



Five Years after China's Plastic Import Ban Have Europeans Taken Responsibility?

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► Key Takeaways

- After the 2017 Chinese waste import ban, the international and European Union (EU) legislative framework on waste exports has been revised. The amendment to the Basel Convention is stricter on the possibility to export plastic waste outside the EU. The EU has integrated the amendment in the waste shipment regulation (WSR) and is considering further export restrictions. Moreover, a Directive to reduce the use of single-use plastics and stimulate local demand for recycled plastics has been adopted.
- The recycling rate of plastic packaging has been deteriorating since 2016 in view of the growing quantities of plastic packaging waste and limited export outlets, despite an increase in the tonnage recycled. Exports of plastic waste from the EU have been reduced and partly redirected, with some negative environmental impacts reported. The EU demand for certain recycled plastics has boomed, encouraged by the new regulation, yet overall, EU plastic packaging consumption keeps increasing.
- The debate on the export ban opposes a view of responsibility for the treatment of waste with the promotion of international waste trade as a means to achieve a global circular economy (for plastics). However, there is no evidence that the waste trade enables to increase the global recycling rate, reduces the use of virgin plastic and reinforces sustainability.
- The European Commission (EC) has released a new legislative proposal that tightens up waste export possibilities but does not ban it.

In July 2017, China announced the ban on twenty-four types of solid waste imports by end of 2017 and that it would only accept plastic scrap with a contamination rate inferior to 0.5%.¹ At the time, the European Union (EU) exported almost half of the plastics collected for recycling outside its territory, with China as the main destination.² This “Chinese import ban” led to a massive disruption of the Western waste management system in 2018 when the ban took effect. Brooks *et al.* (2018) estimated that the Chinese ban would displace 111 million tonnes (Mt) of plastic waste by 2030³.

In 2019, we published a note entitled “(De)globalization of International Plastic Waste Trade” following China's quasi-stop of plastic waste imports.⁴ Five years after the announcement of this ban, this briefing note provides an analysis of the consequences of this displacement, the actions taken and the ongoing debate on a waste export ban from the EU.

Reduction in European plastic waste exports, redirection of flows, and cascading import restrictions

Production of virgin plastics in the EU is declining since 2017 (from 64 Mt to 55 Mt) while it is growing worldwide.⁵ The consumption of plastic products is increasing, at

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least for plastic packaging: the most recent Eurostat data shows a constant increase in plastic packaging waste generation tonnage, up to 15.4 Mt in 2019 in the EU-27, as illustrated by Figure 1.⁶

1. Y. Uhm, “Plastic Waste Trade in Southeast Asia after China's Import Ban: Implications of the New Basel Convention Amendment and Recommendations for the Future”, *California Western Law Review*, Vol. 57, No. 1, 2020, pp. 1-42.

2. “Plastic Waste and Recycling in the EU: Facts and Figures”, European Parliament, December 19, 2018, available at: www.europarl.europa.eu.

