




Transboundary movements of plastic waste from EU countries as a constraint for sustainability

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Abstract

Motivation: In the face of contemporary environmental and economic challenges, a transition to more sustainable global plastics economy is crucial. Countries are implementing circular economy solutions, but one of the common problems is so called “waste tourism” — export of plastic waste to other countries, often less developed. It contributes to global environmental problems but frequently surfaces also as inefficient resource management/trade and an ethical question as well. Transboundary movements of plastic waste from EU countries should be based on the principles set out in the Basel Convention which entail minimizing and disposing all kind of waste in an environmentally sound manner, minimizing the amount of waste transported and treating and disposing it as close as possible to its place of origin. Unfortunately, European plastic waste is exported in large quantities, often to less developed countries and not processed in accordance with European standards.

Aim: This paper aims to identify the volume and directions of UE countries export patterns of plastic waste, its impact on the Sustainable Development Goals and trends in global and EU rules on transboundary plastic waste movements. The considerations are based, to a great extent, on literature on the subject-matter and secondary data, i.e. export data under the trade code 3915 (Waste, pairings and scrap of plastics) derived from the UN Comtrade and Eurostat Database, SDGs data derived from Sustainable Development Report 2022 and UN database and main legal basis for the international trade in plastic waste (the Basel Convention with its recent amendments) and its trends.

Results: EU countries are still the leaders in exporting plastic waste, making it difficult to achieve the 12th SDG. Changes to the Basel Convention have not significantly affected the volume and destinations of EU plastic waste exports. They organize the categories of plastic waste but still leave an ample room for undesirable activities. Although the EU's proposals are more restrictive, the most desirable solution is a complete ban on the export of plastic waste by EU countries outside the EU.

Keywords: plastic waste; circular economy; sustainability

JEL: Q53; Q57; Q5

1. Introduction

The rapid increase in the worldwide production and scale of applications of plastics since the 1950s has increased the amount of plastic waste, which has become a major environmental, industrial and political issue in recent years (Geyer et al., 2017). Closing the loop is therefore an important part of reducing the negative human impact on the environment, but at the heart of the circular economy is waste prevention, reuse and only in the next stage recycling. The EU has taken measures to better manage plastics and plastic waste. These include, in particular, the European strategy for plastics in the circular economy and more ambitious targets for plastic recycling (European Commission, 2018).

Post-consumer plastic waste does not have to be recycled in the country of origin, but can also be exported for this purpose. Transboundary movements of plastic waste from EU countries should be based on the principles set out in the Basel Convention (and transposed into the Waste Shipment Regulation) which entail minimizing and disposing all kind of waste in an environmentally sound manner, minimizing the amount of waste transported and treating and disposing it as close as possible to its place of origin. Unfortunately, European plastic waste is exported in large quantities, often to less developed countries and not processed in accordance with European standards (might even be dumped or burned in unregulated ways). International trade in plastic waste has become a way of dealing with Europe's growing plastic waste, bringing an environmental and ethical challenge on the one hand (burdening less developed countries and intensifying environmental problems) and an economic on the other (inappropriate resource management). A desirable scenario for the EU is to reduce plastics use, expand domestic recycling capacity and increase collection rates in order to reduce export dependency and to lower incineration and landfilling rates. However, at this point in time, plastic waste generated in EU countries and exported remains a key challenge and a constraint for sustainability.

This paper aims to identify trends in the volume and directions of UE countries export patterns of plastic waste and its impact on the Sustainable Development Goals. It begins with a review of the literature on the subject. Main section (results) is divided into 3 subsections. The first one identifies the size and directions of plastic waste transboundary movements from EU countries, the second one shows an export of plastic waste as a sustainability constraint while

the third one deals with the trends in global and EU rules on transboundary plastic waste movements. Statistical and intuitive methods are used in this work. The considerations are based, to a great extent, on literature on the subject-matter and secondary data derived from the Eurostat (2023) and UN Comtrade Database (2023).

