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International Trade and the Circular Economy: A New Frontier

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Abstract

Over the last decades, the global community has been confronted with a real challenge to find sustainable solutions that are suitable to combat environmental degradation. Therefore, the circular economy has emerged to transform environmentally harmful economic activities and practices into sustainable ones. The aim of this article is to explore the dynamic relationship between international trade and the circular economy, with a focus on the principles of such an economy, which will play a central role in the context of international trade. Accordingly, it will investigate how international trade can be used as a catalyst for the transition from a linear to a circular economy, while promoting resource efficiency and environmental sustainability. The extension of product lifetimes will be highlighted, as well as economic integration through regulatory convergence and knowledge sharing in related fields. Using explanatory graphs and significant variables such as material import dependency and trade in recyclable raw materials it will be demonstrated that international trade has a strong impact on the transition from a linear to a circular economy. The paper will analyse these parameters for the European Union countries over a 5-year period, from 2015 to 2019, the period before the sanitary crise and other geopolitical events, thus, demonstrating that the transition to a circular economy not only protects the environment but also offers considerable opportunities for sustainable economic development, including in international trade.

Keywords: economic integration; environmental responsibility; green economy; resource efficiency; sustainability

1. Introduction

Recent history has shown that global environment has witnessed unprecedented challenges, imposing an urgent need to find sustainable solutions to address the accelerating degradation of ecosystems. Climate change, biodiversity loss, and other environmental threats are clear signals that current economic practices should be called upon in order to ensure a sustainable future.

One of the main aspects responsible for this reality is the fact that mass production and consumption made prices more affordable. Thus, society experiences an era of resource neglect, resorting to linear 'take-produce-use-throw-away' consumption patterns. (Velenturf & Purnell, 2021)

The materialization of the circular economy comes as a response to this global challenge, aiming to convert harming activities and practices into sustainable ones such as repair and recycling, out of concern for the environment, increasing inequality and economic stability (Velenturf & Purnell, 2021). This shifting paradigm introduces a more rational approach to resources, focused on reducing raw material consumption and minimizing waste.

Consequently, from this point onwards, both individuals and industries should be required to embrace circular economy and sustainable development practices. However, not all economies can cope with this transition to a circular economy, as they face strong challenges, having to manage accelerated economic growth and handle the pressures of a large population and significant amounts of waste. (Patwa et al., 2021)

The aim of this paper is to analyze how the shift in lifestyle and infrastructure is necessary comply as circular economy will influence international trade. As one of the practices envisaged by the green economy is the consumption of recyclable, renewable or reusable goods and services, this analysis will focus on trade in recyclable raw materials, consumption of raw materials, rate of use of circular materials, dependence on imported materials, aiming to find admissible answers to the following questions:

1. How will the circular economy approach (with its principles and guidelines) change the international trade arena for the European Union?

2. Will the impact of the circular economy on international trade be positive or negative?

The following sections of this study are organized as follows: Section 2 provides a comprehensive review of the existing literature on the circular economy and its relevance to international trade; Section 3 describes the research methodology; Section 4, presents the results, highlighting how international trade can influence the transition to a circular economy, and Section 5 provides the conclusion.

2. Literature review

At the beginning, circular economy was perceived as a type of economy expressed as a strategy to manage waste in a more efficient manner, but this approach was not generally accepted because recycling or reusing certain materials did not fit in every context (Ghisellini et al., 2016).

Nowadays, circular economy goes beyond simple waste management and it is based on fundamental principles, including reduction, reuse, recycling (Ghisellini et al., 2016) and renewal, but a more recent approach enlarges this definition to redesign, redistribute, reuse and recycle (Patwa et al., 2021).

In transitioning to circular economy, alternatives of using resources within the economy are being explored through the following strategies: (1) closing material loops, which includes stimulating repair, reuse, refurbishment and remanufacturing of products at the end of their life cycle; transforming post-consumer materials and waste into secondary raw materials, and promoting product service systems; (2) expanding material loops by adopting eco-design, and (3) narrowing loops by implementing resource efficiency initiatives (Yamaguchi, 2018)

It is noteworthy that the principle of reduction in the circular economy is not only about waste reduction, but also about the efficiency of production processes and consumption. Thus, sustainable business development is now based on business models that emphasize the redesign of production systems at various levels, focusing on the conservation of value in closed loops throughout the life cycle of raw materials and goods, but also more intensive use of product functionality (Patwa et al., 2021).

