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AN ANALYSIS OF EXPORT DEMAND FUNCTION FOR SELECTED AGRICULTURAL PRODUCTS: A CASE OF PAKISTAN

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ABSTRACT

Estimation of export demand function of Pakistan for three important destinations of China, Saudi Arabia and United Arab Emirates has been investigated in this study. The dataset consists of annual time series data spanning from 1990 to 2021. Different data sources like various issues of Economic Survey of Pakistan, UN Comtrade, WDI and State Bank of Pakistan (SBP) were consulted to collect the required data. Based on the three destinations we regress 6 models for our two selected commodities. Before regression we checked the data for unit root and found that our variables have mixed order of integration. To scrutinize the data, we employed ARDL estimation strategy and found that in case of China and Saudi Arabia the foreign income and relative prices have significant influence on rice export demand function while for UAE foreign income were found insignificant. In case of cotton, relative prices are insignificant for Saudi Arabia and China and improve export demand in UAE. Domestic Prices of rice showed negative impacts for Saudi Arabia and United Arab Emirates and positive for China while that of cotton it was found significant for China and United Arab Emirates and insignificant in case of Saudi Arabia. Exchange rate were found with positive contribution towards increase in export demand function of both rice and cotton in case of all the three destinations. We also checked our models for diagnostic tests and discovered that there are no issues related to serial correlation and heteroskedasticity and furthermore, the CUSUM and CUSUMQ analysis suggested that our coefficients have stable behavior over the course of selected study period. Based on the findings of the study it is suggested that the government of Pakistan may continue with devaluation policy as it helps in export promotion.

Keywords: ARDL; Cotton; Rice; UAE; Pakistan

INTRODUCTION

Trade determines the economic activities of a nation. Not only determines the economic activities of the developing countries but also determines of the advanced economies. So, for these purposes, state mostly adopt reforms in trade policy. Trade reforms are necessary for a country for several important reasons, as they can have significant impacts on the nation's economic growth, development, and overall well-being. Some key reasons why reforms are essential such as economic growth and development, access to new markets, Foreign Direct Investment (FDI), consumer benefits, innovations and technology transfer and specialization and efficiency. Reforms in trade policy refer to changes and adjustments made by governments to their trade regulations, tariffs, and agreements to promote and facilitate international trade. These reforms are often aimed at increasing economic efficiency, fostering globalization, and creating opportunities for businesses and Individuals in both local and international markets (Gnutzmann-Mkrtchyan and Volmer, 2022).

The reforms in trade policy implemented by both developed and developing countries with the goal of embracing globalization have brought about a set of opportunities and challenges for the trade in agricultural products. It generate many opportunities like increased market access, diversification of markets, and technology and knowledge transfer. Therefore, many hurdle in trade policy reforms, such as market volatility, unfair competition, food safety and quality standard, and displacement of local farmers are to be faced, (Inomjon et al., 2021). In order to enhance the export capabilities of promising agricultural commodities, it is crucial for economies to grasp the fundamental dynamics of the commodities they produce.

Regarding Pakistan's situation, rice and cotton have been significant export commodities and play a dominant role in the country's agriculture production which face international competition and needs to address the issues that hinder the pace of exports of these commodities. Current study is an attempt to explore the potential markets for cotton and rice, as said, amongst the major exporting commodities of Pakistan. Agriculture is one of the important sector that contribute almost 20 percent in total growth of Pakistan which was 60 percent in 60,s. Despite the decline in its relative contribution to the GDP over the years, the agriculture sector remains a crucial pillar of the economy. It is the largest sector in terms of employment, with approximately half of the country's workforce engaged in agricultural activities (GOP, 2017-18). The agriculture sector's significance extends beyond its direct contribution to GDP. It serves as a vital source of foreign exchange earnings for Pakistan, playing a pivotal role in supporting the country's external trade and balance of payments. Moreover, agriculture plays a crucial role in providing food and sustenance to both rural and urban populations, contributing to food security and ensuring a stable supply of essential commodities (Jatoi, 2020). In Pakistan agriculture products are categorized into food crops and cash crops. Food crops are grown for household consumption, whereas cash crops are grown for commercial purposes. Pakistan holds the 8th position worldwide in terms of agricultural yield, underscoring the significance of its agriculture sector on the global stage. The major crops in Pakistan include wheat, sugarcane, cotton, and rice, which together account for 75% of the overall agriculture output. Within this 75% share, rice and cotton products make up approximately 50%. These crops play a crucial role in the country's agriculture sector and have a significant impact on its economy and trade (Waha et al., 2020; Jatoi, 2020).

Numerous studies have been conducted in various countries to estimate export demands at the product-level. These studies aim to analyze and understand the specific export demands for different products, providing valuable insights into international trade patterns and market dynamics (e.g. Oskooee, Iqbal & Khan, 2017; Shuakat and Hussain, 2010). Numerous research endeavors have examined the export demand and supply dynamics of wheat, corn, and soybeans within the United States. These studies aim to understand the dynamics of these key agricultural commodities in the international market. Different studies analyzing the export demand for wheat, corn, and soybeans in the United States have yielded varied results. Specifically, the export demand for corn was found to be elastic, meaning that changes in price have a relatively large impact on the quantity demanded in the international market. On the other hand, soybean's export demand was found to be inelastic. Such as Anwar, Shuakat and Hussain (2010) studied that the export of cotton lint from Pakistan and found that policies formulation determine export nature. Oskooee, Iqbal and Khan (2017) The investigation unveiled that the exchange rate exerts a short-term impact on competitiveness on 50% of the factories involved in trade. Among these, 26 exporting and 18 importing factories were established designated particularly pretentious by the exchange rate fluctuations. The findings suggest that exchange rate movements can have significant implications for trade dynamics between the two countries, influencing both exporting and importing industries during the specified time frame. Bashir (2003) Conducted research pertaining to the exportation of agricultural commodities in Pakistan and Investigated how the trade policy and liberalization measures of the country influence the export performance within the agricultural sector. The research findings indicated that Pakistan's trade policy and the implementation of trade liberalization measures had a positive effect on the

export enactment of agriculture outputs in Pakistan. This suggests that the adoption of favorable trade policies and the promotion of liberalized trade practices have contributed to the growth and success of agricultural exports in Pakistan. Several other studies also focused on export demand functions of Pakistan but this literature either take bilateral cases or done at aggregate levels but ignore the destination wise analysis. Therefore, the present endeavor concentrated on key target locations to address the existing research gap. The destinations of Pakistan cotton and rice products are taken as per their share and second to the convenience of data availability. China, Saudi Arabia and United Arab Emirates are the selected destinations.

