Research paper on a European tax on plastics

Report

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Zero Waste Europe is the European network of communities, local leaders, businesses, experts, and change agents working towards the same vision: phasing out waste from our society.

We empower communities to redesign their relationship with resources, to adopt smarter lifestyles and sustainable consumption patterns, and think circular.

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Acronyms

EU: European Union
LCA: Life Cycle Analysis
PET: Polyethylene terephthalate
PUR: Polyurethane
PVC: Polyvinyl chloride
PE-HD: High-density polyethylene
PE-MD: Medium-density polyethylene
PE-LD: Low-density polyethylene
PE-LLD: Linear low-density polyethylene
PS: Polystyrene
PS-E: Polystyrene, expandable
PP: Polypropylene
1. Previous relevant experiences

Environmental taxes are economic instruments aimed at affecting behaviour of industries, consumers, and resource managers through market systems. They can be combined with other market-based instruments such as subsidies, deposit-refund systems, resource pricing schemes or with other types of instruments, such as voluntary agreements or traditional command and control measures.

Environmental taxes are generally considered as efficient instruments, in the sense that environmental results are achieved by the economic agents with the lowest abatement costs.

According to the OECD/EEA database on instruments used for environmental policy and natural resources management, most EEA countries are already using economic instruments or are introducing them in various environmental fields, including waste generation and recycling.

The most widespread form of environmental taxation in Europe are energy taxes. In 2015, they accounted for 76.7 percent of the total revenue from environmental taxes in the EU-27. Despite the objective for which they were designed, the main motivation for introducing taxes on energy has been a purely fiscal one (raising revenues), whereas the environmental considerations have only recently become more obvious.

The main piece of legislation on European taxes on energy is the Directive 2003/96/EC, which sets minimum rates of taxation applicable to energy products when used as motor or heating fuels and to electricity. Its aim is to improve the functioning of the single market by reducing distortions of competition between mineral oils and other energy products, and to protect the environment.

Other environmental economic instruments applied in European countries relate to waste management and products and to the extraction of natural resources, being the first ones more common. Some of them are:

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2 http://www.oecd.org/env/policies/database
5 Directive 2003/96/EC on restructuring the Community framework for the taxation of energy products and electricity.
- **Taxes and charges on packaging:** amongst others, applied in Belgium⁶, Croatia⁷, Estonia⁸, Hungary⁹, Latvia¹⁰, Norway¹¹, Poland¹² and The Netherlands¹³.
- **Taxes and fees on plastic products,** such as the Belgian and the Latvian taxes on disposable plastic kitchenware or the German weight-based fees for plastics being part of a product.
- **Levy on plastic bags:** applied in Denmark, Iceland, Ireland¹⁴, Italy¹⁵, Belgium, France, Hungary, Portugal and Spain (Andalusia).
- **Taxes on waste disposal/landfilling,** applied in Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Malta, The Netherlands, Poland, Portugal, Sweden, Slovak Republic, Slovenia, Spain, and the United Kingdom.
- **Taxes on aggregates:** applied in 14 European countries¹⁶.
- **Charge on mineral resource extraction:** applied in Estonia¹⁷.
- **Tax on the use of peat for energy:** applied in Finland¹⁸.

These taxes on waste management and resources are included among the so-called “pollution and resources” taxes, which represent a small share of total environmental tax revenues: 3.5% of total revenues in EU-28 in 2015.¹⁹

