Outlook on the global trade competitiveness of Pakistan’s mandarin industry: An application of revealed symmetric comparative advantage framework

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Abstract
Competitiveness is the ability to trade products that meet the requirements of global demand for better price, quality, and quantity. International competition in the agricultural and food industries has been significantly increased due to globalization. Furthermore, labor-intensive countries are losing competitiveness due to lack of local value addition and other development efforts. This study aims to examine the competitiveness of the mandarin industry for the world’s 15 leading mandarin exporters using revealed symmetric comparative advantage (RSCA). An attempt was also made to assess the effect of productivity growth and real effective exchange rate on the competitiveness of the mandarin industry through panel regression analysis. The results showed that RSCA patterns vary between the selected countries and only five countries, that is, Morocco, Spain, Pakistan, Turkey, and Peru have a comparative advantage in mandarin exports while all other countries have a comparative disadvantage. The highest change in the RSCA value was seen for Pakistan which gives a good indication of the status of the country in the development of its mandarin industry. For Pakistan, there is a need to explore the new high-value market to further exploit this comparative advantage and to increase export earnings.

Keywords
competitiveness, revealed symmetric comparative advantage, mandarin, exports, Pakistan

Introduction
The term competitiveness is defined as the ability to face competition and to be successful while facing international competition. Competitiveness is the ability to trade products that meet requirements for worldwide demand (such as price, quality, and quantity), and at the same time ensuring profits for the firm to thrive (Turi et al., 2014). Competition may be within domestic markets in which firms or sectors in the same country are competing with each other or in the international markets in which comparisons are made between nations. Therefore, competitiveness is a relative measure (Ariyawardana and Collins, 2013; Buckley et al., 1988) and there is more or less a consensus regarding measurement of competitiveness (Ambastha and Momaya, 2004). The two disciplines for measuring competitiveness are first, neoclassical economics, which focuses on trade success and measures competitiveness with the real exchange rate, comparative advantage indices, and export or import indices. The second, strategic management places emphasis on the firm’s structure and strategy. In the latter, competitiveness is measured by various cost indicators, including productivity and efficiency. Particular attention should be given to productivity (and its efficiency component), which is generally agreed to be a part of competitiveness, although not often cited as such in empirical studies (Aiginger et al., 2013).

In recent years, global competition in the fruit and vegetable market has increased (Abu Hatab and Romstad, 2014; McMillan, 2006). Therefore, it is necessary to establish productive cluster plans based on an analysis of the

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structural market (Jaime de Pablo et al., 2012). Examples of such cluster planning are the Silicon Valley in California, the information technology cluster in Bangalore, India, and the Australian and Chilean wine clusters (Esser et al., 2013). These type of productive cluster plans promoting the private sector are based on pro-poor growth creating opportunities for the poor and generating opportunities for those poor to take advantage of them. This type of productive cluster planning will also be useful in specific fruit and vegetables production areas.

Agriculture is the lifeline of Pakistan’s economy contributing about 18.9% to the gross domestic product (GDP), employing the 42.3% of the labor force and is the primary source of raw material for several value-added sectors (GOP, 2018). There is a growing importance of the horticultural activities in the country (Naseer et al., 2016; Raza et al., 2012) due to the natural topography of Pakistan. It is one of the few countries in the world where fruit is grown in cool temperate (apples, plums, pears, and cherries), warm temperate (apricots, grapes, pomegranates, and melon), and subtropical climates (citrus, mango, banana, dates, and guava) (Naseer, 2010). Citrus is the leading fruit in terms of production followed by mango, dates, and guava. Pakistan annually exports about US$441.75 million worth of fruit with mandarin taking a major share (GOP, 2018).