2. Literature review

The transboundary movement of all waste is a great challenge globally and has been studied across disciplines. Thapa et al. (2022) reviewed the transboundary movement of waste literature from 1985 to 2021. They found that most of the articles on this subject deal with the transboundary movement of waste from OECD countries to non-OECD countries, which probably reflects the Basel Convention regulations. Between 1985 and 2000 most papers were focused on transboundary hazardous waste movement (e.g. Bernard, 2015; Kellenberg, 2012). It was the time when Global North countries tried to avoid increasing prices of environmentally and socially responsible waste management by dumping toxic waste in the Global South countries (numerous and publicised cases at the time — termed “toxic colonialism” — led to the establishment i.e. Basel Convention). Around 2000, the academic interest was concentrated on e-waste. One reason was increasing demand for valuable raw materials such as gold, silver, copper, etc. (which could be recovered from electrical and electronic waste). On the other hand, e-waste was (and still is) a problem due to the content of toxic substances. Even though its flow between OECD and non-OECD countries is illegal under the Basel Convention, difficult and costly management of e-waste encourages highly developed countries to export it to lower developed countries (see: Bisschop, 2012). The issue of transboundary flows of plastic waste emerged in academic considerations in the late first decade of the 21st century. In the main, the plastic waste debate is linked to recycling issues. This is the result of the increasingly visible negative environmental impact of plastics — particularly in the marine environment (Beaumont et al., 2019; Borrelle et al., 2020; Coyle et al., 2020; Schmidt et al., 2020; Thompson, 2004) as recycling is considered one of the key ways to deal with plastic waste. The economic reason, meanwhile, is the circular economy concept being implemented in many developed countries and new perception of waste as a resource/value to be retained (Lacy & Rutqvist, 2015; UNEP, 2015). In this context, transboundary trade in plastic waste is also considered as a loss of valuable resources (Gregson & Crang 2015; Kellenberg, 2015) but it is primarily perceived as significant source of exacerbating environmental problems (D’Amato et al., 2019). Dominish et al. (2020) indicate that it directly changes a country’s plastic waste inventory and thus affects the distribution of marine plastic waste. Bishop et al. (2020) quantified the fate of exported European plastic waste destined for recycling. They estimated that 3% ends up in the ocean, suggesting that exported

recycling has the potential to be an important pathway of plastic debris into marine ecosystems.

Many researchers aim to create a global plastic waste trade network, especially in the context of China's 2017 ban on plastic waste imports (Brooks et al., 2018; Wen et al., 2021). This approach has been adopted by, among others, Zhao et al. (2021). Based on the bilateral trade volume of plastic waste from 1990 to 2019 they illustrated directions of the plastic waste import and export from major trading countries around the world. They have also shown a shift of the center of gravity from China to Southeast Asia. Similar conclusions were reached by Wang et al. (2020) who used a complex network to create a topology map and geographic information system data to identify the structure of the global plastic waste trade. Brooks et al. (2018) and Liang et al. (2021) clearly indicate that high-income countries export plastic waste to low-income countries in East Asia and the Pacific. The literature also includes papers explaining these developments and trade patterns. Kellenberg (2012) stresses the importance of such socioeconomic variables as income, environmental regulations and the presence of organized crime (waste are flowing to countries with lower levels of environmental regulations because of lower cost of its managing). Mazzanti & Zoboli (2013) also point out other key factors of trade with plastic waste such as transportation costs, trade barriers (tariffs and legislation) and incentives for recycling. Numerous studies highlight poor waste management practices in low- and middle-income countries, i.e. weak management infrastructure and significant amounts of plastic waste ending up landfilled or dumped (Liang et al., 2021). This is because many actors profit from the inability of legal operators and the failure of authorities to cope with the increased imports, ignoring the local impact on human health and the environment. For example, a field investigation by the Global Alliance for Incinerator Alternatives (GAIA, 2019) in Asia revealed illegal recycling operations, open burning, water contamination, crop death and a rise in illness tied to environmental pollution. It was estimated that only 4% of waste collected in Asia is recycled while the rest is managed by landfilling or open burning.

3. Methods

This article is an insight into plastic waste export initiated by European countries and its impact on the sustainable development goals. Statistical and intuitive methods are used in this work. The considerations are based, to a great extent, on literature on the subject-matter and secondary data. The analysis in the first part of the results section is based on the export data under the trade code 3915 (Waste, pairings and scrap of plastics) derived from the Eurostat (2023) and UN Comtrade Database (2023) (the terms “export” and “import” are used for transboundary waste shipments both within the EU and to third countries, however the paper shows these two groups of countries separately). The second part of the results section is a review of Sustainable Development

Report 2022 and UN primary data while the last one is an analysis of the main legal basis for the international trade in plastic waste (the Basel Convention with its recent amendments) and its trends, in particular those proposed by the European Commission. The study period covers the years from 2017 (the year before the Chinese ban on plastic waste imports) to the latest available data for 2021 (which is the first year of the new Basel Convention rules and the inclusion of the rate “plastic waste exports” in the set of indicators forming the 12th SDG). The main hypothesis is that EU countries are still the leaders in exporting plastic waste, making it difficult to achieve the 12th SDG. Changes to the Basel Convention have not significantly affected the volume and destinations of EU plastic waste exports. They organize the categories of plastic waste but still leave an ample room for undesirable activities.

