Pak. J. Agri. Sci., Vol. 58(2), 719-730;2021
ISSN (Print) 0552-9034, ISSN (Online) 2076-0906
DOI: 10.21162/PAKJAS/21.952
http://www.pakjas.com.pk

ANALYZING EXPORT COMPETITIVENESS OF MAJOR FRUITS AND VEGETABLES OF PAKISTAN: AN APPLICATION OF REVEALED COMPARATIVE ADVANTAGE INDICES

Burhan Ahmad[1,*], Misbah Anwar[1], Hammad Badar[1], Mubashir Mehdi[1] and Farooq Tanwir[2]

[1]Institute of Business Management Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Department of Rural Sociology, University of Agriculture, Faisalabad, Pakistan
***Corresponding author's e-mail: burhan_uaf@hotmail.com**

Countries need an in-depth understanding of their comparative advantage for gaining benefits from the international trade. Historically, Pakistan is a trade deficit country and its exports are mainly agro-based. This study applies Balassa's index of revealed comparative advantage (RCA) and its extensions to analyze the export competitiveness of major fruits and vegetables of Pakistan for the period 2001-2018. Results indicated that mangoes, citrus and dates had revealed comparative advantage. The estimated results of various RCA indices for onions and potatoes showed both revealed comparative advantage as well as disadvantage. The existence of comparative advantage highlights a considerable export potential of fruits and vegetables of Pakistan. Tapping this potential can significantly contribute in enhancing exports and foreign exchange earnings, generating employment opportunities and reducing trade deficit of the country. To increase export competitiveness of fruits and vegetables, the study suggests investment in research and development for finding out new ways for improvements in yield, quality and management of post-harvest losses. Value chain and infrastructural development is also needed to increase the export competitiveness of fruits and vegetables of Pakistan.

Keywords: Competitiveness, Fruits and Vegetables, Revealed Comparative Advantage, Pakistan.

INTRODUCTION

Except a few years, Pakistan has faced trade deficit since its inception. Pakistan's major exports comprise of few commodities which include cotton manufactures, rice, leather, fish, fish preparations and sporting goods. These exports are limited to few countries as fifty percent exports are destined to the United States, the UAE, China, the United Kingdom, Afghanistan, Iran, and Germany. Similarly, Pakistan's imports are also concentrated in few markets (Ahmad and Garcia, 2012; GoP, 2020; SBP, 2015).

Owing to continuous trade deficit, the recent trade policies mainly focused on export expansion, competitiveness and transformation from factor to efficiency and innovation based economy. Pakistan is actively pursuing bilateral and multilateral trade agreements including South Asian Free Trade Area (SAFTA) and Pak-China Free Trade agreements. Pakistan is also a member of the World Trade Organization (WTO) and enjoys GSP and GSP Plus status form the USA and the European Union (EU), respectively. However, Pakistan could not reap benefits from all these arrangements which highlight the need to enhance the competitiveness and supply of exports at international market prices.

Agriculture is a key sector in the economy of Pakistan that contributes nearly 19 percent to the GDP and employs about 42 percent of its workforce. It has strong backward and forward linkages with manufacturing industries and significantly contributes to value-added economic activity. Around two-third population of the country living in rural areas is directly or indirectly dependent on agriculture for their livelihood. Given its importance in the national economy, the government accords a high priority to increase agricultural productivity with a view to raise competitiveness and income levels of farmers of the country (GoP, 2020).

Horticulture is an important sub-sector of agriculture that plays a vital role in strengthening the rural economy. In horticultural crops, fruits and vegetables are rich sources of important vitamins and minerals that improve the nutrition and health of the people. Pakistan is blessed with four seasons and favorable ecological environment for the production of numerous fruits and vegetables (Ikram *et al*., 2020; Talat *et al*., 2020). Citrus, mangoes, and dates are the main fruit crops while onions and potatoes are the main vegetables which contribute substantially to the national income. Pakistan stands among top ten producers and exporters of mangoes, citrus fruits and dates. Onions and potatoes are exported as well as imported (GoP, 2020; UNFAO, 2019; Haleem et al., 2005).

Understanding of comparative advantage is helpful in identifying the effects of policy changes and describing economic welfare. Empirical estimates of comparative advantage can help in finding the direction in which investment and trade of a country should be directed for taking advantage of international differences in supply and demand of products and factors of production (Vollrath,

1991; Cai *et al*., 2007). Wrong specialization may permanently reduce growth rate of a country (Young 1991; Grossman and Helpman 1991; Ferto and Hubbard 2003; Fertö and Hubbard, 2004). Under the World Trade Organization (WTO) regime, the gains from trade in the long run depend on the comparative advantage (Quddus and Mustafa, 2011). Hence, it is important to know the comparative advantage and pattern of specialization of a country in order to make efficient decisions regarding allocation of resources to enhance economic welfare.

Trade theories have established different basis for comparative advantage in international trade. For example, Ricardian trade theory highlights the differences in costs and technologies and Heckscher-Ohlin-Samuelson illustrates differences in factors' cost based on factor endowments as the determinants of comparative advantage. The Neo-Factor-Proportion theory considers factor efficiency as the basis of comparative advantage. Technological innovations and changes as learning-by-doing are regarded as the source of comparative advantage by technological gap and product cycle theory (Bender and Li, 2002). However, quantification of the differences in comparative advantage is challenging because relative autarkic prices are not observable in post-trade equilibriums and post-trade data must be used to measure these differences (Ballance et al., 1987).

Balassa (1965) introduced the concept and calculation of revealed comparative advantage using observed trade data. Later research extended and transformed this index for better and consistent results (White, 1981; Ballance et al., 1987; Vollrath, 1991). Vollrath (1991) introduced the indices for revealed trade advantage, revealed export and import advantage and revealed competitive advantage. Ballance *et al.* (1987) illustrated that the choice among alternative measures must be made on some statistical criteria for revealing the same pattern of comparative advantage. In case alternative indices show different results, the choice should be made on the basis of theoretical relationship.

Given the increasing trade deficit, declining trend in the exports of Pakistan, significance of horticulture sector in the economy of Pakistan, the study is aimed at estimating and analyzing the competitiveness of major fruits and vegetables through applying various indices of revealed comparative advantage during 2001-2018. Earlier studies such as those conducted by Akhter *et al.* (2010), Sundeela (2013), Abbas and Waheed (2017), Bullo (2017) and Kousar *et al.* (2019) studied the comparative advantage through applying Balass (1956) index and its some of its extensions such as revealed export advantage, Revealed Symmetric Comparative Advantage (RSCA) to study the comparative advantage and competitiveness of one or more fruits in Pakistan. However, the present study applies almost all extended indices for the period 2001-2018 to have comprehensive and consistent analysis. Two important vegetables, onions and potato are also included because literature on comparative advantage of vegetables exports in Pakistan is lacking. It is expected that the study findings will help in identifying and formulating polices for the development of agricultural sub-sectors in Pakistan.

MATERIALS AND METHODS

According to Ricardian trade theory, comparative advantage determines the pattern of trade. A country is likely to export a commodity in which it has comparative advantage while import a commodity with comparative disadvantage. On account of complex and burdensome calculation of cost of production, Balassa (1965) introduced the concept of 'revealed comparative advantage (RCA)'. According to this concepts pattern of commodity's trade reflects the differences in cost and non-price factors which in turn 'reveal' the 'comparative advantage' of the country. RCA has been a focus of many studies and various extensions of this index has been formulated. Present study applies the basic Balassa's RCA index and its various extensions to major fruits (citrus, mango, dates) and vegetables (onions, potatoes) of Pakistan for the period 2001 – 2018 to examine the dynamics of comparative advantage of these commodities.

