



Virtual water trade of agri-food products: Evidence from italian-chinese relations



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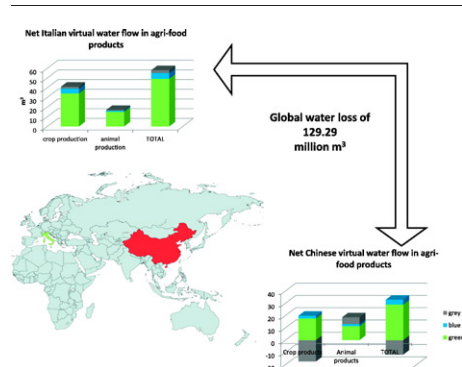
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HIGHLIGHTS

- Water footprint and virtual water can be used as quantitative measurement of the appropriation of water by humans activities.
- International trade and virtual water use are two closely inter-connected activities.
- China imports water from Italy through animal products, instead Italy imports water from China through crop products.
- The water flow involved in the Italy-China trade of agri-food products implies a global water loss of 129.29 million m³ at a global scale.
- The agri-food policies should therefore include an analysis of the effects on water resources.

GRAPHICAL ABSTRACT



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ABSTRACT

At global scale, the majority of world water withdrawal is for the agricultural sector, with differences among countries depending on the relevance of agri-food sector in the economy. Virtual water and water footprint could be useful to express the impact on the water resources of each production process and good with the objective to lead to a sustainable use of water at a global level. International trade could be connected to the virtual water flows, in fact through commodities importation, water poor countries can save their own water resources. The present paper focuses on the bilateral virtual water flows connected to the top ten agri-food products traded between Italy and China. Comparing the virtual water flow related to the top 10 agri-food products, the virtual water flow from Italy to China is bigger than the water flow in the opposite direction. Moreover, the composition of virtual water flows is different; Italy imports significant amounts of grey water from China, depending on the different environmental strategies adopted by the two selected countries. This difference could be also related to the fact that traded commodities are very different; the 91% of virtual water imported by Italy is connected to crops products, while the 95% of virtual water imported by China is related to the animal products. Considering national water saving and global water saving, appears that Italy imports virtual water from China while China exerts pressure on its water resources to supply the exports to Italy. This result at global scale implies a global water loss of 129.29 million m³ because, in general, the agri-food products are traded from the area with lower water productivity to the area with the higher water productivity.

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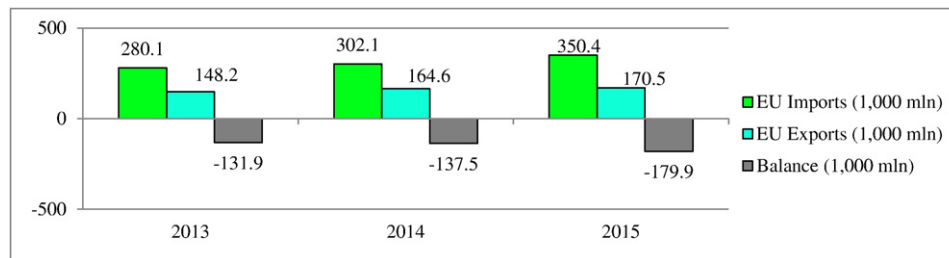


Fig. 1. EU-China Trade in goods (€) 2013–2015.
Source: Elaboration from European Commission, 2016.

1. Introduction

Freshwater availability is not unlimited and water scarcity is growing because of economic and population growth, climate change and the increasing water demand (Miglietta et al., 2016).

Humans are currently consuming 54% of all of the earth's accessible freshwater available in rivers, lakes and underground aquifers (UNWATER, 2016). The present estimates indicate that, by 2025, water stress, a condition in which water is not sufficient to meet agricultural, industrial or domestic needs (Lamastra, 2015), will be a reality for almost half of the world's population. Added to the problems of local and regional water shortages, there is the problem of water pollution which renders enormous volumes of water unsuitable for civil and non-civil use. Pollution threatens the quality of water resources and is also linked to demographic growth and to the access to the market of large swathes of populations previously excluded from mass consumption, which has resulted in an increase in production and in the management of its waste.