The study is aimed because Pakistan has strong potential to produce cotton and rice, which also have gorgeous share in the GDP and it can play important parts in enhancement of economy. Pakistan is agriculture-based country and has sources which are required for the production of rice and cotton just like water and fertile land. So, the study is based on agriculture products, have significant role in research.

LITERATURE REVIEW

The earlier studies on trade, spanning from mercantilist to modern trade theory, extensively discusses the association between growth and exports of countries, revealing a strong positive correlation. Numerous studies have sought to identify factors influencing a country's export growth, which is crucial for overall economic development. Literature relevant to export demand function is the focus of this chapter and divided into; aggregate level, product level and literature that focus on evaluation of rice and cotton export demand function.

Literature Review Focused on Export Demand at Aggregate Level

Numerous studies, after the seminal work of Khan (1974) and Houthakker and Magee (1969) attempted to explore foreign income, growth of exports and its prices, e.g. the same nexus has been investigated by Balassa et al. (1989) for Korea and Greece. Ahmed and Atique (2003) conducted a study focusing on Pakistan's exports from 1972 to 2000, incorporating lags to examine both supply and demand determinants. They found that non-price factors like infrastructure facilities, trade advancements, and high-quality products were crucial for Pakistan's exports, and the global economic movement and exchange rates also significantly influenced export demand. The research emphasizes the importance of developing these non-price factors to promote Pakistan's exports effectively. Narayan and Narayan (2004) Carried out research analyzing the factors influencing export demand in Fiji from 1970 to 1999 using the autoregressive distributed lag model. It is concluded that price elasticities and income of trading partner have considerable influence on export. Hossain (2009) analyzed the aggregate export demand reactions in Indonesia from 1963 to 2005. The primary objective was to examine if there were any structural changes in Indonesia's export demand over time. Using different methodologies like ARDL, Recursive and Rolling Regression (RRR) and Hausen-Johanson (HJ), it is concluded that there is strong connectivity amongst relative export prices, world income, and real exports in Indonesia. Income elasticity and relative export price elasticity of Indonesian exports were found to be opposite, with income elasticity exceeding one and relative export price elasticity being smaller than one. Furthermore, the analysis of Hansen-Johnson and Recursive and Rolling Regression results suggested that Indonesia's export demand experienced significant structural changes since 1990 that causes increase in cross elasticities of export prices and reduce the income elasticity of Indonesian exports. Further, it is pointed out that the slow economic recovery of Indonesian exports since 2000 could be attributed to the financial crises that occurred between 1971 and 1998, which had a lasting impact on the country's export performance. Malefane et al., (2022) For Botswana, an import demand function was estimated. Using ARDL they found that important demand function is inelastic variation in its prices in long- and short-time span. They concluded it by resembling with the economies having fast growth as Botswana imports are fuel, diamonds and many other high price products. Alam (2010), Explored how exchange rates impact the overall exports of Pakistan. He employed ARDL econometric technique, the analysis revealed that the real effective exchange rate, economic activities, and

volatility of the real exchange rate were cointegrated with Pakistan's aggregate exports. Additionally, the research determined a favorable correlation between economic activities and aggregate exports in Pakistan. While negative association between the volatility of REER on total exports of Pakistan. Afzal and Riaz (2011) conducted a study using bilateral trade data from 1973 to 2008 to measure Pakistan's trade elasticities of imports and exports with selected trading allies and Asian countries, aiming to assess Pakistan's trade potential. The study considered various determinants that can influence a country's imports and exports, including factors related to income, gross domestic product (GDP), production costs, and exchange rates, inflation disparities between the country and foreign nations, and domestic supply and demand conditions. They applied several statistical tests, such as the J.J. test of cointegration t, ECM and Granger Causality test for evaluation. The outcomes discovered that income and exchange rates were the primary factors affecting the value of exports. The study recommended that Pakistan should focus on increasing trade with Asian countries, particularly India and China, due to their strong purchasing power. Additionally, they suggested exploring trade opportunities with major partners. Khan, et al., (2013) investigated the export demand determinants for Pakistan using annual data from 1980 to 2010. They focused on two major factors, namely the REER and the trade partners' income level, as determinants of export demand. To estimate the long-run association among the study variables, they employed the auto-regressive distributed lag model. The results of their analysis indicated co-integration among the variables, suggesting a long-term relationship. The study highlighted that the role of foreign income was more significant than the real effective exchange rate during the period of analysis. In essence, the findings revealed that foreign income was the most crucial factor influencing export demand, while the RER did not have a substantial effect on Pakistan's export demand in the extended time frame. The study conducted by Oskooee, et al., (2017), explored the association among Pakistan and USA. They analyzed how fluctuations in exchange rates influenced the bilateral trade relationship between the two countries. In a separate study by Hussain and Mazhar (2018), the researchers focused on the determinants of export value in Pakistan. They considered both the supply-side and demand-side aspects that affect the country's exports. To analyze this, they used the Unrestricted Autoregressive Distributed Lag (ARDL) model and examined data from 1971 to 2015. The results they obtained demonstrated that, on a broader scale, exports exhibited elasticity in response to variations in global income and relative export prices. Additionally, they observed that world income had a high elasticity towards specific products like cotton cloth, leather, and manufactured goods, indicating the significant impact of these products on Pakistan's overall exports.

Literature Review focused on Product-level Export Demand

Wilson (1994) using annual data from 1976-1989 attempted to estimate the demand function of wheat in Malaysia, Republic of Korea, Taiwan, Singapore, Thailand and Taiwan. This study took the aggregate wheat classes for the said purpose. By using AIDS (Almost Ideal Demand System), each country were estimated individually and revealed that wheat imports are the function of expenditures and thus emphasis should be given to these expenditures. Onunkwo and Epperson (2001) investigated the determinants influencing US export demand. This study focus on almond exports to different regions e.g. EU and Asia. Moreover, it focus on the evaluation of US almond export promotion policy. They found that Asia and the EU imported around 93 percent of American almonds. They concluded that its market in EU did not show a noticeable response to promotion efforts. For every dollar spent on devaluing promotion expenses for almonds in Asia, the return accountability promotion expenses were $47.74, indicating a need for more effective utilization of promotion funds in the Asian market due to its sophistication and maturity. On the other hand, the EU appeared as a sophisticated market for U.S. almond exports, suggesting that a simpler and more straightforward promotion process would be more helpful. Gbentnkom and Khan (2002) focused on three major agri-exports of Cameroon over 1971 to 1996. It was concluded that access to market play important role in export promotion as roads infrastructure were found with positive and statistically significant outcomes. Further, the prices of exports were also found with major contribution

