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Drivers of Land Embodied in International Trade of Rice: The Italian Case Study

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Abstract
In the last years, a significant increase of imports of Rice from Cambodia and Myanmar into the European Union has been recorded. In particular, Italian farmers were badly affected by the imports of rice from these two Asiatic countries. Indeed, the European Commission in 2019 has therefore decided to re-introduce specific import duties. In turn, such exported rice corresponds to large quantities of land that are driven by consumption of Asiatic rice in Italy. In this study, we estimate the Virtual Land Trade associated with rice trade between Cambodia and Myanmar to Italy. Our analysis combines physical import data and associated land information. The analysis shows the pro-and-con of these debated trade connections also revealing the effect of replacing the Asiatic import demand with domestic production of rice in Italy in terms of land use. The study is relevant in understanding whether patterns of rice consumption, production and trade represent an efficient, and logical, allocation of natural resources.

Keywords: Virtual land trade; food; consumer awareness; land footprint; agricultural impact; rice; international trade

1. Introduction

Rice cultivation is responsible for using 11% of global arable land (GRISP, 2013) and the expected population growth (Alexandratos and Bruinsma, 2012) will entail an increase of global paddy extension in the next years. The international trade of rice has substantially increased over the last decades. According to FAO (2019), trade of rice increased by 233% from 1990 to 2016, year in which, around 40 Mt of rice were traded globally. Although Asia has the dominant position in rice production and consumption, rice is also consumed in many countries of other continents. While the international trade of rice may represent a good business for exporter countries, it may also be a disadvantage for domestic producer of importer countries. Indeed, it may involve direct import of rice from countries with lower production costs, environmental commitments and environmental performances. Therefore, international agreements and disciplinary measures should be designed to influence production costs, market prices and environmental sustainability.
In this context, the export of rice from Cambodia and Myanmar to Europe has substantially increased over the last few years. In particular, the export of rice between Cambodia and Myanmar to Italy has represented an interesting case study which has been debated in the last few years. Indeed the import of rice from Cambodia and Myanmar to Italy increased by 77% and 64%, respectively from 2013 to 2016 (FAO, 2019). Above all, in Italy, the question has been raised due to the associated reduction of domestic production of rice. As a consequence, the European Union has recently imposed a tax on rice from Cambodia and Myanmar for three years after an investigation

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found that a significant increase in imports of the rice from the two countries caused economic damage to European producers (European Commission, 2019). In terms of environmental impact, trade of agricultural products is also a trade of resources (Taherzadeh and Caro, 2019). That is, resources exploited to produce agricultural products in one country such as land energy and water are shipped in other countries to satisfy final consumption of those products. Therefore, such exported rice corresponds to large quantities of resources that are driven by consumption of Asiatic rice in Italy.

The growth of human population, expected to reach 9 billion in 2050, together with competitive land use causes land scarcity (Alexandratos and Bruinsma, 2012). Hence, agricultural influence on the land is intensifying due to an increasing food requirements. Rice is mainly produced for human consumption, which accounts for 78% (GRISP, 2013), and is the staple food for around half of global population. Therefore, its international trade is driven by direct human consumption, which, in turn, depends on the dietary habits.

In recent years, researchers have developed a sustainability indicator named "virtual land trade" (VLT) able to estimate the hidden flows of land if food or other commodities are traded from one place to another (Qiang et al. 2013). The VLT reflects the land embodied in trade of commodities, highlighting how the growing land demand put increasing pressure on local and national land resources because of international demand. Although, some studies have investigated the VLT of different commodities, including rice, at the global level (Zhang et al. 2016), this study aims to focus on a specific, relevant and current case study concerning Italy and the two largest exporters of rice in Italy such as Cambodia and Myanmar.

In particular the objective of this paper is to develop a VLT to estimate the amount of land exported from Cambodia and Myanmar to Italy due to the export of rice during the period 2013-2016. The flows of land embodied in trade of rice between these countries is revealed and discussed. Moreover, the paper the amount of land saved if the Italian import was replaced with a domestic production of rice. The study is relevant in understanding whether patterns of rice consumption, production and trade represent an efficient, and logical, allocation of natural resources.