Four key aspects of transitioning to a circular economy are noted through research: reduction of exploitation of original natural resources; reduction of vulnerability to supply (geo-political) risks; mitigation of environmental impacts; and emergence of innovative economic opportunities. Interactions between transitioning to circular economy and low-carbon economies also derive from the shift from primary to secondary raw materials, which generally involve less energy-intensive processes and can contribute to reducing carbon emissions depending on the energy mix. In addition, the changeover to circular economy can open up new employment opportunities (Yamaguchi, 2018) .

Considering this, various measures have been taken within the European Union, both at macro and micro level, to ensure that production and consumption activities and society are oriented towards the circular economy.

At the macroeconomic level, governments and authorities at national or regional level have made efforts regarding waste management but have also considered facilitating the association within the construction industry, agriculture and forestry and public administration, stressing the involvement of citizens and local stakeholders. Attempts have been made both by individual firms and organizations to comply with the EU directive framework, with efforts

being most visible in the electricity industry, as well as in wood, furniture, paper and printing production (Mhatre et al., 2021).

Although there are several initiatives on various economic levels, implementing circular economy faces significant obstacles in various areas such as political, economic, technological and legal. To achieve an effective transition to a circular economy, strong political support is essential. Despite this, in some cases there is still a lack of incentives to adopt the circular economy. The researchers have identified the main obstacles to the adoption of the circular economy in small and medium enterprises, including absence of an appropriate supply and demand network, insufficient capital, weak government support, administrative burden, insufficient technical knowledge, shortage of information and (lack of) green business culture. These issues point to the specific complexity of the transition to circular economy, needing integrated approaches to overcome these barriers (Araujo Galvão et al., 2018).

Besides the environmental and ecological effects of the circular economy, it has also several implications for the economy as an ensemble. Among these we count the influence on international trade. The analysis of the relation between international trade and the circular economy has found that international trade affects material consumption rates through indirect flows, which are hidden in the composition of the materials incorporated in traded products. What this demonstrates is that efforts to decouple material consumption from economic growth are not properly accounted for without adequate consideration of the specific patterns of international trade. Furthermore, products and their components are increasingly purchased from different countries and, similarly, once these products complete their life cycle, they may be exported to other countries to be used as secondary goods for further consumption, as secondary materials to support production or as materials and waste for processing (Yamaguchi, 2018).

However, in the dynamics of international trade, interactions take place at different steps of the product value chain. This process includes the exchange of materials and waste for recycling and energy recovery, transactions in secondary raw materials, the sale of second-hand goods and the exchange of products for remanufacturing and refurbishment. A key part of this interface between trade and circular economy is represented by trade in secondary raw materials (Yamaguchi, 2018).

In terms of goods, two distinct trade flows can influence the degree of circularity of an economy. These include trade in supply chains as well as trade in products that have reached the end of their useful life. For example, eco-design or material content management strategies should consider supply chains that extend across borders, as imports can be influenced by trade in raw materials and intermediate goods needed for production processes, as well as final products destined for the final consumer (Yamaguchi, 2018).

As regards the final stage of the life of products, they may be collected, processed and exported in trade in waste and scrap, trade in secondary raw materials, sale of goods for refurbishment and remanufacturing, and trade in second-hand goods (Yamaguchi, 2021).

Besides trade in goods, circular economy can have significant implications for trade in services. Typically, the transition to a circular economy implies a deeper involvement of the service sector, with activities such as maintenance, repair and implementation of service systems for products, thus opening up new opportunities for trade in services (Yamaguchi, 2021).

3. Methodology

From a methodological point of view, this article starts from the premise that scientific research must be multidisciplinary. Numerous methods can be used to measure and monitor the use of resources and the associated impact, as well as the costs and benefits of the concept under consideration.

The methods used in this paper are analysis and synthesis, deduction and induction, content analysis, the historical method, as well as the classic methods of research in the social sciences and humanities: comparative analysis and case study.

The research for this study took place between October and November 2023 and was conducted in two phases. First, bibliometric analysis or scientometrics, a technique applied to publications that allows the extraction of metadata to examine the evolution of a field of knowledge over a given period of time, was applied. Such a method analyses published data, measuring texts and information such as authors, affiliations, citations, and keywords (De Bellis, 2009), revealing articles and showing links between and among papers related to a particular research topic (Fetscherin & Usunier, 2012).