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⁷ Packaging waste charge. For all kinds of beverage packaging (not only made of plastic). Introduced in 2005, fully earmarked (revenues are used to finance separate collection and handling of packaging wastes). Tax rate for plastic packaging: 0.0138 €/unit (https://pinedatabase.oecd.org).
¹¹ Basic tax on disposable packaging. Introduced in 1994 for non-refillable beverage containers, not earmarked. Tax rate: 0.1308 €/unit (the tax rate has increased along time in line with inflation) (https://pinedatabase.oecd.org).
¹³ Packaging tax. Introduced in 2008 for all kinds of packaging (including packaging made of bio-based plastics), not earmarked. Tax rate for packaging made of plastic: 0.4339 €/kg; for packaging made of bio-based plastics: 0.0733 €/kg (https://pinedatabase.oecd.org).
¹⁴ Introduced in 2002 for single-use plastic bags. The tax rate in 2018 is 0.22 €/bag.
¹⁵ Tax on plastic bags that are not biologically decomposable (https://pinedatabase.oecd.org).
¹⁶ Taxes on aggregates have proven to have an effect on reducing the extraction of raw materials, except in Denmark, where the tax rate was low (Legg, D., Zoboli, R., Bleischwitz, R., Skovgaard, M., Herczeg, M., & Leveson-Gower, H. (2006). Economic instruments to promote material resource efficiency. Etc/Rwm, (February), 1–86).
¹⁷ Introduced in 1991 on the extraction of minerals. It has different tax rates depending on the type of mineral. It is 50% earmarked. The charge rates increase on an annual basis. However, it has had negligible effects on the extraction of mineral resources (Legg, D., Zoboli, R., Bleischwitz, R., Skovgaard, M., Herczeg, M., & Leveson-Gower, H. (2006). Economic instruments to promote material resource efficiency. Etc/Rwm, (February), 1–86).
¹⁸ Introduced in 1990 for the use of peat for stationary purposes. Negligible effects.
However, the effects of these taxes have proved to be very positive in reducing the environmental impact of products and waste. For instance, in the case of Ireland, the levy on plastic bags led to a 90% drop in use of plastic bags.\textsuperscript{20} Taxes on waste deposit have also proved to lead to a reduction in the amount of waste landfilled and to increased waste recycling (Bio Intelligence Service 2012).

The experiences with economic instruments on waste management, products and materials highlight a number of lessons, including:\textsuperscript{21}

- the benefits of a specific and explicit link to environmental goals;
- the need of establishing a tax rate which is high enough to influence the market;
- the potential benefits of earmarking revenues for environmental purposes;
- the importance of design aspects such as predictable rate increases and ensuring fairness to those who pay;
- the need to ensure the presence of supporting infrastructures (e.g. for waste management) for implementation;
- the need for sound implementation and monitoring and the possibility to review instruments to improve their effectiveness;
- coherence between relevant instruments and policies allows increased effectiveness;
- the importance of tailoring instruments to the social and economic context;
- the need of analysing the social effects of the tax in order to avoid regressive effects;
- and the benefits of stakeholder engagement in design and implementation.

The above mentioned taxes have been applied at a national level. The experience in relation to EU-wide taxes is very limited. There are no precedents of an EU-wide environmental tax, being the Carbon tax the one that was discussed more deeply. An EU-wide carbon tax was proposed in 1992 in order to tackle greenhouse gas (GHG) emissions.

A proposal for a Directive on combined carbon and energy tax, introducing a tax on CO2 emissions and energy, was submitted by the European Commission to the Council. The condition for such a tax was that it had also to be adopted by other OECD countries. In a communication released in 1991\textsuperscript{22} the Commission provided some reasons for the introduction of such a tax:

- “A Community initiative would avoid a proliferation of separate actions by individual Member States which could lead to distortions of competition and disruption to the Internal Market.”
- “It would allocate a value to natural resources that are limited and which need to be safeguarded for future generations.”

The Commission envisaged two types of tax: an energy tax that would apply equally to all energy sources, and a CO2 tax modulated on the basis of the carbon content. The Commission proposed an implementation based on an early announcement and a gradual introduction in order to ensure

\textsuperscript{20}http://www.irishenvironment.com/iepedia/plastic-bag-levy/.
\textsuperscript{22}“A community strategy to limit carbon dioxide emissions and improve energy efficiency” (SEC(91)1744final).
a smooth introduction of the increased energy prices. It also defended a revenue neutral tax, which should not result in an increase in the overall fiscal pressure. It proposed that the tax would be offset by fiscal incentives and by tax reductions for companies and individuals.

The precise details of the tax were presented in a subsequent communication of the Commission, released in 1992. The Commission proposed a European tax that would be levied at the stage when the energy is consumed in its final form, arguing efficiency and transparency reasons, as well as destination principles (allocate the tax yield to the country where the fuel is used). The collection of the tax and the arrangements to ensure neutrality were left to the States, but the regulation was made by the Commission. The Commission proposed a tax that would be independently applied from other taxes and charges, in order to ensure its effectiveness and to allow a European regulation of the tax. The proposed taxable event was “the extraction of the crude products, the production of their derivatives or the importation”. The Commission envisaged an increase of the tax rate along time, as well as the possibility for authorizing one Member State to suspend the application of the tax temporarily, on an exceptional basis. In order to ensure tax neutrality, reductions in direct and indirect taxation (e.g. reductions of social security contributions or of VAT in those Member States with high rates) were suggested.