4. Results

4.1. Size and directions of plastic wastes transboundary movements from EU countries

Historically and to date, EU countries are the largest consumers of plastics and exporters of plastic waste. 65% of the world’s exported plastic waste originates in the EU and is destined to both its intra-regional market and overseas countries, particularly Asian. Almost half of European post-consumer plastic waste collected for recycling is exported outside its country of origin (UN Comtrade Database, 2023). As a result, some countries are listed among the top recyclers but at the same time they export significant amounts of plastic waste (plastic waste officially exported for recycling purposes raises statistics on the circular economy).

Between 2012 and 2017 the EU exported annually more than 2 million metric tons of plastic waste to non-EU countries, accounting for more than half of its total plastic waste export — extra and intra EU. Following China’s ban on plastic waste imports in 2018, this figure began to fall, dropping to 1.6 in 2018 and to 1.1 in 2021. In 2021, plastic waste exports outside the EU accounted for a third of its total trade (Chart 1). The largest exporter of plastic waste in the EU in 2021 was Germany, followed by Netherlands, France, Belgium and Italy (Chart 2). At the same time, these countries are among the largest exporters of plastic waste globally, which are in order: Germany (0.82 mln tons), Japan (0.62), US (0.63), Netherlands (0.62), France (0.34), Belgium (0.34) and Italy (0.21). Five further EU countries (Austria, Poland, Sweden, Slovenia, Spain) export more than 0.2 mln metric tons of plastic waste while the others — less than 0.1 (Chart 3).

In 2021 compared to 2017, i.e. the year before China’s ban on plastic waste, Germany, Spain, Czech Republic and Denmark significantly reduced their export volume. The Netherlands, Sweden, Estonia and Croatia increased it while

in most countries its level has only slightly changed (Charts 2–3). Until 2017, the largest importer of European plastic waste was China. Following this country's ban, Vietnam, Malaysia, Thailand and India became the early destinations to replace it. In the following years, exports have been redirected also to Indonesia and Turkey. These countries have become a major outlet for the EU, experiencing plastic waste import volumes 20 times higher than in 2017. In 2021, the largest non-EU importers of European plastic waste were: Turkey (36%), Malaysia (12%), Vietnam (11%), the UK (9%) and Indonesia (9%) (Chart 4).

The world's and Europe's biggest exporter of plastic waste — Germany — in 2021 directed its exports mainly to Turkey and Malaysia, although the largest flows from this country were intra-EU (to the Netherlands and Poland). Other major producers and exporters of plastic waste also moved it mainly to other European countries. Netherlands traded mainly with Belgium, Germany and France while France — with Spain, Italy and Belgium (Table 1). Denmark, Sweden, Portugal, Lithuania, Latvia, Luxembourg and Austria are net importers of plastic waste — they recycle more plastic waste than is domestically collected for this purpose. By contrast, the largest net exporters are Germany, Belgium, Spain, France, Slovenia, Netherlands and Italy. The Netherlands, Belgium and Italy are typical intermediaries — they import plastic waste from other countries and re-export it. Internal reasons for export include first of all the lack of capacity (maximum plastic recycling potential in the EU is about 60%), technology (the complexity of the separation process, which makes recycling difficult and expensive) or financial resources to treat the waste locally (depending on the price of plastic and the primary raw material, it may be more profitable to export waste than to process it (European Commission, 2021a).