Balassa's RCA index (BI) is presented in equation 1 as follows:

$$RCA_{ij} = (X_{ij} / X_i) / (X_{wj}/X_w) = (X_{ij} / X_{wj}) / (X_i /X_w) \qquad (1)$$

Where, *i* stands for Pakistan, *j* for selected agricultural commodity and w for world. RCA_{ij} represents the revealed comparative advantage of Pakistan for j commodity in equation 1 whereas X_{ij} and X_i represent the exports of selected *'j'* commodity and total exports of Pakistan respectively. Total World exports of individual, *'j'* commodity and world's total exports are denoted by X_{wj} and X_w respectively in equation 1. A value of RCA > 1 indicates the existence of revealed comparative advantage that is a sector in which the country is relatively more specialized while a value of RCA < 1 reveals comparative disadvantage that is the sector in which country is less specialized.

However, this index has a double counting problem as total exports also include the individual commodity's export. Vollrath (1991) introduced another index, relative export advantage (RXA), to solve this double counting problem by excluding the exports of commodity under study from the total exports and is presented in equation 2.

$$RXA_{ij} = (X_{ij} / X_{ir}) / (X_{wj}/X_{wr}) \qquad (2)$$

Where *'r'* is the Pakistan's exports of rest of the commodities except *'j'* commodity, '*wr*' rest of the world's exports of *'j'* commodity excluding Pakistan's exports of '*j*' commodity and '*ws*' represents the total exports of the world except Pakistan's total exports. The interpretation of the outcomes of this index is the same as of the original Balassa's index.

Vollrath (1991) developed three more indices namely relative trade advantage (RTA), relative import advantage (RMA) and relative competiveness index (RC) which are given below in equations 3, 4 and 5 respectively:

$$RMA_{ij} = (M_{ij} / M_{ir}) / (M_{wj}/M_{ws}) \quad (3)$$

Where *M* represents the imports, *i* refers to Pakistan, *j* is commodity, *r* is rest of the commodities, M_{wj} shows the total world imports except *j* commodity and M_{ws} is the total world exports except Pakistan. This index is similar to RXA but exports are replaced with imports. RTA index is the difference between RXA and RMA.

$$RTA = RXA - RMA \quad (4)$$

Relative competitiveness index is the natural logarithmic transformation of the RTA.

$$RC = lnRXA - lnRMA \quad (5)$$

Positive values of RTA and RXA represent the comparative advantage and negative values show comparative disadvantage. Vollrath suggested RTA as it portrays both supply and demand conditions. But this had limitations particularly when exports or imports are zero (Havrila and Gunawardana, 2003). Positive values of RC indicate the competitiveness of exports while negative values show non-competitiveness.

Hoen and Oosterhaven (2006) proposed an additive type of Balassa's index called "additive revealed comparative advantage index (AI)" and can be formulized as:

$$AI = (X_{ij} / X_i) - (X_{wj}/X_w) \quad (6)$$

Xs are as defined above and values of *AI* are distributed between +1 and -1. *AI* is more suitable in cross-sector studies compared to cross-country studies and therefore is intended to be estimated in the present study.

Dalum *et al.* (1998, 1999) used revealed symmetric comparative advantage (RSCA) in the regression which is constructed to eliminate the skewness problem with the Balassa's index because its value is asymmetric as it varies from one to infinity for products in which a country has a revealed comparative advantage, but only from zero to one for commodities with a comparative disadvantage. Due this feature, the distribution of Balassa's index will be skewed to the right. The formula for RSCA in the present study is as follows:

$$RSCA = (B-1) / (B+1) \quad (7)$$

where *B* is original Balassa's revealed comparative advantage index and values of *RSCA* range in +1 and -1 with zero as neutral point with respect to comparative advantage.

Yu et al., (2009) introduced and calculated normalized revealed comparative advantage (NRCA) index as the degree of deviation of a country's actual exports from its comparative-advantage-neutral level in terms of its relative scale with respect to the world exports market. Important characteristics of NRCA index comprise its symmetrical distribution. The NRCA index can be written as follows:

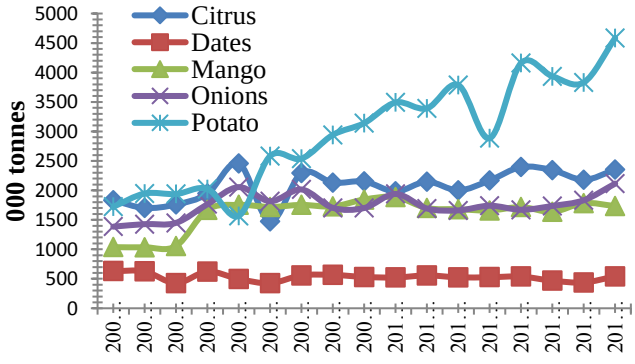
$$NRCA_{ij} = (X_{ij}/X_j) - (X_iX_j/X_wX_w) \quad (8)$$

Where X_{ij} is the export of commodity *j* in Pakistan, *Xj* indicates total world exports of commodity j; Xi stands for total exports of Pakistan and X_w represents total world exports. The value of $NRCA_{ij} > 0$ represent comparative advantage while $NRCA_{ij} < 0$ shows comparative disadvantage. Moreover, higher values of NRCA reveals stronger comparative advantage and vice versa (Hassan and Ahmad, 2018).

Data on exports of major fruits and vegetables in this study, needed to calculate above mentioned indices, are taken from online data bases of Food and Agricultural Organization (UNFAO, 2019) and International Trade Statistics (ITC, 2019) for the period 2001-2018.

RESULTS AND DISCUSSION

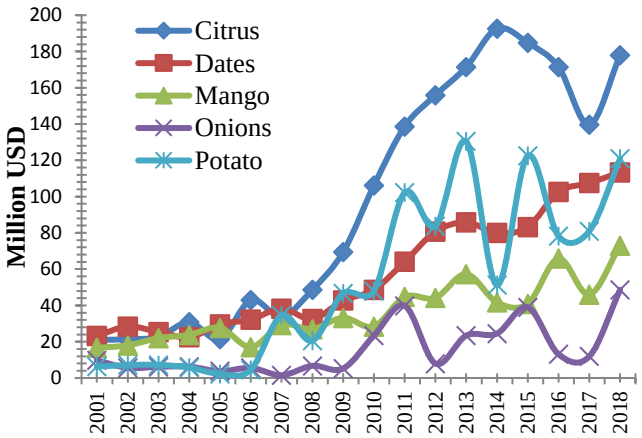
As described earlier, the present study applies various revealed comparative advantage indices to major fruits comprising mangoes, citrus, and dates while major vegetables include potatoes and onions. These fruits and vegetables capture a major share in production and export of horticultural crops. Production trends in citrus, dates, mangoes, onions and potatoes are depicted in Figure 1. Comparatively, potato production reflects a clear increasing trend. Relatively, a stable trend can be viewed in the production of dates as well. Average production of citrus during 2001-2018 has remained at 2077 thousand tonnes and varied in between 1472.5 to 2458.4 thousand tonnes with 13% value of coefficient of variation. Dates' production varied from 426.4 to 630.3 thousand tonnes with an average value of 529.3 thousand tonnes and 12% coefficient of variation. Average production level of mango remained at 1611.5 thousand tonnes during 2001-2018. Mango production varied between 1034.6 and 1885.9 thousand tonnes with 17% value of coefficient of variation. Average production levels of onions and potatoes have remained at 1747.5 and 2968.7 thousand tonnes respectively during 2001-2018. While production range of onions and potatoes was 1385 – 2115 and 1567.9 – 4584.3 respectively with 12% and 31% values of coefficient of variation, respectively (AMIS, 2020).



