Estimation of commercial capacities between Iran and Turkey with an emphasis on virtual water trade: Case Study (selected agricultural goods)

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Abstract
On one hand, Iran due to the low annual rainfall and lack of appropriate spatial and temporal distribution in precipitation is considered as an arid and semi-arid country experiencing stress and water scarcity; on the other hand, 90% of annual water consumption has been allocated to agriculture sector in Iran and efficiency and productivity of water consumption do not enjoy favorable status in this sector. While it can overcome this problem by use of virtual water criterion in trade with the countries which enjoy water status such as Turkey. In this regards, the present study has examined this issue in form of selected agriculture goods based on common indices for detection of trade opportunities. Cosine criterion indicated that the degree of similarity and complementary of Turkey’s export with Iran is greater than structural similarity of Iran’s export with Turkey. With regard to trade potential calculations, Iran and Turkey have high export capacity in trade of agriculture goods. Further, Index of Drysdale indicated that the possibility for development of trade from Turkey to Iran is greater than trade from Iran to Turkey and ultimately adjustment of Balasa index based on virtual water trade process indicated that Iran should change its import and export priorities at area of agriculture products. Further, results from research indicate that applying virtual water criterion and removing the products lacking relative advantage in trade between Iran and Turkey result in increase in export of Turkey’s agricultural products to Iran and increase in Iran’s benefit in trade of virtual water.

Key Words: trade arrangements, agricultural goods, virtual water, and detected relative advantage.

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Introduction
Proper management of existing natural resources has been regarded as an essential necessity to achieve sustainable development. Among all natural resources, drinking water has been regarded as the most fundamental resource to which it must give the highest priority. Most of countries due to exploitation from fossil water for Rapid decompression caused by water stress have emptied water resources and reserves and undermined economic development and reduced their long term food security (Yang & Zehnder, 2001). This issue is very important in the countries such as Iran which enjoy the average rainfall level less than the global average, so that Iran with average annual rainfall of 252 mm (413 billion cubic meters) and 130 billion cubic meters of renewable water resources enjoys the irregular distribution of water resources(Rouhani, et al. 2008). On the other hand, population growth and the need for more food have caused the agricultural sector still remains the largest consumer of water in the country. Yet, due to the negative trade balance of agricultural products, their production still does not meet the total demand for food. Iran is vulnerable to water stress due to unreliable water resources, intense competition for water by other sectors and the increasing demand for food. One important way to deal with this situation is attention to the phenomenon of virtual water. Taking into account the volume of water that enters the country through imports of goods and products, referred to as virtual water trade. Now, virtual water trade is economically invisible and politically inactive (Water and Wastewater Engineering Company, 2015). Virtual water trade between the countries has been estimated to 1340 billion cubic meters in 2000 that 60 percent relates to agricultural products, 14% relates to the trade of fish and seafood, 13 percent relates to the Livestock and 13% relates to meat trade (Zimmer & Renault, 2003). However, Oki & Kanae (2004) showed that the trade has reserved 450 billion cubic meters of water in virtual form worldwide in that year. Therefore, it is expected that it can reduce water stress relating to existing water resources by exchange of virtual water considering the virtual water trade in trade of goods especially agricultural goods in Iran. Hence, the present research intends to detect agricultural goods with relative advantage in foreign trade of Iran with Turkey with an emphasis on virtual water trade. Awareness from commercial opportunities relating to import of virtual water and adoption of optimal commercial arrangements to increase optimal efficiency of water consumption will take place in country. In this regards, revision on water resources management policies is required to develop trade of virtual water based on relative advantage and collaboration of all sectors. With regard to significance of this issue, the present research intends to give response to questions below:
1. How is the degree of trade similarity and complementary and status of trade potential between Iran and Turkey about the agricultural commodities?
2. In which of selected agricultural goods, Iran and Turkey enjoy export comparative advantage?
3. Whether a possibility for development of trade between Iran and Turkey exists based on trade of virtual water?
To give response to the questions above, a review of status of water has been proposed in Iran and Turkey; in following theoretical
background and empirical studies on trade of virtual water and detection of trade opportunities have been discussed. Further a glance at the indices related to development of trade has been taken place. The results with emphasis on virtual water trade will be adjusted and the conclusion will be proposed. It should be noted that data have been taken from United Nations Conference on Trade and Development.

A review of status of water sector in Turkey and Iran

Renewable water resources per capita have been introduced as the most fundamental indicator representing status of water resources. Renewable resources in the world are about 7,600 cubic meters per capita per year. In Iran, this index is about a quarter of the global average in the country (1844 m), which is dramatically reduced due to population growth, successive droughts and lack of compliance with optimal pattern of consumption.