2. Methods

Virtual land trade of rice (VLT) refers to the rice-specific land use which corresponds to the physical quantity of rice produced for export. For country n the VLT is calculated by multiplying the quantity of rice traded (RT) by rice specific yield (Y) of country n:

$$VLT_{(ne,ni,t)} = RT_{(ne,ni,t)} \times Y_{(ne,t)} \quad (1)$$

VLT indicates the cropland (ha) traded from exporting country n_e to importing country n_i in year t. In this paper as exporting country (n_e) we analyzed Cambodia and Myanmar whereas as importing importing country (n_i) Italy. Y indicates the yield of an exporting country n_e in year t. It is estimated as the ratio between the national rice specific area harvested (ha) and the national rice-specific production (tonnes) in the year t:

$$Y(n_e,t) = Area\ harvested(n_e,t) \,/\, Production\ of\ rice(n_e,t) \quad (2)$$

The annual rice paddy yield was provided by FAO (2019) as well as the quantity of rice

traded.
When we hypothesize a shift in imported rice from Cambodia and Myanmar, we considered the same amount of rice imported from these two countries as domestically produced in Italy. That is, the same amount of rice imported from Cambodia (or Myanmar) is allocated to the domestic production of rice in Italy.
According to FAO (2019), export of rice from Cambodia and Myanmar to Italy started to be significant in 2013. Therefore, results are provided from the period 2013-2016.

3. Results

We find that in 2016, 5270 and 621 ha of land were used for producing rice in Cambodia and Myanmar respectively to be exported in Italy. Overall, in 2016, Italy imported 5890 ha of land from these two countries to satisfy national consumption of rice. During the period 2013-2016 the land exported from Cambodia to Italy increased by 64%. Indeed, in 2013 the amount of exported land was about 3213 ha. In the same period, the exported land from Myanmar to Italy also substantially increased. Indeed in 2013, we record an amount of land exported equal to 32 ha.
However figure 1 shows two different trend associated with Cambodia and Myanmar. The export of rice related land from Cambodia to Italy decreased by 48% from 2013 to 2014 and then significantly increased from 2014 to 2015 (313%). A slight decrease is recorded from 2015 to 2016 (-22%). The export of rice related land from Myanmar to Italy significantly increased from 2013 to 2015 and then decreased (-75%) in the last year analyzed.

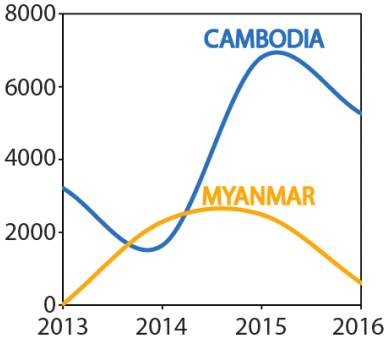

Figure 1: Land embodied in export of rice from Cambodia to Italy (blue line) and Myanmar to Italy (orange line) during the period 2013-2016. Values of land exported are expressed as hectares of land.

Figure 2 shows the land potentially saved when Italian import of rice from Cambodia and Myanmar is replaced with national domestic production. Basically the total amount of imported rice is allocated to the Italian production of rice. This kind of scenario shows if, from a land point of view, the Italian import of rice from Cambodia and Myanmar is advantageous or not compared with the Italian rice production. We find that in each analyzed year, Italy would save land by domestically producing rice instead of importing it from Cambodia and Myanmar. Basically, it implies that production of rice in Italy is more efficient than production of rice in Cambodia and Myanmar in terms of

land use. Indeed in 2016, about 2900 ha of land would have been saved with an increase of 71% with respect to the amount of land that would have been saved in 2013 (about 1690 ha). The highest value of land saved is recorded in 2015 (4459 ha).

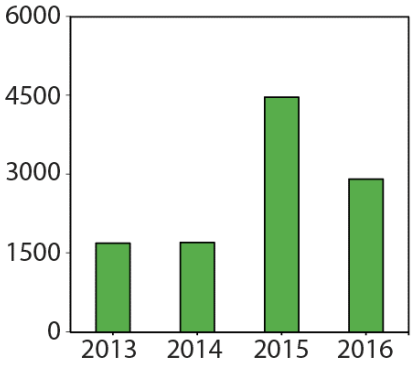

Figure 2: Land potentially saved when the same amount of rice imported from Cambodia and Myanmar is considered as domestically produced in Italy during the period 2013-2016. Values of land potentially saved are expressed as hectares of land.