in case of banana but not with respect to the exports of cocoa and coffee. The quality of the products were also found one of the important factors that determine exports direction. Haleem, et al., (2005) focused on the exports of citrus fruits of Pakistan. They found that weather plays an important role in production and thus exports. Yosaf and Yosaf (2017), conducted a study to examine the factors influencing Nigeria's exports of palm-kernal, rubber and cocoa, the three important export products. This research utilized time series analysis with annual data spanning thirty-three years from 1970 to 2002. The study revealed a significant relationship between the selected variables. More specifically it indicated that past year GDP had a positive effect on cocoa exports, while past year production had a negative impact. Exchange rate devaluation improved rubber exports. GDP positively influenced palm-kernel exports, and palm-kernel production also had a positive impact on exports. Overall, enhancing agricultural commodity production could reduce Nigeria's dependency on oil exports. Hussain (2010), conducted a study using annual data from 1988 to 2009, aiming to explore the key factors influencing Pakistan's export performance, with a focus on world demand as a significant aspect. The research paper revealed four distinct periods of Pakistan's export development: from 1989 to 1994, 1995 to 1999, 2000 to 2004, and 2005 to 2009. During the first and third phases, Pakistan's exports experienced rapid expansion, while the growth rate was lower in the second and fourth phases. The study categorized exports into various sectors, including rice, leather, textile yarn, cotton fabrics, and different articles of textiles and garments. Bourdan and Korinek (2011) focused take Europe, China and US to examine the volatility of exchange rate and its effects on the exports of agro-industrial sectors. Further, they cross compare these sectors with each other regions (economies). The authors used the Autoregressive Distributed Lag model (ARDL) with cointegration for their empirical analysis, finding that this model was more significant than other techniques like the Johnson Cointegration (JC) technique. The results revealed that the exchange rate affect the trade pattern between China and USA more than the trade between US-Euro region or Europe and China. Moreover, tit was also concluded that Imports are less sensitive to fluctuations in exchange rate as compared to exports and agricultural exports response was more than industrial exports. Factors that determine the products exports potential were different for both the sectors where exchange rates having a stronger effect on the agriculture sector than on the mining and manufacturing sector. Adonzia and Royales (2012) highlight the extreme drought that occurred in the United States during the summer season of 2012. This severe drought had a significant impact on agricultural crops, particularly corn. The drought caused physical damage to the corn crops, resulting in a substantial increase in U.S export prices, which rose by The calculated figure is 128 percent higher than the 20-year average as determined by the Bureau of Labor Statistics (BLS).. Given that the United States is a major corn producer globally, the damage to corn production brings negative consequences for world supplies and thus affecting U.S. trade dynamics. Aftab, Abbas, and Kayani (2012) Undertook a comprehensive study to elucidate the intricate interplay between exchange rate volatility and the nuanced landscape of sectoral export trade within the context of Pakistan. They analyzed data from 2003 to 2010 for 20 different sectors. Each sector were regress and analyzed separately. To observe the interconnection among sectoral exports and exchange rate instability, they employed the bounding testing tool, recommended by Pesaran et al. (2001). Additionally, they used the Robert F. Engle designed test i.e. Generalized Autoregressive Conditional Heteroscedasticity (GARCH) which was later suggested by Bollerslev, to evaluate instability of exchange rate. For their analysis, the authors applied the Auto Regressive Distributed Lag (ARDL) model, known for its validity in both stationary and non-stationary data. The findings revealed that exchange rate instability and relative prices reduce the export volume of Pakistan as it reduce the demand by having negative association with. Moreover, trading partner income played significant role in the selected sectors indicating a long-run relationship, although some results were insignificant. Ridley and Devadoss (2023) found that US cotton export face tremendous competition from Brazil and thus disrupted. Similarly Too et al., (2023) found that what export in Kenya increased from the last two decades. The take the data from 2000 to 2019 and found strong cointegration in the model.

Literature Review focused on Cotton and Rice Export Demand Determinants

Hussain (1964) presented a qualitative research paper emphasizing rice as a significant source of earning for Pakistan. The study explored rice exports from West Pakistan during 1958-59 and emphasized the importance of understanding world supply and demand information to improve rice exports and ensure staple food supply. The research focused on the cultivation of different types of rice, particularly fine rice, in Punjab. It aimed to provide crucial evidence on the supply and demand of Pakistan's rice. This study come up with a conclusion that providing sufficient water and economic suggestions were essential, and recommended changing the current policy and institutional structure to favor a free domestic rice market and open private export trade. These changes could benefit growers with better prices, improve exports, and enhance flexibility in export prices in the global market, benefiting Pakistan. Banuri (1998) conducted a study on cotton production in Pakistan, which holds a significant share in the country's agriculture sector. The author highlighted the positive connection between the common procedures of cotton production and environmental and health costs. Environmental costs were particularly linked to the use of agro-chemicals like pesticides, water consumption in the initial stages, and the use of various chemicals during dyeing and finishing processes in the textile industry. The research emphasized that cotton production and the textile industry have implications for various environmental issues. The study relied on primary data collected through questionnaires. On the other hand, Hudson and Ethridge (1999) examined the influence of export taxes on raw cotton to regulate domestic cotton prices and support the domestic yarn industry in Pakistan. Using data from fiscal years 1988-1995, they applied separate estimation methods for both sectors. The structural econometric model was utilized to analyze the results. Yarn sector output were found in no response to the taxation policy that were imposed on exports but the cotton output growth was found in negative association with that policy or it responded negatively to taxation on exports. Hussain, (2010), analyzed the export demand function for agricultural products of Pakistan. in this study the performance of Pakistani exports were analyzed. The products were divided into 9 categories and estimated the annual data through GMM. The causes of price fluctuations and elasticities of expenditures for export categories were determined by the author. In 2005, Afzal (2005) estimated the supply and demand determinants of Pakistanis export. He divided the analysis into aggregate level, manufactured products and primary level exports. The price elasticity for primary and aggregate products were found below the unit elasticity while that of manufactured products it was more than unity. Ghafoor, et al., (2013) studied the mangoes export response in case of Pakistan by using cointegration analysis on the data taken from 1975 to 2005. They found that coefficient elasticities are high for mangoes export of Pakistan. Further they checked for granger causality and found two way causation between exports of mangoes and relative prices which mean both move in a same direction where one leads to other. In their study on the determinants of rice export, Bilal and Rizvi (2013) focused on identifying the factors that influence Pakistan's rice exports. They highlighted that Pakistan is the third-largest exporter of rice globally, and rice represents a major agricultural production in the country. The research utilized annual series data from 1980 to 2010. To test for the presence of a unit root among variables, the authors applied the Augmented Dickey Fuller test. To assess the long-run connection between the variables, they used the Johansen Cointegration Method. For further estimation, they employed a two-lagged model with all variables taken in log (ln) form. Their findings revealed that domestic price and export price had a negative and significant impact. Based on the results, the study suggested that policies should be designed to promote increased rice production to enhance exports. Rehman, et al., (2015) investigated the economic aspects of major crops in Pakistan. They took the 65 years of data from 1950 to 2015 to fully capture the phenomenon in Pakistan. By using Johansen cointegration test they found that GDP of agriculture enhanced by the production of cotton, rice and wheat and suggested that government of Pakistan may promote agriculture sector to achieve high growth objective. Mirza et al., (2016) analyzed the behavior of Pakistan cash crops exports. The two cash crops taken for this analysis were rice and cotton. They took the sample period from 1980 to