Within the EU, the adoption of any proposal for a fiscal measure requires unanimous agreement of the Member States. A minority of Member States were opposed to such a measure. Most of the industry was also against it. As a result, the proposed CO2/energy tax was never adopted.

The initiative was converted into a cap and trade system, which entered into force as the European Trading Scheme in 2005. It covers the 28 countries of the European Union, and three non-EU countries: Iceland, Liechtenstein, and Norway.

In the meantime, several European countries have enacted their own carbon taxes. They include: Denmark (2002), Finland (which introduced the world’s first carbon tax in 1990), Ireland (2010), the Netherlands (1990, replaced by the tax on fuels), Norway (1991), Slovenia, Sweden (1991), Switzerland (2008), and the UK (1993).

From this carbon tax initiative several lessons can be learned, being the most important ones for the purpose of this report, that:

- Unanimity among Member States is necessary for the approval of tax initiatives, so negotiations and agreements should take place before or in parallel to developing such a proposal.

- Not only political negotiations are necessary, but also a dialogue between governments and directly affected sectors, such as industry, NGOs and other stakeholders, in order to ensure transparent debates.

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23 “Proposal for a Council Directive introducing a tax on carbon dioxide emissions and energy” (COM(92) 226 final)
Recently, an EU-wide tax on aviation fuel (kerosene) has been proposed. The tax would be levied in all Member States for intra-EU flights. The proposal is to use the revenues for the funding of measures against climate change world-wide and to foster sustainable transport projects in the EU, such as the modernisation of railway lines across borders, as well as to support and promote research in the field of transport. India, Japan and the USA already charge a similar tax on domestic flights.
2. The value chain of plastic

A wide range of synthetic materials are included under the general denomination of “plastics”. Plas\-\tics are defined as an organic solid, essentially a polymer or combination of polymers of high molecular mass\textsuperscript{27}. These polymers are chemically synthesised from oil-based or bio-based feedstocks (monomers), which in turn are produced from light forms of distilled crude oil and biomass, respectively. Figure 1 shows a schematic view of the value chain for plastics including the raw materials originating them plus plastic waste management and recycling.

For oil-based plastics, crude oil is processed in refineries in order to distill different subproducts according to their complexity, resulting into: gas, petrol, naphtha, kerosene, light oil such as diesel, heavy oils such as fuels, lubricants and waxes, and bitumen or asphalt. The main precursor of plastics in the EU is naphtha (although in the US, gas makes a significant contribution as well).


which is subsequently “cracked” into more simple chemical products (called monomers) such as ethylene, propylene, benzene, etc. Next, monomers are converted into polymers (also called resins, the most simple form of plastics), such as polyethylene, polypropylene, etc. This step is considered to be "plastic manufacturing".

Polymers can be also synthesised from bio-based materials, resulting into bio-based resins. Note that the origin of the polymer does not determine its biodegradability, therefore both bio-based and oil-based resins can be either biodegradable or not biodegradable. In turn, the design of biodegradable plastics determines the conditions in which these plastics can be composted: for example, the most common biodegradable plastics can be properly degraded only in industrial composters.

These polymers, either raw or mixed with additives, are the primary input to the so-called "converters", which are industrial agents in charge of transforming resins and compounds (often in the form of pellets, nurdles or dust) into finished plastic products through a wide variety of industrial procedures (e.g. injection, extrusion, moulding, thermoconforming, etc.). These products are then placed in the market, either included into larger industrial processes as intermediate goods (e.g. car pieces) or for final consumption by households and businesses (e.g. bottles, greenhouse plastics, rooftops coverage).