This research method can be used to describe, evaluate, and monitor the state of a particular field over time, meta-analytically assessing the development of a particular research area to identify key components and underlying theoretical frameworks (Fetscherin & Heinrich, 2015). Thus, a bibliometric analysis was conducted to identify articles describing both international trade and the circular economy, while revealing the most cited authors, the keywords mentioned and the journals in which they were published.

Secondly, the integration procedure was applied, which consists of selecting the spatial and temporal scale as well as selecting representative data. A roadmap for sequential or parallel application of the methods was designed and the results were compared between them. For this paper it was important to delimit a specific time frame and a clear territory in which to apply and discuss the concepts analyzed. This provided a better and clearer picture of the perception of the circular economy in relation to international trade.

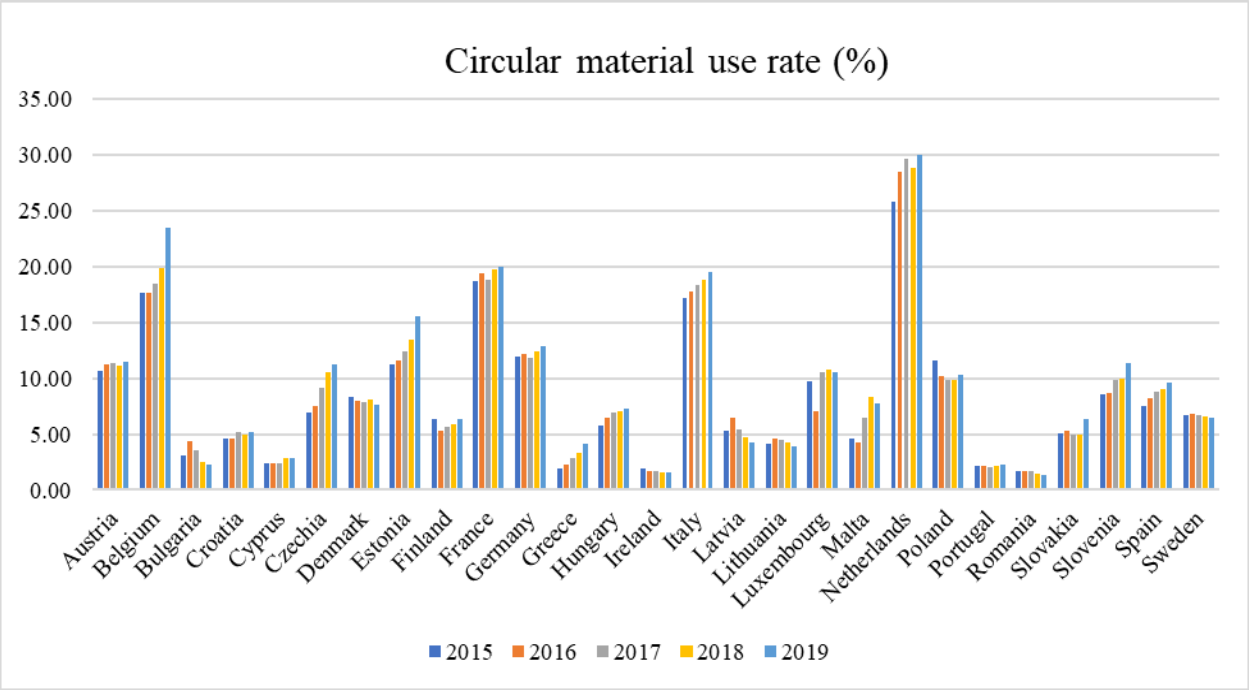
4. Results and discussions

In order to illustrate the link between the circular economy and international trade we have enlisted the help of some adjacent concepts such as circular material use rate, material import dependency, raw material consumption and trade in recyclable raw materials. All these notions

helped us to have a clearer picture of the connection between circular economy and international trade.

The graph below illustrates the percentage of circular material use rate for the EU 27 Member States during a 5-year period between 2015 and 2019. We have chosen to illustrate this concept in pre-pandemic times in order to show the fluctuation per member states before some of the more forceful regulations regarding circular economy we imposed.

