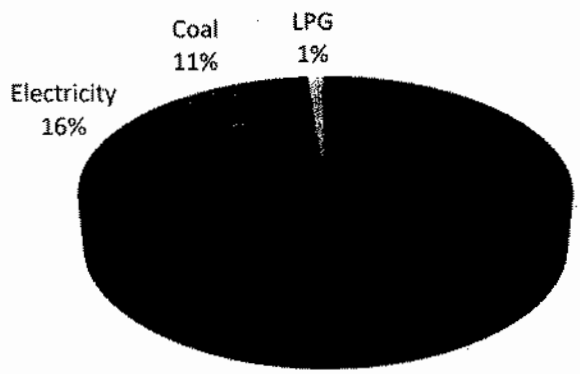
CHAPTER 2

2.1 An Overview of Energy Consumption and Exports of Pakistan

Before analysing the relationship between energy consumption and exports, it is necessary to have a hollistic view about different sources and consumption patterns of energy In this chapter we will briefly describe the trends and patterns of different sectors of energy. We will also discuss about the composition of exports of Pakistan.

The energy sources in Pakistan are natural gas, coal, hydropower and crude oil but most of the oil requirement is met by imports. Energy consumption in Pakistan was about 38.8 Million Tons of Oil equivalent (MTOE) in 2013-14, wherein the share of gas, oil, electricity, coal and LPG consumption was 43%, 29%, 16%, 10% and 1% respectively as illustrated in Figure 1.

Figure 1: Energy Consumption by Source



Source : Hydrocarbon Development Institute of Pakistan

During the last ten years the petroleum consumption has increased by 0.5% per annum while consumption of coal, gas and electricity has increased by 12.5%, 6.8% and 5% respectively, showing a shift from petroleum to other energy sources. But total energy consumption is decreased by 5.2% in 2009, while energy consumption in industrial sector is declined by 17.4% due to energy crisis in Pakistan (Economic Survey of Pakistan, 2009-10).

Through the course of its economic development Pakistans energy requirement has grown rapidly. The primary energy consumption in Pakistan rose by 27 MTOE to 63 MTOE since 1994 -95 which is an increase of more than double in the last 17 years. A comparative picture of energy use per capita in selected economies is given in Table 1.

Table 1: Energy Use Per Capita in KGOE (Kilogram of Oil Equivalent)

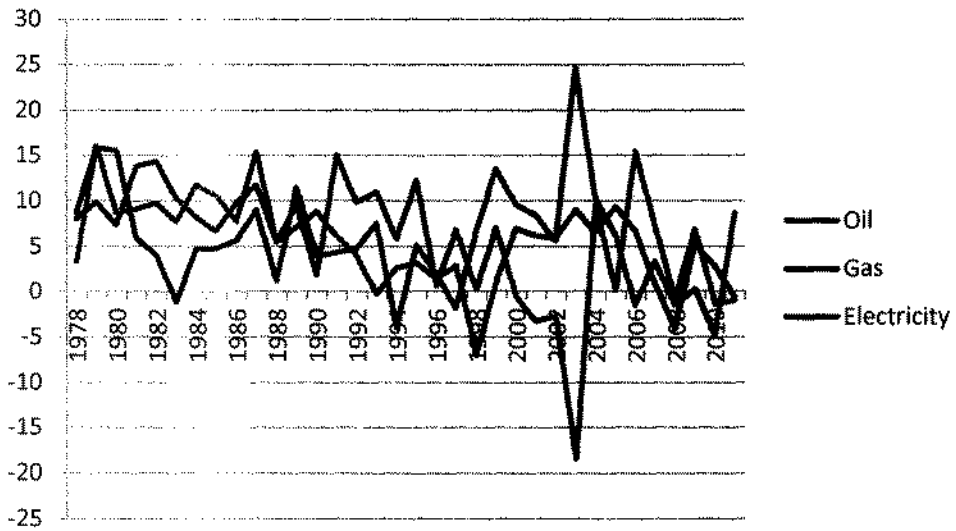
Country	1990	2010
Pakistan	[illegible]	[illegible]
India	372.95	600
Indonesia	[illegible]	[illegible]
Malaysia	1207.54	2569
Thailand	[illegible]	[illegible]
USA	7671.55	3242
China	[illegible]	[illegible]

Source : World Development Indicators, 2010

Energy use in Pakistan rose from 382.92 KGOE in 1990 to 502 KGOE in 2010. The economies listed in the table exceed Pakistan in term of energy use espicially the emerging economies like Malaysia, Thailand and China showing a remarkabale increase in per capita energy use. The strong economic performance and a significent increase in per capita energy use builds the case of energy exports relationship.

Figure 2 shows the annual growth rates of energy consmption in accordance with the types of fuel from 1978 to 2012.

Figure 2:Annual Growth Rates of Oil, Gas and Electricity Consumption (1978-2012)

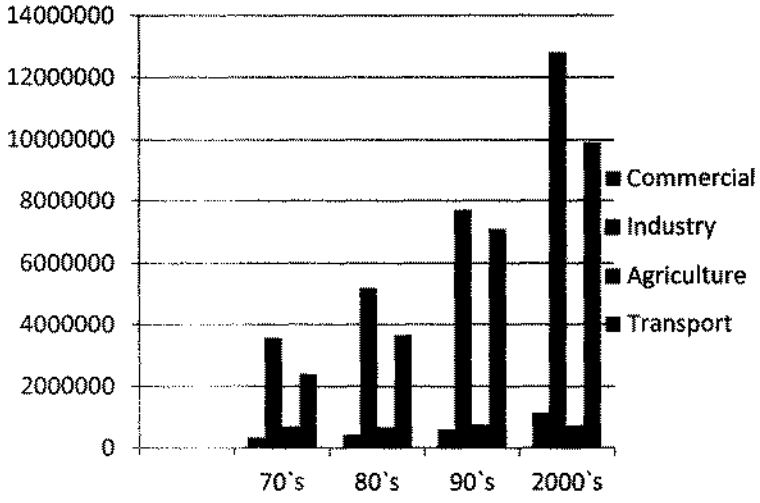


Source : Hydrocarbon Development Institute of Pakistan

Oil is most commonly used followed by the electricity, natural gas and coal. The growth pattern of oil and gas show variations while growth pattern of electricity consumption is more or less stable untill 1997 and experienced negative growth rate in 1998. Growth pattern of oil consumption exhibited negative growth rate in 1990 and again in 2000 to 2005. Whereas, gas consumption exhibited negative growth in 1994 and

and 2007. Energy consumption has experienced negative growth rates in all sources of energy due to lower economic activity and circular debt in 2008-20094.

