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

Roohalah Bayat-*Assistant professor, Imam Khomeini International University, Qazvin, Iran.*
Elham Sadeghian[1] -*Professor at SAMA Technical and Vocational Training College, Islamic Azad University, Kermanshah Branch, Kermanshah, Iran.*

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.*

1. Corresponding Author, Tel: 09128206558, Email Address: Elhamsadeghian09@gmail.com

■ 300 ■

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 food, more water will be available for the consumption (Rouhani, et al. 2008). In fact, through virtual water imports and reduction of exports of agricultural products, it can reduce a major part of water use efficiency and low productivity in agriculture and other sectors. In general, virtual water is called to the amount of water that the product or products consume in a manufacturing process from the beginning to the end. Developers of the idea of virtual water believe that a large volume of water is displaced by export and import 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 fromUnited 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 treat-

ed 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

| Average virtual water (cubic meter per Kg) | | Maximum trade advantage based on Balassa index | | | | Maximum export income for exporting country | | | | The highest rate of export of virtual water | | | | Basis |
| | | Export advantage of Turkey to Iran | | Export advantage of Iran to Turkey | | Export value of Turkey to Iran | | Export value of Iran to Turkey | | Export of virtual water from Turkey to Iran | | Export of virtual water from Iran to Turkey | | |
M3/KG	Product	Balassa index	Product	Balassa index	Product	Thousands of cubic meters of water	Product	Thousands of cubic meters of water	Product	Thousands of dollar	Product	Thousands of dollar	Product	Rank
0.24	onion	40.183	Sugar beet	14.49	Pistachios	178624	Wheat	39394	Grape	987027	Wheat	32866	date	1
0.25	tomato	43.79	Citrus	93024	Cucumbers	53519	Barley	14729	date	345974	Barley	19306	Pistachios	1
0.28	Watermelon	57.18	Lentil	69.16	date	25297	rice	14435	Pistachios	86153	Lentil	11764	Grape	3
0.3	Cucumbers	7.40	tomato	8.43	Watermelon	22676	Citrus	13706	nut	53550	Pea	6498	Watermelon	4
0.31	potato	4.88	Cucumbers	5.54	potato	9716	Lentil	6548	Watermelon	47718	rice	3909	nut	5
0.31	Sugar beet	3.22	Grape	3.91	Citrus	7200	Pea	5562	apple	37154	Citrus	2688	apple	6
0.57	apple	1.93	nut	3.03	Pea	2517	bean	283	Cucumbers	7205	bean	389	Oil Seeds	7
0.84	Grape	1.28	Pistachios	2.72	Grape	802	potato	156	onion	184	potato	236	Pea	8
1.03	Corn	1.09	Watermelon	2.35	onion	0	Pistachios	156	tomato	0	Pistachios	107	Cucumbers	9
1.25	Citrus	1.07	onion	1.50	Sugar beet	0	Oil Seeds	66	Oil Seeds	0	Oil Seeds	97	tomato	10
1.87	rice	0.51	apple	1.30	Oil Seeds	0	date	22	Pea	0	date	73	onion	11
2.3	Wheat	0.48	date	0.86	tomato	0	nut	10	Sugar beet	0	nut	15	Sugar beet	12
2.58	Barley	0.32	rice	0.73	apple	0	Corn	7	Citrus	0	Corn	13	bean	13
2.85	nut	0.26	Pea	0.16	nut	0	Grape	3	bean	0	Grape	13	Citrus	14
3.16	bean	0.25	potato	0.03	rice	0	apple	0	Lentil	0	apple	1	Lentil	15
3.22	date	0.16	Wheat	0.01	Lentil	0	Sugar beet	0	Barley	0	Sugar beet	0	Barley	16
4.89	Oil Seeds	0.04	bean	0.01	bean	0	Cucumbers	0	Wheat	0	Cucumbers	0	Wheat	17
9.75	Lentil	0	Barley	0	Corn	0	Watermelon	0	rice	0	Watermelon	0	rice	18
10.72	Pea	0	Oil Seeds	0	Barley	0	tomato	0	Corn	0	tomato	0	Corn	19
11.53	Pistachios	0	Corn	0	Wheat	0	onion	0	potato	0	onion	0	potato	20
						300406	Sum	95077	Sum	1564920	Sum	77974	Sum	