Source: AMIS 2020

Figure 1. Production Trends of Major Fruits and vegetables of Pakistan

Trends in exports of citrus, dates, mangoes, onions and potatoes are presented in Figure 2. The three fruits exhibit an increasing trend. Exports of citrus are in leading position followed by dates and mangoes. However, the value of coefficient of variation (CV) for citrus is 70% which is higher than these values for dates (55%) and mangoes (45%) indicating relatively high variation in case of citrus. Average level of exports of citrus during 2001-2018 has remained at million 97.3 USD and varied between million 21 USD and million 192.6 USD. Dates' exports varied from million 22.5 USD to million 113.4 USD with an average value of million 57.8 USD. Average exports level of mango has remained at 36.5 million USD during 2001-2018 and ranged between 16.6 and 73 million USD. Exports of onions and potatoes have remained at low levels compared with fruits and showed high variation as indicated by the values of CV which are 91% for onions and 86% for potatoes. Average export levels of onions and potatoes have remained at 15.7 and 52.9 million USD respectively during 2001-2018. While exports range of onions and potatoes was 1.5 – 48.6 and 2.2 – 130.4, respectively (ITC, 2019; UNFAO, 2019).



Source: UNFAO and ITC 2019

Figure 2. Export Trends of Major Fruits and Vegetables from Pakistan

***Comparative advantage*:** As present study applies Balassa's index to estimate the revealed comparative advantage, the results of these estimations are exhibited in figure 3. Results reveal that citrus, mangoes and dates have retained the comparative advantage, RCA value greater than 1, throughout the study period 2001-2018 but with fluctuating trend. Blassa's RCA index values for Dates remained at the top followed by mango. Citrus export performance and RCA have remained relatively high during the last ten years of the study period. Onions have also exhibited comparative advantage with a varying degree during the study period except 2007 in which it showed a comparative disadvantage while potatoes exhibited comparative disadvantage in 2005. The results have been detailed in the following sections.

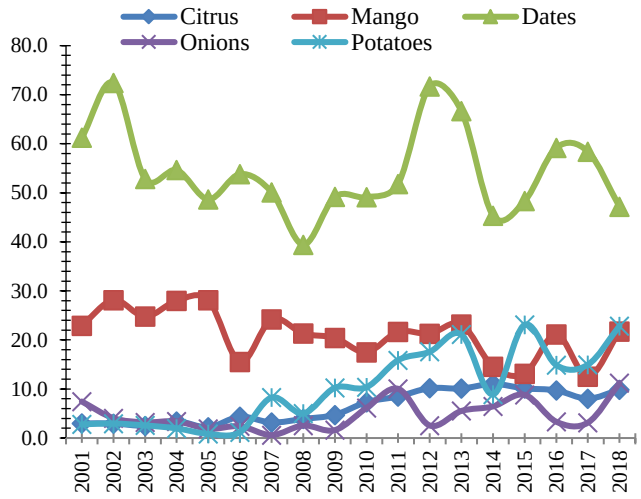


Figure 3. Revealed Comparative Advantage of Major Fruits and Vegetables using Balassa's Index

***Citrus*:** Pakistan is ranked among top ten producers and exporters of citrus in the world. However, its exports exhibit a high variation. Among citrus, kinnow is the main exportable item which accounts for about 95% of Pakistan's mandarin export (Mahmood, 2004; Ahmad et al., 2018; UNFAO, 2019). Over the past 10 years while production and exports have increased, market share in high price markets such as the EU have declined significantly. Exports have increased in lower value markets of developing countries (Afghanistan, Iran, Indonesia, Malaysia) and the Russian Federation. In spite of some good characteristics (sweetness, juice content, easy to peel), the major citrus variety, kinnow mandarin, is regarded as a low value fruit due to seed presence and issues relating to fruit quality, appearance and chemical residues. The marketing system is traditional and dominated by middlemen. Majority of growers are disconnected from markets and sell their fruit to pre-harvest contractors prior to harvest. Poor orchard management and traditional harvest and post-harvest practices result in losses.

Results of the estimates of various RCA indices for citrus are provided in Table 1. These results show the existence of comparative advantage throughout the study period 2001-2018. However, the degree of comparative advantage has increased after 2010 that may be attributed to improvement in the value chain and adoption of improved practices for harvesting and processing. The values of Balassa's index remained fluctuating between 2.2-11 with mean value of 2.2 while the mean values of RXA and LnRXA are 6.43 and 1.17 with the range 2.2-11.10 and 0.80-2.41, respectively indicating export competitiveness. Mean values of RSCA, AI and NRCA indices are 0.67, 0.004 and 0.0008,

Table 1. RCA indices for Citrus

YEAR	RCA	RXA	RMA	RTA	LNRXA	LNRMA	RC	AI	SI	NRCA
2001	2.97	2.98	0.001	2.98	1.09	-6.65	7.74	0.002	0.50	0.0000020
2002	2.96	2.97	0.001	2.97	1.09	-6.86	7.95	0.002	0.50	0.0000020
2003	2.50	2.51	0.001	2.51	0.92	-6.77	7.69	0.001	0.43	0.0000020
2004	3.42	3.43	0.000	3.43	1.23	-7.62	8.85	0.002	0.55	0.0000020
2005	2.21	2.22	0.002	2.21	0.80	-6.30	7.09	0.001	0.38	0.0000010
2006	4.34	4.35	0.001	4.35	1.47	-6.92	8.39	0.002	0.63	0.0000030
2007	3.17	3.18	0.002	3.18	1.16	-6.27	7.43	0.001	0.52	0.0000020
2008	3.89	3.90	0.001	3.90	1.36	-7.26	8.62	0.002	0.59	0.0000020
2009	4.73	4.74	0.001	4.74	1.56	-6.85	8.41	0.003	0.65	0.0000040
2010	7.32	7.35	0.001	7.35	2.00	-7.40	9.40	0.005	0.76	0.0000060
2011	8.48	8.52	0.005	8.52	2.14	-5.36	7.50	0.005	0.79	0.0000070
2012	10.17	10.23	0.008	10.22	2.33	-4.84	7.16	0.006	0.82	0.0000080
2013	10.09	10.16	0.007	10.15	2.32	-4.90	7.21	0.006	0.82	0.0000080
2014	11.03	11.10	0.007	11.10	2.41	-5.01	7.42	0.007	0.83	0.0000090
2015	10.13	10.20	0.010	10.19	2.32	-4.57	6.90	0.007	0.82	0.0000100
2016	9.72	9.79	0.010	9.78	2.28	-4.65	6.93	0.007	0.81	0.0000100
2017	8.04	8.09	0.002	8.08	2.09	-6.21	8.30	0.006	0.78	0.0000070
2018	9.85	9.92	0.000	9.92	2.29	-8.74	11.03	0.007	0.82	0.0000080
Mean	6.39	6.43	0.000	6.42	1.71	-6.29	8.00	0.002	0.67	0.0000052
S.D.	3.28	3.31	0.000	3.31	0.58	1.18	1.04	0.004	0.16	0.0000032
Min	2.20	2.20	0.000	2.21	0.80	-8.74	6.90	0.001	0.38	0.0000010
Max	11.00	11.10	0.010	11.10	2.41	-4.57	11.03	0.007	0.83	0.0000100
C.V.	51.31	51.44	104.430	51.49	33.66	-18.73	12.96	62.000	23.60	62.280000