There are several varieties of citrus fruit grown in Pakistan; the most popular among these is mandarin (Kino in local language) which may interest importers in Asia and Europe. Mandarin is rightly called the king of all the types of easy peelers and excels as one of the best varieties in the world (Memon, 2017a; Naseer, 2010). Pakistan is the 12th largest producer of citrus (FAO, 2018) and the 6th largest exporter of mandarin in the world (ITC, 2018). In Pakistan, mandarin is produced on about 80% of the total citrus growing area. Application of modern techniques at all stages of growth and during the post-harvest phase could not only add value to the fruit to attract premium prices but also increase export volume to fetch much-needed foreign exchange to the country (Memon, 2017a). At present, Pakistan is exporting only 10% of its total mandarin production. During 2016, mandarin exported from Pakistan was worth US$158 million (ITC, 2018), and the major international markets were Afghanistan, Azerbaijan, Indonesia, Mauritius, Oman, and the Philippines (Memon, 2017b).

Haberler (1936) defined comparative advantage on the basis of the theory of opportunity cost and this idea became famous, and it is referred to as the comparative cost. These definitions only built a theoretical argument. Trade studies also need to be measured to assess comparative advantage (Abbas and Waheed, 2017; Salvatore, 2013). This gap was filled by Balassa (1965) who introduced the concept of revealed comparative advantage (RCA), for the measurement of comparative advantage based on the performance of trade structure. This concept concluded that the pattern of trade of a country imitates both changes in input endowments and, relative to the costs, resulting in comparative advantage.

Matthew et al. (2000) measured the competitiveness of the agriculture sector in the Czech Republic and Bulgaria, comparing the European and international market using RCA and domestic resource cost (DRC). The study concluded that cereal producers in both countries were competitive in world market prices as well as in European prices. But they did not express RCA for trade with the European Union. Feröö and Hubbard (2003) studied RCA and competitiveness in Hungarian agri-food sectors. They found that Hungary has RCAs in 11 out of 22 products, that is, live animals, meat, cereals, fruits and vegetables, sugar, beverages, oilseeds, and so on. Yercan and Isikli (2007) measured the international competitiveness of Turkish agriculture by providing empirical evidence of how DRC determines international competitiveness. This study concluded that Turkey has a comparative advantage in plant products, due to labor intensiveness compared to the others.

Huo (2014) studied the impact of a country’s factors on the trade competitiveness of the horticulture industry from emerging markets using RCA for measuring competitiveness. Furthermore, using regression analysis revealed that agricultural exports, agricultural land, and exchange rate affect positively the export or trade competitiveness of the agricultural sector. Gupta and Kumar (2017) identified Rwanda’s patterns of trade using standard Balassa revealed comparative advantage index (RCAI). They found due to the increasing pressure from the supply side the export product lines have been decreasing, and the high competition between exporting countries made Rwandan exports uncompetitive.

In Pakistan, several studies have been done to measure the export competitiveness for different sectors including agriculture. Irsahd and Xin (2017) studied the determinants of export competitiveness using RCA. The results of the study showed that Pakistan is not a major trading player in the international market, but Pakistan has prominent RCA in textiles, clothing, vegetables, and the hides and skins sector. Rizwanulhassan and Shafigurrehman (2015) analyzed the global competitiveness of Pakistan’s mango exports. Along with RCA, they used revealed symmetric comparative advantage (RSCA) and relative export advantage. They found that for Pakistan, India, and Brazil, comparative advantage declined from 2004 to 2012 whereas Mexico, Peru, Thailand, and the Philippines were growing in the international market. Anwar and Hussain (2009) analyzed the changing comparative advantage and competitiveness of cotton in Pakistan. They used the policy analysis matrix (PAM), and the DRC was used to measure comparative advantage. Their results showed that Pakistan had a comparative advantage in cotton production at export parity prices and could maintain competitiveness in the international market.

There have been past studies on competitiveness in Pakistan using the RCA index, but very few considered the normality assumption in the traditional RCA index. This study uses the latest concept of RSCA for measuring competitiveness. Moreover, in the case of fruit, the literature is more limited. The fruit and vegetable sector has a high contribution to total agricultural exports, and mandarin (Kino) ranked top of exportable fruits list of Pakistan.
This study compared the international competitiveness of the mandarin industry of Pakistan with the world leading exporters as well as the effect of per capita domestic output growth and real effective exchange rate on the comparative advantage index using panel regression analysis.