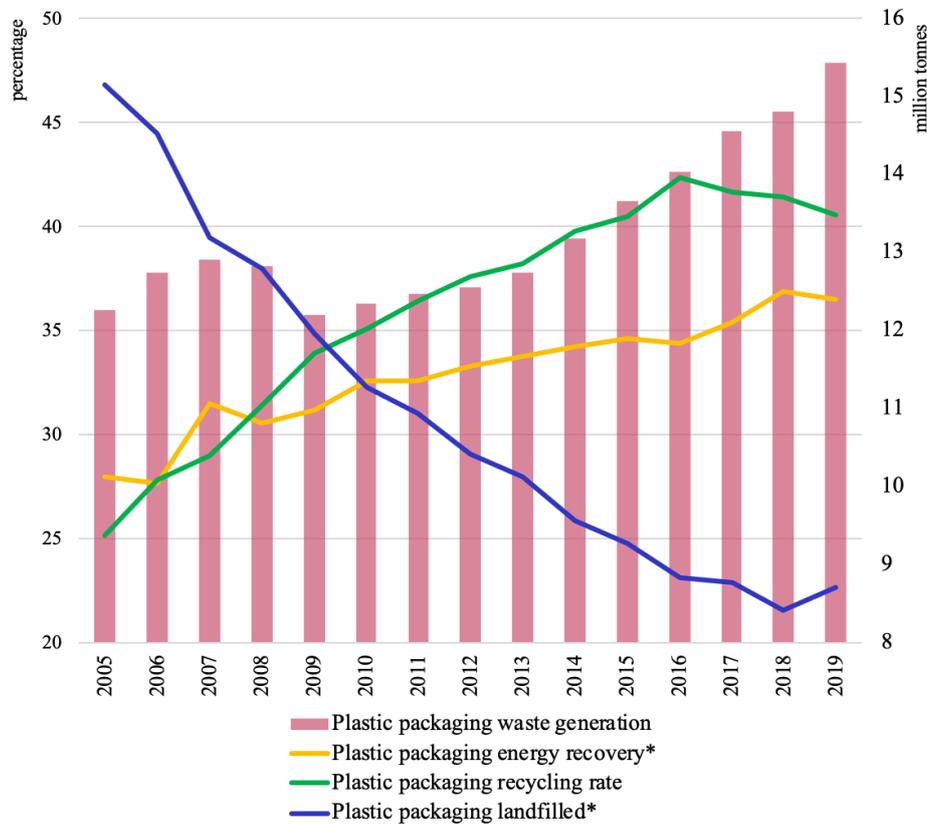
3. A. L. Brooks, S. Wang and J. R. Jambeck, “Supplementary Materials for The Chinese Import Ban and its Impact on Global Plastic Waste Trade”, *Science Advances*, Vol. 4, No. 6, June 20, 2018, available at: <https://doi.org>.

4. E. Joltreau, “(De)globalization of International Plastic Waste Trade: Stakes at Play and Perspectives”, *Edito Energie*, Ifri, September 18, 2019, available at: www.ifri.org.

5. “The Facts.- 2021”, Plastics Europe, 2021; *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options*, Paris: OECD Publishing, 2022.

6. Eurostat database, ENV_WASPAC, Figures for the EU-27.

Figure 1: Evolution of plastic packaging waste generation (Mt) in the European Union (27 countries) and treatment (% , locally or abroad) over years



Source: Eurostat data

*Notes: the percentage of landfill was estimated as 100% minus the percentage of recovery. The percentage of incineration with energy recovery was estimated by subtracting the percentage of recycling from the percentage of recovery for the years 2005-2013.

At the time the Chinese ban was implemented, most wastes were seen piling up in exporting countries and started to deviate into incineration and landfill.⁷ Since then, the EU has found outlets (internal and external) for its plastic packaging waste, but without maintaining its performance in view of the growing quantities of packaging and limited export outlets.

Indeed, the recycling rate is declining since 2016, from 42.4% in 2016 to 40.6% in 2019, although recycling has risen *in quantity* since 2016. In comparison, incineration for energy recovery increased from 34.4% to 36.5% between 2016 and 2019. Estimated disposal, as a percentage, has been declining since 2005, but slightly increased in 2019.

The recycling rate is declining since 2016

7. P. Tamma, "China's Trash Ban Forces Europe to Confront its Waste Problem", *Politico*, February 21, 2018, available at: www.politico.eu.

The figures provided by Plastics Europe⁸ (including other waste than packaging waste, excluding non-collected waste) show an increase in collected post-consumer plastic waste (from 27 mt in 2016 to 29.5 mt in 2020; in the recycling rate (from 31.1% to 34.6%); a stable energy recovery performance and a sharp decrease in landfill (from 27.3% to 23.4%). The organization notes a decline of 16% of plastic waste exports outside Europe in 2020 compared to 2018.⁹

Following the Chinese ban, plastic waste exports from the EU decreased and were redirected to other destinations. Between 2016 and 2019, exported volumes decreased from 300 kilotons (kt) monthly to 150 kt.¹⁰ EU exports to non-OECD (Organisation for Economic Co-operation and Development) countries were about 486 kt for the year 2021 (against 887 kt in 2020).¹¹

