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Trade liberalization in environmental goods☆

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ABSTRACT

Trade negotiations have started to pay attention to liberalization in environmental goods (EGs), whose production may require dirty intermediate goods. We construct a two-country trade model to explore the effects of trade liberalization in EGs on the local pollution, the global environment and welfare in the presence of such an environmental conundrum. We find that countries do not necessarily benefit from trade liberalization in EGs in the absence of an environmental policy. With the assistance of an upstream pollution tax, trade liberalization in EGs improves each country's welfare. This result holds independent of whether the upstream market is competitive or not, or whether we have upstream trade across countries. For asymmetric countries, trade liberalization in EGs improves the world welfare and the welfare for the country if it has a smaller demand for EGs; or experiences less damage from the production of dirty inputs; or values environment improvement more.

1. Introduction

Recent debates on market access have highlighted the reduction and elimination of trade barriers on environmental goods (EGs) that are intended to reduce emissions and mitigate pollution damages through improving countries' ability to obtain high quality EGs and lowering the costs of environmental protection.[1] EGs generally encompass equipment and facilities such as sulphur dioxide scrubbers, solar panels, wind turbines, catalytic converters, and air and water treatment filters.[2]

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[1] A remarkable example was that the members of the Asia-Pacific Economic Cooperation (APEC) reached an agreement in 2011 to reduce applied tariff rates of 54 EGs at the six-digit level of the Harmonized System (http://www.apec.org/Press/News-Releases/2016/0128_EG.aspx). Another good example was that in 2014, fourteen World Trade Organization (WTO) members such as Canada, China, the European Union, Japan, and the United States launched plurilateral negotiations for an EGs Agreement (https://www.wto.org/english/tratop_e/envir_e/ega_e.htm). See also the websites of the United Nations Environment Programme (UNEP 2014) (http://www.iisd.org/sites/default/files/publications/trade-green-economy-handbook-third-edition-en.pdf).

[2] There is no clear definition of EGs because there is the dual-use problem (i.e., dual-use products that have both environmental and non-environmental applications), there are still debates on the approach of trade liberalization (i.e., the list-based approach and the project-based

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However, there are concerns that the utilization of EGs will have (unintended) negative side effects because their production often requires dirty intermediate goods such as fossil fuels that cause air pollution and particular minerals whose mining processes pollute local environments like soils or water. For instance, polysilicon is an essential input for solar panels but silicon tetrachloride, one of the byproducts of polysilicon, is a toxic substance that causes environmental hazards.[3] Another good example is wind turbines that are highly dependent of the use of rare metals for their efficiency such as neodymium whose production process generates considerable amounts of toxic acids and heavy metals that cause serious water and air pollution problems. Thus, it is generally unclear whether the penetration of EGs leads to emission reduction as a whole.[4]

The purpose of this paper is to consider the effects of facilitating the utilization of EGs through trade liberalization when their production employs dirty intermediate goods. We focus on trade liberalization because world trade in EGs is becoming more and more important and many countries, especially developing ones, still maintain high import tariffs for EGs.[5] In particular, we elucidate how eliminating tariffs on EGs affects environmental policies that regulate externalities associated with producing dirty intermediate inputs, the environment as a whole, firms' profits, and welfare.[6] In doing this, we construct a two-country oligopoly model of international trade with the vertical market structure to deal explicitly with upstream producing dirty intermediate inputs and downstream producing EGs. To our knowledge, no theoretical models have rigorously addressed the effects of trade liberalization in EGs in the presence of an environmental conundrum of using dirty inputs to produce clean goods.