4.2. Export of plastic waste as a sustainability constraint

Plastic waste generation and its transboundary movement relate to the environmental, social and economic dimensions of sustainability. For this reason, in 2021 a new indicator — export of plastic waste — has been included in the set of indicators forming one of the 17 Sustainable Development Goals, i.e. SDGs 12: “Responsible Consumption and Production”¹. It represents the average annual amount of plastic waste exported over the last 5 years, expressed per capita. Chart 5 shows the level of plastic waste export in 2021 and the its trend estimated from 2016–2021 volume (shown by arrows). The highest rate is recorded in Slovenia (63.7), followed by Belgium, the Netherlands, Austria and Luxembourg. Only 7 EU countries export less than 5 kg of plastic waste per capita (Finland, Poland, Spain, Italy, Hungary, Bulgaria and Romania). In 9 countries, the trend is a major challenge (↓) and decreases the implementation of 12 SDGs while

¹ The other are: Circular material use rate (%), Production-based SO₂ emissions (kg/capita), Production-based emissions of reactive nitrogen (kg/capita), Gross value added in environmental goods and services sector (% of GDP), Imported SO₂ emissions (kg/capita) and Imported emissions of reactive nitrogen (kg/capita).

in another 8 countries it is a significant challenge (with stagnation at a similar level →). In 7 countries the trend shows moderate improvement (↗) and only Malta and Spain are on track to achieve the goal (↑). A desirable situation is not to export any amount of plastic waste.

The data show that the biggest challenge for the EU is precisely to meet SDG 12 “Responsible Consumption and Production” (22 countries are in red — with major challenges and 6 countries in orange — with significant challenges)². In this area, the EU made little progress between 2011 and 2021 and performs worst among all SDGs (Chart 6), which adversely affects SDG Index Score. It means that EU countries are failing to reduce pollution and material consumption and minimize their negative environmental impact. It should also be noted that until now, institutional frameworks to assess the SDGs have been mainly focused on domestic performance. The new approach assumes that governments should also measure the scale of their society’s impact on the other countries’ ability to progress towards the SDGs. This is because some countries cannot achieve the SDGs when negative externalities from other countries are counteracting their efforts (Sachs et al., 2019). In line with this approach, in 2022 European Spillover Index (ESI) has been structured. It measures Europe’s progress in reducing environmental and social spillovers embodied in trade, economic and financial flows across countries and in the area of security. It comprises 14 indicators and one of them is “Export of plastic waste”. The data shows that although the EU performs better than the rest of the world on the global SDG Index (mainly because of better relative performance on socio-economic goals — SDGs 1 to 9), it comes last on the Spillover Index (63.8) with the Benelux countries among the top (Netherlands 35.7, Belgium 43.8, Luxembourg 46.6), followed by Ireland, Cyprus, Lithuania, France and Austria (Chart 7). In contrast, those with the least negative impact on other countries’ achievement of the SDGs are Romania (81.7), Poland (81.3) and Croatia (81.1).

4.3. Trends in global and EU rules on transboundary plastic waste movements

The most comprehensive global environmental treaty addressing transboundary shipments of waste is the Basel Convention (UNEP, 1989). Its primary objective is to restrict shipments of hazardous wastes to developing countries, but it also obliges Parties to manage and dispose all kind of waste in an environmentally sound manner, to minimize the amount of waste transported and to treat and dispose of wastes as close as possible to their place of generation. The obligations of the Basel Convention have been transposed into EU legislation by Regulation (EC) No 1013/2006 on shipments of waste (so called Waste Shipment Regulation, WSR). The WSR has also implemented the provisions of the OECD

² The other two assessment categories are: challenges remain (yellow) and SDG achieved (green).

decision establishing a control system for waste shipments destined for recovery within the OECD area.

Transboundary movements of plastic waste are not covered by a separate regulation. By 2021, post-consumer plastic waste was classified as non-hazardous and could be exported to non-OECD countries (unless prohibited by the import country), only for recycling purposes (prohibited for incineration, energy recovery or landfilling)³. Plastic waste was classified as hazardous when it contained lead or halogenated organic compounds or was not ecotoxic but was defined as (or was considered to be) hazardous waste by the domestic legislation of the Party of export, import or transit. In 2019, amendments were adopted (in force from 2021) which imposed restrictions on plastic waste exports (UNEP, 2019). The Convention defines now three categories for plastic waste in international trade (Table 2): hazardous plastic waste (Annex VIII), plastic waste sorted by polymer, almost free from contamination and destined for recycling in an environmentally sound manner (Annex IX) and the other plastic waste (Annex II). Through this listing, it has been clarified that all plastic waste (including mixtures of such waste) belongs to the category of other waste, with the exception of that presumed hazardous (Annex VIII) or non-hazardous (Annex IX). The scope of plastic waste not covered by the Convention has been therefore reduced. On the other hand, new categories of plastic waste have come under the scope of the Convention and are now covered by the procedure for transboundary movements (Prior Informed Consent, PIC), provisions pertaining to waste minimization and to the environmentally sound management of waste.