▲ 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)

(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, peas, 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 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 through products of Wheat, barley, lentils, peas, rice, citrus fruits, beans, potatoes, nuts, oil seeds, dates, walnuts, corn, grapes, apple, beet, cucumber, lettuce, tomatoes and

302

	Priority based on existing status
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

onions so that this amount of virtual water has been about 1564920 thousand cubic meters. As a result, concerning trade of virtual water in selected products, Iran with 1486946 thousand cubic meters of virtual water has benefited from trade with Turkey. In contrast, Turkey has gained benefit equal to 205329 thousands dollar. On the other hand, if Iran discards export of the products which lack relative advantage to Turkey, the benefit from trade of virtual water will be equal to 1493652 thousand cubic meters; specifically Turkey will be benefit from export of virtual water about 280979 thousand cubic meters. If the total net benefit in terms of dollars from the trade of virtual water and the trade deficit in the state after the removal of items is more than the total before deleting items, it can say that Iran has benefited from trade of agricultural products by considering the requirements of trade of virtual water, otherwise it has been harmed. In table 2, export items of Iran to Turkey and vice versa aiming at maximizing net benefit from trade of virtual water for Iran have been prioritized from different perspectives. With regard to this table, it can say that if relative advantage and requirements

of trade of virtual water are complied, the selected export products for export from Iran to Turkey should include Onion, watermelon, cucumber, potato, sugar beet, grapes, citrus, dates, grain oil, lentils and pistachios and imports from Iran to Turkey include Pistachios, lentils, nuts, citrus, grapes, sugar beets, cucumbers, watermelons, tomatoes and onions. Yet, with regard to Balassa index, Iran and Turkey have relative advantage in export of products including Pistachio, citrus, grapes, sugar beets, cucumber, watermelon, tomatoes and onions. Yet, Turkey just exports citrus to Iran and Iran exports all the mentioned products to Turkey.

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

1. Allan, J. A. (1997). Virtual water: A long-term solution for water short Middle Eastern economies? Paper presented at the 1997 British Assoc. Festival of Sci., University of Leeds, UK.

2. Allan, J. A. (2003). Virtual water eliminates water wars? A case study from the Middle East. PP. 137-145. In: A. Y.

3. Allen, Roy. G. D, (1970). Mathematical Economics, London. P. 381.

4. Anderson. J. E. , (1979), A Theoretical Foundation for the Gravity Equation, American Economic Review, 69 (1): 106-116.

5. Ardakanian, R. (2005). Overview of water management in Iran. Proc of Water Conservation, Reuse and Recycling Workshop, the National Academic Press, Washinton D.C., PP: 106-113.

6. Ardakanian, R. (20050. Overview of water management in Iran. Proc of Water Conservation, Reuse and Recycling Workshop, the National Academic Press, Washinton D.C., PP: 106-113.

7. Arnon,Arie. Spivak,Avia and J. Weinblatt. (1995). the Potential for Trade between Israel, the Palestinians and Jordan. The World Economy,Vol. 19, January.

8. Arnon,Arie. Spivak,Avia and Weinblatt. J. (1995). The Potential for Trade between Israel, the Palestinians and Jordan. Institute for International Economics

9. Artis, M., Okubo T. , 2011), The International Business Cycle in Japan, Oxford Economic Papers, 63 (1): 111-133.

10. Balassa B. ,(1965), Trade Liberalization and Revealed Comparative Advantage, Manchester School 33 (2),99-123

11. Baldwin, R. (1994). Towards An Integrated Europe. London: Centre for Economic Policy Research.

12. Baldwin, R. (1997). The Causes of Regionalism. The World Economy. Vol. 20, o. 7, pp: 865-888.

13. Barry, Donald and Ronald C. Keith, eds. (1999) Regionalism, Multilateralism, and the Politics of Global Trade. Vancouver: UBC Press.

14. Bergstrand, J., (1985), The Gravity Equation in International Trade: some microeconomic foundation and empirical evidence, The Review of Economics and Statistics 67 (3): 474–481.