Figure 3: Sector wise Energy Consumption (in TOE) from 1978 to 2008



Source: Hydrocarbon Development Institute of Pakistan

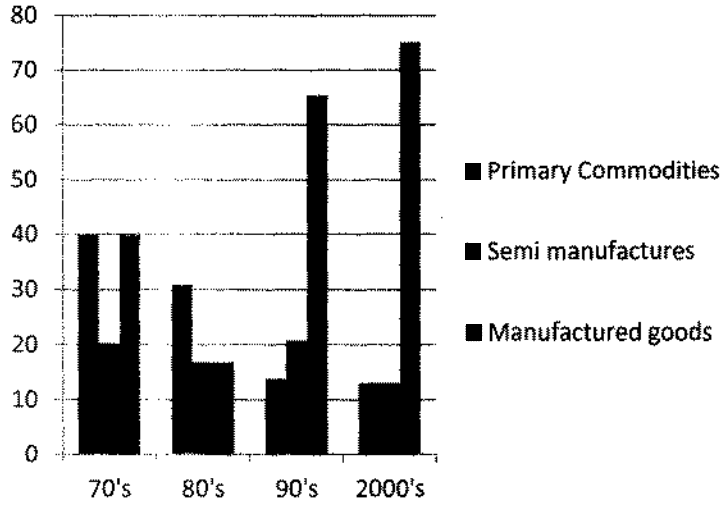
The consumption pattern of various sectors displayed in the above figure, illustrates that the industrial sector recorded the highest consumption followed by transport, commercial and agriculture sector respectively. The industrial, transport and agriculture sector witnessed little bit fluctuation, whereas commercial sector increased anually. Industrial sector is the largest consumer of energy excluding domestic secor.

A significant increase in the share of industrial sector in gross domestic product and decline in the share of agricultural sector in GDP caused tremendous pressure in final energy consumption.

[4] Circular debt is a situation when one party withholds payments to his supplier due to lack of cash flows. When it happens, it affects other entities in the supply chain, they also withhold payments. As a result operational difficulities arise for the providers of services in the concerned sector resulting in the unnecessary loadshedding (For detail see Economic Survey of Pakistan, 2008-2009).

Currently, in 2011 agriculture sector contributes 20.9% to the GDP, whereas industrial sector contributes 25.8% to the GDP (Economic survey of Pakistan 2011-2012). Moreover, there is a dramatic shift in the economic classification of exports from primary commodities to manufactured goods. Figure 4 shows a shift in economic classification of Pakistan`s exports from primary to manufactured commodities.

Figure 4: Economic Classification of Exports of Pakistan

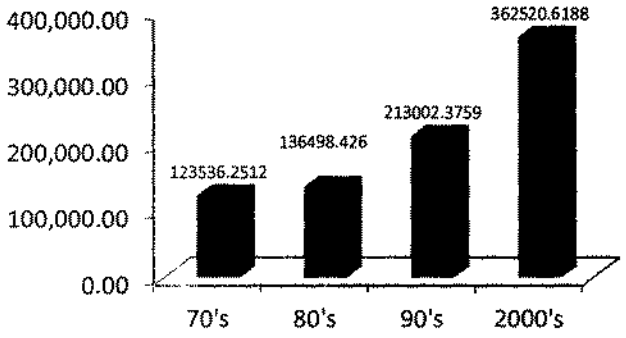


Source: Economic Survey of Pakistan, Government of Pakistan Finance division.

During 1970`s primary commodities contributed 39.9% while semi manufactured and manufactured commodities contributed 20.3% and 39.9% respectively. But the share of primary commodities decreased to 13.1% and the share of manufactured commodities increased to 75.9% in 2000`s. Whereeas, the share of semi manufactured commodities experienced fluctuations during the same time period. Broadly speaking, the share of manufactured commodities in the overall exports of Pakistan has inceased over time.

Figure 5 reflects the annual average final energy consumption. It shows that there is sharp increase in energy consumption from 1970`s to 2000`s when there was a shift in economic classification of exports from primary commodities to semi manufactured commodities.

Figure 5: Annual Average Final Energy Consumption



Source : Hydrocarbon Development Institute of Pakistan

Hence, the data of energy consumption and export of Pakistan shows that there is a positive correlation between energy consumption and exports of Pakistan. Exports have increased from US$ 1311.1 million in 1978 to US$ 21688.0 million in 2012. During the same time period final energy consumption has increased from 12303130 (TOE) to 37344540 (TOE). Both the figures displayed a trend in the exports and energy consumption of Pakistan. Such a trend leads us to find the relationship between energy consumption and exports of Pakistan.

Though, the visual representation of energy consumption and exports of Pakistan shows a relationship but according to Stern (2004) theoretical approach to such a relationship is manifold. Therefore, we will go for emperical approach.

CHAPTER 3

Literature Review

There are a lot of studies attempting to provide a link between energy consupmtion and economic growth. Indeed, the studies provide discussion about the link between energy consumption and economic growth. However, one of the direction of the research is to investigate the relationship between energy consumption and exports. This chapter will provide a brief summary of the studies conducted uptil now on this issue. Studies that have been conductied on the determinants of exports have also been summarized.

3.1 Energy Consumption and Exports

Researchers have divided the relationship between energy consumption and exports into four different types of testable hypotheses, i.e. export led energy hypothesis, energy led export hypothesis, neutrality hypothesis and feedback hypothesis.

Export led energy hypothesis assumes that change in exports affects change in energy consumption. There are a number of avenues in which exports can effect energy consumption. For example, during the process of export of goods, machinery and other equipments are required to be loaded and transported to airports, seaports and other stations where the exports are off-loaded and then re-loaded to be sent abroad. The machinery and equipments used in the process of production and transportation of goods require energy for operation. Therefore, an increase in exports means an increase in

economic activity which will ultimately increase the demand for energy (Sadorsky, 2011).

Energy led export hypothesis states that change in energy affects exports because energy is used as an input for production and transportation of exportable goods. Any sort of deficiency in energy will hinder the process of production and transportation of exportable goods. Therefore, energy is an indispensible input for expansion of exports (Xin and Quan, 2011).

The feedback hypothesis implies that energy consumption affects exports and exports affect energy consumption. In this case, increase or decrease in energy consumption will increases or decreases exports and vice versa (Lean and Smith, 2010).

The neutrality hypothesis assumes that there exists no relationship between exports and energy consumption because the correlation between energy consumption and exports shows statistically insignificant relationship in all conventional tests. (Sadorsky 2011).

The relationship between energy consumption and exports have been examined by many researchers but the results are mixed. For example, Erkan et al (2009) conducted a study to examine the impact of energy consumption on exports for the Turkish economy by applying Granger causality test and ECM. The study revealed that energy consumption makes a positive contribution to exports. In addition, they suggested that provision of energy to productive sector will support exports of Turkish economy.

Kharl and Host (2008) examining the linkage between energy and exports of China found that exports are the greatest source of energy demand in China. While the research conducted by lan Li (2010) for Shandong (China) reveals that increase in the exports is the main reason for increase in energy consumption in Shangdong. The author suggested that exports which cost more energy should be reduced and the firms associated with production of exports should renew their technology in order to minimize the energy consumption. Similar study was conducted by Xin and Quan (2011) for Beijing and found that increase in exports was stimulated by increase in energy consumption.