respectively. RCA indices values for citrus are low compared to other sectors which indicate a greater room for its improvement. One important factor in this regard is the production and commercialization of seedless kinnow varieties because of its high demand in the international market. It is claimed that seedless varieties have been developed in Pakistan. However, they are yet to be commercialized. Hence, public and private sectors should formulate and implement strategies for commercialization of seedless kinnow varieties.

Riaz and Jansen (2012) found comparative advantage of Pakistani Kinnow in its different export markets such as Philippines, Singapore, Malaysia, Iran, Sri Lanka, Oman, Saudi Arabia, UAE, Bahrain, Kuwait etc., through computing Balassa's revealed comparative advantage index. They suggested that RCA in kinnow could be further enhanced through the best agronomic practices and trade promotion campaigns particularly in East-Asian and Central Asian markets. They also emphasized that processed citrus products such as kinnow juice and pulp, and citrus peel oil possessed a good potential for exports which can be tapped through serious quality control as the lowest quality Kinnow fruits were processed and sold in the domestic market. Ahmad et al. (2018) found that large well-established exporters dominate the citrus export industry and their profitability is attributed to higher sales at low prices. Exports of kinnow from Pakistan are primarily directed to low price markets because of inability to meet the quality requirements related to Sanitary and Phytosanitary (SPS) agreement of the WTO. Based upon the empirical results, they suggested an increase in investment on research and development. They further elaborated that focus on research should be on improving quality, yield per hectare, production and commercialization of seedless kinnow and reducing the post-harvest losses in citrus supply chain[1].

***Mango*:** Pakistan stands among the leading mango producing and exporting countries of the world (Mehdi et al., 2016; UNFAO, 2019). Pakistani mangoes are famous for their delicious taste. A number of mango varieties are produced in Pakistan which differs in physiological characteristics, particularly shape, order, size, color, sugar content level and acidity etc (Badar et al., 2015). While production is dominated by two major varieties: Chaunsa and Sindhri, other varieties such as Langra, Anwar Ratole, Dasheri, and Neelam are cultivated to a lesser extent. Only Chaunsa and Sindhri varieties have a significant contribution

[1]Important strategies to improve competitiveness in global value chains (GVCs) include product upgrading, process upgrading, functional upgrading, intersectoral (chain) upgradin (Humphrey and Schmitz, 2002 in Gereffi, 2019). Gereffi (2019) and Marcato and Baltar (2020) provide a detailed discusssion on economic and social upgrading under the context of GVCs.

in making commercial value of mango fruits (GoP, 2019; Mehdi et al., 2016).

The results of the estimates of all of the RCA indices for mangoes are presented in Table 2. These results indicate a comparative advantage of mangoes during 2001-2018. The values of Balassa's index varied between 13 and 28 with an average value of 21. The mean values of RXA and LnRXA are 21 and 3 and remained within the range of 13-28 and 2.53-3.34 respectively indicating export competitiveness. The mean values of RSCA, AI and NRCA indices are 0.85, 0.001 and 0.000002, respectively. The values of coefficient of variation of all the indices; BI, RXA, LNRXA, SI, AI and NRCA; are 23%, 23%, 8.25, 2.69%, 28% and 30.6%, respectively.

Riaz and Jansen (2012) applied Balassa's RCA index and found revealed comparative advantage in different export markets of mango such as Oman, Saudi Arabia, UAE, Behrain, Qatar, Norway etc. They suggested that high quality mangoes should be marketed to high end Chinese fruit market and meeting SPS requirements could find place in the USA market. Rizwanulhassan and Shafiqurrehman (2015) found that comparative advantage of Pakistani mangoes was declining during 2004-2012 and urged to meet quality requirements of the international markets to increase the mango exports from Pakistan. Badar *et al*., (2019) identified three mango value chains namely traditional, carrying all types of quality for all income groups: modern, better quality mangoes for middle and high income groups, and export mango value chains for consumers of the international markets. They suggested that chain performance can be improved trough better information flows and more effective chain governance.

Sandeela (2014) evaluated the competitiveness and potential of the mango and kinnow exports from Pakistan through investigating all important aspects of their supply chains. Findings of the study exhibited the potential of enhancing exports of mangoes and kinnows from Pakistan. Furthermore, he identified constraints in the mango and kinnow supply chains that inhibited their export growth. He illustrated that the kinnow sector had developed more than the mango sector. This could be attributed to a more compact plantation that makes the setting up of processing facilities easier. Comparatively, the mango plantation is spread over around a thousand kilometers, and the season keeps moving from the south to the north. Moreover, this difference in the level of development could also be linked to kinnows being less perishable than mangoes. He suggested to educate and train farmers about international quality requirements and also emphasized resurrection of trade missions, supported by well-planned marketing efforts.

In recent years, considerable value chain development efforts have been made in the mango industry. However, the adoption rate of best practices is very low as only 5-7% of the mango producers have adopted premium quality best practices. There is high demand for value-added products such as mango pulp and its made-ups in the international

Table 2. RCA Indices or Mangoes

YEAR	RCA	RXA	RMA	RTA	LNRXA	LNRMA	RC	AI	SI	NRCA
2001	22.90	22.94	0.00	22.94	3.13	0.00	3.13	0.002	0.92	0.0000030
2002	28.10	28.18	0.00	28.18	3.34	0.00	3.34	0.002	0.93	0.0000030
2003	24.80	24.81	0.00	24.81	3.21	0.00	3.21	0.002	0.92	0.0000030
2004	28.00	28.04	0.00	28.04	3.33	0.00	3.33	0.002	0.93	0.0000030
2005	28.10	28.16	0.00	28.16	3.34	0.00	3.34	0.002	0.93	0.0000030
2006	15.50	15.53	0.00	15.53	2.74	0.00	2.74	0.001	0.88	0.0000010
2007	24.20	24.25	0.00	24.25	3.19	0.00	3.19	0.002	0.92	0.0000020
2008	21.30	21.34	0.00	21.34	3.06	0.00	3.06	0.001	0.91	0.0000020
2009	20.40	20.46	0.00	20.46	3.02	0.00	3.02	0.002	0.91	0.0000030
2010	17.50	17.52	0.00	8.28	2.86	0.00	2.86	0.001	0.89	0.0000020
2011	21.70	21.70	0.24	21.45	3.08	-1.41	4.49	0.002	0.91	0.0000020
2012	21.30	21.32	0.66	20.66	3.06	-0.42	3.48	0.002	0.91	0.0000020
2013	23.20	23.23	0.19	23.03	3.15	-1.64	4.79	0.002	0.92	0.0000030
2014	14.60	14.58	3.34	11.24	2.68	1.20	1.47	0.002	0.87	0.0000020
2015	13.10	13.15	3.62	9.53	2.58	1.29	1.29	0.002	0.86	0.0000020
2016	21.10	21.20	4.91	16.29	3.05	1.59	1.46	0.003	0.91	0.0000040
2017	12.50	12.56	0.96	11.60	2.53	-0.04	2.57	0.002	0.85	0.0000020
2018	21.80	21.82	0.10	21.71	3.08	-2.26	5.34	0.003	0.91	0.0000040
Mean	21.12	21.16	0.78	19.86	3.02	-0.09	3.12	0.002	0.90	0.0000026
S.D.	4.87	4.87	1.51	6.38	0.25	0.95	1.06	0.0005	0.02	0.0000008
Min	12.50	12.56	0.00	8.28	2.53	-2.26	1.29	0.001	0.85	0.0000010
Max	28.10	28.18	4.91	28.18	3.34	1.59	5.34	0.003	0.93	0.0000040
C.V.	23.04	23.03	194.23	32.13	8.25	-1014.94	34.12	26.860	2.69	30.625000

