The environmental effect of service trade:A Summary and Prospect

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Abstract. The environmental impact of trade has long been a topical issue in academic research. In previous studies, most of the research focused on trade in goods, whereas the environmental effect of service trade received less interest. This paper compares existing research and outlines three main academic insights into the study of the environmental effect of service trade: firstly, service trade positively affects the environment, i.e. trade in services helps to reduce environmental pollution and improve environmental quality; secondly, service trade negatively affects the environment, i.e. trade in services exacerbates pollution and emission; thirdly, the environmental effects of service trade are comprehensive and complex. Based on this, the existing literature is reviewed, and future research is prospected.

Keywords: service trade; environmental effects; foreign trade.

1. Introduction

Service trade is characterized by the intangibility of the subject matter of transactions, the synchronisation of production and consumption, the flexibility of content, the concealment of protection methods and the complexity of management, so it was not until the eighth round of GATT multilateral trade negotiations in 1986 that a more authoritative interpretation of the General Agreement on Trade in Services (GATS) was formed. Specifically, service trade can be summarized as follows. Firstly, the provision of services in the territory of a member to any other member or to any other member's consumers of services; secondly, the provision of services in the territory of any other member by a member's service providers in the form of commercial presence or in the name of a natural person. In recent years, global trade in services has grown rapidly. As of 2019, total world service trade import reached US$5.91 trillion, and total world service export reached US$6.28 trillion, while the proportion of total service trade in world GDP reached 13.6%, all of which were historical highs. (Data from World Bank database). At the same time, the negative impact of human economic activities on the environment has gradually accumulated and erupted over the years, and global environmental problems have become increasingly prominent, resulting in serious conflicts between economic development and environmental protection. As an integrated component of foreign trade in most countries and regions of the world, the environmental effect of service trade is relevant to the green and sustainable development of human society.

2. Review of the literature

2.1 Positive environmental effect of service trade

Some scholars have found that service trade is not the fundamental cause of environmental problems. On the contrary, service trade can facilitate environmental protection during the process of economic activities in varying levels, and there are positive effects of service trade on the environment. Fernandez (2010) demonstrated that liberalization of trade in transportation services within the context of NAFTA can significantly reduce air pollution and improve air quality.[1] Levinson (2010) focused on trade export and examined the relationship between US service trade and environmental pollution, and found that US service trade exports were concentrated in some industries with lower pollution levels, and that the growth of service trade exports decreased the pollution intensity of the US service industry. [2] Cai & Qu (2010) analyzed the environmental effects of US service trade export in terms of sectors and showed that service export played an indirect positive influence on

maintaining lower pollution and emission levels in the US. [3] Chen & Wei (2016) incorporated pollution and emission into the examination of economic growth quality, and empirically verified that the liberalization of service industry can effectively enhance the quality of economic development. [4] Zhang & Zhang (2018) based on data from 1982-2016, empirically found that growth in service trade and an improving trade structure can curb China's carbon emission. [5] Wang et al. (2019) based on service industry segment data from nine developing economies, an empirical study examined the impact of service export trade on green total factor productivity (TFP) in the service industry and concluded that service export trade can significantly increase the overall green TFP growth of the service industry in developing economies. [6] Hu et al. (2018) studied commercial service trade in 25 developing countries and discovered that the expansion of commercial service trade can effectively contribute to carbon emission reduction. [7] Sun et al. (2021) selected data from 30 countries from 1980 to 2013 and pointed out that the liberalization of trade in services, especially the globalization of emerging service industries, had positively influenced the promotion of energy use efficiency and CO2 emission efficiency. [8] Han et al. (2022) studied the carbon emission effects of digital service trade based on cross-country panel data from 50 countries, and the results showed that digital service trade exerted a beneficial effect on carbon emission reduction. [9] Rui et al. (2022) based on panel data for 55 countries worldwide from 2001-2015, empirically found that service trade can dramatically raise carbon efficiency. [10]

2.2 Negative environmental effect of service trade

Although the absolute level of pollution as well as emission from the service industry itself is much lower than that of other industries such as industrial manufacturing, the pollution and emission from the service industry and service trade cannot be ignored, and some scholars have considered that the service industry and service trade generate pollution and emission on a wide range of fronts. Mayrand & Paquin (2007) analyzed cases from different service branches proving that services had strong negative environmental impacts, and further compared and evaluated various methods of assessing the environmental effects of service trade. [11] Alcantara & Padilla (2009) estimated CO2 emission from the main service industries in Spain and found that the transport industry emitted the most CO2 directly, while hotels and restaurants, wholesale and retail, and real estate can also contribute to a strong indirect effect on carbon emission .[12] Butnar & Llop (2011) studied the relationship between the service industry and CO2 emission in Spain and found that the service industry caused an increase in carbon emission, but that the carbon emission from it was mainly caused by the final demand for the service industry from the non-service industry .[13] Wang et al. (2020) revealed that carbon productivity in China's service industry generally showed a yearly growing tendency .[14] Studies on the environmental degradation caused by services development had also enlightened the academic community on the different levels of pollution as well as emission that service trade may bring to the environment. Salzman (1999) classified the environmental impacts of the service trade subsectors into direct and indirect impacts according to their different influences on the environment, while dividing the service industries into chimney service, cumulative service and leveraged service according to their role and ability to reduce environmental negative impacts. [15] Qu & Li (2004) theoretically analyzed that service trade existed with negative effects on the environment and elaborated methods to assess the environmental effects of service trade liberalization. [16] Chakraborty & Mukherjee (2013) found that trade in goods and services leaded to an increase in per capita CO2 emission in both higher and lower income countries. [17] Xie & Zhao (2016) measured the environmental effects of China's foreign trade based on the GMRIO model and structurally decomposed its influencing factors, which revealed that China's foreign trade in services increased China's environmental trade deficit in carbon dioxide and three pollutants, the terms of trade in air transport, accommodation and catering, rental and business services, and water transport of China were on the upward trend when measured from the perspective of pollutants, i.e. imports of these services were "cleaner" than exports.[18]