From the literature review, we note that most of the existing studies done have serious methodological issues. In particular, we have summarized the major shortcomings of the existing studies below.

Most of the existing studies considered only bivariate regression models, mainly energy consumption and GDP or energy consumption and exports, ignoring the control variables and (as they omitted some important variables) leading to biased results. For example, Granger Causality test has been used by most of the existing studies to check the causal effect of one variable on other.

Gujrati (1988) pointed out that the results of this test are dependent on a) number of observations, b) lag-length used. Similarly, Freedman (1997) has argued that "investigators may be able to use summaries and predictions to draw substantive conclusions. However, regression equations, let alone the more complex methods, have

not succeeded as engines for discovering causal relationships". According to Zaman (2008), the results obtained from this test can be used as an additional support to the causal relationship and one should not rely totally on this test for the causality.

Due to erroneous use of Granger Causality test, existing studies have concluded different and contradictory results even for the same country. For example, Akinlo (2009) and Ighodaro (2010) found uni-directional causality from electricity consumption to GDP for Nigeria, while Emika (2010) and Sa'ad (2010) found uni-directional causality from GDP to electricity consumption. So different policy implications are suggested by different studies which seems very surprising and therefore out of the box thinking is required to derive policy implications for a country. Moreover, very few studies tried to incorporate control variables but they used poor proxy variables. For exmple, consumer price index (CPI) has been used as a proxy for energy prices by Lean and Smith (2010) and by Rafiq (2008).

Freedman (1997) argued, "investigators have only vague ideas as to the relevant variables and their causal order, functional forms are chosen on the basis of convenience, serious problems of measurement are frequently encountered. To attain roboust results relevant variables must be used while investigating the causal relations".

Keeping in view the above drawbacks of the existing literature, it is therefore necessary to include the relevant determinants of exports. In this way, it will be worthwhile to examine the relation between energy consumption and exports by

controlling other variables that may affect the exports. Therefore, the focal point of our review of literature will be to discuss the studies concerning the determinants of exports.

In the existing emperical literature there are a lot of studies adressing the determinats of exports. Some studies have incorporated only demand side determinants of exports, yet others have incorporated both demand and supply side determinants of exports (e.g Anwar, 1985; Riedel,1988; Muscatelli et al., 1995; Afia, 2004 and Hussain, 2010). These studies are testimony of the significance of the issue and require further enquiry about export behaviour. However, there is hardly any study that addresses the issue of energy consumption and exports by incorporating both demand and supply side determinants in a simultanious framework.

Houthakeer and Magee (1969) were the pioneers to conduct a study on export performance. They draw the conclusion that relative prices are important in determing exports. Later on Khan (1974), Goldstein and Khan (1978), Bond (1985), Reinhart and Carmen (1995), Senhadji et al (1998 and 1999) also reinstated that relative prices are key variables in determining the export performance. However, there is no consensus in the emperical literature regarding the determinants of exports. Some studies give importance to the demand side determinants (e.g. Muscatelli et al, 1992, Roy, 2002 and Atique and Ahmad, 2005), while other studies (e.g. Reidel, 1988 and Raju, 2007) give importance to both demand and supply side determinants of exports.

The literature on export determinants can be sub-divided into three relevant subsections. First subsection provides literature related to demand determinants, second

subsection gives overview of supply side determinants and third section summarizes studies carried out taking both demand as well as supply side determinants of exports.

3.2 Studies on Demand Side Determinants of Exports

The demand side determinants of exports generally comprise of trading ability of trade parteners, the price of exports and exchange rate, etc. Fugaza (2004) has discussed that demand is also affected by the geographical location of a country, for example, countries located at the centre of rapidly growing area benefit more than the countries located outside the area. Furthermore, trade policy and physical infrastructure also play a vital role.

Few studies have been carried out relating to demand side determinants of exports for Pakistan. Siddiqi et al (2012) conducted a study using a time series data from 1971 to 2009 to determine the export demand of textile and clothing sector of Pakistan using cointegration technique. They included world GDP, real exchange rate, CPI and trade oppeness as determinants of exports of textile and clothing sector pf Pakistan. The main finding of their paper was that among other determinants world GDP was the most important one. They concluded that domestic producers should adopt the market demand strategy to boost export sectors of clothing and textile.

Haider et al. (2011), in a comprehensive study by using time series data for the period from 1973 to 2008, found that world income and exchange rate are important in determining the export level of Pakistan. They focused on the trade between Pakistan and its traditional trading parteners. However, they emphasized that Pakistan should make efforts to trade with fast growing economies, such as India and China, to boost the level of exports.

Similarly, the study conducted by Hussain (2010) revealed that world demand is an important factor in determining the performance of exports of Pakistan. World demand is responsive to value added exports than that of low value added and primary exports. He concluded that classifying the exports from primary and low value added to value added is better to get benefit from world demand.

Naryan and Naryan (2004) investigated about the demand determinants of Fiji`s exports. By using autoregressive distributed lag (ARDL) approach the authors also found that world demand has positive impact on exports.

Though, the above studies have found world demand as an important determinant of exports, however, they have used different proxies to capture the effect of world demand on exports. For example, Siddiqi et al. (2012) and Naryan and Naryan (2004) have used world income and trading partners income respectively as proxies for world demand. Whereas, Hussain (2010) has used world real imports to capture the effect of world demand.

3.3 Studies on Supply Side Determinants of Exports

The supply side determinants of exports generally include the gross domestic product (GDP), relative prices, gross capital formation, labor force, etc. According to

Fugaza (2004) supply side is also affected by economic policies, development variables (e.g. technology) and size of economy[5].

Muniruzaman et al. (2011) conducted a study on the export supply model of Bangladesh using vector error correction model (ECM) for the period from 1973 to 2009. GDP, relative prices of exports and gross capital formation were taken as supply side determinants of exports. The main finding of their study revealed that it is the gross capital formation that is the most important determinant of exports of Bangladesh. Whereas, Ahmad (2010) by employing ECM and co integration test for the period from 1974 to 1995 found that relative prices, GDP and real effective exchange rate are imprtant determinants of exports of Bangladesh. However, the study has a loophole of using short time period.

Similarly, Haleem et.al (2005) while examining the export supply function for citrus fruits of Pakistan for the period from 1974 to 2005 and by employing cointegration test found that gross domestic product (GDP) and export prices (international prices) play a vital role in determining the supply determinants of exports of citrus fruits of Pakistan. As far as Indian economy is concerned, Ali (1987) conducted a study on supply factors affecting manufactured exports. He applied ordinary least sequare method (OLS) and concluded that relative price and capital stock[6] are important in determining Indian manufactured exports.