4. Discussion and Conclusions

This paper has provided two important information. First, as a consequence of export of rice, Cambodia and Myanmar have virtually exported land to Italy during the period 2013-2016. In particular the land exported from Cambodia to Italy is significant and it substantially increased over the years analyzed (Fig. 1). Second, if Italy had domestically produced rice imported from Cambodia and Myanmar, a substantial amount of land would have been saved (Fig. 2). It implies that the production of rice in Italy is more efficient than Cambodia and Myanmar in terms of land use.

The case study presented in this paper is strictly connected with the current political and economic debate around the European import of rice from Asia. In particular, the case of Cambodia and Myanmar has been deeply discussed in Europe over the last year with a special focus on Italy. Indeed, the European Union has recently imposed tariffs on rice from Cambodia and Myanmar in response to a request by the Italian government (European Commission, 2019). In this way, European Union has incentivized Italian local producers to gain protection from the import of rice.

The debate around the tariffs has mainly concerned economic and political aspects. In practice, the reason upon which the tariffs have been levied has been due to the different prices of rice between Italy and the two Asiatic countries. Hence, low-priced imports from Cambodia and Myanmar has been considered the main responsible for difficulties of the Italian rice producers. However, considerations based on environmental issues have been neglected. Nevertheless, to ensure sustainable production and consumption patterns is one of the 17 Sustainable Development Goals (SDG 12) of the 2030 Agenda of Sustainable Development (United Nations, 2015) adopted by 193 Member States of United Nations including Italy, Cambodia and Myanmar.

In this paper, an environmental perspective of the situation is also provided. That is, an

evaluation may also be evaluated as a function of the impact on land. In general, growing demand induces growing impacts transferred via international trade. It's therefore necessary to look for a feasible way to prevent it, either acting on the i) reduction of the demand from importing countries that may be incentivized by tariffs (European Commission, 2016); ii) reduction of the impacts in exporting countries. In some cases, the latter might alleviate the high pressure on domestic resources and reduce conflicts for valuable scarce resources (Yao et al. 2019).

Our results have shown that the main driver of land embodied in trade of rice is the trade that is the amount of rice exported from Cambodia and Myanmar to Italy. However, it also depends on the country-specific yield. Figure 2 reveals that Italy, due to a more efficient yield (with respect to Myanmar and Cambodia), would save land by domestically producing rice instead of importing it from the two Asiatic countries. The yield strictly depends on various environmental factors, such as ground composition, land morphology and climate and global rice yield is expected to increase of 12% in the next decade (OECD/FAO, 2018).

From this point of view, the approach of our analysis is relevant because it captures the flows of environmental impact such as land use embodied in trade thus providing information about impacts generated by the final consumer (Italy). This consumer perspective allows understanding the impact associated with the final demand of rice and shows the impact that Italy generates on Cambodia and Myanmar to satisfy its domestic demand. Since an analysis of this sort is able to reveal if it is more advantageous to have rice produced in one country rather than another one, it is reasonable that including the trade flows, it could eventually be used to impose border taxes also based on environmental issues (Caro et al. 2017).

Although it is not an easily implementable solution, another option to reduce the land used for producing rice is to act on the dietary habits. A shift toward a more sustainable products may reduce demand and associated external dependency of rice. In this context, products such as sweet potato and cassava have been investigated as potential substitutes of rice (GRISP, 2013). However, deepened analyses evaluating the overall environmental impacts associated with alternative products are needed. In particular, studies assessing the overall environmental burden related to virtual trade of rice and potential substitutes, including the impacts on land, water and greenhouse gas emissions would provide a complete overview of the situation. Indeed, focusing only on one environmental impact associated with trade of rice such as land represents a limitation of the paper as considerations about potential trade-offs with other relevant environmental impacts are not possible from the current study. Therefore, future analyses should investigate potential trade-offs focusing on the overall environmental impacts embodied in international trade of rice.

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