All these products become waste sooner or later. When plastics becomes waste, they can be: 1) separately collected through bins, extended producer responsibility (EPR) collection schemes, deposit return schemes, etc., 2) collected together with residual waste of which a part can be recovered through mechanical sorting, 3) directly disposed of in landfills or incinerators, or 4) thrown away in the environment. The recovered materials through separate collection and mechanical sorting of residual waste can be transformed into recycled resins (converting plastics into resins is known as mechanical recycling), which in turn can be converted into new products. Also, it is possible to convert recycled plastics into monomers, although at a high energy and economic cost (converting plastic into monomers is known as chemical or feedstock recycling, mostly applied to the most complex plastics). It should be noted that converting plastic for one specific purpose into plastic for the same purpose is not always technologically and/or economically feasible. Converting plastics into lower quality/value materials is known as "downcycling" or cascaded recycling. It is important to keep in mind that, while material losses and waste generation prior to plastic manufacturing can be considered low (refineries usually reach high efficiency levels in oil processing), once resins have been manufactured, the following steps prior to consumption (e.g. converters) also generates plastic waste.
3. At what stage could a plastic tax be applied

The plastics value chain is complex, as shown in the previous section. In terms of stages where a tax could be levied, the whole life cycle of plastics comprises raw materials’ transformation into intermediate products, conversion into plastic resins, then into plastic products, and finally into plastic waste. In principle, a levy on any of the stages would have an effect on plastic production and consumption, however there are pros and cons to be considered at each stage regarding the number of taxpayers (e.g. how many agents will be subject to the tax), tariffs and exemptions on foreign trade required to preserve the competitiveness of the EU industry, implications in terms of communication (e.g. how the rationale, goals and operative terms of the tax are conveyed to stakeholders) and the fit of possible tax credits, among others. These are discussed below and summarised in table 1.

A tax on plastic levied on raw materials (crude oil) and intermediate products (naphtha) has been discarded a priori because it could distort other already operating taxing schemes, such as harmonised fuel taxes. Moreover, these products have alternative uses different from plastic production, which would be difficult to screen out of the scope of the tax. This same reason applies to production and sales of monomers.

A first consideration common to all alternatives is that, in order for the tax not to shift plastic consumption from EU-made plastics towards imports, taxing plastics at one specific stage of the value chain (i.e. monomers/resins/plastic products) should be accompanied by tariffs on imports and exemptions on exports of all products/stages downstream that stage in the value chain. In practice, setting tariffs on imports and exemptions on exports is technically feasible as far as the classification of goods used in foreign trade allows for their identification (e.g. the combined nomenclature in the EU). This is relatively straightforward in the case of monomers, resins and plastics products. However, for imports and exports of plastic products and products containing plastic the actual content of plastic should be credited (e.g. through labelling, plastic contents declarations, etc.) in order to set the level of tariffs and execute exemptions. Furthermore, it should be acknowledged that following the combined nomenclature, a great number of products containing plastic could not be identified in order to apply tariffs and exemptions. This would have a negative effect over the competitiveness of the products manufactured in the EU. However, the costs related to plastics parts within products (e.g. plastic parts within a computer) may not have a significant distorting effect in the competitiveness of the EU products at an aggregate scale (e.g. the difference in the sell price of a computer with and without the plastic tax may not be perceived by consumers, since the share of the cost corresponding to plastic pieces is very low). In any case,

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29 For a description of the combined nomenclature see: [https://goo.gl/fMpNuz](https://goo.gl/fMpNuz)
30 A great number of products are categorised and labelled according to the nature of the product but not necessarily according to the materials they are made of. For example, plastic bottles do not have a specific denomination within each type of beverages in the combined nomenclature, therefore one cannot discriminate glass from plastic bottles. Within the combined nomenclature, there are only 54 categories including a specification about its composition and mentioning “made of plastic”, besides the dedicated category of plastics (category 39 of the combined nomenclature).
where tariffs and exemptions are involved, competition issues should be carefully taken into account\textsuperscript{31}.

In this sense, there is a general trade-off between taxing upstream versus taxing downstream the value chain. Taxing upstream will be easier in terms of the number of economic agents involved in sales and purchases, but will require complementary trade arrangements, whereas the opposite is true if the tax is levied on consumption (figure 2): a tax levied on the final consumption of plastic would not require tariffs (as both imported and domestic products would be affected), but on the contrary the number of agents involved would be very high.

\textbf{Figure 2: Stages at which the tax could be levied}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Stages at which the tax could be levied}
\end{figure}

A second general consideration common to all alternatives is that an upstream tax would encourage efficiency in all processes downstream, minimising losses in plastic manufacturing and

\textsuperscript{31} For example, regarding the WTO agreements.
processing. Moreover, it could contribute to make recycled plastics more competitive (see below). In contrast, a tax levied on consumption would require additional arrangements in terms of crediting the content of recycled plastic into products (e.g. specific labelling, auditing and inspection) in order to set up exemptions/reductions.