Figure 1: Circular material use rate in the UE member states, from 2015 to 2019 (percentage)



Source: Own representation based on the data availabe at: (*Statistics | Eurostat*, 2023a)

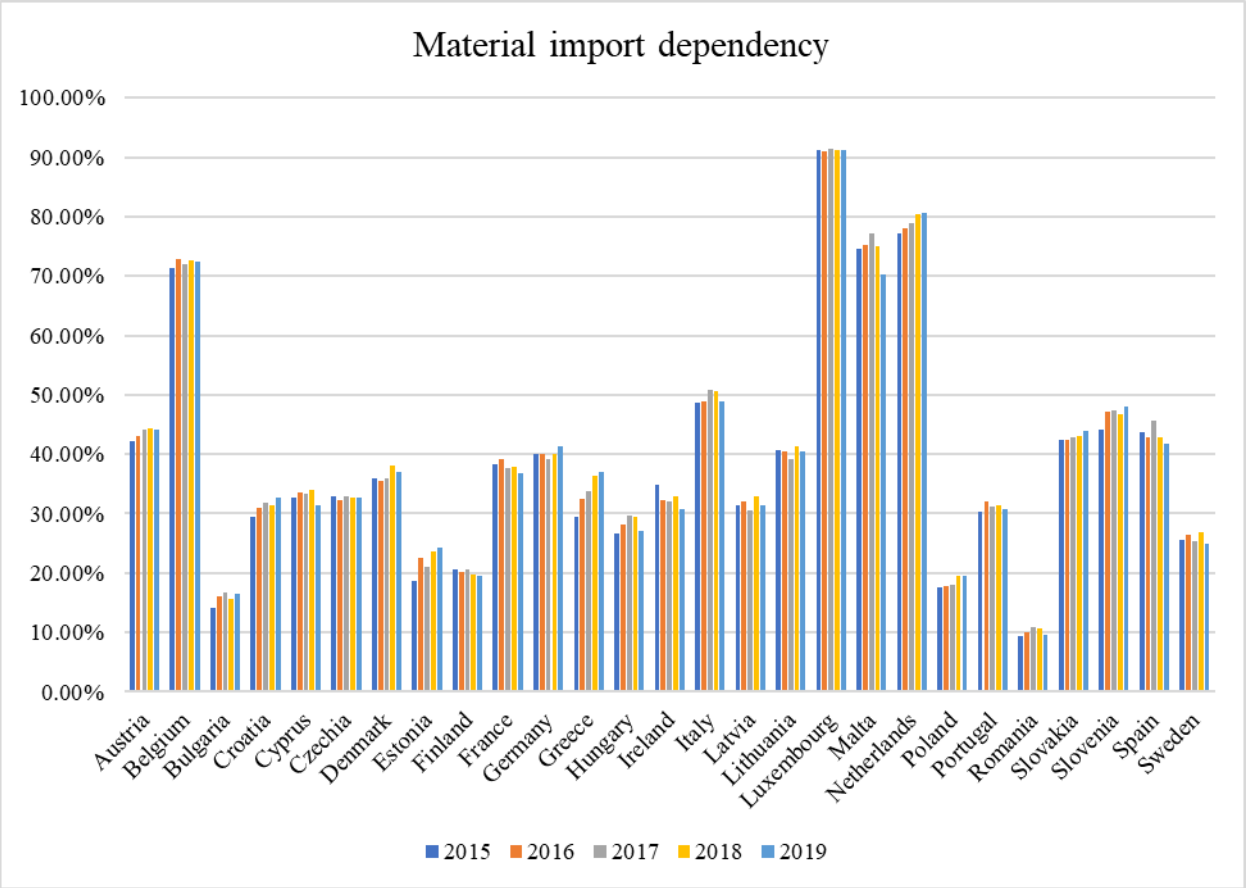
The circular material utilization rate (CMR) shows the proportion of materials that are recovered and reintroduced into the economy out of the total materials used, calculated as the ratio of circular material use to total material consumption. Total material consumption is measured by aggregating internal material consumption and circular material use. Circular material use is estimated by the amount of waste recycled in domestic recovery facilities minus waste imported for recovery and plus waste exported for recovery abroad. A higher CMR indicates a higher incorporation of secondary materials, which replace primary raw materials, thus reducing the environmental impact associated with the extraction of primary materials. (*Statistics | Eurostat*, 2023a)

As it shows above, The Netherlands, followed by Belgium, France and Italy have a higher circular material use rate, while in other states such as Ireland, Portugal and Romania the rates are lower.