market. But, only two mango pulp plants are working in Pakistan. Hence, production and export of value-added products need to be encouraged along with premium quality mangoes (Ahmad et al., 2018).

***Dates*:** Pakistan is included among top five producers and exporters of dates in the world. Sindh is the main producing province and about 300 varieties of dates are being produced there. Dates are among the highly consumable fruits in Pakistan particularly its consumption is increased manifolds in Ramadan. These are also imported mainly from Saudi Arabia (Bullo, 2017; UNFAO, 2019).

Table 3 depicts the results of the estimates of all of the indices for dates. Results indicate that dates also possess strong comparative advantage as reflected by the values of all the RCA indices. Results of all the indices are consistent with each other showing comparative advantage. The range of values of Balassa's index is 39-72 with mean value of 54 while the mean values of RXA and LnRXA are 55 and 4 with the range of 40-73 and 3.7-4.3 respectively indicating export competitiveness. Average values of SI, AI and NRCA indices are 0.96, 0.0028 and 0.0000039 respectively. Values of coefficient of variation of BI, RXA, LNRXA, SI, AI and NRCA are 16.49%, 16.54%, 4.03%, 0.60%, 38.76% and 32.39% respectively.

Riaz and Jansen (2012) applied Balassa's RCA index and found revealed comparative advantage of dates in India, Maldives, Nepal, Denmark and Paraguay with highest export performance in India. They suggested that Pakistan should diversify date export markets and investment should be done in modern packaging and processing technologies and farmers should be trained about post-harvest technologies. Bullo (2017) described that although Sindh province is the largest dates producer, it could not be able to develop appropriate infrastructure for keeping dates fresh for selling at good price. He further added that dates are exposed to physical risk because their maturity stage generally comes under rainy season (moon soon) and their proper post-harvest treatment is also lacking. To cover this risk, majority of the dates' producers in Sindh collect hard unripe dates and boil them for making Chuhara. Due to lack of post-harvest management, dates are mostly exported to India in dry form at low prices. Hence, appropriate post-harvest management and efficient value chain development are vital for taping the export potential of dates.

Above findings on citrus, mango and dates are consistent with earlier studies which determined the existence of comparative advantage of Pakistan in citrus exports (Akhter et al., 2009; Riaz et al., 2010; Riaz et al., 2012; Abbas and Waheed, 2017). However, results of relative competitiveness (RC) of this study do not support the results of Kousar et al. (2019) that Pakistan does not have competitive advantage in citrus exports. Results of Balassa's index employed by Kousar et al. (2019) found comparative advantage in these fruits but the results of RXA and LnRXA indicate that exports of these fruits from Pakistan are not competitive. The reason for this is that RXA is defined differently in

Table 3: RCA Indices of Dates

YEAR	RCA	RXA	RMA	RTA	LNRXA	LNRMA	RC	AI	SI	NRCA
2001	61.20	61.40	13.49	47.90	4.12	2.60	1.52	0.0020	0.97	0.0000037
2002	72.40	72.60	13.21	59.43	4.29	2.58	1.70	0.0030	0.97	0.0000043
2003	52.80	52.90	6.10	46.85	3.97	1.81	2.16	0.0020	0.96	0.0000033
2004	54.60	54.70	15.69	39.05	4.00	2.75	1.25	0.0020	0.96	0.0000024
2005	48.70	48.80	2.91	45.85	3.89	1.07	2.82	0.0020	0.96	0.0000028
2006	53.80	53.90	5.41	48.51	3.99	1.69	2.30	0.0020	0.96	0.0000026
2007	50.10	50.20	3.83	46.42	3.92	1.34	2.58	0.0020	0.96	0.0000027
2008	39.40	39.50	1.17	38.32	3.68	0.16	3.52	0.0020	0.95	0.0000020
2009	49.20	49.30	2.18	47.11	3.90	0.78	3.12	0.0020	0.96	0.0000034
2010	49.10	49.20	0.60	48.63	3.90	-0.52	4.42	0.0020	0.96	0.0000032
2011	51.80	51.90	3.53	48.41	3.95	1.26	2.69	0.0030	0.96	0.0000035
2012	71.70	72.00	1.89	70.07	4.28	0.64	3.64	0.0030	0.97	0.0000043
2013	66.70	66.90	0.85	66.06	4.20	-0.16	4.36	0.0030	0.97	0.0000045
2014	45.40	45.50	0.86	44.65	3.82	-0.15	3.97	0.0030	0.96	0.0000041
2015	48.30	48.50	1.46	47.02	3.88	0.38	3.50	0.0030	0.96	0.0000050
2016	59.20	59.50	0.00	59.47	4.09	0.00	-1.00	0.0050	0.97	0.0000063
2017	58.40	58.70	0.00	58.68	4.07	0.00	-1.00	0.0050	0.97	0.0000060
2018	47.20	47.40	0.00	47.39	3.86	0.00	-1.00	0.0050	0.96	0.0000057
Mean	54.44	54.61	4.06	50.55	3.99	0.90	2.25	0.0028	0.96	0.0000039
S.D.	8.98	9.03	4.98	8.64	0.16	1.04	1.75	0.0011	0.01	0.0000013
Min	39.40	39.50	0.00	38.32	3.68	-0.52	-1.00	0.0020	0.95	0.0000020
Max	72.40	72.60	15.69	70.07	4.29	2.75	4.42	0.0050	0.97	0.0000063
CV	16.49	16.54	122.40	17.10	4.03	115.73	77.74	38.7600	0.60	32.390000

Kousar et al. (2019). Whereas, the present study has employed the RXA, RMA and RC indices proposed by Vollrath (1991) because Vollrath (1991) has provided theoretical justification of these indices. Akther et al. (2009) employed Balassa's and Vollrath indices to estimate the competitiveness of horticultural products and found that Pakistan possessed comparative advantage and competitive advantage in the export of citrus, mangoes and dates which are in line with the results of the study in hand.