### 3.1. Taxing oil-based monomers

A first suitable product/stage where the tax can be applied is monomers, where they are purchased by plastic manufacturers (P1 in Figure 2). In this case, the tax base could be the weight or value of the monomers, and the taxpayers would be the plastic manufacturers. As pointed above, taxing monomers purchases should be accompanied by exemptions on the exports of resins (EXP2 in figure 2), potentially plastic products and products containing plastics (EXP3 in figure 2), plus tariffs on the imports of monomers (IMP1), resins (IMP2 in figure 2), plastic products and products containing plastics (IMP3). Tariffs on imports and exemptions on exports should be somehow related to monomer content in order to be consistent. The exports of monomers would not be subject to the tax.

Recycled monomers could be exempted in order to encourage the chemical recycling of plastics. However, since the chemical recycling of plastic is an energy intensive process, this exemption should be grounded on life cycle assessment. Otherwise, the tax could be encouraging environmentally harmful activities.

Monomers are a well-defined product in terms of the number of companies producing and selling them in the EU, closely related to the petrochemical and chemical industries. Therefore identifying taxpayers (i.e. plastic manufacturers purchasing monomers) should be easier than at other stages downstream the value chain.

Monomers are not plastics themselves, so a tax on monomers would actually not be a tax on plastics. This should be carefully communicated to the stakeholders and the general public (e.g. defining plastic production as the taxable event and monomers purchases by plastic manufacturers as the tax base).

Taxing the purchases of oil-based monomers would impact on virgin resins prices, making recycled resins more competitive while encouraging resource efficiency along the value chain.

Taxing monomers would neither allow for applying different rates to specific resins (i.e. resins derived from ethylene could be targeted as a whole, but specific resins made from ethylene could not) nor to particular products and uses of plastics (e.g. single-use plastics vs. long-lasting plastics, all products and uses would be equally penalised).

Under this alternative, bio-based resins would be out of the scope of the tax, so additional arrangements should be set if these materials were decided to be taxed as well.
Finally, the allocation of the tax burden would be proportional to the participation of each Member State in plastics manufacturing, which in the EU context is concentrated in a few countries: 80% of the demand comes from Germany, Italy, France, Spain, UK, Poland and Benelux\textsuperscript{32}.

### 3.2. Taxing resins

There would be two options in relation to taxing resins:

- **Taxing virgin resins production or sales (S\textsubscript{2} in Figure 2).** The tax base would be the weight/value of the resins and the taxpayers would be the plastic manufacturers. This should be accompanied by exemptions on the exports of resins (EXP\textsubscript{2}), plastic products and products containing plastics (EXP\textsubscript{3}) plus tariffs on the imports of the same products (IMP\textsubscript{2}, IMP\textsubscript{3}).

- **Taxing virgin resins purchases by converters (P\textsubscript{2} in Figure 2).** The tax base would be the weight/value of the resins, and the taxpayer being the converters. Again, this should be accompanied by tariffs on the imports (IMP\textsubscript{3}) and exemptions on the exports of plastic products and products containing plastics (EXP\textsubscript{3}). The import and exports of resins would not be subject to the tax in this case.

In both cases, tariffs on imports and exemptions on exports should be related to its resin content in order to be consistent with the tax.

Virgin resins are the first product in the plastics value chain that can be considered to be “plastic”, therefore a tax on resins would literally be a tax on plastics, which facilitates communication with stakeholders and citizens.

The number of companies buying and selling virgin resins is larger than the number of companies trading monomers, but much lower than the agents involved in final consumption, therefore the tax administration would be moderately complex, but still manageable.

Recycled resins, in principle not subject to the tax, re-enter the value chain at this stage. An increase in the use of recycled resins plus an improvement of the recyclability of virgin resins could be expected if tax rates are set at the appropriate level.

Bio-based resins are easily identifiable at this stage, so in case different rates were to be set, these would be easier to apply at this stage in comparison with a tax levied on monomers or consumption.

Again, 80% of the tax burden would be concentrated in Germany, Italy, France, Spain, UK, Poland and Benelux.