2. Background

Between 1900 and 2010, global agriculture water withdrawal consumption increased from 600 km³/year to about 2700 km³/year (FAO, 2016a) and the forecast for 2050 predicts an increase of about 20% if there is not an improvement in the efficiency of the agricultural production systems (UNWATER, 2016). An important indicator which captures this efficiency is water productivity. It defined as the ratio of agricultural output to the total amount of water consumed ("crop per drop") (Kijne et al., 2003; Molden et al., 2010).

In this context, it is important to have a way to express the impact on the water resources of each production process and consumer good with the objective to guide and urge for the most sustainable use of water. Water footprint and virtual water concepts were born to set a quantitative measurement of the appropriation of water by human activities, both representing the volume of freshwater virtually "contained" in a product. The water content, in this case, represents all the water used and polluted throughout the production process. However, the water footprint, differently by the virtual water, expresses and distinguishes the different types of water used and it is spatiotemporal explicit (Bonamente et al., 2016; Lamastra et al., 2014).

International trade and water use are two closely inter-connected activities. The increasing importance of international trade, especially in agricultural products, placed freshwater issues in a global context that should be analyzed and regulated by sustainable policies. The effects of international trade in virtual water are very important, especially for water-scarce countries which, through commodities importations, can save their own water resources. According to Hoekstra (2010), if water-intensive commodities were traded from countries with high water productivity to countries with low water productivity there would be a reduction of 5% in the global water use. In fact, if one country exports a product to another country, it also exports virtual water.

About 81% of virtual water is traded by China, the United States and the European Union which compose the "world's trading centre" (Chen and Chen, 2013).

Commodity trade plays a significant role in redistributing water resources between nations and it is confirmed by the fact that one-third of global withdrawal represents the total virtual water embodied in international trade (Chen and Chen, 2013).

This paper addresses the issues of freshwater scarcity, its relation with trade and the need for international regulation and focuses on the bilateral virtual water trade of agricultural products with the case study of Italy and China.

In Italy, the distribution of water withdrawal is 44.07% for the agricultural sector, 35.67% for the industrial sector and 20.06% for the municipal sector (Gleick and Ajami, 2014). In China, instead, 64.61% is used for the agricultural sector, 23.21% for the industrial sector and 12.19% for the municipal sector (FAO, 2016b).

China is one of the most important trading partner for the EU and Italy, especially for imports. Europe and Italy, in fact, have a trade deficit with China as shown in Figs. 1 and 2. The trade flow between Italy and China is characterized by industrial products, but there is not a suitable procedure to calculate their virtual water content. For these reasons the research focuses on agricultural products that also contribute to the global virtual water flow more than the industrial ones.

The aim of this research is to assess the bilateral virtual water trade in agricultural products between Italy and China measuring the amount of water saved on a national and global level with a distinction of green, blue and grey water.

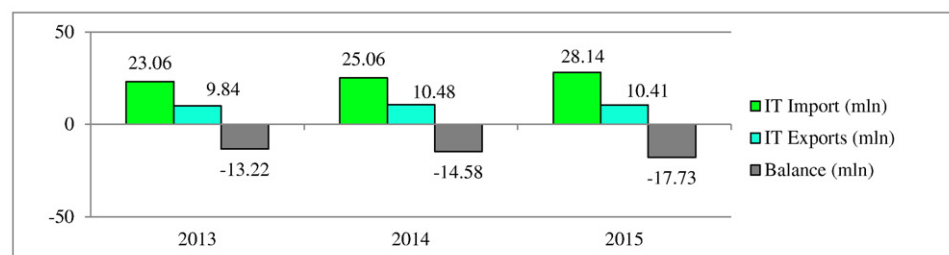


Fig. 2. Italy-China Trade in goods (€) 2013–2015.
Source: Elaboration from Eurostat, 2016.

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