Our analysis highlights the following four important features of EGs. First, consumption of EGs improves environmental quality but their production degrades it. It is quite important to investigate whether the utilization of EGs leads to emission reduction overall. Second, we consider local and global externalities caused by EGs. There are EGs that (i) directly contribute to local environmental protection such as helping solid and hazardous waste management,[7] (ii) contribute to global warming mitigation by improving energy efficiency such as heat pumps and thermostats or by generating renewable energy such as solar, wind, or hydroelectric,[8] and (iii) generate both local and global spillovers such as the measuring and monitoring equipment for various types of pollution. We examine whether trade liberalization in EGs with various types of spillovers may generate different outcomes. Third, we consider strategic interactions between firms as well as countries. As we described above, EGs have different types of positive spillovers, which may induce countries to behave strategically with respect to environmental policies. Furthermore, the upstream market for intermediate inputs such as minerals are usually concentrated, and most countries import these key intermediate inputs from countries that are their rivals in the market for EGs. This will generate the so called rent-shifting effects not only between domestic and foreign producers but also between final and intermediate good firms, thereby inducing countries to behave strategically. Last but not least, environmental and trade policies mutually affect each other. Not all the countries appropriately regulate emissions from producing dirty intermediate inputs, partly because of the rent-shifting effects described above. Environmental policy thus, shall be deliberately considered in order to explore the effects of trade liberalization in EGs.

The main result of this paper is that without environmental policy that controls local negative externalities from the upstream industry, countries do not necessarily benefit from trade liberalization in EGs. With the assistance of upstream environmental policy, free trade in EGs always improves each country's welfare. Provided that two countries are identical,

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or integrated approach), and technologies are developing so rapidly that the classification process of EGs tends to lag behind. In fact, several proposed lists coexist such as the APEC list, the Organisation for Economic Co-operation and Development (OECD) list, the World Bank list, and the WTO list. See, e.g., Yoo and Kim (2011) and the note by the International Centre for Trade and Sustainable Development (ICTSD) (http://www.ictsd.org/themes/environment/research/list-of-environmental-goods-an-overview).

[3] Cha, Ariana Eunjung. (March 9, 2008) Solar Energy Firms Leave Waste Behind in China. Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2008/03/08/AR2008030802595.html.

[4] There are some concerns over how clean EGs are especially when they are utilized for natural gas utilization or nuclear energy production. Nuclear energy has an obvious advantage for carbon dioxide reduction but there are other issues in radioactive wastes. Although natural gas has lower carbon content and is relatively clean compared to other fossil fuels such as oils and coals, it still increases carbon dioxide emissions. Related issues are the dual-use problem that some products can be utilized with various renewable energy sources and also with fossil-fuel sources. See, e.g., ICTSD (http://www.ictsd.org/bridges-news/biores/news/apecs-environmental-goods-initiative-how-climate-friendly-is-it) and the World Bank (http://blogs.worldbank.org/trade/wto-environmental-goods-agreement-why-even-small-step-forward-good-step).

[5] According to the report by the International Trade Centre (http://www.intracen.org/publication/Trade-in-environmental-goods-and-services-Opportunities-and-challenges/), world trade in environmental goods and services was estimated at nearly 0.9 trillion US dollar (USD) in 2011, and is expected to rise to around 1.9 trillion USD by 2020. Environmental services refer to consultancy services on such as wastewater management. With respect to tariffs on the WTO Core List of EGs, in 2010, Brazil and the European Union imposed about 30 percent and 9 percent for bound tariff rates and about 12 percent and 2 percent for applied tariff rates on weighted average, respectively. Interestingly, both bound and applied tariff rates for the proposed lists of EGs tend to be higher than tariffs for all industrial goods. See, e.g., Yoo and Kim (2011) and UNEP (http://www.unep.org/greeneconomy/Portals/88/documents/research_products/PolicyBriefs/environmental-goods.pdf).

[6] Non-tariff barriers on EGs such as subsidies on fossil fuels, technical specifications, and local content requirements are also important but it is out of our focus. See, e.g., "Trade and Green Economy: A Handbook" by the International Institute for Sustainable Development (IISD) and United Nations Environment Programme (UNEP) 2014 (http://www.unep.org/greeneconomy/portals/88/documents/Trade-GE-Handbook-FINAL-FULL-WEB.pdf).

[7] For example, waste water management such as water treatment filters (e.g., device for removing heavy metal ions for industry uses), waste sorting, screening, crushing, grinding, shredding, washing and compacting devices, agitator for wastewater treatment, air pollution emission monitoring systems such as automatic SO_2 sampler and measuring apparatus will reduce local pollution.

[8] For example, utilization of wind turbines displaces consumption of dirty substitutes such as combusting fossil fuels and thus it will generate environmental benefits, which is implicitly assumed in our model. Although we could develop a complete model that includes both clean and dirty downstream substitutes, such an additional sector would increase the complexity of the model without providing any new insights.