Figure 2 presents the percentage of material import dependency rate for the EU 27 member states during a 5-year period between 2015 and 2019. The term “material import dependency” refers to the measure to which an economy relies on imports to satisfy its material needs.

Material import dependency takes values from 0 to 100%, and a value of 100% indicates that there are no domestic extractions during the reference year (*Statistics | Eurostat*, 2023b).

Figure 2: Material import dependency in the UE member states, from 2015 to 2019 (percentage)



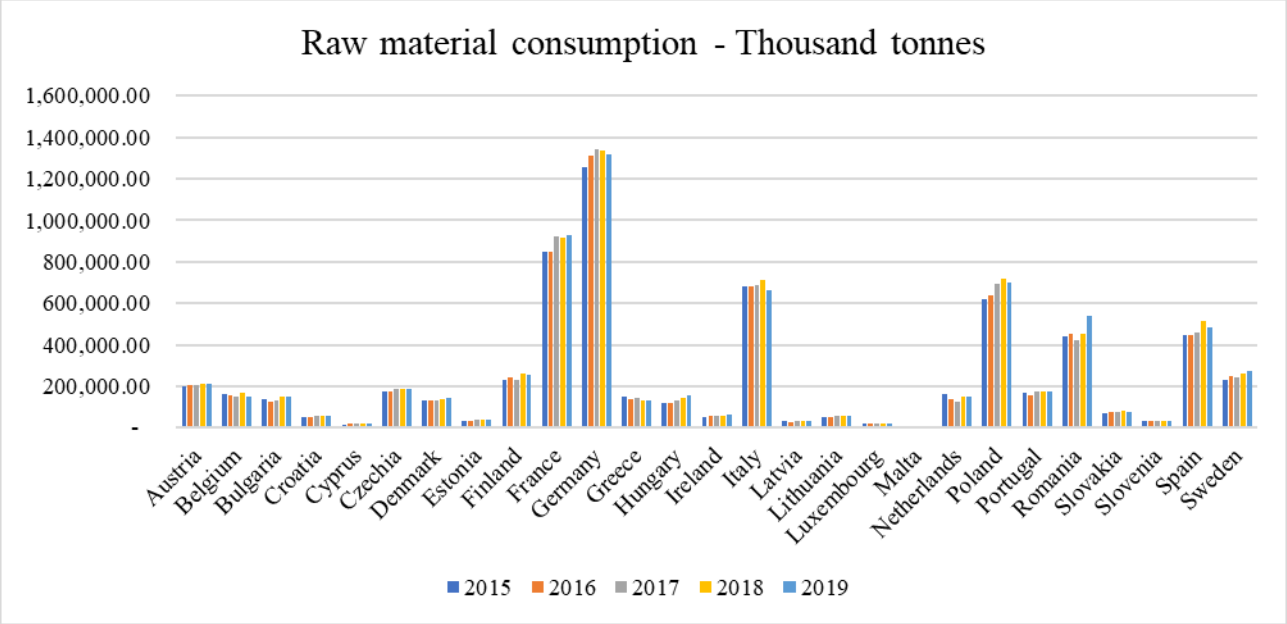
Source: Own representation based on the data availabe at: (*Statistics | Eurostat*, 2023b)

This graph shows how the material import dependency varies from country to country, this can be explained by the fact that some countries are not so rich in resources or perhaps, other countries import materials because they have a larger production capacity or a larger population that requires a higher amount of resources.

This explains why economically developed countries such as Belgium, Luxembourg and the Netherlands have higher levels of material import dependency, while countries such as Romania and Bulgaria have the lowest.

Closely related to the material import dependency is the consumption of raw materials. This is the overall demand for extraction of materials (minerals, metal ores, biomass, fossil energy materials) driven by the demand for consumption of goods and services in a reference geographical area. It indicates the amount of extraction required to produce the goods demanded by end-users in the reference geographical area, regardless of where in the world the extraction of raw materials took place (*Statistics | Eurostat*, 2023c).