This study has two broad objectives: (i) to measure the competitiveness of changes in mandarin exports using the RSCA approach on export data from international trade center (ITC) and (ii) to determine the effect of per capita domestic output growth and real effective exchange rate on the competitiveness of the mandarin industry using data from world development indicators (WDIs).

Based on the theories explained above, a theoretical framework is constructed in Figure 1 that defines competitiveness as domestic and international competition as well as the indicators and approaches adapted to measure competitiveness. Due to the limitation of primary data used to study domestic competition, this article places emphasis only on the international competition linked to the export and trade performance of Pakistan’s mandarin industry compared with the world leading exporters.

**Methodology and data**

This article investigated the competitiveness of the mandarin industry (HS code 080520) for the 15 world leading exporters that account for more than 85% of the total mandarin exports (ITC, 2018), using RSCA index from 2007 to 2016. In our case, the BRCAI is calculated by dividing the country’s export share of mandarin by its share combined in the total agriculture exports (Balassa, 1965), presented as

\[
RCA_{mit} = \frac{X_{mit}}{X_{mit} + 1}
\]

where \(RCA \leq 0 \leq \infty; x_{mit}\) is the export share of mandarin of country \(i\) in year \(t\); \(X_{mit}\) is the total international exports of mandarin in year \(t\); \(X_{mit}\) is the total agriculture export form country \(i\) in year \(t\); and \(X_{awt}\) is the total world’s agriculture exports in year \(t\). If the value of the index is greater than unity (RCA > 1) for a particular country, then it is said that country has a comparative advantage and vice versa.

Some studies narrated necessary and sufficient monotonic conditions under identical homothetic preferences to explore the association between the Balassa index and pre-trade price across countries. Hence, the value between zero to infinity in BRCAI raises the risk of normality and employing regression analysis using RCA values gives high weight to the values above one (Cole et al., 2005; Esmaeili, 2014; Laursen, 1998; Rizwanulhassan and Shafiqurrehman, 2015). It can be handled by using the logarithmic transformation of the Balassa index (Vollrath, 1991). But this solution is not satisfactory because of the allocation of weights to small, large, and undefined values that occur although export is equal to zero (Dalum et al., 1998). Hence, different studies used RSCA a transformed form of RCA index (Esmaeili, 2014; Laursen, 2015), where

\[
RSCA_{mit} = \frac{RCA_{mit} - 1}{RCA_{mit} + 1}
\]
Now, this new index lies between $-1$ and $+1$, and the RSCA value greater than 0 indicates specialization, and the value for lower than 0 indicates the comparative disadvantage. Further, to identify the patterns among the mandarin exporting countries, Spearman’s correlation was also used. Are these similarities in RSCA between countries in the same region or between the countries that specialize in similar kinds of mandarin production?

The mandarin industry RSCA index values are subjected to correlation coefficients to identify the particular patterns among the exporting countries that have a comparative advantage. The RSCA indices calculated in this study are then subjected to panel regression analysis to determine the effect of domestic productivity growth and real exchange rate on the competitiveness of mandarin industry

\[
\text{RSCA}_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln \text{REER}_{it} + \mu_t \tag{3}
\]

where $Y$ is the real GDP at time $t$ of country $i$; and

REER is the real effective exchange rate at time $t$ of country $i$.

The international competitiveness characterized by price or cost differential is estimated by a real effective exchange rate (Durand and Giorno, 1987). The REER is the nominal effective exchange rate divided by a price deflator or index of costs and calculated as

\[
\text{REER}_{it} = \frac{\text{ER}_{it} * P_{wt}}{P_{it}} \tag{4}
\]

where ER is the nominal exchange rate at time $t$ of country $i$; $P_{wt}$ is the international or world price measured by a wholesale price index, and $P_{it}$ is the domestic price measured by the consumer price index. The annual time-series data of mandarin exports is taken from the ITC, and the annual GDP and real effective exchange rate data are taken from WDI’s of the World Bank (WDI, 2018).