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As in the case of monomers, taxing resins would not permit distinguishing the final use of plastics, whereas specific tax rates could be applied to each resin.

### 3.3. Taxing plastic placed on the market for final consumption

A tax levied on final consumption of plastic products and plastic containing products (P3) is the only option that would not require additional trade arrangements in terms of tariffs and exemptions.

Taxing final consumption of plastic products and plastic containing products makes the tax base difficult to measure for those products not made of plastics only (e.g. cars, computers) which should somehow declare the quantity/value of plastic content. Considering that a large share of the products placed in the market contain plastic, administrative complexity and fraud could be potentially significant. This could be overcome by excluding certain products from the scope of the tax, which besides practicalities, finds no ground in economic nor environmental terms. In this sense, a tax on specific plastic products (e.g. single use plastics, beverages) would possibly be more consistent that a tax on plastics leaving a great share of products out of the scope of the tax. In fact, the capacity of targeting specific products is an advantage of a tax levied on consumption. However, the narrower the scope, the lesser the revenues.

Taxing consumption is the only option which does not encourage the substitution of virgin resins with recycled plastics. In order for such a tax to be an incentive for recycling, specific labelling for recycled materials and recycled plastic content would be required, so exemptions/reductions could be applied. This would be reasonably easy for plastic products (i.e. products mostly made of plastic), but complex for products containing plastic. The same is true for bio-based plastics, which would be taxed a priori. Setting separate rates or exemptions on bio-based plastics would entail additional requirements in terms of traceability (e.g. specific labelling). Anyhow, setting fiscal credits for recycled or bio-based plastic contents might result into significant administrative burden.

The communication of a plastic tax on consumption would be easier for those products made of plastic only, but complex for compound products, unless reliable labelling system for plastic content were set up.

The allocation of the tax burden would be more equally distributed across Member States in this case, since according to data on trade and plastic waste, the per capita consumption of plastic should not differ as much as plastic manufacturing and processing.

The following table summarises the pros and cons of the main possible alternatives in relation to at what stage could the tax be applied:
To sum up, there are three main stages at which a tax on plastic could be levied: where monomers are purchased by plastic manufacturers, where polymers are either sold by plastic manufacturers or purchased by converters and products placed in the market for final consumption. Both three options have pros and cons, being the most relevant that for the first two options (tax on monomers, resins) tariffs and exemption on imports and exports respectively are required; whereas the last (tax on consumption) is rather complex given the potential number of agents and products subject to the tax.

Table 1: Pros and cons of the main stages at which the tax could be levied

<table>
<thead>
<tr>
<th>Alternatives to the point of application</th>
<th>Pros</th>
<th>Cons</th>
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| Taxing monomers where these are purchased by plastic manufacturers | ● Well defined products and taxpayers.  
● Monomers are easily identifiable in foreign trade operations.  
● Encourages resource efficiency at design and production stages.  
● Encourages the substitution of virgin plastics with recycled plastics. | ● Communication and tax design (tax base, taxable event) should be consistent and carefully communicated.  
● A possible specific treatment on bio-based plastics would require additional arrangements.  
● Requires tariffs and exemptions  
● Does not allow targeting specific resins/products/uses (e.g. single use plastics).  
● The petrochemical and chemical industries are a strong lobby in the EU.  
● Uneven tax burden allocation across Member States (80% of demand comes from Germany, Italy, France, Spain, the UK, Poland and Benelux). |
| Taxing virgin resins | ● Well defined products and taxpayers.  
● Bio-based plastics included and easy to segregate for exemptions.  
● Easy to communicate.  
● Encourages resource efficiency at design and production stages.  
● Encourages the substitution of virgin plastics with recycled plastics. | ● Larger number of companies selling/purchasing resins.  
● Requires tariffs and exemptions.  
● Does not allow targeting specific products/uses (e.g. single use plastics).  
● The petrochemical and chemical industries are a strong lobby in the EU.  
● Uneven tax burden allocation across Member States (80% of demand comes from Germany, Italy, France, Spain, the UK, Poland and Benelux). |
| Taxing plastic placed on the market for final consumption | ● Does not require tariffs and exemptions.  
● Easy to communicate.  
● It could address bio-based plastics within the same taxing framework.  
● Allows for targeting specific products/uses (e.g. single use plastics).  
● Similar tax burden allocation per capita across Member States. | ● Extremely large number of agents involved, administrative complexity and fraud could be significant.  
● The traceability of products containing plastics is difficult, tax base difficult to define. Some products (e.g. packaging) would be easier to charge than others (e.g. computers, cars), if the tax base is established in weight (e.g. €/Kg).  
● Additional arrangements required to encourage the use of recycled resins.  
● Requires additional certification for crediting the use of recycled plastics. |
4. Interaction with the EU policy framework

This section explores the interaction of a possible plastic tax with the EU legislative framework in relation to waste management and in relation to EU finances.