Figure 3: Raw material consumption in the UE member states, from 2015 to 2019 (thousand tonnes)

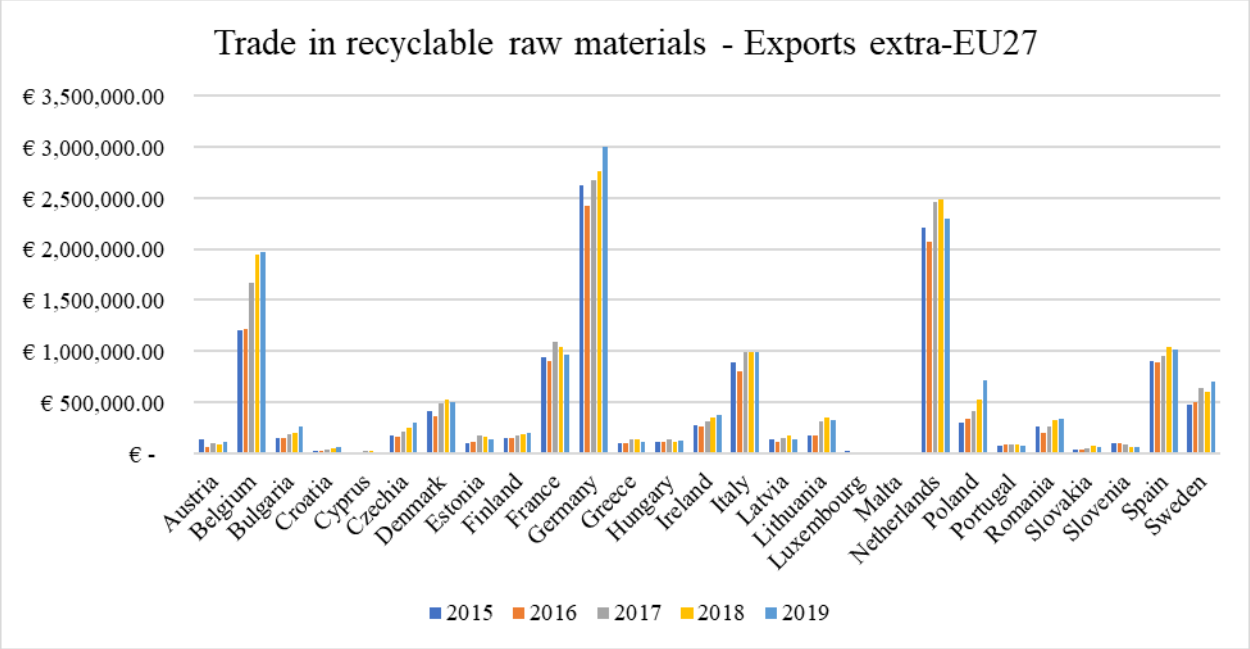


Source: Own representation based on the data availabe at: (*Statistics | Eurostat*, 2023c)

The large differences in raw material consumption within the European Union is determined by the population of each Member State. It can be seen that the most populous countries in the EU, such as Germany, France, Italy, Poland and Spain, are also at the top of the table when it comes to raw material consumption.

Another important indicator worth looking at when talking about the circular economy is the trade in recyclable raw materials. This includes 5 categories of materials: plastic; paper and cardboard; precious metals; iron and steel; copper, aluminum and nickel (*Statistics | Eurostat*, 2023d).