Although ESM (Environmental Management Systems) framework has been updated, the concepts of EMS recycling have not been clarified and they still create a lot of technical questions on which recycling processes are sound and what is required of parties to fulfil their obligations under the Convention e.g. they do not specify the manner or the extent to which the country of export must verify ESM abroad. Furthermore, since presumed non-hazardous waste is not subject to any control, there is a risk that other controlled wastes (Annex II) may be deliberately classified precisely as presumed non-hazardous (Annex IX). This may leave the way exported plastic waste is managed unchanged which means it will still not subject to any control in the destination country regarding its quality and actual management (exported plastic waste is only managed by the relevant customs authorities by collecting data on waste volume, its country of origin and destination).

At the time of this briefing's publication, the EU is reviewing its control regime for the shipment of plastic waste which may even go further than Basel Convention. A lack of knowledge about what happens to exported plastic waste means that is preferable to handle it internally. On the other side, there is also

³ Plastic waste could be classified as hazardous when they contain lead or halogenated organic compounds or are not ecotoxic but are defined as (or are considered to be) hazardous wastes by the domestic legislation of the Party of export, import or transit.

a strong voice that there might not be enough capacity in the EU to deal with waste that is currently exported from the EU (European Commission, 2021a). In November 2021, the European Commission (2021b) proposed new regulations under which it would be possible to export of non-hazardous waste only to those non-OECD countries that explicitly give their consent to receive EU waste and demonstrate their ability to treat this waste in an environmentally sound manner. Prior to exporting waste, exporters would have to make sure that the facilities they ship waste to have undergone an audit by an independent and accredited third party. Regarding the export of plastic waste to OECD countries, monitoring by the European Commission would be introduced (through the digitalization of procedures), with the possibility to suspend them in the event of concerns regarding possible environmental damage at destination. In December 2022, European Parliament Committee on the Environment, Public Health and Food Safety (ENVI) adopted the legislative report which is going to strengthen this proposal, notably on transparency, monitoring, and scrutiny of waste management in third countries for the purpose of waste exports and which actually would put end to EU exports of non-hazardous plastic waste to non-OECD countries. The report awaits a vote and the adopted text will become Parliament's position for negotiations with the Council, which has still to agree on a general approach (as of 10 January 2023). A complete ban on the export of plastic waste outside the EU is advocated by the Environmental Investigation Agency (EIA, 2023). EIA emphasizes that a plastic waste export ban should not give rise to false solutions within the EU, such as increasing the incineration of plastics, including with energy recovery. On the contrary, this shift should be capitalised and act as an incentive to heighten a reduction of plastic produced, consumed and wasted, prioritising the elimination of particularly problematic, hard-to-recycle plastics and nonessential single-use plastics, in addition to the promotion of product ecodesign and reuse systems.

5. Conclusions

This paper aimed to identify trends in the volume and directions of UE countries export patterns of plastic waste and their impact on the implementation of the SDGs. Statistics show that EU countries are still the leaders in exporting plastic waste: 65% of the world's export plastic waste originates in the EU and almost half of post-consumer plastic waste from Europe collected for recycling is exported outside of the source country (including intra-EU trade). The largest exporter of plastic waste in the EU in 2021 was Germany, followed by Netherlands, France, Belgium and Italy while the largest non-EU importers were: Turkey (36%), Malaysia (12%), Vietnam (11%), the UK (9%) and Indonesia (9%). EU countries also export significant amounts of plastic waste per capita, with the highest rate recorded in Sweden (63.7), followed by Belgium, the Netherlands, Luxembourg and Germany. This indicator has been included in the set of indicators forming SDGs 12 (Responsible Consumption and Produc-

tion) and European Spillover Index which measures the EU countries' impact on the other countries' ability to progress towards the SDGs. The biggest challenge for the EU is meeting the 12th SDG and low level of ESI. Changes to the Basel Convention have not significantly affected the volume and destinations of EU plastic waste exports. They organize the categories of plastic waste but still leave an ample room for undesirable activities. Although the EU's proposals are more restrictive, the most desirable solution is a complete ban on the export of plastic waste by EU. Further research is therefore needed to justify this direction of change. It is also important to assess the performance of European recycling industries by identifying their weaknesses and strengths in order to respond to the challenges of plastic waste export restrictions in the near future.