2009. A strong relationship between the selected model's dependent and independent variables was identified in their findings. The supply and demand aspects of Pakistan export were also analyzed by Sayed et al., (2018). They took the sample from 1971 to 2015 and used ARDL to scrutinize the data. Further, the data were used at both disaggregated and aggregate levels. In response of world income, this study found that export are elastic at aggregate level. Manufacturing exports were found elastic at disaggregate level and further cotton and leather products were found in positive response with respect to world income. They concluded that at aggregate level demand factors plays important role while at disaggregate level supply factors are the major contributors. Hussain et al., (2020), export performance with respect to supply side factors were analyzed in this study over the period of 1971 to 2014. By employing ARDL, this study found different response from different categories of supply factors i.e. considerable impacts of relative prices were recorded for raw materials and manufacturing industrial products. Omer et al., (2022) looked at the fluctuations in exchange rate and its impacts on trade balane in case of Pakistan. They took the data from 1968 to 2019 and Generalized Method of Moments to extrat the results. They found that exchange rate fluactuations are helpful for export promotion and reduce the imports bills in Pakistan. Same results were also found by Gulzar et al., (2022) who tested the Marshall Learner condition in Pakistan.

Research Gap

Literatures are numerous that have been analyzed aggregate export demand and disaggregate. Some of the studies executed product wise export demand estimation. However, there is scanty literature that has been analyzed export demand to important destinations for the products of cotton and rice. The present study fills the gap and estimate export demand using data for the product of cotton and rice in which Pakistan has the potential over other commodities.

Model and Methodology

Theoretical Framework

Focus of this study is to examine the demand function for specific commodities, namely cotton and rice. Goldstein and Khan (1985) imperfect substitute models are designed for this type of studies and therefore have a base models status in literature. This model is used to associate Income of trading partners, volume of exports and relative export values. So a specific demand function will become;

$$Z_{d,t} = f(RelPr_t, FI_t) \qquad (3.1.)$$

Here Z is the volume of exports, "d" is for demand and subscript "t" used to represent time. "RelPr" is used here to show relative prices and "FI" is the foreign (trading partner) income. But these are not the few that determine export demand as exchange rate volatility also have significant role in determination of export demand (Oskooee's, 1998; Bourdan and Korinek,2011). Therefore our above equation with the inclusion of exchange rate will become;

$$Z_{d,t} = f(RelPr_t, FI_t, ExR) \qquad (3.2)$$

Gbentnkom and Khan (2002) claimed that domestic prices of a commodity also have important role in framing the export demand function so its role as explanatory factors shall not be ignore, hence we have;

$$Z_{d,t} = f(RelPr_t, FI_t, ExR, DmPt) \qquad (3.3)$$

This theoretical foundation which state that export demand function for any product is determine by relative price, income of trading partner which we express with foreign income, exchange rates and domestic prices is the bases for our empirical model.

Empirical Model

Based on the above theoretical foundation our empirical model for the two selected commodities is given below.

$$\ln XCt = \alpha_0 + \alpha 1\ lnRelPr_t + \alpha 4\ lnCDmP_t + \alpha 2\ lnFI_t + \alpha 3 \ln ExR_t + \varepsilon t \qquad (3.4)$$

$$\ln XRt = \alpha_0 + \alpha 1\ lnRelPr_t + \alpha 4\ lnRDmP_t + \alpha 2\ lnFI_t + \alpha 3 \ln ExR_t + \varepsilon t \qquad (3.5)$$

Equation 3.4 and 3.5 are the two equations estimated for cotton and rice where there are three destinations like China, Saudi Arabia (SA) and United Arab Emirate (UAE). As we have 3 countries (destination in our case) therefore to run a model for every single country, we estimated a total of 6 models.

Data Sources

From 1990 to 2021, annual time series data was collected on the selected variable from different sources like UN Comtrade, Economics Survey of Pakistan and World Development Indicators, (See table 3.1)

Table 3.1

Variables of the Model and Data Sources

Time periods	Annual Data from 1990 to 2021
Economies	United Arab Emirates (UAE); Saudi Arabia; China
Products	Cotton. Rice.
Variables	Export of Rice & Cotton, Relative prices, Domestic prices of Rice & cotton, Foreign Income, Exchange Rates with the destination country
Data Bases	State Bank Of Pakistan; Economics Survey of Pakistan; UN-Comtrade; World Development Indicators (WDI).

METHODOLOGY

Unite Root Test: Augmented Dickey Fuller (ADF)

Augmented Dickey and Fuller unit root test were introduced by Dickey Fuller (ADF) in 1979 to look at the stationarity of the data. The non-stationary data if regressed, have, serious implications for policy makers and therefore academicians suggested to avoid these, one has to check the data for stationarity and if found non-stationary, should make stationary. The fundamental equation and primary specifications for the ADF unit root estimation are as follows:

$$dlnzt = \delta 1 + \delta 2 + \varphi y_{t-1} + \gamma 1 \sum_{i=1}^{m} dtz - 1 + \varepsilon t \ldots\ldots\ldots\ldots\ldots (3.6)$$

In this equation; εt is error term and $dz_{t-1} = (z_{t-1} - z_{t-2}),\ (dz_{t-2} - z_{t-3})$

During the ADF test, the estimation of "φ" results in a value of zero. The stationarity hypothesis within the ADF is presented as follows:

$$H0: \varphi = 0$$
$$H1: \varphi \neq 0$$

Here, equation (3.4.2) denotes the null hypothesis, and the presence of a unit root implies that the variables are not stationary. Is alternate hypothesis, indicate that the variable is stationary at level.

Estimation procedure

This study employed Autoregressive Distributive Lag model (ARDL) estimation technique of Pesaran et al (2001) for cointegration analysis. It is preferred over rest of other techniques because i. it is simple in application as once the integration order decided, through OLS one can estimate for long run estimates, ii. It does not need prior test of unit root as it is applicable in mixed order of integration or have similar order but none of the variable should exceed the first order and iii. It is best suited for short span of time period.