Outside the EU, the flows are principally redirected to countries in Southeast Asia. Before the Chinese ban, Southeast Asian countries were already involved in the global recycling value chain. They were pre-sorting, cleaning, and shredding waste before sending it to China for ultimate reprocessing.¹² After the ban, some Chinese recycling companies relocated their factories to Southeast Asia, Japan, and Taiwan to export recycled pellets to China directly.¹³

In 2017, Malaysia, Vietnam, India, and Thailand became the early destinations to replace China but rapidly established their own import restrictions. As a result, exports have been redirected to Indonesia and Turkey,¹⁴ which has become a major outlet for the EU, experiencing plastic waste import volumes 20 times higher in 2020 (44 kt)¹⁵ than in 2016.¹⁶ Following the discovery of plastic dumpsites in the Adana province, the Turkish government banned the imports of recovered polyethylene.¹⁷ Shortly after, the government repealed the ban, a decision welcomed by the local industry, and EU exports grew again from 4.5 kt in June 2021 to 38.2 kt in December.¹⁸

8. "The facts 2016" and "The facts 2020", Plastics Europe, available at: <http://plasticseurope.org>.

9. "The facts 2021", Plastics Europe. Europe means here the EU27 + 3: Switzerland, United-Kingdom, Norway

10. "The Plastic Waste Trade in the Circular Economy", *Briefing*, European Environment Agency (EEA), March 9, 2021.

11. "European Union Export Data. 2021 Annual Summary", Basel Action Network, available at: www.ban.org.

12. Y. Xia, "China's Environmental Campaign: How China's 'War On Pollution' Is Transforming The International Trade In Waste", *New York University Journal of International Law & Politics*, Vol. 51, No. 4, 2019, pp. 1101-1178.

13. A. Yoshida, "China's Ban of Imported Recyclable Waste and its Impact on the Waste Plastic Recycling Industry in China and Taiwan", *Journal of Material Cycles and Waste Management*, Vol. 24, September 23, 2022, pp. 73-82, available at: <https://doi.org>.

14. "Data from the Global Plastics Waste Trade 2016-2018 and the Offshore Impact of China's Foreign Waste Import Ban: An Analysis of Import-Export Data from the top 21 Exporters and 21 Importers", Greenpeace, April 23, 2019, available at: www.greenpeace.org.

15. M. Reintjes, "Wonderful Situation we've Only Dreamt Of", *Recycling International*, June 8, 2021, available at: <https://recyclinginternational.com>.

16. S. Laville, "Turkey to Ban Plastic Waste Imports", *The Guardian*, May 19, 2021, available at: www.theguardian.com.

17. T. Gumrukcu, "Turkey Bans Most Plastic Imports as EU Trash Found Dumped on Roadsides", Reuters, May 20, 2021, available at: www.reuters.com.

18. "European Union Export Data. Monthly Data", Basel Action Network, available at: www.ban.org.

Trinomics, a consultancy, shows that some European countries, such as the Czech Republic and Romania, increased their imports of plastic waste in the period 2016-2019.¹⁹ The press reports some illegal plastic waste exports and treatment in Romania²⁰ and Bulgaria, where it is burned without the appropriate filters.²¹ The regulation for exports between European countries is less stringent, and (legal and illegal) exports could also be redirected to European countries in the medium term.

The global waste crisis has accelerated the adoption of new legislative frameworks

Revision of the Basel Convention

Transboundary waste shipments are regulated under the Basel Convention, which aims to prevent transboundary movements of hazardous waste, especially to developing countries. It classifies hazardous (“amber” list) and non-hazardous waste (“green-listed” waste). The convention forbids to export waste in a State where there is reason to believe that the wastes in question will not be managed in an environmentally sound manner. The “Ban Amendment” forbids the exports of hazardous waste to developing countries.

The convention and the “Ban Amendment” are applied in the EU in the framework of the Waste Shipment Regulation (WSR). The EC recognizes a surge in exports of waste outside the EU since the WSR adoption in 2006 “with few or no controls on whether they are treated sustainably in the countries of destination”.²² The EC notes that this is particularly the case for green-listed waste, whose exports are not subject to any prior authorization from the relevant authorities.