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Appendix

Table 1.
Top 5 EU plastic waste exporters and their main destination in 2021

Country	5 main non-EU destination countries	5 main EU destination countries
Germany	Turkey (13%), Malaysia (6%), Switzerland (4%), Rep. of Korea (3%), Vietnam (1.6%)	Netherlands (24%), Poland (11%), Austria (6%), Belgium (4%), France (3%)
Netherlands	Indonesia (11%), Vietnam (10%), Malaysia (8%), UK (6%), Turkey (4%)	Belgium (18%), Germany (17%), France (5%), Italy (3%), Poland (3%)
France	Switzerland (3%), UK (2%), Turkey (0.3%), USA (0.2%), Canada (0.2%)	Spain (28%), Italy (20%), Belgium (14%), Germany (13%), Netherlands (11%)
Belgium	Turkey (13%), UK (5%), Indonesia (5%), Malaysia (5%), Vietnam (5%), India (1%)	Netherlands (35%), France (12%), Germany (8%), Italy (2%), Luxembourg (2%)
Italy	USA (8%), Turkey (6%), Switzerland (5%), Yemen (1%)	Austria (25%), Slovenia (13%), Germany (10%), Spain (6%), France (6%)

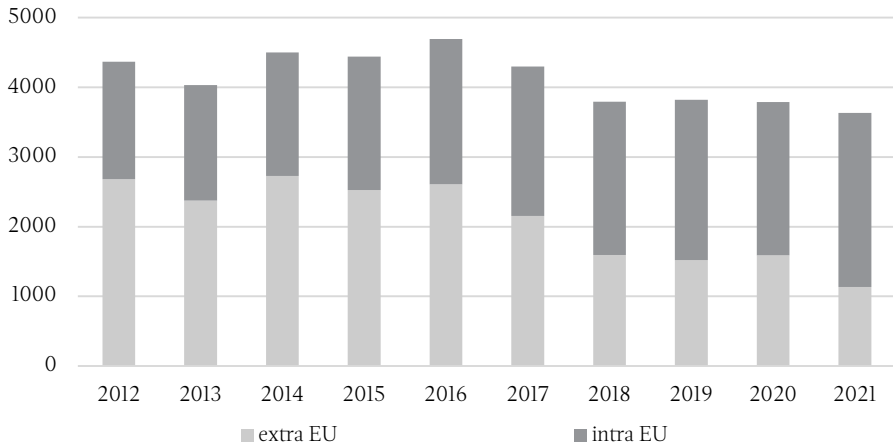
Source: Own preparation based on Statista Database (2023).

Table 2.
Export of plastic waste in Pre- and Post-Basel Amendments

	Pre-Basel Amendments		Post-Basel Amendments
Annex II	code	none	Y48
	classification	none	plastic waste that is either unsorted by polymer (mixed), contaminated or not destined for recycling (so long as not hazardous)
	control	–	PIC
Annex VIII	code	none	A3210
	classification	hazardous plastic waste	hazardous plastic waste
	control	PIC, banned to non-OECD	PIC, banned to non-OECD
Annex IX	code	B3010	B3011
	classification	solid plastic waste (all)	plastic waste that is sorted by polymer, almost free from contamination and destined for recycling in an environmentally sound manner (so long as not hazardous)
	control	free movement	free movement

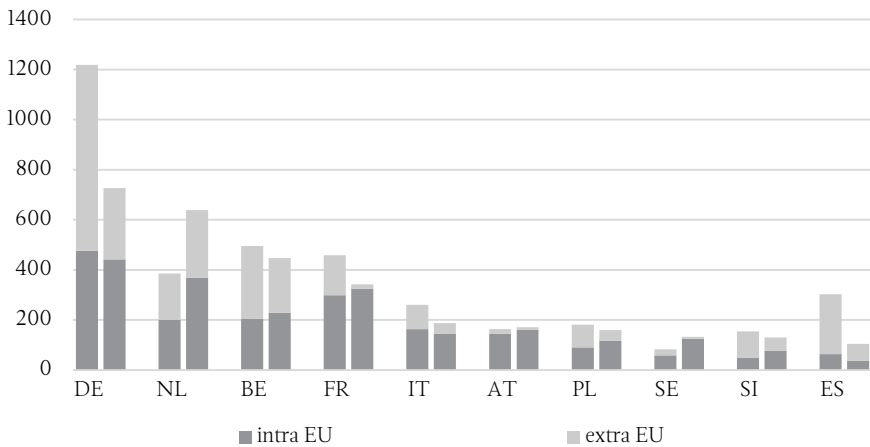
Source: Own preparation based on UNEP (1989; 2019).