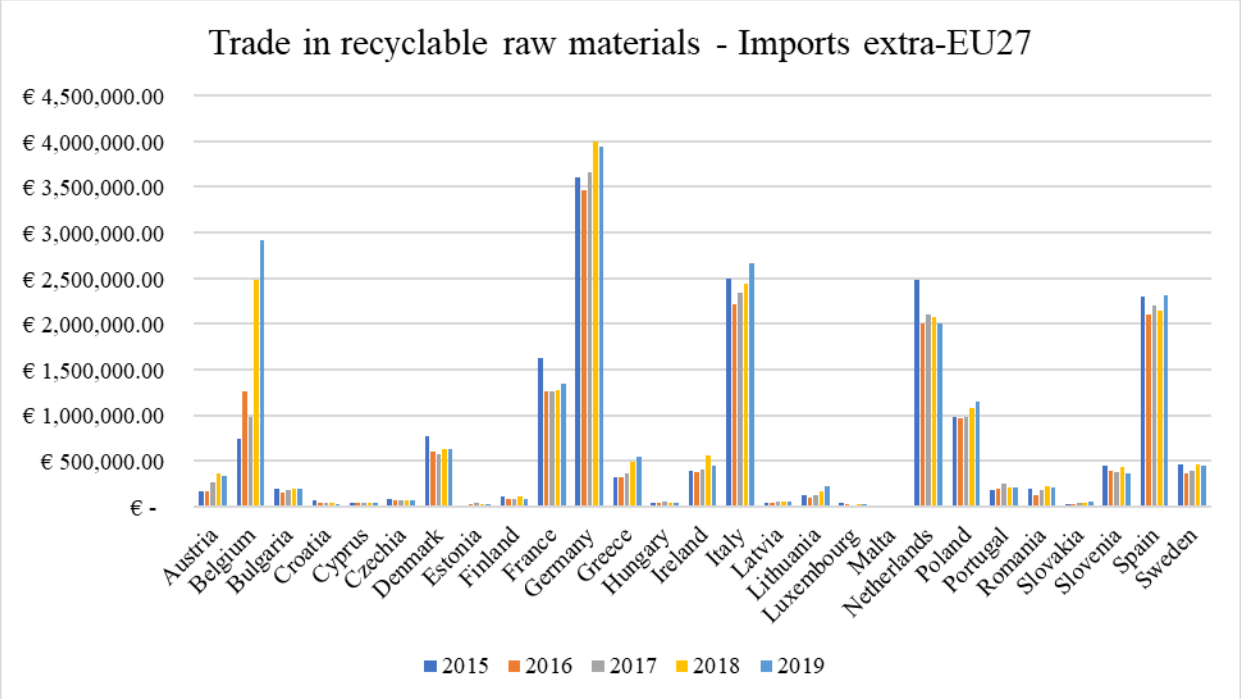
Figure 4: Trade in recyclable raw materials – Exports extra-EU27, from 2015 to 2019 (Euro)



Source: Own representation based on the data availabe at: (*Statistics | Eurostat*, 2023d)

Figures 4 and 5 show that the main players in this market for recyclable raw materials are the western EU countries.

Figure 5: Trade in recyclable raw materials – Imports extra-EU27, from 2015 to 2019 (Euro)



Source: Own representation based on the data availabe at: (*Statistics | Eurostat*, 2023d)

Analyzing the previous graphs, it can be seen that in the period 2015-2019, there has been an increasing trend in the use rates of circular materials in the European Union. This has had a

similar effect on the dependence on imported materials, i.e. on the consumption of raw materials.

All these changes spill over into the EU's external trade when it comes to recycled raw materials. There is an increasing trend in both imports and exports into and out of the EU. Thus, given the first research question, it can be said that almost all EU Member States have seen an increase in international trade in renewable raw materials, thus positively influencing it. It is important to note that this positive influence is not only economic but also environmental, as an increase in trade in raw materials means a decrease in the consumption of natural resources.

5. Conclusion

In the last decade, there has been a growing concern for environmental protection, which led to important changes in the approach to both natural resources and the economy. The transition from a linear to a circular economy is a necessary step to make more efficient and appropriate use of natural resources. This has significant implications for both the environment and the economy.

Circular economy prerequisites are being directly influenced by the manner in which raw materials are managed, as demonstrated by the extension of their lifespan. This is not only an environmental conservation effort, but also a necessary adaptation to efficiently manage the planet's limited resources. This adaptation has implications for consumption and production processes, which means that the structure of international trade will change.

There is a significant change in international trade in recyclable raw materials, particularly within the European Union, where there is a trend towards increased imports and exports of such resources. There are two main factors that can explain this development.

Firstly, the decrease in consumption of raw natural resources is a direct result of the transition to the circular economy. Replacing the linear buy-consume-dispose model with a circular model that promotes recycling and reuse reduces demand for new raw materials. Accordingly, making use of recycled secondary raw materials not only facilitates curbing the intensifying demand for primary resources but also presents an appealing solution for nations heavily reliant on importing primary raw materials (Mathieux et al., 2017). This approach not only promotes resource conservation but also reduces the strain on global supply chains, fostering greater economic resilience and sustainability (Knäble et al., 2022).

Secondly, higher rates of use of circular materials lead to increased demand for them, stimulating international trade in recyclable raw materials. The association between the development of the circular economy and trade in recycled raw materials can be seen from two different perspectives: trade in recyclable raw materials is the main indicator of the development of the circular economy, from other viewpoint, private investment in circular economy sectors reveals the growth of trade in recycled raw materials (Lingaitiene & Burinskiene, 2024).

To conclude, the transition to a circular economy not only protects the environment but also offers considerable opportunities for sustainable economic development, including in international trade.

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