[5] Size of economy determine the size of internal market, see Fugaza (2004).
[6] Capital stock is used as a proxy for domestic production capicity.

From the above mentioned emperical studies it seems that the relative prices are an important determinant to examine the export supply behaviour of any economy.

3.4 Studies on Demand and Supply Side Determinants of Exports

In a comprehensive study Funke and Holley (1992) have discussed that earlier studies have focused only on the demand side factors of exports. They further argue that such models are unsuccessful for the determination of export performance in the long run. They considered quartely time series data for the period from 1961 to 1987 and employed full information likelihood method to estimate both demand as well as supply side determinants for West German manufacturing sector. Their study suggested that supply side determinants are more important than demand side determinants for exploring the export performance.

Riedel (1988) conducted a study to find the determinants of exports for Hong Kong by using simultaneous approach for the period between 1972 and 1984. The results of the study revealed statistically insignificant income elasticity of demand for exports and infinite price elasticity of demand for exports. These results support the small country hypothesis[7]. Moreover, the supply side factors (domestic price of exports, price of raw material, industrial inputs) appeared to be significant with correct sign.

Riedel, Hall and Grawe (1984) explored the determinants of export performance of India by using time series data for the period from 1968 to1978. They examined the

[7] Small country hypothesis suggests that developing countries are price takers in the international market and they have to cope with infinite elastic demand curve.

impact of relative domestic demand, relative price of exports and domestic profitability on export performance. Their study revealed all the variables turned out to be statistically significant. They concluded that export behavior is closely connected with domestic market conditions.

Muscatelli et al. (1995) conducted a study to find out the determinants of newly industrialized economies (i.e. Hong Kong, Thailand, Singapore, Malaysia and Korea) by using simultaneous equation model for the period from 1967 to 1987. Price of exports, world income and price of the competing goods were used as demand side factors whereas, price of raw materials, price of exports and unit labor cost were considered as supply side factors. The study concluded that price and income elasticity of demand were statistically significant determinants of exports of all countries. The study also confirmed that small country hypothesis is not applicable to newly industrialized economies.

Edwards and Elves (2005) conducted a study on South African manufacturing export performance by incorporating both demand and supply function of exports for the period between 1970 and 2002. They found that world demand and relative prices are insignificant in determining the export performance supporting the small country hypothesis that South African exporters are price takers in the international market, while exchange rate positively affects export performance. The study revealed that South African exports are supply driven.

Menji (2010) carried out a comprehensive study to find out the determinants of exports of Ethiopia for the period of 1981-2004 by using simultaneous approach. The

exports included merchandise exports and manufactured exports which were estimated separately. Export demand equation was specified with nominal exchange rate, real income and relative prices whereas, export supply equation was specified with gross capital formation, GDP of trading partners, trade liberalization, commercial energy consumption, term of trade (TOT) and foreign direct investment. The results revealed that Ethiopia`s merchandise exports are influenced significantly by gross capital formation and trade liberalization while other variables appeared to be insignificant. Similarly, manufactured exports are influenced positively by gross capital formation. World income affected manufactured exports negatively and significantly, other variables appeared to be insignificant. Commercial energy use appeared to be insignificant in affecting exports of Ethiopia. The reason behind the insignificant impact of commercial energy use is that most of the Ethiopia`s exports include primary products. For example coffee, flower, oil seeds, hides and skin and chat. These items contribute 78% to export revenue, where the shares of manufactured products in total exports are very small.

Studies have been conducted on the Indian economy as well, but the results are mixed. Roy (2002) has discussed that this is due to different estimation procedures or time period of study. Earlier studies, such as Goldar (1989), Rath and Sahoo (1990), Virmani (1991), Srinivasan (1998) and Kareem (2000), have found world demand as significant determinant of exports of India. Some studies, such as Arize (1990), Joshi and Little (1994) and Krishnamurthy and Pandit (1995), pointed out that exports of India are price responsive.

Most recent studies conducted on export determinants of India emphasized on demand determinants. For example, Roy (2007) carried out a study to find out the demand and supply determinants of exports of Indian manufactured exports over the period from 1960 to 2004. The results suggested the importance of demand side determinants (world income, real exchange rate). The study conducted by Raju (2007) also suggested the importance of demand side factors (real exchange rate and world income) for Indian machine tool exports. Domestic prices and skilled labor also have some significant impact on supply side.

Roy (2002) carried out a study to find out the determinant of export of India in a simultaneous framework using error correction model. The study gave due importance to the demand determinants of exports (world income, real exchange rate) against the supply side determinants (relative prices, domestic GDP). Sharma (2001) investigating the determinants of exports of India found that demand for Indian exports increases when export price falls with relation to world prices while appreciation of rupee adversely affects Indian exports. On the other hand export is positively related with domestic relative prices of export products. In a nutshell, world demand seemed to be the most important determinant of exports while relative prices showed mixed results.

As far as Pakistan is concerned, studies have been carried out to find out the determinants of exports by incorporating both supply and demand side determinants. For example, Anwar (1985) used simultaneous equation approach and found that world income and domestic production is important in explaining the supply and demand

determinants of Pakistan. Hassan and Khan (1994) conducted a study to identify the export performance of Pakistan by employing simultaneous equation approach. They concluded that demand for exports is positively related with world income and negatively related with relative price in case of manufactured products. While nominal exchange rate showed a positive relationship with export demand implying that devaluation policies positively affect exports.

Afia (2004) conducted a study to find out the determinants of textile and clothing export of Pakistan for the period of 1973-1996. Supply side determinants (price of textile exports, domestic price of textile exports and nominal exchange rate) appeared to be statistically significant while demand side determinants (price of textile exports and world income) appeared to be insignificant. These results are similar to the findings of Riedel (1988) supporting the small country hypothesis that developing countries are price takers and world income has no effect on the exports.

Similarly, Atiq and Ahmad (2003) found that on the demand side, world economic activities and real exchange rate are important determinants of exports while on the supply side domestic production is important determinant for the export performance of Pakistan. Relative prices proved to be insignificant. Similar results were previously obtained by Anwar (1985).

Majeed and Ahmad (2006) carried out a study on the determinants of exports of developing countries using a panel data over the period from 1970 to 2004. The determinants of exports used in the study were GDP, GDP growth rate, FDI, indirect

taxes, savings, official development assistance, industry value added, exchange rate and communication facilities. The entire variables proved to be significant except FDI. Similar study was conducted by Nadeem et al. (2012) to find out the factors influencing exports of Pakistan for the period of 1981-2011. Explanatory variables used in the study were FDI, indirect taxes, savings, industry value added, GDP, exchange rate and world income. By using OLS method the authors concluded that all variables except FDI had statistically significant relationship with the export performance. These results were similar to the results obtained by Majeed and Ahmad (2006).