Chart 1.
Trade in plastic waste intra- and extra-EU borders (in 1000 metric tons)



Source: Own preparation based on Eurostat (2023).

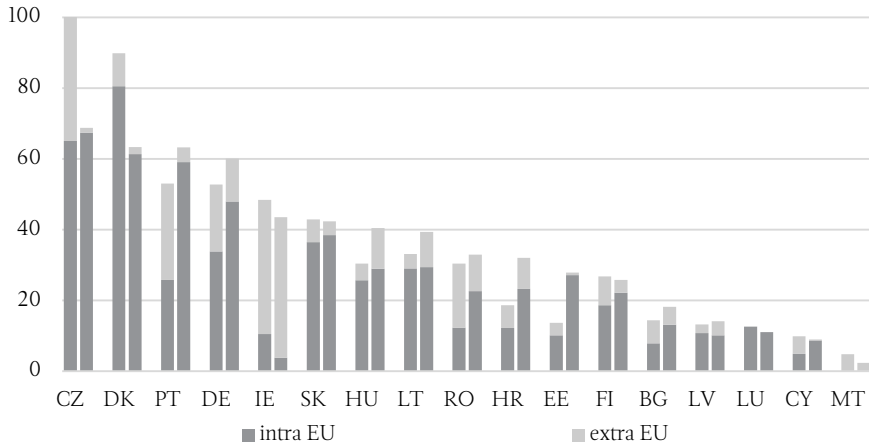
Chart 2.
Top 10 EU exporters of plastic waste in 2017 (first pillar) and in 2021, broken down by exports to the EU and non-EU countries (in 1000 metric tons)



Source: Own preparation based on Eurostat (2023).

Chart 3.

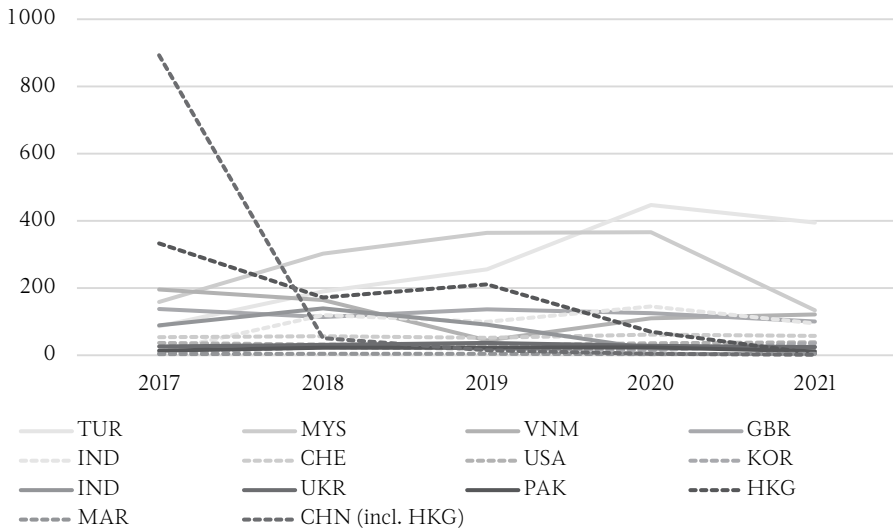
The last 15 EU exporters of plastic waste in 2017 (first pillar) and in 2021, broken down by exports to the EU and non-EU countries



Source: Own preparation based on Eurostat (2023).

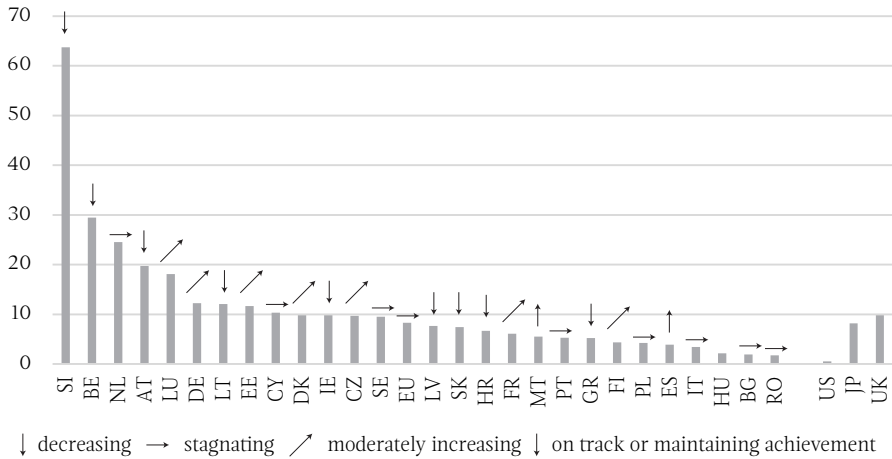
Chart 4.