4.1. Link with EU waste management regulation

The **Waste Framework Directive** (WFD)\(^{33}\) is the main piece of legislation regarding the management of waste within the EU. It establishes waste prevention and recycling objectives. As for plastics, it establishes a 50% recycling objective for 2020. It states that Member States shall apply *inter alia* economic instruments in order to achieve these goals.

Also relevant is the EU **Directive on Packaging and Packaging waste**.\(^{34}\) The Directive covers all packaging placed on the market in the Community and all packaging waste, regardless of the material used. It set targets for the recovering of packaging waste by 2008:

- 60% valorisation
- Between 55 and 80% of recycling (with specific targets for the different materials, being 22.5% for plastic packaging)

It also sets basic requirements about the composition of packaging, among which: the reduction of the harmfulness of packaging and the increase of the recyclability, the reusability and the content of recycled material in packaging.

In July 2015, the European Commission presented the **Circular Economy Package**\(^{35}\), which was accompanied by a legislative proposal which is now at its final stage of approval. On 18 December 2017, a provisional agreement was reached on four legislative proposals of the waste package, including the WFD and the Packaging directive.\(^{36}\) The agreement includes binding waste reduction targets and updated rules to decrease waste generation, ensure a better control of waste management, encourage the reuse of products and improve recycling in all EU countries. The final adopted Directives will in principle include the following EU targets on waste and packaging waste:

- 55% for the preparing for reuse and recycling of municipal waste by 2025; 60% by 2030, and 65% by 2035
- 65% recycling of all packaging waste by 2025; 70% by 2030
- 50% recycling of plastic packaging waste by 2025; 55% by 2030

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In January 2018, the European Commission also presented the **EU strategy on plastics**, aimed at:

- Fostering the durability of plastics
- Making the reuse and recycling of plastics easier
- Making the separate collection of plastics easier
- Substitute the use of plastic for other materials where possible
- Avoid the landfilling of plastics

The only mention to environmental taxation is to use economic instruments to reward the uptake of recycled plastics and favour reuse and recycling over landfilling and incineration. This measure is recommended to national authorities and not planned as a European-wide measure.

### 4.2. Link with EU financial instruments and Brexit gap

The finances of the European Union depend mainly on **own resources**, which are integrated by:

- Customs duties on imports from outside the EU
- Own resources based on VAT (value added tax)
- Own resources based on GNI (gross national income)

Although designed simply to cover the balance of total expenditure not covered by other own resources, own resources based on GNI have become the largest source of revenue of the EU budget.  

In 2015, the UK contribution to the EU budget was 18.20 billion euros of a total of 118.60 billion euros of budget. The exit of the UK will thus leave a gap in the European budget, which will have to be addressed either through adjustments in the expenses or through an increase in the incomes. Some estimates define the financial gap in the range of 13 billion € (REF).

The current EU budget is planned out until 2020. The European Commission is due to come up with proposals on the future of the budget in May 2018, when the 2020-2026 budget period will be planned.

One of the main financial instruments of the EU to be taken into account for the purpose of this proposal is the **customs duties** applied to imports and exports of materials and products.

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The construction of the free European trade area, in 1968, was one of the main elements of the common market. The duties between Member States were eliminated, and a common duty with third countries was adopted. Since 1971, the EU receives 80% of the duties collected. EU Member States keep 20% of the amounts as collection costs.

All goods that enter into or are sent out of the EU are classified with an integrated code called TARIC (Integrated Tariff of the European Union). Furthermore, a customs code is assigned by the World Trade Organization to all goods, through a harmonized system.

Currently, the legal base of the common custom tariffs is found in the Treaty of the European Union and in the following pieces of legislation:

- Council Regulation (EEC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff

The management of the customs tariffs and policy is a jurisdiction of the EU and the Member States cannot modify it on a unilateral basis.