Zada et al. (2011) concluded a study on the determinants of exports of Pakistan for the period from 1975 to 2008. By using simultaneous equation approach the authors ascertained the importance of the demand side determinants (world income, exchange rate and world prices). They examined determinants of exports of Pakistan vis-a-viz its trading partners. Their results revealed a significant demand for exports to Middle East, European Union and NAFTA region.

3.5 Summary

This chapter briefly looks at the existing literature and the linkage between energy consumption and exports. In order to include the relevent variables for the specification of demand and supply equations, studies conducted on the determinants of exports have been reviewed. In a nutshell, the world income and exchange rate proved to be most important determinants of export demand, whereas, relative prices showed statistically

mixed results. The analysis reveals two important gaps in the existing literature. First, none of the studies took the case of Pakistan to investigate the relationship between energy consumption and exports. Second, none of the studies have included the demand and supply side determinants to explore the relationship between energy consumption and exports.

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CHAPTER 4

Research Methodology

The core objective of the study is to find the relationship between energy consumption and manufactured exports of Pakistan. In order to find the relationship, this chapter will provide the methodology used in this study. This chapter describes variables and data sources, discusses about the econometric model and postulates estimation strategy.

4.1 The Econometric Model (the arrangement in this chapter have been changed as advised by the external examiner i.e first the economic model then construction of variables and then data source)

To analyze the impact of energy consumption on exports, it is required to include both the demand and supply side determinants of exports. We will follow imperfect substitution model which is based on the assumption that neither exports nor imports are perfect substitutes for domestically produced goods. As a result, domestic and export prices differ from one another (Goldstein and Khan, 1985). In this study, both the demand and supply equations will be estimated simultaneously. Menji (2010) has used the same model to investigate the export performance of Ethiopia while incorporating commercial energy consumption as one of the supply side determinant of exports. The model can be written as follow:

$EXP_t = F(REER_t, WI_t, RP_t, IVA_t, EC_t, LF_t)$

Where,

EXP = Manufactured exports of Pakistan

REER = Real effective exchange rate

WI = World income

RP = Relative prices

IVA = Industry value added

EC = Energy consumption

LF = Labor force

In log linear form the above model can be expressed as follow:

$$\ln(EXP_t) = \alpha_0 + \alpha_1 \ln(REER_t) + \alpha_2 \ln(WI_t) + \alpha_3 \ln(RP_t) + \alpha_4 \ln(IVA_t) + \alpha_5 \ln(EC_t) + \alpha_6 \ln(LF_t) + u_t$$

In the above model there are two endogenous variables, i.e. exports and prices. Both the variables have to be determined simultaneously in order to cope with the problem of simultaneous equation bias. Therefore, it is necessary to estimate both the variables simultaneously in a simultaneous framework by incorporating both the demand and supply equations. Raju (2007) has explained that in such situations one cannot rely on ordinary least square method (OLS) to estimate this model. Therefore, there are two possibilities to solve this dilemma. One way is to solve the model after getting a reduced form and second way is to use simultaneous equation method. However, one may not be able to find structural parameters from reduced form parameters. Therefore, we proceed by using simultaneous equation approach. Two stage least square (2SLS), three stage

least square (3SLS) or generalized method of moments (GMM) can be used for the estimation of simultaneous equations.

By following existing literature [Hasan and Khan (1994), Raju (2007), Roy (2007) and Menji (2010) etc.] export demand equation is specified with real effective exchange rate and world income as independent variables. while export supply equation is specified with relative prices, energy consumption (oil, gas and electricity), industry value added and total labor force as independent variables. In this way, we will be able to identify the role of energy in exports of Pakistan while controlling the effect of other variables. Export demand function can be written as:

$$X^d = f(REER, WI) - - - - - - - - - (1)$$

In equation (1) X^d represents the demand for manufactured exports of Pakistan. REER is real effective exchange rate and is used to capture the price competitiveness of exports. WI (or world GDP as a proxy) represents the foreign demand for exports. In log-linear form the above equation can be written as:

$$\ln(X^d t) = \alpha_0 + \alpha_1 \ln(REER_t) + \alpha_2 \ln(WI_t) + u_t - - - - (2)$$

Where α_1 and α_2 represents the elasticities of manufactured exports with respect to REER and WI. α_1 and α_2 are expected to carry positive sign.

Export supply function can be written as:

$$X^s = f(RP, IVA, EC, LF) - - - - - - - - (3)$$

In equation (3) X^S represents supply of manufactured exports of Pakistan. RP represents the relative prices of manufactured exports. IVA is industry value added and it is used as a proxy for industrialization. EC and LF are energy consumption (oil, gas and electricity) and total labor force, respectively. Both of these variables are used as inputs during the production of manufactured exports. In log-linear form, the above equation can be written as follow:

$$\ln(X^s) = \beta_0 + \beta_1 \ln(\mathrm{RP_t}) + \beta_2 \ln(\mathrm{IVA_t}) + \beta_3 \ln(EC_t) + \beta_4 \ln(LF_t) + v_t - (4)$$

Where β_1 is expected to carry positive sign in the supply equation of manufactured exports. Higher the relative prices, higher will be the incentive for the exporters to supply exports. β_2, β_3 *and* β_4 are expected to be positive.

4.2 The Variables

After reviewing the literature this study has incorporated both the demand and supply side determinants of manufactured exports. Demand side equation is specified with world GDP and Real Effective Exchange Rate. Whereas, supply side equation is specified with relative prices, industry value added energy consumption and total labor force. The brief explanation and justification of all variables is given below:

4.2.1 Real Effective Exchange Rate (REER)

It is the demand side determinant of exports. The relative price difference in domestic and international market has a direct impact on exports demand. This relative

price difference is identified as REER. As per theory, depreciation in exchange rate makes the domestic prices of exports to fall resulting exports to be cheaper in the international market relative to its competitors. This will increase the demand for Pakistan's exports, ceteris peribus. Therefore, a depreciation of REER is expected to have a positive impact on the exports. In emperical literature, Hassan and Khan (1994), Sharma (2000), Majeed and Ahmad (2006) and Hassan et al (2013) have found positive impact of exchange rate depreciation on exports.

4.2.2 World GDP

Apart from real exchange rate demand for exports is also influenced by the conditions prevailing in the international market (Kareem, 2000). Hence, Gross Domestic Product (GDP) of the world is considered to be a demand side determinant of exports. Higher the world GDP, higher will be demand for exports, ceteris paribus.

Studies have found that world demand is an important factor in determining the export performance of a country. For example, Goldar (1989), Kareem (2000) and Roy (2002a, 2007b) have emphasized that world demand is a significant variable in determining export performance. However, different studies have used different proxies for world demand. Generally, World GDP, industrial production index or real imports have been taken as proxy for world demand[8]. As far as our study is concerned, we will follow Hassan and Khan (1994) and consider world GDP as a proxy for world demand.

8 See Hasan and Khan (1994), Sharma (2000) and Hussain (2010) for further details.

We expect positive impact of World GDP on exports. World GDP will be measured at constant dollar prices.