Annual volumes of plastic waste exported outside the EU, 2017–2021, by main destination in 2021 (in 1000 metric tons)



Source: Own preparation based on UN Comtrade Database (2023).

Chart 5.
Plastic waste export (kg/capita)

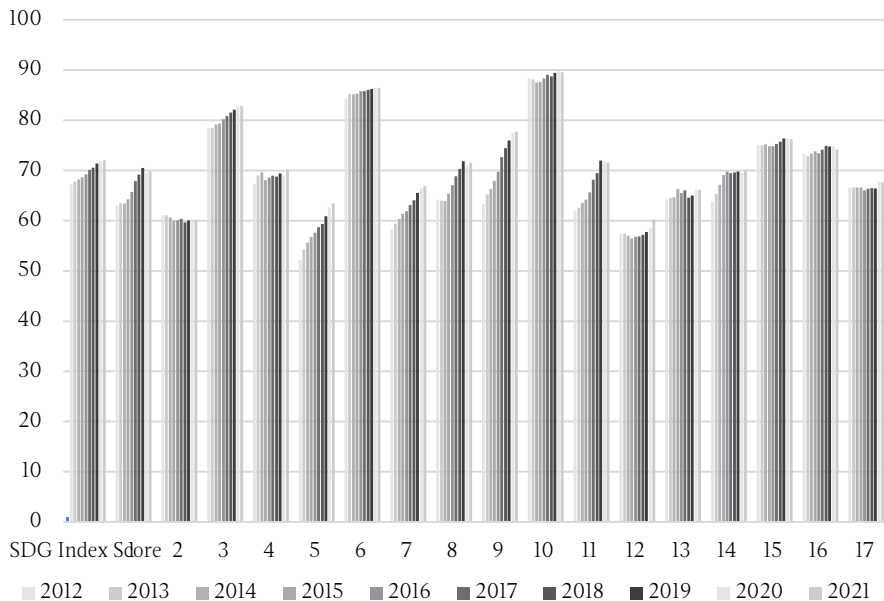


Notes:

Hungary: 2016 volume (no trend set)

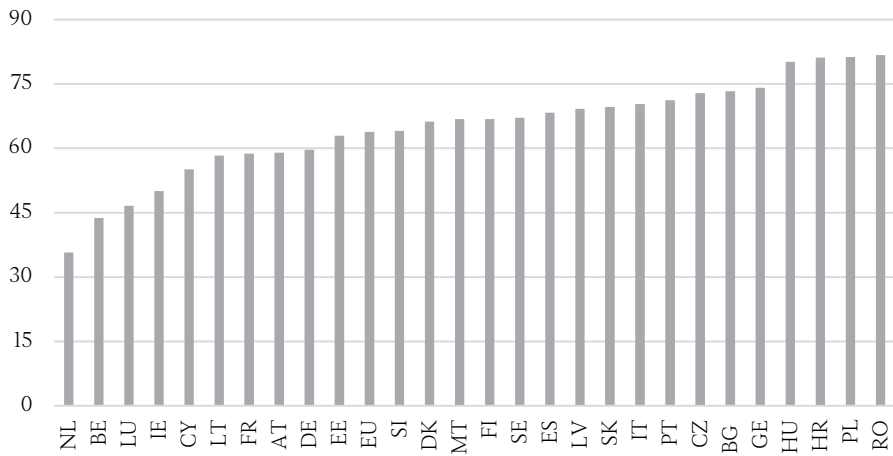
Source: Own preparation based on Lafortune (2022) and UN database (2023).

Chart 6.
SDG Index Score and reaching each of the 17 SDGs over the period 2011–2021 in the EU (best score: 100)



Source: Own preparation based on Lafortune (2022) and UN database (2023).

Chart 7.
Spillover Index for the EU countries in 2021



Notes:

A higher score means that a country causes more positive and fewer negative spillover effects.

Source: Own preparation based on Lafortune (2022).