***Onion*:** Onion is a highly consumable vegetable in Pakistan and is used as an essential ingredient in cooking various foods. Although Pakistan is one of the major producers of onions in the world, it is not the leading exporter of onions. Onions are an integral component of the Pakistani diet, consumed almost every day. The consumption of onions rises during specific events such as Ramadan and Eid-ul-Azha, and at the times when marriage ceremonies are mostly arranged. Punjab and Sindh are the leading producing provinces of onions. Majority of onion producers in Punjab, Baluchistan and KPK are smallholders with less than 5 hectares.

Although Pakistan once had a very wide range of germplasm, currently two varieties, Nassarpuri and Phulkara, dominate domestic production. These varieties have also issues associated with storage life. Little seed is imported and certified seed is not produced domestically. Yields in Sindh (the largest producer) and Punjab (the largest consumer) provinces are below regional and world averages, suggesting that improvements in farm productivity are possible.

Estimated results of RCA indices are presented in Table 4 which exhibit that onion crop has retained its comparative advantage for exports during the study period 2001-2018. In 2007, however, it had a comparative disadvantage as values of BI and RXA remained less than 1. A relatively higher comparative import advantage can be visualized in 2007 as the value of RMA is 6.10. In 2009, both comparative export advantage as well as comparative import advantage is revealed as values of RXA and RMA remained at 1.6 and 14.7, respectively. In 2011, the same situation can be witnessed. But comparative export advantage remained higher than comparative export advantage. During the period from 2012 to 2015, the values of both RXA and RMA were found greater than 1. From 2016 to 2018, it exhibited only comparative advantage as there were no imports in these years. Results of the other indices for onions are consistent with each other. The value of C.V. of these indices have remained among the highest ranging from 65% to 89% which divulge the existence of instability that requires proper attention to maintain comparative advantage for enhancing its exports and reduce its imports in the long run.

Onion marketing across Pakistan follows a very traditional pattern. The marketing system is dominated by middlemen (contractors, commission agents and wholesalers) upon whom farmers traditionally rely for finance to pay for production inputs and to tide them over from one season to

Table 4. RCA indices for onions

YEAR	RCA	RXA	RMA	RTA	LNRXA	LNRMA	RC	AI	RSCA	NRCA
2001	7.45	7.50	0.71	6.79	2.01	-0.34	2.35	0.00090	0.76	0.0000014
2002	4.06	4.10	2.36	1.74	1.40	0.86	0.54	0.00050	0.60	0.0000007
2003	3.20	3.20	0.23	2.97	1.16	-1.45	2.61	0.00040	0.52	0.0000006
2004	3.40	3.40	0.30	3.10	1.22	-1.19	2.42	0.00040	0.55	0.0000005
2005	1.89	1.90	2.94	-1.04	0.64	1.08	-0.44	0.00010	0.31	0.0000002
2006	2.40	2.40	0.55	1.85	0.88	-0.60	1.48	0.00020	0.41	0.0000003
2007	0.60	0.60	6.10	-5.50	-0.51	1.81	-2.32	-0.00010	-0.25	-0.0000001
2008	2.55	2.60	1.83	0.77	0.94	0.60	0.33	0.00020	0.44	0.0000003
2009	1.62	1.60	14.71	-13.11	0.48	2.69	-2.21	0.00010	0.24	0.0000002
2010	6.13	6.10	3.28	2.82	1.81	1.19	0.63	0.00100	0.72	0.0000013
2011	10.04	10.10	2.40	7.70	2.31	0.87	1.43	0.00140	0.82	0.0000020
2012	2.56	2.60	5.70	-3.10	0.94	1.74	-0.80	0.00020	0.44	0.0000003
2013	5.52	5.50	5.23	0.27	1.71	1.66	0.05	0.00080	0.69	0.0000010
2014	6.44	6.40	1.60	4.80	1.86	0.47	1.39	0.00080	0.73	0.0000011
2015	8.81	8.80	2.30	6.50	2.18	0.83	1.34	0.00150	0.80	0.0000021
2016	3.32	3.30	0.00	3.30	1.20	0.00	-1.00	0.00040	0.54	0.0000006
2017	3.14	3.10	0.00	3.10	1.15	0.00	-1.00	0.00040	0.52	0.0000005
2018	11.20	11.20	0.00	11.20	2.42	0.00	-1.00	0.00190	0.84	0.0000023
Mean	4.69	4.69	2.79	1.90	1.32	0.57	0.32	0.00062	0.54	0.0000008
S.D.	3.05	3.06	3.57	5.41	0.73	1.08	1.52	0.00055	0.26	0.0000007
Min	0.60	0.60	0.00	-13.10	-0.51	-1.45	-2.32	-0.00010	-0.25	-0.0000001
Max	11.20	11.20	14.71	11.22	2.42	2.69	2.61	0.00190	0.84	0.0000023
C.V.	65.14	65.17	127.73	285.35	55.56	190.25	471.17	88.86	49.07	86.4000000

the next. There is little farmer direct marketing or organization into clusters, though one USAID project in Baluchistan had has some success in this area. There is a lack of suitable facilities for onion drying and storage. Poor storability limits exports to those markets that are nearby, such as UAE, Sri Lanka and Malaysia.

Improved on-farm grading and storage combined with collective approaches to business management and marketing can improve competitiveness of onion sector and household incomes. Women contribute 70-75% of farm labour and their capacity building on pre- and postharvest skills could generate diverse opportunities, higher wages, supervisory roles and better conditions for them. There may be local village-based value adding opportunities for women, such as making vegetable pickles and dried onion.

Potato: Potato is also a highly consumable vegetable in Pakistan both in fresh and processed forms such as chips and fries (Badar et al., 2020). Pakistan ranks at about 20th level in world production of potatoes. Punjab province is the major producer and contributes about 90% to total potato production in the country. About 65-70% of farmers in Punjab are small and medium with landholdings below 25 acres (GOP, 2020; UNFAO, 2019) .

Since 2000, the potato area has increased by about 60% and production volume has more than doubled, with strongest increases since 2008-09. All of the increase has come from Punjab province, which has more than 90% contribution in potato production. The yield in Punjab at around 20t/ha are in line with the China average of 20t/ha, but well below those obtained in developed countries. The bulk of the autumn crops are stored then sold from June onwards. Off-season production in hill areas (KPK) targets domestic markets at premium prices, thus the size of the hill crop directly impacts prices of stored potatoes. Poor handling, storage and transport systems result in postharvest losses. The main autumn crop (harvested from January to March) is sold at lower prices than any other time of the year, thus exports are mostly from the autumn crop.

The marketing system is dominated by middlemen (both contractors and commission agents) particularly for smallholders, who traditionally rely on them to finance production inputs. Close relationships between large farmers and large commission agents are used to control supplies to the market, at the expense of smallholders.

Estimated results of RCA indices are presented in Table 5. Results exhibit comparative advantage of potatoes for their exports during the study period 2001-2018 except 2005 where it realized a comparative disadvantage as values of both RCA and RXA are 0.84 which is less than 1. Comparative import advantage can be observed in 2006, 2008, 2009 and 2014 with highest value of RMA, 8.37. Results of the other indices for onions are consistent with each other. The values of C.V. of these indices have also remained among the highest ranging from 54% to 82% which indicate the presence of instability. This highlights the need to maintain comparative advantage and enhance its

Table 5. RCA Indices or Potatoes.