4.2.5 Relative Prices

Relative prices are the supply side determinant of exports. In the emperical literature, relative prices have been used widely to analyze the export performance and proved to be significant in explaining the export behaviour (see e.g. Srinivasan, 1998; Virmani, 1991 and Roy, 2007). Relative prices is the ratio of prices of exports at world market to the prices of exports at domestic market, i.e. p^w/p^x, where p^w denotes prices of exports at world market and p^x denotes price of exportable goods at domestic market. Higher export prices will increase the level of exports because higher prices will provide an incentive for the exporters to engage with exports. On the other hand, higher domestic price will negatively affect exports as the exporters will engage to fulfill domestic demand. Therefore, we expect that an increase in relative price will increase the exports. Price of exports (p^W) will be measured by export unit value while domestic price of exports (p^X) will be measured by consumer price index of Pakistan (CPI). Base year for both the indicies is 2000. In emperical literature Goldstein and Khan (1985) as well as Atiq and Ahmed (2000) have used CPI. Whereas, Muscatelli (1992), Funk and Holly (1992) and Raju (2007) have used WPI.

4.2.6 Labor Force

According to International Labour Organization (ILO) total labor force comprise of the people who supply labor for the production of goods and services during a specific period of time whether employed or unemployed. However, people unavailable for work or available for work but are not looking for work are not included in labor force. As per

theory labor is primary factor of production and optimal usage of resources depends upon labor force. Majeed and Ahmad (2006) have pointed out that in developing countries agriulture sector is facing the problem of unemployment. Therefore, huge number of labor force can be transferred to industrial sector. Such labor force can be used in industrial sector to expand export sector. However, skilled labor force is considered to be a source of competitiveness in export sector whereas the effect of unskilled labor force is opposite on competitiveness. As far as our study is concerned, we expect positive or negative impact of labor force on manufactured exports of Pakistan. In the emperical literature Hassan et al. (2013) have found negative impact of labor force on exports.

4.3 The Estimation Techniques

4.3.1 Unit Root Test

First step in the estimation procedure would be to check the order of integration of the concerned variables. Most of the time series are not stationary, if they are simply regressed, spurious regression may take place to reduce the reliability of research results (Gujarati, 2004). Therefore, in order to avoid the spurious results we will check whether the time series holds the properties of stationarity. If the data appeared to be non-stationary, then differencing will be used to make it stationary. Augmented Dickey Fuller (ADF) test will be used to check the level of integration.

4.3.2 Generalized Method of Moments

Second step in the estimation is to estimate the above model by employing the GMM method. As discussed earlier, to estimate the simultaneous equations one can use

two stage least square (2SLS), three stage least square (3SLS) or generalized method of moments (GMM). We have chosen Generalized Method of Moments (GMM) to solve the simultaneous equations. Since, 2SLS cannot test the over identifying restrictions therefore it is not suitable method of estimation. On the other hand, GMM solves the problem of endogeneity in the simultaneous equation and also solves the problem of omitted variable problem (Waldemare, 2010).

The generalized method of moments (GMM) dates back to seminal paper of Hansen (1982). Since then GMM has been widely used in economics and finance to analyze and estimate the data. For example, among others Edwards and Alves (2005), Menji (2010) and Damijan et al. (2012) have used GMM to explore the export performance.

GMM is a much known estimator while other estimators, for example, ordinary least square (OLS), instrumental variable (IV) and maximum likelihood (ML) can be viewed as special cases of GMM. The likelihood investigation starts with the description of the data and the likelihood function explains the characteristics of the data. One can test the hypothesis of the economic theory based on these likelihood functions. On the other hand, estimation of the GMM starts with the economic theory and then data is used for the estimation of the model. Minimum statistical assumptions and little attention are required to fit the model (Nielsen 2005).

There are two kinds of the GMM estimators, namely System GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) and Difference GMM (Arellano and Bond, 1991).

Difference GMM employs differenced equations through lagged levels as instruments. On the other hand, System GMM employs lagged difference as instruments. System GMM is a step up progress of Difference GMM. Arellano and Bover (1995) and Blundell and Bond (1998) have shown that for regression in differences, the lagged levels of explanatory variables, if they are persistent over the time, are weak instruments resulting in the increase of asymptotic variance of the estimator and generate small sample bias in Difference GMM (Calderone and Serven, 2004). Therefore, this study will use System GMM for the estimation of simultaneous equations.

4.4 The Data

Annual time series data from 1978 to 2014 have been used for the analysis. In this study, data on different variables have been taken from various sources. Among these variables, data on world GDP, industry value added and total labor force have been taken from World Development Indicators (WDI). Data on manufactured exports have been taken from Pakistan Economic Survey 2011-2012. Similarly, data on REER, export unit value and CPI have been taken from International Financial Statistics (IFS), the data base of IMF. Whereas, data on different energy sources are considered from Hydrocarbon Development Institute of Pakistan (HDIP) and Pakistan Energy Year Book 2012.

CHAPTER 5

Empirical Results and Discussions

This chapter presents the results of the model which have been discussed in chapter 4. We discuss and compare our results with the previous studies. The rest of the chapter are organized as follow. Section 5.1 discuss the descriptive statistics. Section 5.2 deals with stationary properties. Section 5.3 addresses the GMM results of the model.

5.1 Descriptive Statistics

The descriptive statistics allows the researcher to significantly describe many parts of data. The major types of descriptive statistics are measure of central tendency and measure of variability. The measure of central tendency is helpful for describing a data set with a single number. Mean and median are frequent indices of central tendency. Whereas, the extent to which the data points differ from each other refers to measure of variability. Standard deviation and inter quartile range (IQR) are most commonly used measures of variability. Table 2 represents the descriptive statistics of the concerned variables. Mean of electricity consumption is 9.992 wheraeas median of electricity consumption is 10.081. Similarly, minimum value of electricity consumption is 8.834 and maximum value of electricity consumption is 10.482. Overall, there is minor difference between mean and median therefore we can say that data is symmetric in nature.

Table 2: Descriptive Statistics:

Variables	Mean	SD	Median	IQR	Min	Max
IVA	9.661	0.541	9.723	0.831	8.6	10.482
Electcons	9.992	0.512	10.081	0.722	8.834	10.623
Exports	8.461	0.9	8.53	1.681	6.691	9.742
Gascons	13.113	0.541	13.061	0.974	12.123	13.9
LF	3.624	0.3	3.581	0.513	3.153	4.152
Oilcons	16.165	0.554	16.4	0.9	14.981	16.761
RRER	4.842	0.281	4.752	0.426	4.561	5.44
RP	0.633	0.691	0.62	1.261	0.381	1.821
WI	17.363	0.282	17.351	0.482	16.91	17.812

Note: Number of observation is 36.