The index is equal to 2950 cubic meters per year in Turkey that is better than Iran (the second UN World Water Development Report, 2006). But the uptake of renewable water resources in 2006 has been equal to 96 billion cubic meters which is about 73.8% of renewable water resources in the country in that year. In Turkey, the withdrawn amount is equal to 39.78 billion cubic meters per year which is about 18.6% of renewable resources in the country. The share of agriculture, industry and drinking from the consumption of amounts above in Iran equals to 92.3%, 6.3% and 1.4% in Iran and equals to 74%, 15% and 11% in Turkey (World Water Organization and Deputy President of strategic planning and control, 2013). Per capita consumption per person per year to Turkey and Iran equals to 544 and 1297 cubic meters per year, so that values of agriculture, drinking and industry sectors equal to 1197, 82 and 18 cubic meters in Iran and equal to 404, 80 and 59 cubic meters in Turkey. The percent of use of surface water, groundwater and sugar water and treated wastewater (drainage or sewage) equals to 45%, 54.1%, 0.2% and 0.7% in Iran and the percent of use of surface and underground water and treated wastewater equals to 98% and 2% in Turkey. Irrigation efficiency in the agricultural sector in Turkey and Iran equals to 38 and 33 percent, respectively. Yet with regard to water efficiency, 1 cubic meter water is used in Iran and 5.3 cubic meter water is used in Turkey per 1.5$ value-added production (World Bank, 2006). However, the figure for this index in agriculture and industry sector equals to 0.2 and 26.2 dollar per cubic meter in Iran and equals to 1 and 10.4 dollar per cubic meter in Turkey. At industry sector, water productivity in Iran has been greater than the average rate worldwide which is equal to 18.7 dollar, but the productivity is less in agriculture sector (The World Bank, 2008). As observed, due to Iran's position in the arid, semi-arid and sharp region and lack of homogeneous distribution of water resources in various sectors, this country compared to Turkey which is among the countries with sufficient water consumes greater amount of water. These indicate lack of proper use of water which will result in water crisis in Iran (Vice President of Strategic Planning and Control, 2013). It seems that it can benefit from the conditions in Turkey and increase efficiency at water sector especially at agriculture sector in the country with an emphasis on trade of virtual water in form of trade exchange of agriculture goods with country.

Discussion and analysis with an emphasis on virtual water

To benefit from trade of virtual water, Iran should export the products through which the least amount of virtual water excludes from country and import the products through which the highest amount of virtual water enters into the country. In this regards, trade of virtual water between Turkey and Iran has been calculated for the selected products in 2012 and then the selected products have been arranged from the more to less amount
(table 1). This has been made for export value and trade advantage. As observed in this table, in 2012 maximum export value of Iran to Turkey relates to the products of grapes, dates, pistachios, walnuts, watermelon, apples, cucumbers, onions, tomatoes, oil seeds, peas, sugar beet, citrus fruits, beans, lentils, barley, wheat, rice, corn and potatoes. With regard to trade advantage, Balassa index of these priorities should be in turn Pistachios, cucumbers, dates, melons, potatoes, oranges, peaches, grapes, onions, sugar beet, oilseed crops, tomatoes, apples, walnuts, rice, lentils, beans, corn, barley and wheat. Yet, with regard to rate of trade of virtual water, maximum rate of export of virtual water from Iran to Turkey relates to export of Dates, pistachios, grapes, watermelon, walnuts, potatoes, oilseeds, peas, cucumbers, tomatoes, onions, sugar beets, beans, citrus fruits, lentils, barley, wheat, rice, corn and potatoes, so that about 77,974 thousand cubic meters of virtual water have excluded from Iran under export of virtual water from Iran to Turkey. In contrast, the highest amount of virtual water has been imported from Turkey to Iran relates to the products of grapes, dates, melons, potatoes, oranges, peaches, grapes, onions, sugar beets, beans, lentils, barley, wheat, rice, corn and potatoes. Import value of Turkey to Iran relates to the products of grapes, dates, melons, potatoes, oranges, peaches, grapes, onions, sugar beets, beans, lentils, barley, wheat, rice, corn and potatoes.