### Results

The results of the world top 15 exporters of the mandarin industry for 2007–2016 (latest 10 years available data) are presented in Table 1. The calculated RSCAs for the selected countries showed that RSCA patterns differed between countries, although the intercountry difference of the factor intensities. The last column of Table 1 shows the 10-year average RSCA value. The values of RSCA range from $-1$ to $+1$, which means a value higher than 0 shows the country’s specialization (having a comparative advantage) in the mandarin industry, and a value less than 0 showed the country has a comparative disadvantage in the mandarin industry.

The RSCA values are more apparent in Figure 2, which shows the 10-year average value of RSCA on the horizontal axis and the 10-year average annual per capita GDP growth rate on the vertical axis. The size of the bubble in Figure 2 shows the average export value of mandarin in US dollars. It is evident from results that only five countries Morocco, Spain, Pakistan, Turkey, and Peru show specialization in mandarin and Morocco, with the highest value of RSCA, shows the highest comparative advantage in the mandarin industry. The second largest exporter of mandarin, that is, China has a comparative disadvantage relative to the eight largest exporters among the selected countries, but it has the highest GDP growth rate compared to all other countries. Spain is the largest exporter of mandarin and has a comparative advantage over the 15 largest mandarin exporters. The situation for Pakistan’s mandarin industry is comparable as Pakistan is the fifth largest exporter of mandarin and has the third highest comparative advantage.

The change in the value of RSCA in the last 10 years in Figure 3 shows that all countries except Spain and the Netherlands have improved their specialization in mandarin exports. It is possible that for Spain, although the largest exporter, its specialization has decreased in the last 10 years. The highest improvement is seen in Pakistan as its RSCA value shows an increasing trend in the period under

### Table 1. RSCA of the mandarin industry.

| Country | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Ave. |
|---------|------|------|------|------|------|------|------|------|------|------|------|
| Spain   | 0.613| 0.569| 0.512| 0.564| 0.570| 0.537| 0.479| 0.461| 0.439| 0.384| 0.513|
| China   | -0.843| -0.784| -0.743| -0.741| -0.673| -0.647| -0.647| -0.674| -0.663| -0.668| -0.708|
| Turkey  | 0.068| -0.085| 0.020| 0.154| 0.237| 0.060| 0.108| 0.068| -0.020| 0.014| 0.049|
| Morocco | 0.724| 0.709| 0.705| 0.769| 0.826| 0.751| 0.780| 0.724| 0.721| 0.714| 0.742|
| South Africa | -0.315| -0.341| -0.348| -0.302| -0.244| -0.201| -0.178| -0.114| -0.190| 0.068| -0.216|
| Chile   | -0.616| -0.642| -0.522| -0.466| -0.351| -0.327| -0.325| -0.348| -0.315| -0.092| -0.414|
| Israel  | -0.636| -0.624| -0.522| -0.465| -0.465| -0.327| -0.325| -0.348| -0.315| -0.092| -0.414|
| Australia | -0.791| -0.848| -0.826| -0.837| -0.795| -0.766| -0.803| -0.811| -0.727| -0.699| -0.790|
| Italy   | -0.870| -0.893| -0.841| -0.827| -0.810| -0.841| -0.890| -0.882| -0.890| -0.877| -0.862|
| USA     | -0.969| -0.959| -0.965| -0.958| -0.936| -0.956| -0.955| -0.963| -0.956| -0.962| -0.958|
| Greece  | -0.242| -0.069| 0.025| 0.064| 0.034| -0.072| -0.112| -0.229| -0.129| -0.009| -0.081|
| France  | -0.925| -0.944| -0.934| -0.900| -0.901| -0.902| -0.916| -0.912| -0.914| -0.920| -0.917|

RSCA: revealed symmetric comparative advantage.
study and has the highest change in RSCA value from 2007 to 2016.