5.2 Results of Unit Root Test

Before employing the GMM technique we have employed the Augmented Dickey Fuller (ADF) test and Philips-Perron (PP) test by using both intercept and intercept as well as trend specification to check the order of integration among the concerned variables. However, it is not necessary to check the order of integration if we are intrested in applying GMM. All the variables are non stationary at level. However, after taking their first difference all the variables are found to be integrated of order one, i.e. I (1). The results are displayed in Table 3 and Table 4.

Table 3: Augmented Dickey Fuller Test For Unit Root

	With Intercept		With Intercept and trend		
	Level	1st Diff	Level	1st Diff	Status
IVA	-2.29	-4.21***	-2.07	-4.68***	I(1)
LF	-1.15	-6.28***	-1.52	-6.69***	I(1)
Exports	-1.81	-6.05***	-1.52	-6.69***	I(1)
Gascons	-1.31	-4.16***	-2.25	-4.14**	I(1)
Electcons	-2.38	-4.15***	-1.51	-4.54***	I(1)
Oilcons	-2.3	-4.02***	-0.9	-5.64***	I(1)
RRER	-1.26	-4.57***	-1.19	-4.65***	I(1)
RP	-0.28	-6.05***	-2.77	-6.15***	I(1)
WI	-0.68	-4.53***	-2.48	-4.43***	I(1)
Test critical values			Test critical values		
	1%level	-3.64	1% level		-4.26
	5%level	-2.99	5% level		-3.55
	10%level	-2.61	10% level		-3.2

Note:

1) H0: Series contains a unit root.
2) We have used SIC to choose the optimal lag length
3) (*), (**) and (***) represent the level of significance at 10%, 5% and 1%, respectively.

Table 4: Phillips Perron Test For Unit Root

	With Intercept		With Intercept and trend		
	Level	1st Diff	Level	1st Diff	Status
IVA	-2.29	-4.21***	-2.07	-4.68***	I(1)
LF	-1.15	-6.28***	-1.52	-6.69***	I(1)
Exports	-1.81	-6.05***	-1.52	-6.69***	I(1)
Gascons	-1.31	-4.16***	-2.25	-4.14**	I(1)
Electcons	-2.38	-4.15***	-1.51	-4.54***	I(1)
Oilcons	-2.3	-4.02***	-0.9	-5.64***	I(1)
RRER	-1.26	-4.57***	-1.19	-4.65***	I(1)
RP	-0.28	-6.05***	-2.77	-6.15***	I(1)
WI	-0.68	-4.53***	-2.48	-4.43***	I(1)
Test critical values			Test critical values		
	1%level	-3.64	1% level		-4.26
	5%level	-2.99	5% level		-3.55
	10%level	-2.61	10% level		-0.31

5.3 Results of Simultaneous Equation Model

Now, we turn to the estimation of our simultaneous equation model. We have estimated three models (one model for each energy type) to explore the impact of energy consumption on exports in Pakistan. Beside other variables, in the first model we have incorporated electricity consumption as a supply side determinant. Similarly, in the second and third model we have included oil consumption and gas consumption as supply side determinants. Table 5 displays the results of the simultaneous equation model.

Table 5: GMM Estimates for Demand and Supply Equations

Model 1							
Demand side equation $\ln(EXP_t) = \alpha_0 + \alpha_1 \ln(REER_t) + \alpha_2 \ln(WI_t) + u_t$			Supply side equation $\ln(EXP_t) = \beta_0 + \beta_1 \ln(RP_t) + \beta_2 \ln(EC_t) + \beta_3 \ln(IVA_t) + \beta_4 \ln(LF_t) + u_t$				
Intercept	LnREER	LnWI	Intercept	lnRP	LnEC	LnIVA	LnLF
.06***	0.57***	1.63***	.09***	0.76***	1.19***	0.42***	-0.23**
(3.42)	(3.19)	(2.92)	(3.06)	(6.79)	(5.74)	(3.32)	(-0.30)
R^2=0.83 J statistics= 0.193, pvalue=0.16732 SE of Reg=0.120			R^2=0.84, J statistics= 0.193, Pvalue=0.1211 SE of Reg=0.1080				
Model 2							
Demand side equation $\ln(EXP_t) = \alpha_0 + \alpha_1 \ln(REER_t) + \alpha_2 \ln(WI_t) + u_t$			Supply side equation $\ln(EXP_t) = \beta_0 + \beta_1 \ln(RP_t) + \beta_2 \ln(OC_t) + \beta_3 \ln(IVA_t) + \beta_4 \ln(LF_t) + u_t$				
Intercept	LnREER	LnWI	Intercept	lnRP	LnOC	LnIVA	LnLF
.06***	0.58***	1.36***	0.11***	0.59***	0.14***	0.39***	-0.31**
(4.88)	(3.25)	(3.40)	(2.67.)	(4.79)	(2.46)	(3.06)	(-0.33)
R^2= 0.82 J statistics 0.184, pvalue=0.19731 SE of Reg=0.120			R^2= 0.83, J statistics=0.184, pvalue=0.1059 SE of Reg=0.115				
Model 3							
Demand side equation $\ln(EXP_t) = \alpha_0 + \alpha_1 \ln(REER_t) + \alpha_2 \ln(WI_t) + u_t$			Supply side equation $\ln(EXP_t) = \beta_0 + \beta_1 \ln(RP_t) + \beta_2 \ln(GC_t) + \beta_3 \ln(IVA_t) + \beta_4 \ln(LF_t) + u_t$				
Intercep	LnREER	LnWI	Intercept	lnRP	LnGC	LnIVA	LnLF
.07***	0.53***	1.23***	0.15***	0.58***	0.39***	0.11***	-1.63**
(6.63)	(2.99)	(3.35)	(4.55)	(4.74)	(2.37)	(0.82)	(-1.93)
R^2= 0.83, J statistics= 0.17 pvalue=0.2702 SE of Reg=0.120			R^2= 0.84, J statistics=0.17, pvalue=0.1579 SE of Reg=0.112				

Note: EXP is manufactured Exports, REER is Real Effective Exchange Rate, WI is world income, RP is relative prices, IVA is Industrial Value Added. EC, OC & GC represents Electricity Consumption, Oil Consumption and Gas consumption. The values in the parentheses show the t statistics of the coefficients whereas (*), (**) and (***) represents the level of significance at 10%, 5% and 1%, respectively

For GMM estimation the instruments used as WI, REER, RP, IVA, LF and EC. These instruments should be uncorrelated with error term and sometimes referred as test of overidentifying restrictions. J-statistics is commonly used to check the validity of overidentifying restrictions. For this purpose p-value of J-statistics is checked and it should be above 5 % threshold (Jintranun et al (2011).