As a result, after the Chinese ban, “mixed, unrecyclable, and contaminated” plastics have been added to the control system (amber list) of the Basel Convention. Thus, since January 1, 2021, EU countries can no longer export these plastic wastes, considered “unsuitable” for recycling. The European Environment Agency expects the new Plastic Amendment to reduce the plastic waste trade outside the EU and increase landfilling in the short term.²³

19. Trinomics, “Expanding the Knowledge Base on Intra-EU Waste Movements in a Circular Economy”, Final Report for the European Environmental Agency, February 26, 2021, available at: www.eea.europa.eu.

20. C. Gherasim, “After China Ban, Romania Hit by Illegal Imports”, *EUobserver*, April 22, 2021, available at: <https://euobserver.com>.

21. “Activists Accuse Bulgarian Government of Illegally Allowing Waste Burning”, Reuters, March 6, 2020, available at: www.reuters.com; A. Lévy, A. Tchobanov and D. Stoianov, “La Bulgarie n’en peut plus d’être la poubelle de l’Europe”, *Le Courrier des Balkans*, December 29, 2020, available at: www.courrierdesbalkans.fr.

22. Communication from the EC to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: “Our Waste, our Responsibility: Waste Shipments in a Clean and More Circular Economy” COM/2021/708 final.

23. “The Plastic Waste Trade in the Circular Economy”, EEA, *op. cit.*

The Single-Use Plastics Directive

In parallel to increased control over trade flows, the EU has adopted a new legislative framework to prevent plastic waste locally and encourage local recycling.

The 2019 Directive on single-use plastics considers several items to be banned²⁴. However, prevention targets for different plastic wastes and large-scale measures are still not widespread in Europe, despite the steady increase in the generation of plastic packaging waste.²⁵

In parallel, the Directive introduces incorporation rates. Polyethylene terephthalate (PET) beverage bottles should integrate 25% of recycled plastic from 2025. This rate is defined at 30% in all plastic beverage bottles from 2030.

Increased demand for recycled products due to new legislation and growing environmental concerns

Following the adoption of the new incorporation targets and consumer pressure²⁶, the demand, and thus prices, for certain types of recycled plastics have boomed. The recycling industry is even concerned about being able to supply enough recycled materials to meet the

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incorporation objectives of the Directive. Some companies are willing to pay higher prices for recycled materials, as demonstrated by colorless PET flake, traded above virgin these last years.²⁷ PET collection will have to increase significantly to meet demand. However, not all plastic resins are as demanded as PET (one of the most mature technologies).

To meet the 2030 deadline, in particular for resins other than PET, investments in capacity and in technology -to improve quality and cost-efficiency- are required.

According to Plastics Recyclers Europe, plastics recycling capacity increased by 1.1 Mt between 2019 and 2020, i.e. a 13% increase.²⁸ In particular, recycling capacities increased by 10% for flexible film (a plastic considered very difficult to recycle) reaching 2.7 Mt

24. Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment, available at: <https://eur-lex.europa.eu>.

25. "What are European countries doing to tackle plastic waste?", EEA, December 10, 2019, available at: www.eea.europa.eu.

26. B. Brooks, "Recycled Plastics Market Will Feel the Feat from Consumer Demand in 2020", *S&P Global Commodity Insights*, June 22, 2020.

27. "Global eForum - Plastics Committee: Recycled Prices at 'Levels we Never Expected', but Supply the Key Issue", BIR, November 9, 2021, available at: www.bir.org.

28. "Plastic Recycling Industry Continues Fast-Paced Efforts Towards Reaching the EU Targets", Plastics Recyclers Europe, May 11, 2022, available at: www.plasticsrecyclers.eu.

capacity.²⁹ According to the industrial lobby, this growth was permitted by the new legislative targets and facilitated by technological developments in collection, sorting and recycling. Today, the overall plastic recycling capacity is 9.6 Mt. Recycling capacities are still far from matching the volume of European plastic demand (49 Mt in 2020) or collected post-consumer waste (29,5 Mt in 2020).³⁰ The organization hopes to triple recycling capacity by 2030 with large investments in capacity required.