YEAR	RCA	RXA	RMA	RTA	LNRXA	LNRMA	RC	AI	RSCA	NRCA
2001	2.77	2.77	0.77	2.01	1.02	-0.26	1.28	0.00043	0.47	0.0000006
2002	2.96	2.96	0.66	2.30	1.09	-0.41	1.50	0.00052	0.49	0.0000007
2003	2.58	2.58	0.17	2.41	0.95	-1.77	2.71	0.00040	0.44	0.0000006
2004	1.96	1.96	0.14	1.82	0.67	-1.95	2.63	0.00023	0.32	0.0000003
2005	0.84	0.84	0.96	-0.12	-0.17	-0.04	-0.13	-0.00003	-0.09	0.0000000
2006	1.20	1.20	1.16	0.04	0.18	0.15	0.03	0.00004	0.09	0.0000001
2007	8.26	8.27	0.74	7.53	2.11	-0.30	2.41	0.00179	0.78	0.0000022
2008	5.00	5.00	3.18	1.82	1.61	1.16	0.45	0.00086	0.67	0.0000010
2009	10.25	10.28	1.40	8.88	2.33	0.33	2.00	0.00239	0.82	0.0000034
2010	10.36	10.39	0.56	9.83	2.34	-0.58	2.92	0.00224	0.82	0.0000029
2011	15.88	15.94	0.43	15.51	2.77	-0.85	3.61	0.00386	0.88	0.0000053
2012	17.59	17.64	0.29	17.36	2.87	-1.25	4.12	0.00334	0.89	0.0000043
2013	21.11	21.22	0.54	20.68	3.05	-0.62	3.67	0.00508	0.91	0.0000066
2014	8.89	8.90	8.37	0.54	2.19	2.12	0.06	0.00181	0.80	0.0000024
2015	23.10	23.21	0.37	22.84	3.14	-0.98	4.13	0.00495	0.92	0.0000071
2016	14.87	14.92	0.40	14.53	2.70	-0.92	3.62	0.00351	0.87	0.0000046
2017	14.96	15.01	0.40	14.61	2.71	-0.91	3.62	0.00345	0.87	0.0000043
2018	22.85	22.96	0.31	22.65	3.13	-1.16	4.29	0.00489	0.92	0.0000060
Mean	10.30	10.34	1.16	9.18	1.93	-0.46	2.38	0.00200	0.66	0.0000029
S.D.	7.71	7.75	1.93	8.28	1.06	0.98	1.52	0.00180	0.31	0.0000023
Min	0.84	0.84	0.14	-0.12	-0.17	-1.95	-0.13	-0.00003	-0.09	0.0000000
Max	23.10	23.21	8.37	22.84	3.14	2.12	4.29	0.00400	0.92	0.0000071
C.V.	74.87	75.00	166.58	90.22	54.90	-214.87	63.94	81.64000	46.36	81.790000

exports and reduce its imports in the long run.

Khan and Akhter (2006) explained that production of potatoes was efficient in Pakistan. Riaz and Jansen (2012) found revealed comparative advantage in fresh and dried vegetables of Pakistan. They explained that low-value neighboring counties capture highest share of vegetables exports from Pakistan and efforts should be made to encourage tunnel farming and exporting off-season vegetables for a good price. They further added that better cool chain infrastructure, modern post-harvest technologies, good agricultural practices, certifications and contract farming on behalf of exporting firms could lead to capture distant and high-income international markets.

Vanitha *et al.* (2014) determined comparative advantage and export competitiveness of selected fresh vegetables grown in India through computing the nominal protection coefficient (NPC), rate of protection, revealed comparative advantage (RCA), and revealed symmetric comparative advantage (RSCA). They found high comparative advantage in exporting onions and peas, however, tomato, onion, and potato accounted for major share of exported vegetables from India. Bangladesh for export of tomatoes; Maldives, Nepal, and Mauritius for export of potato; and the UAE and Bangladesh were found stable markets for onion exports from India. They concluded that cabbage, cauliflower, tomato, and eggplant contained high export potential while existing markets in Singapore, Pakistan, Sri Lanka, Bangladesh, and Mauritius would be made stronger and new emerging markets could be focused.

Improved on-farm grading combined with better business management and marketing have the potential to improve potato production and exports and increase the profitability of value chain actors. Women provide 60-70% of farm labour, of which 30% is permanent and 70 % is hired on casual basis. Capacity building relating to pre and postharvest skills and food processing can help them in capturing higher wages, expanded roles and village-based value-adding opportunities such as production and marketing of vegetable pickles.

Conclusion: The study has applied Balassa's index of revealed comparative advantage (RCA) and its extensions such as revealed export advantage (RXA), revealed symmetric comparative advantage (RSCA) additive revealed comparative advantage (AI) and normalized RCA to major fruits and vegetables of Pakistan for the period 2001-2018. The study has determined the existence and pattern of comparative advantage and compared the sectors with low and high comparative advantage and their expected future development potential. Mangoes, citrus and dates are found to have revealed comparative advantage during entire study period with highest values of these indices. Onions and potatoes also showed comparative advantage but with lower values and also showed revealed comparative disadvantage in some years. However, yearly fluctuations are observed in all these fruits and vegetables that highlight the need to stabilize at higher level of comparative advantage and exports. Vegetable are of main concern in this regard as they also showed comparative disadvantages.

In short, there is dire need to increase exports of fruits and vegetables from Pakistan. This will help in reducing trade deficit and raising foreign exchange reserves to partially finance heavy import bill and payment of external debt as well as generating employment opportunities. Competitiveness of fruits and vegetables can be enhanced through investing in research and development and improvements in infrastructure. Meeting SPS quality requirements and iimprovements in yields can be attained through improved seed quality, better pest and disease management and lowering postharvest losses. Government should focus on infrastructural improvements for reducing postharvest losses. There is need to build good roads from farm to market and arrange good quality transport vessels. Future research can focus on detailed qualitative and quantitative investigation of factors affecting the export competitiveness.

REFERENCES

Abbas, S. and A. Waheed. 2017. Trade competitiveness of Pakistan: Evidence from the revealed comparative advantage approach. Com. Rev. An Int. Bus. J. 27:462-475.

Ahmad, B. and R.J. Garcia. 2012. Measuring commodity-specific trade determinants and export potential: A gravity model of Pakistan's rice exports. J. Int. Agri. Trad. Dev. 8: 125-148.

Ahmad, B., M. Mehdi, A. Ghafoor and H. Anwar. 2018. Value chain assessment and measuring export determinants of citrus fruits in Pakistan: An analysis of primary data. Pak. J. Agri. Sci. 55:685-692.

Ahmad, S. and R.P. Martin. 2000. Agricultural policy analysis in Pakistan: Illustrations in the use of the policy analysis matrix (Working Paper 00-27). Lahore: Lahore University of Management Sciences.

Akhtar, W., M. Sharif and H. Shah. 2009. Competitiveness of Pakistani fruits in the world market. Lhr. J. Econ. 14:25-133.

AMIS. 2020. Agriculture Marketing Information Service, Directorate of Agriculture (Economics and Marketing) Punjab, Lahore. http://www.amis.pk/agristatistics /area.aspx.

Badar, H., A. Ariyawardana and R. Collins. 2015. Capturing consumer preferences for value chain improvements in the mango industry of Pakistan. Int. Food Agribus. Manag. Rev. 18:131-148.