In three stages we concluded ARDL based estimation. i. Calculation of cointegration based on Wald F-statistics. The decision of presence of cointegration in the model is ended through calculation of Wald F statistics. One can face three scenario while calculating Wald F, i. the calculated value can exceed the higher limit of a given value at 5 percent level of significance, ii. It can be lower than the lower bounds and iii. May lie in between the upper bound and lower bounds.

When the case is first one, we decide for the existence of cointegration and if it is lower than the lower bounds of tabulated Wald F statistics, It signified the absence of long-term cointegration, with consideration for the third scenario i.e. If the computed value falls within the range of upper and lower bounds, it enters an indeterminate zone, leading to inconclusive results and one should not decide whether there exist a long run cointegration or not.

The general form of ARDL also known as Bound test is as;

$$\Delta Vt = \text{constant} + \sum_{i=1}^{p} \beta i \Delta Vt - i + \sum_{i=0}^{p} \gamma i \Delta Nt - i + JVt - 1 + KNt - 1 + \mu t - - - - 3.7$$

Here in this equation (3.7), "V_t" & "N_t" are those variables that will be tested for cointegration for which the null hypothesis is constructed as;

$$H0 : J = K = 0$$
$$H1 : J \neq K \neq 0$$

Establishment of long run cointegration is followed by the extraction of estimates for long span of time through through application of OLS;

$$Vt = Cpnstant + \sum_{i=0}^{p} + JVt - 1 + \sum_{i=0}^{p} KNt - 1 + \mu t \text{----------} 3.8$$

Here J, K are the long run coefficients in the above model.

After extracting the long run estimates, the short run effects are found. Through linear transformation, error correction model is applied to find the speed with which the disequilibria can be adjusted, the general form is;

$$\Delta Vt = constant + \sum_{i=1}^{p} \beta i \Delta Vt - i + \sum_{i=1}^{p} \gamma i \Delta Nt - i + \mu t \text{----------} 3.9$$

$\beta i, \gamma i,$ are the coefficients for a short run.

Diagnostic tests

Different diagnostic tests are applied on the selected model to check whether there is any econometric problem existed or not. In this study we used LM test for the detection of serial correlation and heteroscedasticity is tested through the application of White Noise test.

Stability Test

This study employs the Recursive and CUSUM test to analyze the coefficients of long run stability. Basically it is based on residuals of recursive and supposed by Brown, Durbin and Evans in 1975. Fundamentally it capture time events especially when structural change is unknown to the investigator. An assumption is set about the coefficient vector "β" that it does not change its pattern over the specified period. This test is preferred as it does not require any prior information for a structural change in specific period. in this test two limits for residuals are drawn and if the residual does not exceeds the boundaries but remain within the set limits, it indicate and evident for stability and vice versa if it exceeds and goes outside the error boundaries. These two boundaries range from -2 to +2.

Result and Discussion

Unit Root Analysis

Unit root results of the selected variables are presented in table 4.1 Regarding the export demand function for rice and 4.2 for the demand function of cotton exports respectively. These tables have the results while following a procedure of taking intercept once and then by taking intercepts and trends. The displayed results suggested that relative export prices for China and export of rice for UAE are stationarity at level while remaining selected variables become stationary when they are checked for taking the first difference. Similarly, the random walk analysis for cotton export price model revealed that cotton export prices for China and Cotton exports for UAE are stationary at level while rest of the variables become stationary at first difference. Therefore, we conclude that in our case there is mixed order of integration.

Table 4.1

Unit Root Analysis of Rice Export Demand

Note: "p-values" of all the variables are in parenthesis

Destination	Var.	Level		1st Difference		Decision
		C	C,T	C	C,T	
China	XR	-1.81 .68)	-1.75 (0.48)	-3.79 (0.00)	-3.95(0.00)	I(1)
	RelPrr	-3.26(0.002)	-3.61 (0.000)	----------	----------	I(0)
	RDmP	-1.69(0.423)	-1.75(0.429)	-4.79 (0.000)	-4.85(0.000)	I(1)
	FrI	-0.78(0.923)	-1.07 (0.865)	-4.845 (0.00)	-4.673(0.000)	I(1)
	EXRr	-1.97(0.825)	-1.85 (0.793)	-5.65 (0.000)	-5.42(0.000)	I(1)
Saudi Arabia	XR	-1.35(0.651)	-0.974(0.312)	-7.81 (0.000)	-6.89 (0.000)	I(1)
	RelPrr	-.906 (0.540)	-1.705(0.582)	-4.381 (0.000)	-4.942 (0.000)	I(1)
	RDmP	-1.69(0.423)	-1.75(0.429)	-4.79 (0.000)	-4.85(0.000)	I(1)
	FrI	-0.78(0.923)	-1.07 (0.865)	-4.845 (0.00)	-4.673(0.000)	I(1)
	EXRr	-1.97(0.825)	-1.85 (0.793)	-5.65 (0.000)	-5.42(0.000)	I(1)
United Arab Emirates	XR	-5.84 (0.000)	-527 (0.000)	----------	----------	I(0)
	RelPrr	-0.93(0.759)	-1.28 (0.843)	-3.68 (0.000)	-3.93 (0.000)	I(1)
	RDmP	1.25 (0.546)	-1.68 (0.782)	-2.84 (0.009)	-2.73 (0.005)	I(1)
	FrI	-0.690 (0.51)	-0.98 (0.279)	-3.12 (0.007)	-3.83 (0.003)	I(1)

	EXRr	-0.186 (0.73)	-0.952(0.83)	-2.82 (0.006)	-2.94 (0.004)	I(1)