Due to a lack of demand so far, there is no recycled polyethylene and polypropylene with the necessary quality for food contact. Recently, Nestlé committed two billion Swiss francs to stimulate chemical recycling projects for these resins.³¹ Chemical recycling is a technology that can achieve a higher quality recycled material than mechanical recycling. However, the environmental impact of this technology is contested.³²

Recycling capacities are still far from matching the volume of European plastic demand

The question of banning exports from Europe has agitated the industry and environmental groups

In a 2019 communication regarding the European Green Deal, the EC stated that the EU should stop exporting waste outside its borders and that it will revisit the rules on waste shipments and illegal exports. Hence stricter rules for exports of waste from the EU were expected.

On this point, two visions seem to oppose.

On the one hand, environmental non-governmental organizations (NGOs), through the Plastic Waste Trade Action, call for a full ban on plastic waste exports outside of the EU borders. The NGOs criticize the EU's inability to handle its plastic consumption and the resulting waste. In addition, the Basel Action Network advocates an export ban in accordance with the Basel Convention, which calls for self-sufficiency in waste management.

On the other hand, the possibility of export restrictions has worried a large part of the recycling industry. In this field, the word *waste* is avoided. The industrialists

29. "Flexible Film Recycling Capacity Grows by Almost 10% in a Year Despite COVID Pandemic", Plastics Recyclers Europe, September 21, 2021, available at: www.plasticsrecyclers.eu.

30. Figures retrieved from Plastics Europe, "Plastics – the Facts 2021".

31. M. Chauvot, "Pourquoi le plastique recyclé devient une denrée rare... et chère", *Les Echos*, January 18, 2020, available at: www.lesechos.fr.

32. K. Taylor, "EU Defines Sustainable Plastic Manufacturing in Draft Green Finance Rules", Euractiv, November 18, 2020, available at: www.euractiv.com.

speak about “raw material from recycling”³³, since the process of sorting and separation of waste materials is more or less advanced and that this material must be seen as a factor of production.

The Brussels-based Bureau of International Recycling (BIR) held a webinar explaining that international trade balances supply surpluses and demand deficits. In the European case, the supply surplus of plastic waste appears structural. The industrialists claim free and fair trade for “raw materials from recycling”. The IEC Chairman Olivier François of Galloo in Belgium/France states that “The Circular Economy exists already - it’s just that it’s not local”, rather, “It’s a Circular Economy at a global level.”³⁴

The OECD takes up the concept of a global circular economy. It states that “Trade can provide potential opportunities towards a global circular economy by channeling waste and materials to destinations where there is comparative advantage in sorting and processing these materials” (p. 9), to boost global recycling rates. The institution, therefore, claims “that unnecessary trade barriers such as import and export restrictions on waste and scrap should be avoided to the extent possible” (p. 4). The industrialists and the OECD agree that these exports must avoid adverse environmental impacts. However, waste mostly flows from developed to developing countries. And, there, “comparative advantages” are rather lower labor costs and environmental standards than advanced clean technologies. Nevertheless, the EC sees the export as an opportunity to improve waste management standards in third countries, with the intention of improving controls on treatment conditions.³⁵

In response to the “globalized circular economy argument”, the “Plastic Manifesto”, which brings together, among others, the NGOs involved in “The Plastic Waste Trade Action”, invokes a moral responsibility and ecological nonsense: the plastic waste trade ignores the principle of proximity and shirks the responsibility to ensure proper and safe waste management³⁶. Once again, the question of Europe’s real control capacities arises.

33. “Global Eforum – International Environment Council: Recycling Industry Holds its Breath Ahead of EU Waste Shipment Recast”, BIR, November 12, 2021, available at www.bir.org.

34. *Ibid.*

35. Interview of Kestutis Sadauskas, the Director of Circular Economy and Green Growth at the Directorate General for the Environment, by Eurodeputies on 26 January 2022.

36. The plastic waste trade manifesto: “Irresponsibly managed plastic waste trade has no place in a circular economy”, BAN, CIEL, EEB, EIA, GAIA NABU, ZWE, April 2021, available at: www.breakfreefromplastic.org.