To evaluate the dynamics of the changing comparative advantage of the top five competitors in this study, Spearman correlation coefficients between each country were compared in Table 2. If a country’s competitive position had not changed or remained in the same direction, the RSCA index between the countries would be significantly correlated and have a large positive value. The results in Table 2 revealed that countries located in similar regions or having similar export markets tend to be positively correlated and vice versa. Spearman correlation coefficients revealed that Pakistan is negatively correlated with Spain. This is because Pakistan’s mandarin export was on an increasing trend while Spain’s was on a decreasing tendency in the period under study.

The impact of domestic productivity growth and the real effective exchange rate on mandarin competitiveness was investigated using the panel random effect model (Hausman test specification). The results in Table 3 revealed that there is a significant positive impact of GDP per capita growth on the country’s mandarin competitiveness. It means that there is a deterministic relationship between domestic supply constraints with mandarin competitiveness. On the other hand, the coefficient of the real effective exchange rate showed a significant negative
relationship with mandarin competitiveness. This means that an increase in the real effective exchange rate will tend to decrease exports. It will become more attractive to another country’s mandarin by the importers.

**Discussion**

Total world exports of mandarin have been increasing in recent years due to the high juice contents as compared with the other citrus varieties. Currently, Spain is the largest producer and exporter of mandarin in the world followed by China, Morocco, Turkey, Pakistan, and South Africa (ITC, 2018). This fruit is largely grown in warm climatic conditions from tropical to subtropical countries (Martínez-Ferri et al., 2013; Reitz, 1984). In Pakistan, citrus is largely grown in the Punjab province out of which 86% is under mandarin. Due to domestic constraints such as quarantine measures and deficient processing industry and transportation facilities, the export of the citrus is very low out of total production. Most fruit is consumed locally in the domestic market. This study attempts to answer the lesser share of export to production ratio by assessing the international competitiveness of Pakistani mandarin industry with the world leading exporters.

The study used the RSCA approach to investigate the international trade competitiveness of mandarin industry among 15 major mandarin exporting countries. There is no other study specifically on mandarin competitiveness. All previous studies (Dlikilili, 2018; Fidan, 2009; Lyle, 2008; Ndou, 2012; Niviesvkyi and von Cramon-Taubadel, 2009; Zi-fen et al., 2008 and there are several others) have measured citrus competitiveness using RCA, DRC, PAM, relative trade advantage, and net export index. Furthermore, a panel regression analysis was also employed to assess the effect of domestic productivity growth and real effective exchange rate on the competitiveness, which was not done previously specifically in mandarin or citrus case studies. Comparing the last 10 years average of RSCA values, Morocco, Spain, Pakistan, Turkey, and Peru have a comparative advantage in mandarin export relative to another 10 countries which have a comparative disadvantage in mandarin exports. The highest change in the RSCA value is seen in the case of Pakistan which is becoming more competitive in the world. On the other hand, Spain showed a decrease in the comparative advantage over the last 10 years.

Past studies have looked at the competitiveness of the citrus industry as a whole (Akhtar et al., 2009; Ndou, 2012; Sinngu and Antwi, 2014). The main contribution of this study was to segregate the mandarin from other citrus fruit and to assess its comparative advantage separately by using RSCA. The novel finding of this study is that the international competitiveness of Pakistan’s mandarin industry is increasing since the last decade which is a good sign for the country’s economic growth in the horticulture sector. But, it still the case that the share of exports compared to the total mandarin production is quite limited (Memon, 2017a, 2017b). These results supported the arguments of Akhtar et al. (2009) and Riaz et al. (2010) which found that Pakistan has a comparative advantage in mandarin exports although they did not use the RSCA framework and they did not have empirical evidence of their results.