Table 4.2
Unit Root Analysis of Cotton Export Demand

Destination	***Var.***	***Level***		***1st Difference***		***Decision***
		C	*C,T*	*C*	*C,T*	
China	*XC*	*-0.780(0.342)*	*-1.507 (0.812)*	*-6.42(0.000)*	*-6.14(0.000)*	*I(1)*
	RelPrc	*-3.27 (0.003)*	*-3.84 (0.002)*	----------	----------	*I(0)*
	CDmP	*-2.12(0.090)*	*-1.81 (0.954)*	*-2.87 (0.003)*	*-2.85 (0.004)*	*I(1)*
	FrI	*-1.33 (0.763)*	*-1.89 (0.088)*	*-3.68 (0.000)*	*-4.12 (0.000)*	*I(1)*
	EXRc	*-1.91 (0.897)*	*-1.98(0.943)*	*-5.43 (0.000)*	*-5.82 (0.000)*	*I(1)*
Saudi Arabia	*XC*	*-0.780(0.342)*	*-1.507 (0.812)*	*-6.42(0.000)*	*-6.14(0.000)*	*I(1)*
	RelPrc	*-1.33 (0.763)*	*-1.89 (0.088)*	*-3.68 (0.000)*	*-4.12 (0.000)*	*I(1)*
	CDmP	*-2.12(0.090)*	*-1.81 (0.954)*	*-2.87 (0.003)*	*-2.85 (0.004)*	*I(1)*
	FrI	*-1.33 (0.763)*	*-1.89 (0.088)*	*-3.68 (0.000)*	*-4.12 (0.000)*	*I(1)*
	EXRc	*-1.91 (0.897)*	*-1.98(0.943)*	*-5.43 (0.000)*	*-5.82 (0.000)*	*I(1)*
United Arab Emirates	*XC*	*-4.69 (0.000)*	*-4.72 (0.000)*	----------	----------	*I(0)*
	RelPrc	*-1.33 (0.763)*	*-1.89 (0.088)*	*-3.68 (0.000)*	*-4.12 (0.000)*	*I(1)*
	CDmP	*-2.12(0.090)*	*-1.81 (0.954)*	*-2.87 (0.003)*	*-2.85 (0.004)*	*I(1)*
	FrI	*-1.33 (0.763)*	*-1.89 (0.088)*	*-3.68 (0.000)*	*-4.12 (0.000)*	*I(1)*
	EXRc	*-1.91 (0.897)*	*-1.98(0.943)*	*-5.43 (0.000)*	*-5.82 (0.000)*	*I(1)*

Note: "p-values" of all the variables are in parenthesis

Analysis of Cointegration

The results of cointegration for their respective models are presented in table 4.2. and 4.3 which indicate that in all our models there is cointegration which mean our calculated Wald- F values are greater than the tabulated values at 5 percent significance level. In cotton models, the one which we estimated for China the Wald F- value is 5.978, for Saudi Arabia it is 9.692 and for UAE it is 7.381. In all these models the calculated values are greater than the ones tabulated by Pesaran (2001). Similarly in case of rice models the Wald F-statistics is 4.462, for SA it is 6.235 and for UAE it is 5.589 and again here too there is evidence of cointegration as per the guidelines suggested by Peasaran (2001).

Table 4.3
Cointegration in Cotton Models

Country	**F-stat (p-value)**	**Upper bound (%) Intercept and no trend**
China	5.978	4.01 (5%)
SA	9.692	4.01 (5%)
UAE	7.381	4.01 (5%)

Table 4.4
Cointegration in Rice Models

Country	**F-stat (p-value)**	**Upper bound (%) Intercept and no trend**
China	4.462	4.01 (5%)
SA	6.235	4.01 (5%)
UAE	5.589	4.01 (5%)

Long-Run Results for Export Demand Function of Rice and Cotton:

Amongst the two, in case of China, relative prices for are significant and negatively associated with the export demand function of rice while that of cotton it is insignificant. Further, the relative prices reduce the rice export demand function by 45 percent while that of cotton is increased by 42 percent although it is insignificant statistically. There are several reason for negative association between the two. The sign of coefficient values of domestic prices for both rice and cotton is positive and statistically significant. The domestic prices of rice has 2 percent contribution in enhance of the

export demand function for rice while the domestic prices of cotton have 77 percent contribution in increase in export demand function for cotton. Foreign income in both the cases have negative and significant role in our model. Exchange rate have positive and significant influence on the export demand function of both rice and cotton. Our results for Saudi Arabia revealed that, relative prices for rice and cotton are insignificant and theoretically the sign of coefficient suggested that it have negative association with export demand function of both rice and cotton. The domestic prices of rice and cotton contributed 27 percent and 32 percent each. The foreign income for rice and cotton have significant impacts on the export demand function of rice and cotton. Exchange rate found positive in both the cases.

Similarly, as far the export demand of rice and cotton in case of UAE is concerned, it is evident from the results displayed in table 5 that relative prices have positive impacts by contributing 31 percent and 17 percent respectively. Both domestic prices and foreign income response for rice and cotton are insignificant while exchange rate have positive impacts.

Discussion

Different factors contribute in the impacts of relative prices on export demand function of both rice and cotton e.g. product characteristics, producer and consumer behavior, economic status of the trading countries, government policies etc. Furthermore, the export demand elasticity with respect to change in relative prices and competition in market also have major role in deciding the fate of their contribution. The insignificance shows that the rice prices does not have a meaningful influence on demand from foreign nationals which may be because of quality of the product, intervention from the government and the dominance of income effects. Similarly as noted from the results that the domestic prices of both cotton and rice contribute in export demand function. Various factors are responsible for this relationship where on one hand low prices at domestic economy increase the demand from foreign consumer and on the other hand vice versa is the case. Consumer preferences is also one of the important factor that matter in export demand function for rice and cotton. Foreign income is the importing countries level of income and affect the export demand function in various ways like change in preferences, change I purchasing power etc. The demand for basic commodities like cotton and rice change when there is change in foreign income. It is possible that the income elasticity for these goods may be low but the aggregate effect of increase in income in many countries (importing) increase the demand function of export. The role of Exchange rate also found significant in driving the export demand function for our selected commodities. By definition it is the value of a domestic currency in terms of another currency. Through various channels it can transmit its effect like cost, low prices, expectation against currency, trade agreements and relations etc. In short it affect the demand function for cotton and rice significantly.

Table 4.5

Estimated Long Run Elasticity's of Rice & Cotton Export Demand

	Rice		Cotton	
Country	**Variables**	**Coefficient**	**Variables**	**Coefficient**
China	RelPrr	-0.451 (0.005)	RelPrc	0.424 (0.199)
	RDmP	0.029 (0.024)	CDmP	0.774 (0.002)
	FrI	-1.781 (0.021)	FcI	-0.147 (0.000)
	EXRr	0.707 (0.009)	EXRc	0.667 (0.012)
Saudi Arabia	RelPrr	-0.887 (0.173)	RelPrc	-1.865 (0.101)
	RDmP	-.270 (0.002)	CDmP	-0.213 (0.480)
	FrI	-0.507 0.007)	FcI	-1.319 (0.049)
	EXRr	0.652 (0.003)	EXRc	0.985 (0.076)
UAE	RelPrr	-0.316 (0.004)	RelPrc	0.174 (0.000)
	RDmP	-0.217 0.747)	CDmP	3.300 (0.004)
	FrI	0.048 (0.865)	FcI	-0.278 (0.512)
	EXRr	0.707 (0.009)	EXRc	0.235 (0.007)

Note: P values are in Parenthesis.