Badar, H., A. Ariyawardana and R. Collins. 2019. Dynamics of mango value chains in Pakistan. Pak. J. Agri. Sci. 56:523-530.

Badar, H., Z. Mohsin, K. Mushtaq, B. Ahmad, M. Mehdi, Adedullah and A. Rasool. 2020. An assessment of consumer preferences for fresh potatoes in Punjab, Pakistan. Pak. J. Agri. Sci. 57:773-778.

Balassa, B. 1965. Trade liberalization and revealed comparative advantage. Man. Sch. Econ. Soc. Stu. 33:92-123.

Balassa, B. and M. Noland. 1989. Revealed comparative advantage in Japan and the United States. J. Int. Eco. Integ. 2:8-22.

Ballance, R.H., H. Forstner and T. Murray. 1987. Consistency tests of alternative measures of comparative advantage. The Rev. Econ. Stat. 69:157-161.

Bullo, M.M. 2017. Dates sector of Pakistan. Trade Development Authority of Pakistan https://www.tdap.gov.pk/doc_reports/Date%20Sector.docx

Bender, S. and K.W. Li, 2002. The changing trade and revealed comparative advantages of Asian and Latin American manufacture exports. Yale Economic Growth Center Discussion Paper, 843.

Cai, J. and P.S. Leung. 2008. Towards a more general measure of revealed comparative advantage variation. App. Econ. Lett. 15:723-726.

Dalum, B., K. Laursen, and B. Verspagen. 1999. Does specialization matter for growth? Indus. Corp. Chan. 8:267-288.

Dalum, B., K. Laursen, and G. Villumsen. 1998. Structural change in OECD export specialisation patterns: De-specialisation and 'Stickiness'. Int. Rev. App. Econ. 12: 447-467.

Fertő, I. and L.J. Hubbard. 2004. The dynamics of agri-food trade patterns. The accession countries' case. Seventy Eighth Ann. Conf. Agric. Econ. Soc., Imperial Coll. London

Fertö, I., and L.J. Hubbard. 2003. Revealed comparative advantage and competitiveness in Hungarian agri–food sectors. The World Econ. 26:247-259.

Gereffi, G., 2019. Economic upgrading in global value chains. In Handbook on global value chains. Edward Elgar Publishing.

Government of Pakistan (GoP). 2020. Economic Survey of Pakistan 2019-20. Statistical Division, Ministry of Finance, Islamabad, Pakistan. http://finance.gov.pk /survey_1920.html.

Grossman, G. and E. Helpman, 1991. Innovation and Growth in the Global Economy. MIT Press, Cambridge.

Haleem, U., K. Mushtaq, A. Abbas and A.D. Sheikh. 2015. Estimation of export supply function for citrus fruit in Pakistan. The Pak. Dev. Rev. 44:659-672.

Hassan, M.U. and H.K. Ahmad. 2018. An estimation of normalized revealed comparative advantage and its determinants in Pakistan. Pak. Vis. 19:231-257.

Havrila, I. and P. Gunawardana. 2003. Analysing comparative advantage and competitiveness: An application to Australia's textile and clothing industries. Aust. Econ. Papr. 42:103-117.

Hoen, A.R. and J. Oosterhaven. 2006. On the measurement of comparative advantage. The Annals of Reg. Sci. 40:677-691.

Ikram, S., W. Shafqat, M.A. Qureshi, S. Din, S. Rehman, A. Mehmood, Y. Sajjad and M. Nafees. 2020. Causes and control of fruit cracking in pomegranate: A review. J. Glob. Innov. Agric. Soc. Sci. 8:183-190.

Ilyas, M., T. Mukhtar and M.T. Javed. 2011. Competitiveness among Asian exporters in the world rice market. The Pak. Dev. Rev. 48:783-794. https://www.jstor.org/stable/pdf/41261347.pdf.

Khan, N.P. and J. Akhtar. 2006. Competitiveness and policy analysis of potato production in different agro-ecological zones of Northern Areas: Implications for food security and poverty alleviation. The Pak. Dev. Rev. 45:1137-1154.

Kousar, R., T. Sadaf, M.S.A. Makhdum, M.A. Iqbal and R. Ullah. 2019. Competiveness of Pakistan's selected fruits in the world market. Sarh. J. Agri. 35:1175-1184.

Mahmood, A. 2004. Export competitiveness and comparative advantage of Pakistan's non-agricultural production sectors: Trends and analysis. The Pak. Dev. Rev. 43:541-561.

Marcato, M.B. and C.T. Baltar. 2020. Economic upgrading in global value chains: Concepts and measures. Revista Brasileira de Inovação. 19:1-25.

Mehdi, M., B. Ahmad, A. Yaseen, A. Adeel and N. Sayyed. 2016. A comparative study of traditional versus best practices mango value chain. Pak. J. Agric. Sci. 53:733-742.

Quddus, M.A. and U. Mustafa. 2011. Comparative advantage of major crops production in Punjab: An application of policy analysis matrix. Lhr. J. Econ. 16:63-94.

Riaz, K. 2009. Revealed comparative advantage analysis of Pakistan's agricultural exports. Pak. J. App. Eco. 19:103-127.

Riaz, K. and H.G.P. Jansen. 2012. Spatial patterns of revealed comparative advantage of Pakistan's agricultural exports. Pak. Econ. Soc. Rev. 50:97-120

Riaz, K., H.G. Jansen and S. Malik. 2010. Revealed comparative advantage of Pakistan's agricultural exports. Washington D.C: World Bank. [online] available at: http://documents.worldbank.org/curated/en/2010/11/16269213/revealedcomparativeadvantage-pakistansagricultural-exports.

Rizwanulhassan, M. and Shafiqurrehman. 2015. Analysis of competitiveness of Pakistan's mango exports in the world Market. J. Bus. Manag. 17:69-75.

State Bank of Pakistan (SBP). 2015. A handbook statistics of Pakistan 2015. State Bank of Pakistan.

Sandeela, Y. 2015. Policy reform to enhance competitiveness and exports of horticulture (kinnow and mango). Trade related Technical Assistance Programme II, International Trade Center, Islamabad, Pakistan. http://trtapakistan.org/wp-content/uploads/2013/10/Mango-and-Kinnow.pdf

Talat, H., W. Shafqat, M.A. Qureshi, N. Sharif, M.K. Raza, S. ud Din, S. Ikram and M.J. Jaskani. 2020. Effect of gibberellic acid on fruit quality of Kinnow mandarin. J. Glob. Innov. Agric. Soc. Sci. 8:59-63.

United Nations Food and Agricultural Organization (UNFAO). 2019. UNFAO statistical database, www.fao.org

Vanitha, S. M., G. Kumari and R. Singh. 2014. Export competitiveness of fresh vegetables in India. Int. J. Veg. Sci. 20:227-234.

Vollrath, T.L. 1991. A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. Weltwirtschaftliches Arch. 127:265-280.

White, H.C. 1981. Where do markets come from? Amer. J. Soc. 87:517-547.

Young, A. 1991. Learning-by-doing and dynamic effects of international trade. Quart. J. Econ. 106:396-406.

Yu, R., J. Cai and P.S. Leung. 2009. The normalized revealed comparative advantage index. Annals of Reg. Sci. 43:267-282.

[Received 23 Nov 2020; Accepted 28 Dec 2020; Published (online) 18 April 2021]