This study also, unlike previous studies, identified the impact of per capita domestic output growth and real effective exchange rate on competitiveness. Previous empirical studies on trade liberalization reported that there is a negative impact of globalization on exports and economic growth in the less specialized developing countries (Aigner et al., 2013; French, 2017). Similarly, several trade theories and empirical studies on the international trade found that countries have a competitive advantage in comparatively input (labor) intensive production sectors (Chatterjee, 2017; Keogh et al., 2015). In this study of mandarin exports, the countries having high RSCA value, that is, a high trend of specialization in the mandarin export also had it’s a labor-intensive production system. This study showed that Spain, Turkey, Morocco, Pakistan, and Peru clearly are nations with factor-intensive production systems. The results of the panel regression showed that economic growth and real effective exchange rate have positive and negative impact respectively on RSCA of the mandarin industry. Hence, the study concluded that countries need to place emphasis on local production constraints and

### Table 2. Spearman correlation coefficient RSCA for mandarin between the top five competitors.

|      | Spain | Turkey | Morocco | Pakistan | Peru |
|------|-------|--------|---------|----------|------|
| Spain | 1.00  |        |         |          |      |
| Turkey | 0.0303 (0.9338) | 1.00  |         |          |      |
| Morocco | 0.2606 (0.4671) | 0.8061 (0.0049) | 1.00  |          |      |
| Pakistan | −0.7455 (0.0133) | 0.1879 (0.6032) | 0.1758 (0.6272) | 1.00  |      |
| Peru | −0.7818 (0.0075) | 0.1273 (0.7261) | 0.1879 (0.6032) | 0.8667 (0.0012) | 1.00 |

RSCA: revealed symmetric comparative advantage.

*p Values are given in parenthesis.

### Table 3. Results of the panel regression analysis (random effect model).

| Variable | Coefficient | Std. error | p Value |
|----------|-------------|------------|---------|
| Ln REER  | −0.4808     | 0.1604     | 0.003   |
| Ln GDP   | 0.4672      | 0.0153     | 0.002   |
| Constant | −2.5332     | 0.7539     | 0.001   |

*a Hausman: χ² = 1.32 | Prob > χ² = 0.5158, accepting the null hypothesis of random effect. Dependent variable: RSCA index value.*
problems if they are to maintain a competitive real effective exchange rate to intensify export competitiveness in the mandarin industry.

Conclusions and recommendation

The findings of the study revealed that the international competitiveness of Pakistan’s mandarin industry has recuperated over the period from 2007 to 2016. Pakistan is in the better position in the specialization of mandarin than most of the leading exporters. However, the export value of mandarin from Pakistan is lower than expected due to the lowest export price compared to other leading exporters (Figures 1A and 1B). Furthermore, it is found that domestic productivity has a positive and real effective exchange rate has a negative effect on competitiveness. In the case of Pakistan, there is a need to explore new high-value markets to increase the mandarin’s export value and to better utilize its comparative advantage. The other problem that needs to be addressed is the low export to production ratio in Pakistan. This was due to low-quality fruit produced by traditional cultivation practices and quarantine measure that prevent low-quality fruit being exported (Siddique, 2015). Public–private partnerships can play a vital role to improve the export supply chain of the country by providing all related information and infrastructure.

Authors’ note

The study is the part of the research from the dissertation of the first author’s doctoral degree.

Acknowledgements

The author highly acknowledges the Higher Education Commission (HEC), Pakistan for the international research support initiative program (IRSSIP) opportunity to sponsor his travel as a visiting research scholar to the University of Queensland Australia. That enables the author to write this article under the supervision of world-renowned researchers. Authors also acknowledge the World Bank and ITC databases to use the open access data used for the study.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Appendix 1

Figure 1A. Average mandarin exports of the last 10 years (2007–2016). Source: ITC (2018).

Figure 1B. Mandarin export price in 2016 (US dollar per ton). Source: ITC (2018).