Short Run Dynamics

In short run the relative prices of cotton have positive influence on export demand function in case of China and UAE while from dragging the last year impacts into current year it shows

influence on export demand function in case of Saudi Arabia as well. In short run exchange rate is insignificant in case of all the three destinations of Pakistani cotton exports. The domestic price of cotton in short run brings positive outcomes for export to Saudi Arabia while the UAE income have reduce the cotton exports of Pakistan I short run. ECM value suggested that the disequilibria in long run is adjusted with a speed of 51 percent, 37 percent and 28 percent for China, Saudi Arabia and UAE respectively.

Table 4.6
Error Correction Model Results Cotton

Variable/Country	China		SA		UAE	
	Coeff	Prob	Coeff	Prob	Coeff	Prob
RelPrc	0.397	0.022	-0.728	0.592	.075	0.000
RelPrc (-1)	.971	0.074	.317	0.001		
EXRc	.319	0.133	-0.065	0.893	-0.062	0.426
EXRc(-1)	-2.191	0.601	-6.521	0.043		
CDmP	-0.331	0.583	2.945	0.000	0.147	0.672
CDmP (-1)	0.443	0.875	-1.447	0.003		
CDmP (-2)	.302	0.245	.859	0.000		
FcI	0.481	0.537	0.577	0.673	-0.672	0.003
FcI (-1)	2.27	0.251	1.838	0.000	0.757	0.006
FcI (-2)	-1.53	0.097				
ECM(-1)	-.516	0.000	-0.379	0.000	-.287	0.000

The table 4.6 displayed the estimated results of export demand function for rice in short run which suggested that relative prices of rice have significant contribution in case of China and Saudi Arabia while insignificant in case of UAE. Exchange rate have negative association with rice export demand function in short run for UAE and insignificant for other two destinations, domestic prices of rice in short run have significant contribution where it have negative association in China and UAE and positive in SA. Foreign Income is insignificant in all the three destinations. The ECM is negative and below 1 percent which is ideal and evident that speed of adjustment is 37 percent, 55 percent and 42 percent for China, SA and UAE respectively.

Further, we also checked for diagnostic tests to test for serial correlation and heteroscadasticity and it is found that our models are free from both of them, (See table 4.8)

Table 4.7
Error Correction Model Results Rice Export Demand

Variable/Country	China		SA		UAE	
	Coeff	Prob	Coeff	Prob	Coeff	Prob
RelPrr	-.192	0.068	.015	0.007	-.312	0.602
RelPrr (-1)					.095	0.811
EXRr	-.752	0.987			0.412	0.002
EXRr (-1)	-1.59	0.005	1.28	0.322	-1.338	0.742
RDmP	-1.361	0.000	0.381	0.001	-.062	0.008
RDmP (-1)	.632	0.008			-0.541	0.732
RDmP (-2)						
FrI	-1.85	0.032	0.004	0.846	.823	0.253
FrI (-1)	-0.051	0.001	-0.871	0.000	-1.91	0.053
FrI (-2)			.063	0.005	.037	0.248
ECM(-1)	-.37	0.000	-0.55	0.000	-.42	0.000

Table 4.8
Serial Correlation and Heteroscadasticity Diagnostic Test:

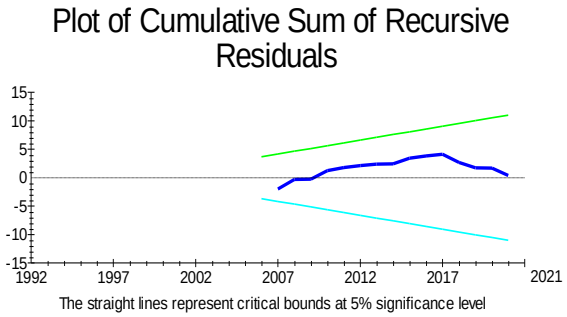
Country	Serial Correlation		Heteroscadasticity	
	F-statistic **CED**	F-statistic **RED**	F-statistic **CED**	F-statistic **RED**
China	1.431 (0.815)	2.916 (0.134)	0.372 (0.974)	0.744 (0.391)
Saudi	1.744 (0.251)	1.672 (0.245)	1.367 (0.324)	0.722 (0.618)
UAE	.548 (0.171)	1.342 (0.511)	1.693 0.221)	0.573 (0.472)

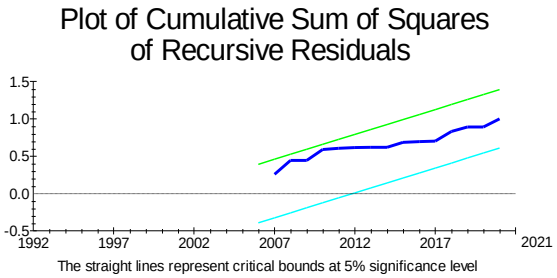
Stability Test

The stability of the coefficients has been observed through the application of CUSUM and CUSUMQ and it is evident from their respective figures that there is no evidence of instability of the coefficients.

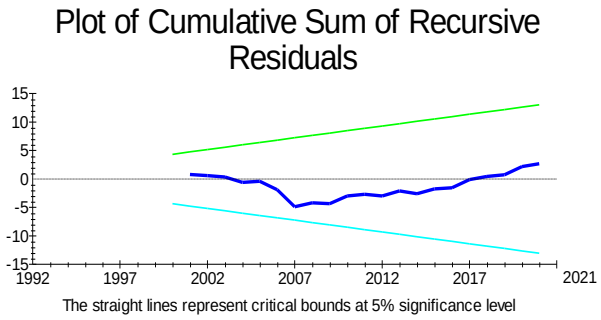
Fig 1
CUSUM and SUSUM square results for models of cotton

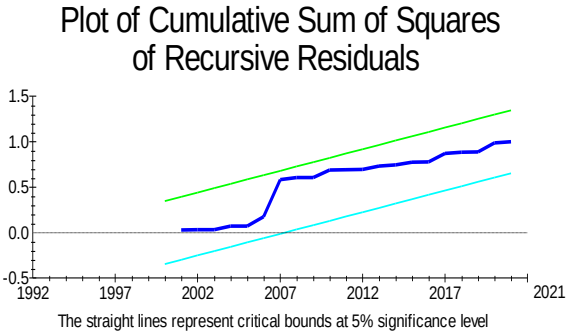
i. For China (Cotton)