The release of the EC's proposal and its implications

The EC has finally reversed the total ban on exporting waste outside the EU and presented its proposal on 17 November 2021.³⁷ The proposed legislation is mainly based on control, monitoring and verification measures and is now discussed by co-legislators, which will release a rapporteur's draft report. These measures are a step in the right direction, but it remains to be seen whether they can and will be effectively implemented. As long as plastic waste production increases and the domestic recycling market is not fully mature, in terms of technology (quality) and capacity, the export market can be expected to be risky (from an environmental and health perspective). The Circular Economy Action Plan foresees to implement waste prevention targets and measures.

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direction

The proposed regulation provides for a “default” export prohibition of green-listed waste to non- OECD countries, except to countries that explicitly notified the EU of their willingness to receive EU “green-listed” waste exports and that demonstrated their ability to treat this waste in an “environmentally sustainable manner”. The EC also proposes: to step up the monitoring of EU waste exported to OECD countries by dialoguing with the receiving country and eventually suspend exports; that all companies exporting waste outside the EU conduct independent audits in the facilities to where they ship waste in order to ensure proper waste management; to establish clear criteria to prevent waste from being falsely exported as “used goods”.

The EC justifies the absence of a total ban on the ground that Member states do not have the capacity to manage this waste in the long term. Waste would probably end up in landfills or incineration without exports. Another reason is that an export ban would be challenged at the World Trade Organization (WTO). The NGOs and the European Steel Association welcome to some extent the proposal, but point to a lack of clarity, e.g., concerning audit requirements. Moreover, they are concerned about the lack of consent procedures on transfers between EU/OECD countries, where they expect inappropriate treatment and an increase in illegal trade.

Can waste trade contribute to a sustainable and global circular economy?

On several occasions, the term “global circular economy” has been invoked, including by the OECD, to promote free trade. But *is there such a thing as a global circular economy?* In other words, can waste exports increase the global recycling rate, save virgin resources and make the European model more sustainable?

Firstly, the usual criticism of recycling is that it does not necessarily save virgin materials. For Geyer *et al.* (2016), “recycling displacing primary production” is a naïve

37. “Proposal for a new regulation on waste shipments”, European Commission, November 17, 2021, available at: <https://ec.europa.eu>.

assumption. Recycling may create an opportunity to use more material globally (called a “rebound effect”). Second, as theoretically demonstrated in Joltreau (2021)³⁸, waste imports may substitute for domestic waste collection: foreign waste is recycled, and local waste is landfilled. This theoretical result finds empirical resonance in the declarations of China, Turkey and India. These countries see the import ban as an environmental protection tool and a way to develop local recycling.

While this does not confirm a theoretical result, it shows that the desirability of such a market is not obvious. Mostly because we fail to answer this question with

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certitude: *What would have happened in China (or any importing country) without the possibility of importing waste?* Several hypotheses should be tested, such as **1)** The country would have used less plastics (e.g., fewer plastic products), **2)** It would have developed local recycling, **3)** It would have imported recycled materials; **4)** It would have used more virgin materials. Moreover, the impossibility to export could increase landfills in the short term and stimulate a more stringent policy mix in the long term.

If waste imports were only a means to overcome the lack of virgin materials, as reported by Velis (2014)³⁹, then hypothesis 4), the core of the “circular economy argument”, is excluded. Nevertheless, Yoshida (2022) conducted a field survey in China and finds that following the ban, China increased the use of virgin materials and the imports of recycled pellets. The author explains that it was to fill the raw material shortage due to the time frame required to establish an effective collection system. We can also note that, from a long-term perspective, the availability of waste might prevent investment in virgin production capacity. In addition, the reality is, of course, more complex and nuanced. For example, Velis (2014) explains that the possibility of local plastic recycling in China was limited by the quality of the plastic used in local goods and, therefore, local waste.