5.3.1 GMM Estimates for Demand Side Equation

Real effective exchange rate appeared with expected positive sign. All the coefficients of REER are significant at 1% significance level. The coefficients of REER appeared with different magnitudes, i.e. the highest coefficient is 0.58 and the lowest coefficient is 0.53. This means that one percent increase in REER will increase our exports by 0.53 to 0.58 percent. The positive and significant estimated coefficients of REER indicate that a depreciation or (devaluation) of Pakistani currency has a positive impact on the manufactured exports of Pakistan. Our empirical results are in accordance with the theory and previous findings, i.e. Hassan and Khan (1994), Majeed and Ahmed (2006) and Hassan et al. (2013).

Similarly, world income has expected positive impact on manufactured exports of Pakistan. The coefficients of world income have expected positive signs and greater than unity in all the three models ranging from 1.63 to 1.23. It implies that one percent increase in word income leads the manufactured exports of Pakistan to increase by more than one percent. All the coefficients of income elasticity of demand are significant at 1% significance level. It means that increase in world income will have a positive and favorable impact on the manufactured exports of Pakistan. The significant and positive

income elasticity of world income is in confirmation with the previous studies of Hassan and Khan (1994), Atique and Ahmad (2003) and Zada (2012).

5.3.2 GMM Estimates for Supply Side Equation

The variable 'relative prices' has expected positive impact on manufactured exports. All the coefficients are significant at 1%. The positive price elasticity of exports reveals that increase in export prices with respect to domestic prices will increase the supply of exports indicating that export prices are more essential than domestic prices in determining the supply of exports.

Another significant and positive coefficient is the industrial value added variable in the present study. Most of the developing countries are agrarian and the agriculture output is unstable due to uncertain weather conditions and the attacks of pests. For a developing country like Pakistan, the importance of industrialization cannot be overlooked because by relying only on agriculture output no country can expand its export supply (Majeed and Ahmed 2006). Our results support the importance of industrialization for a sustainable export growth. Significance of industrialization for exports is confirmed by the previous findings of Majeed and Ahmed (2006) and Nadeem et al. (2012).

The impact of labor force on manufactured exports is significant and negatively related to manufactured exports of Pakistan. The negative relation between exports and total labor force is attributed to the unskilled labor force. The effect of unskilled labor force on the exports is negative because unskilled labor force cannot efficiently take part

in the export oriented sectors where skilled labor is required. Consequently, the addition of unskilled labor will increase the domestic demand and reduce the exports (Hassan et al (2013).

The main result of our study relates to the behavior of export in context of energy consumption. Our study has examined the sectoral relationship viz, oil, gas and electricity consumption with that of exports. The results have shown that all the three sources of energy consumption, i.e. electricity consumption, oil consumption and gas consumption, have positive and significant relationship with exports. The highest coefficient is 1.19 for electricity consumption whereas the lowest coefficient is 0.14 for oil consumption. This implies that one percent increase in electricity, gas and oil consumption will increase the manufactured exports by 1.19, 0.39 and 0.14 percent, respectively. Therefore, electricity (and hence hydel power as most cheapest source) plays the most important role in the promotion of exports followed by gas.

The results support the fact that energy which is considered as an important input during the production process bears great importance in term of foreign trade. Effective usage of energy sources generates positive effect on exports and economic growth as empirically confirmed by Erkan et.al (2010).

CHAPTER 6

Conclusion and Policy Implications

Keeping in view the worst energy crises in an energy hungry and energy deficient country like Pakistan, the core objective of this study is to explore the relationship between different sources of energy and manufactured exports of Pakistan. Although there is a wide literature that provides information about the relationship between energy consumption and income and even more and separate literature relates to the relationship between income and trade. However, there is little literature that combines these two streams of economic literature to explore the relationship between energy consumption and exports.

Keeping this in mind, in this study we have attempted to find the impact of energy consumption on manufactured exports of Pakistan by employing simultaneous equation model for the period from 1978 to 2014. In the demand side equation, REER and world income have been taken as independent variables whereas in supply side equation relative prices, industrial value added, energy consumption and total labor force have been considered as independent variables. Three simultaneous equation models have been constructed to analyze the impact of oil, gas and electricity consumption on exports, respectively. The demand and supply equations have been estimated by using GMM technique. This study finds significant and positive relationship between REER and exports indicating that depreciation has a favorable impact to improve exports. Similarly, world income also appeared with significant and positive sign.

As far as the supply side is concerned, relative prices appeared with significant and positive sign indicating that higher the export prices higher will be the incentive for the exporters to engage with exports. Industrial value added also carried significant and positive sign implying the importance of industrialization for a developing country like Pakistan. Energy sources turned out to be positive and highly significant indicating that any sort of deficiency in the supply of energy, specifically electricity and gas, will ultimately hinder the export growth. On the other hand labor force appeared with significant and negative sign indicating that high labor growth in the export oriented sectors with lack of skills will adversely affect the exports.

Forgone in view, it will not be an exaggeration to say that energy plays a pivotal role in the determination of manufactured exports of Pakistan. Energy shortage can create catastrophic results for the export performance of Pakistan which will ultimately have severe repercussions on the economic growth. Multidimensional policies are required to achieve high export growth with special emphasis on the energy sector followed by stringent implementation strategy. Keeping in view the above discussion, this study derives following policy recommendations:

1. The positive relationship between exports and different sources of energy consumption revealed that if energy supply to the export oriented industries is not guaranteed, then export performance of Pakistan will be negatively affected leaving a certain impact on economic growth. It is therefore necessary to shift extensive mode to quality oriented intensive mode for foreign trade, which will be

beneficial for optimization of energy consumption. Export producing enterprises should update their technology to reduce the energy consumption.

2. Similarly, gas load shedding has also become quite common adversely affecting domestic and commercial sector in general and industrial sector in particular. This situation is very alarming because it will shake the confidence of industries and hardly leaves any room to stay competitive in local and international markets. Efforts should be made to provide gas and electricity to the industrial sector without any disruption. For this purpose, special attention should be paid for the development of coal and fuel for industries and power sector. Investment from private sector should also be encouraged to reap the benefits from this cheap source of energy.
3. It is of critical importance to maintain a stable and depriciating exchange rate in order to increase the exports and trade volume in general and to avoid the exchange rate risk in perticular. While the significant and positive cofficient of world income indicates colossal dependence of pakistan`s exports on world economies. Though the world income has grown rapidly but due to poor market acess and other trade resrrictions the growth in exports has not been matched with the growth in world income. Therefore, for sustainable export growth better market acess has to be ensured and our exporters should adopt market demand oriented strategy. Government should monior the business cycles of its trade parteners in order to expand the exports during the periods of cyclical booms.

4. The negative and statistically significant cofficent of labor force indicates that government should focus on skill development programme to develop the human resource in a way that they can be a bonus to the country by participating in the economic and productive activies instead of being burden to the country. Similarly the results of Industrial value added indicates the importance of industrialisation for a developing country like Pakistan. Government should promote and facilitate the process of industrialisation which will trim down the dependance on imports by initiating the import substitution.

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