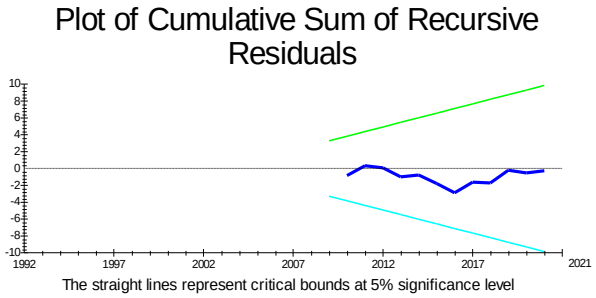


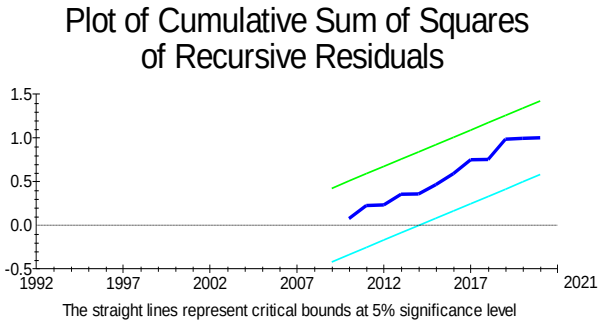
ii. For SA (Cotton)



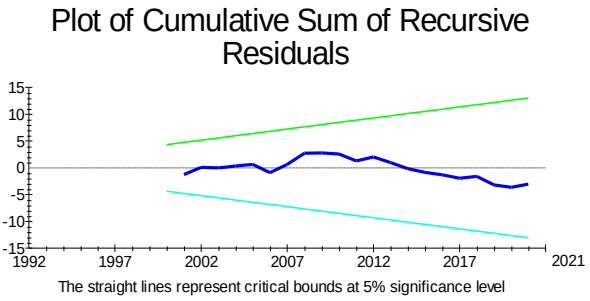


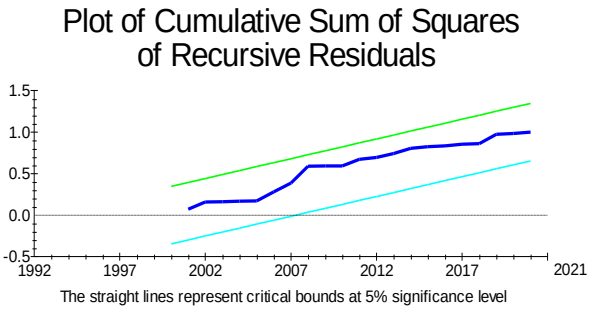
iii. For UAE (Cotton)



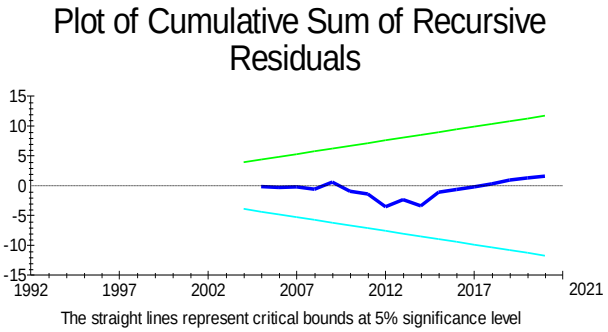


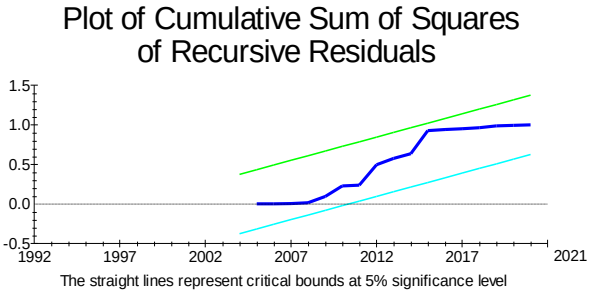
i. For China (Rice)



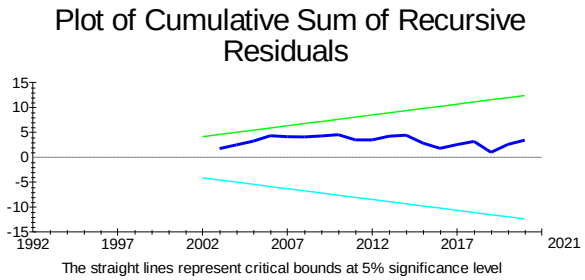


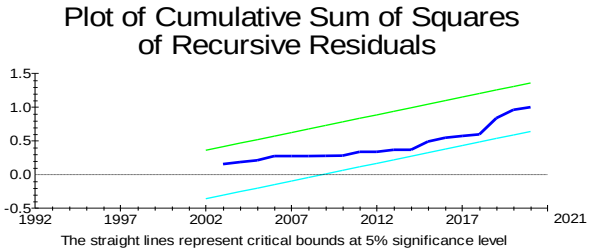
ii. For SA (Rice)





iii. For UAE (Rice)





Conclusion and Policy Recommendation

Conclusion

Estimation of export demand function for Paki tan has been investigated in this study where three important destination like China, Saudi Arabia and United Arab Emirates were selected. Annual time series data from 1990 to 2021 has been taken from various sources like UN Comtrade, WDI and Economic Survey of Pakistan. Six models for two commodities rice and cotton were constructed to fully capture the underlying hypothesis. Unit root analysis were conducted through ADF test and found that there is mixed order of integration where some variables were stationary at level and the rest at first difference. To extract the long run estimates this study used ARDL estimation strategy and Error correction mechanism were employed to found the speed of adjustment with which any disequilibria was to be adjusted. The results showed that for rice in case of China and Saudi Arabia the relative prices and foreign income negatively drive the export demand function and foreign income is insignificant in case of UAE while negative in are the impacts of relative prices. Domestic prices of rice comes up with negative influence in case of SA and UAE while positive for China, Exchange rate is positive and significant for all the three destinations, As for cotton is concerned, it is

concluded that relative prices have no role to drive the export demand function in case of China and SA while left positive impacts in case of UAE. Domestic prices is significant for China and UAE while insignificant for SA. Foreign income have positive impacts in case of China and SA while insignificant impacts in case of UAW. Exchange rate have positive outcomes in all the three destinations for cotton export demand functions. The ECM coefficient values suggested moderate speed of adjustment in all the models. The diagnostic tests suggested that our selected models does not have serial correlation and heteroscadasticity issues and stability of the coefficient were validated through CUSUM and CUSUMQ.

Policy Suggestion

Several policy suggestion can be put forward in light of the findings of this study;

Exchange rate volatility were found significant for the demand functions of both the commodities, therefore the government of Pakistan should continue with devaluation policy as it helps in export promotion.

Domestic prices plays significant role in driving the export demand function of rice and cotton. This relationship is effected from different factors like conditions of international market, currency fluctuations, production level at local market, trade contracts, consumer choices etc. therefore, there is a need of comprehensive assessment of all these factors to understand the mechanism of functioning of domestic prices and its role in determination of export demand function especially for cotton and rice.

There is a need of a policy reforms that helps in successful promotion of exports. An effective approach will be a consideration of both internal and external factors (relative prices) to improve the competitive environment and sustain in world market.

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