2.3 Environmental effect of service trade: an integrated analysis

Studies on the effects of service trade on the environment either argued that service trade was beneficial to environmental protection, or that it increased pollution as well as emission and had negative effects on the environment. These two views are sharply opposed, with scholars expressing their own views and finding support from their own research, which further reveals the complexity of the environmental effect of service trade. Academics comprehensively analyzed the complex impact of service trade on the environment in the following three main aspects. Firstly, the specific analysis of differential environmental effects related to different departments of service trade was emphasized. For example, Ni & Yu (2011) analyzed the environmental effects of service trade export in the United States with the example of commercial presence and found that although service export could promote the reduction of pollutants such as carbon monoxide, it aggravated the emission of sulfur dioxide; further analyzing the heterogeneity of the environmental effects of various service departments, they found that the financial and insurance industries as well as the information industry caused an increase in air pollutant emission, while the service exports of wholesale trade, management scientific, technical consulting , transport and storage reduced air pollutant emissions.[19] Secondly, it was argued that the overall impact of service trade on the environment can be decomposed into multiple effects, and that the impact of service trade on the environment should depend on the combined forces of multiple effects, which when integrated can determine the positive or negative impact. For example, Yu & Chen (2015) found that there is a long-term positive equilibrium relationship between China's service export and its carbon emissions; in terms of decomposition, the scale effect as well as structure effect of service export trade on its carbon emission were negative, the technology effect was positive and the total effect was negative.[20] Wang & Men (2022) also examined the impact of service trade on carbon dioxide emission through three paths: scale effect, technology effect and structure effect. The study showed that the technology effect and structure effect of service import and export can significantly reduce carbon emission; the scale effect had a significant threshold feature, and the relationship between service import and carbon emission showed a " U-shaped curve ", while the impact of service export on carbon dioxide emission can be roughly fitted to the " N-shaped curve ", currently China's service import reduced carbon dioxide emission, while the service export did the opposite, and the two offset had a weak improvement on carbon dioxide emissions reduction generally.[21] Thirdly, it was focused on exploring the differential effects of service trade on the environment at different stages of economic development or in different economies. For example, Li & Yao (2015) empirically analyzed the relationship between services trade openness and carbon emission, and the results showed an inverted U-shaped relationship between service trade openness and carbon dioxide emission, which was in accordance with the environmental Kuznets curve; the empirical examination by income level grouping found that increased trade openness in high-income countries significantly cut CO2 emissions, with an inverted U-shaped relationship in higher middle-income countries and a non-significant relationship in lower middle-income countries. [22] Wu (2017) used carbon emission from the service industry as a specific indicator to measure environmental effect, calculated the carbon emission and liberalization status of service trade in China, and empirically investigated the environmental effect of service trade liberalization as well as service trade scale at the industry level, showing that low level of service trade opening increased carbon emission, and the expansion of trade scale also boosted carbon dioxide emission; there were differences in carbon emission effect and scale effect of trade opening in the sub-sectors of Chinese service industry.[23]

3. Review of the literature and prospect

The effect of trade on the environment has long been a heated issue in academic research, and there have been many relevant theoretical and empirical research results, but the environmental effect of trade in service has not received much attention for a long time. Analyzing the existing literature on the environmental effect of service trade, this paper finds that there are limitations as well as

deficiencies in research on this topic, which can be deepened and expanded from the following four aspects.

Firstly, enriching the research subjects. There have been some studies that try to draw universal conclusions on the environmental effect of service trade by increasing the number of research subjects without dividing the economic levels of different countries and regions. Rather, the studies that have been conducted after dividing the economic levels of countries or regions also mostly focus on developed countries or economies, and there are fewer studies in developing countries. Considering that service trade is closely related to resource endowment and geographical location, the following research should strengthen the analysis of more specific differences for various research targets, focusing on the heterogeneity of the environmental effect of service trade on diverse research subjects.

Secondly, expanding research perspectives. Most studies have been conducted on the environmental effect of overall service trade, or separately from the perspective of service import and service export, while fewer studies have particularly measured the different environmental effects brought about by different service trade sub-sectors. There are many different types of service trade, and in recent years the emerging service trade branches, represented by digital service trade, have continued to innovate and scale up. The research perspectives can be expanded to keep up with the latest developments in service trade and examine the diverse environmental effects brought about by different types of service trade.

Thirdly, building a more scientific and reasonable indicator evaluating system. In terms of indicators to measure the level of development of service trade, there is a lack of authoritative indicator systems, and existing studies have mostly adopted a single indicator of the total amount of service trade or the degree of service trade dependence to represent the development level of service trade itself, which is not a comprehensive measure for it; similarly, most of the existing studies measuring pollution and emission have directly selected specific statistics of them. How to scientifically assess the development level of service trade and its environmental effect under the framework of high-quality economic development, and how to build a more rational and scientific indicator evaluation system, should be the key consideration for future research.

Fourth, innovating research methods. Studies focusing on the environmental effect of service trade are only at the initial stage, the number of studies is limited, and the methodology is still restricted to the previous methods of studying the environmental impact of trade in goods, while service trade and goods trade are two distinct trade patterns. If the research method of the environmental effect of trade in goods is directly replicated, it will obviously cause the study of service trade to be biased and discrepant with the actual situation. Therefore, to address the special characteristics of service trade, research methods should be innovated, and the depth of research should be extended in an effort to restore the true environmental effect of service trade as much as possible.

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