<table>
<thead>
<tr>
<th>Product</th>
<th>Watermelon</th>
<th>Wheat</th>
<th>Barley</th>
<th>Lentil</th>
<th>Citrus</th>
<th>Tomato</th>
<th>Onion</th>
<th>Apple</th>
<th>Beet</th>
<th>Sugar</th>
<th>Pea</th>
<th>Oil Seeds</th>
</tr>
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<tbody>
<tr>
<td>Sum</td>
<td>345974</td>
<td>345974</td>
<td>14729</td>
<td>14435</td>
<td>35350</td>
<td>156</td>
<td>63</td>
<td>256</td>
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<td>37</td>
<td>4998</td>
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<td>Product</td>
<td>Barley</td>
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<td>Export value of Iran to Turkey</td>
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<td>Export value from Turkey to Iran</td>
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</tr>
</tbody>
</table>

**Table 7. Comparison of priorities of export from Iran to Turkey and imports from Turkey in terms of trade of virtual water, trade value and relative advantage in 2012; Source: research calculations, Rouhani et al (2008)**
洋葱所以这个虚拟水的数量约为15,649,200立方米。因此，涉及到贸易的虚拟水的产品中，伊朗从与土耳其的贸易中受益1,486,946,000立方米的虚拟水。相比之下，土耳其从贸易中受益20,532,900美元。另一方面，如果伊朗放弃出口具有相对劣势的农产品，贸易的虚拟水的净收益将等于1,493,652,000立方米。具体来说，土耳其从出口虚拟水中受益28,097,900立方米。如果考虑虚拟水贸易的净收益大于从删除项目后的总净收益，可以认为伊朗通过考虑贸易的虚拟水的需求，从进出口农产品中受益。Table 2，伊朗和土耳其进出口农产品以最大化虚拟水的贸易净收益为目标。

| Watermelon, Grape, date, apple, Pistachios, nut, tomato, Cucumbers, onion, Oil Seeds, Sugar beet, Pea, Citrus, bean, Lentil, Barley, Wheat, rice, Corn & potato | Priority based on existing status |
| Pistachios, Cucumbers, date, Watermelon, potato, Citrus, Pea, Grape, onion, Sugar beet, Oil Seeds & Pistachios | Priority of goods with relative advantage based on Balassa index |
| Sugar beet, Citrus, Lentil, tomato, Cucumbers, Grape, nut, Pistachios, Watermelon, onion | Priority for import from Turkey based on Balassa index |
| onion, tomato, Watermelon, Cucumbers, potato, Sugar beet, apple, Grape, Corn, Citrus, rice, Wheat Barley, nut, bean, date, Oil Seeds, Lentil, Pea & Pistachios | Priority for export based on trade of virtual water |
| onion, Watermelon, Cucumbers, potato, Sugar beet, Grape, Citrus, date, oily seeds, Pea & Pistachios | Priority for export to Turkey in terms of trade of virtual water |
| Pistachios, Lentil, nut, Citrus, Grape, Sugar beet Cucumbers, Watermelon, tomato, onion | Priority for import from Turkey in terms of trade of virtual water |

Table 8. Priority of trade potentials between Iran and Turkey with an emphasis on trade of virtual water

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conclusion

Iran due to the low annual rainfall and lack of appropriate spatial and temporal distribution in precipitation is considered as an arid and semi-arid country experiencing stress and water scarcity. On the other hand, 90% of annual water consumption has been allocated to agriculture sector in Iran and efficiency and productivity of water consumption do not enjoy favorable status in this sector. As a result of these factors, the country has undergone water scarcity. Use of virtual water trade at the area of trade of agricultural goods can pave
the way for increase of efficiency of water consumption at agriculture sector. In this regards, the present research has estimated the trade capacities between Iran and Turkey with an emphasis on trade of virtual water based on common patterns of international trade, under which the questions below were proposed:

How is the degree of similarity between Iran and Turkey about the selected agricultural goods?

How is the potential trade status of Turkey with Iran about the selected agricultural goods?

In which of the selected agricultural goods, Iran and Turkey enjoy relative export advantage? It can state that Iran can be considered as a target export market for Turkey about agricultural products. Further, capacity of export potential in Iran belongs to the goods including potato, date, Pea, Citrus, apple, rice, Oil Seeds, Watermelon, Sugar beet, nut, Grape, Pistachios, onion, tomato, Lentil, bean, Corn, Barley, Wheat and cucumbers, but in contrast potential for export from Turkey to Iran includes export potential from Turkey to Iran including Oil Seeds, Corn, Sugar beet, Wheat, Citrus, rice, Lentil, Pea, onion, bean, tomato, Barley, Pistachios, date, nut, apple, potato, Cucumbers, Grape.

References