To explain its position, the OECD relies on the example of India for scrap metal, which is a major producer of secondary steel despite low waste generation locally (i.e., no substitution with local waste), and on the study by Higashida and Managi (2014)⁴⁰. However, the illustration of scrap metals may not transpose to plastics.⁴¹ Higashida and

38. E. Joltreau, “Chapter 3 Recycling in a Globalised Economy” in *Développer une économie circulaire : politiques publiques et réponses des acteurs économiques* [Developing a Circular Economy : Public policies and responses of economic actors], Ph.D. Thesis in Economics, University Paris-Dauphine, PSL. (in French; research articles in English), 2021, available at: www.theses.fr.

39. C. Velis, “Global recycling markets: plastic waste. A story for one player – China”, ISWA Globalisation and Waste Management Task Force, September 5, 2014. Original unfindable cited source: Z. P. Liao, “Analysis of Supply and Demand, and Development Potential of Waste Plastics”, *Resource Recycling*, (01), 10-13, 2010 (in Chinese).

40. K. Higashida and S. Managi, “Determinants of Trade in Recyclable Wastes: Evidence From Commodity-Based Trade of Waste and Scrap”, *Environment and Development Economics*, Vol. 19, No. 2, November 25, 2013, pp. 250–270, available at: <https://doi.org>.

41. Recycled metals can be more competitive compared to metals from virgin material, than recycled plastics compared to virgin ones (material characteristics, different market evolution).

Managi empirically demonstrate a link between gross domestic product per capita and waste imports. The authors' conclusion, echoed by the OECD, is that trade restrictions should be avoided as they can lead to a decrease in production efficiency (costs and/or quantities). The EC, too, explains that it wants to avoid the disruption of resource flows.⁴² However, material growth alone is not a circular economy.

Although importing countries may find economic benefits in importing, the impact on global recycling rates and resource preservation remains to be demonstrated; and a strong external dependency is not sustainable. This is seen in ban after ban made by importing countries. Plastic waste import bans are likely to continue, as domestic waste generation and environmental concerns grow in receiving countries. Unanticipated export restrictions are likely to only increase landfills and incineration in the short term because building new recycling facilities can take years.⁴³ Hence, the European policy mix must be strengthened in anticipation.

Are we sitting on a plastic bomb?

Beyond plastic recycling, the real issue is undoubtedly the very nature of these materials. Recycling delays plastics' release into the environment (and eventually reduces the use of virgin plastic) but does not negate the risk of fragmentation (even if fragmentation may be faster in the natural environment).

According to Nathalie Gontard, research director at French National Institute for Agricultural Research (INRAE) and laureate of the International Academy of Food Sciences, plastics fragment leak inexorably into the natural environment, even for goods that are considered durable, such as a lawn chair: "In any case, the plastic of the chair will inexorably continue to transform into a multitude of smaller and smaller pieces, numerous and uncontrollable" (p. 112).⁴⁴ According to her, there is no biological mechanism capable of assimilating plastic nanoparticles, which accumulate on our planet, including in living organisms. Recently, Leslie *et al.* (2022)⁴⁵ found plastic particle pollution in human blood. This lack of information on plastic toxicity also alarmed the team of Persson *et al.* (2022).⁴⁶ They estimate that humanity has passed a new global limit because annual production and releases are increasing at a rate that exceeds the global capacity to assess and monitor this pollution. Urgent research is needed to understand the health and environmental consequences of plastic fragmentation.

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42. Interview of Kestutis Sadauskas, *op. cit.*

43. Declaration of Plastics Recyclers Europe in the press article by F. Simon, "Recyclers Fret as EU Plastic Waste Export Ban Comes into Force", Euractiv, January 7, 2021, available at: www.euractiv.com.

44. Translated from French, N. Gontard, *Plastique, le grand emballément*, Paris: Éditions Stock, 2020.

45. H. A. Leslie, *et al.*, "Discovery and Quantification of Plastic Particle Pollution in Human Blood", *Environment International*, Vol. 163, 2022, pp. 107-199, available at: <https://doi.org>.

46. L. Persson, *et al.*, "Outside the Safe Operating Space of the Planetary Boundary for Novel Entities", *Environmental Science & Technology*, Vol. 56, No. 3, 2022, pp. 1510-1521, available at: <http://doi.org>.

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