For the purpose of the proposal it is also worth analysing the EU VAT regulation. The application of VAT corresponds to national tax authorities, but there are some standard EU rules that all Member States need to follow.

The main piece of legislation in relation to this tax is the Council Directive 2006/112/EC of 28 November 2006 on the common system of value added tax. Each Member State is responsible for the transposition of these provisions into national legislation and their correct application within its territory. In addition, binding measures to ensure uniform application of the VAT Directive can be found in the VAT Implementing Regulation (Council Regulation (EU) No 282/2011). Those measures are directly applicable without transposition into national law.

The VAT applies to:

- The supply of goods
- The intra-community acquisition of goods
- The supply of services
- The importation of goods

The exports to non-EU countries are exempt of VAT.

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42 The customs tariffs are the same for each Member State, i.e., all of them apply the same tariffs to the same products.
The VAT Directive allows for different types of rates: a general or standard rate and reduced rates (Member States may apply one or two reduced rates).

VAT is collected by Member States. A part of the revenues generated is used to finance the European Union, as part of the own resources: a uniform rate of 0.3 % is levied on the harmonised VAT base of each Member States.43

43 http://ec.europa.eu/budget/mff/resources/index_en.cfm

Research paper on a European tax on plastics

www.zerowasteeurope.eu
5. Legal nature of the proposed instrument

The proposed tax could mainly be implemented in two different ways:

1) As a new and independent tax
2) As a tax integrated in or linked to an existing tax

It has to be taken into account that within the framework of the treaties of the European Community and the European Union, all decisions related to taxation to be taken at European level are subject to the unanimity rule.

The European Commission has provided arguments for the approval of some taxation issues by qualified majority instead of unanimity. Among these issues are environmental measures, and more specifically, taxes on packaging and packaging waste. However, so far this proposal has not succeeded.

Despite the unanimity rule, there may be some practical differences depending on the option chosen for implementing the instrument. Below is a description of the main features of each possibility and the pros and cons of each of them.

1) A new and independent tax

This option has two different approaches:

1.1 An independent tax fixed at EU level

The tax would be collected by the Member States, and all revenues -or an important part of them- would go to the European Union. The tax rates and the main arrangements for administering the tax would be established and regulated at EU level.

This was the approach of the Carbon tax proposed by the European Commission in 1992 (see section 1 for more details).

The definition of the main elements would be articulated by means of an EU regulation, such as the one currently applied to custom duties. A number of implementing details could, however, be left to Member States in accordance with the principle of subsidiarity. This flexibility would allow Member States to optimise the use of existing administrative structures so as to reduce the administrative burden and the cost for operators, users and authorities.

1.2 An independent tax regulated at EU and national level

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45 As it is the case for VAT, for instance.
In this case, an EU Directive would define the main aspects of the tax (e.g. destination of the revenues, minimum tax rates, etc.) and Member States would have flexibility for defining the details of the tax (among which, the tax rates above the defined minimum rates, and some exemptions).

Again, the tax would be collected by the Member States. This would be similar to what currently happens with energy taxation or VAT, which are also regulated through Directives. A possible configuration would be that the revenue corresponding to the minimum tax rates would go to the EU, whereas the revenue corresponding to tax rates above the minimum levels would go to the national treasuries.

While in principle both of the previous options ensure certainty in the amount of revenues only the first one would guarantee a completely uniform application of the tax across all Member States.

2) A tax integrated in or linked to an existing tax

In this case, the tax would be included or linked to an existing tax. This is for example the case of electricity taxes in some EU countries, which are linked to VAT.

This option would reduce the visibility of the tax, but would also reduce the administrative costs for Member States.

This tax could be regulated through an EU regulation or through a Directive. VAT seems the most adequate tax to link to. In that case, the plastic tax would be conceived as an *ad valorem* tax (i.e. a tax whose base is the price of the product; see section 7.1 for more details).
6. Likely impacts of the tax

Although the impact of a plastic tax will depend completely on its design, this section presents some general considerations on its possible impacts on competitiveness, on the different types and uses of plastics, and on the environment. The analysis of these different elements provides insights on elements to consider when presenting recommendations for its design.

6.1. Competitiveness

The effect of environmental policies on companies’ competitiveness and on national economies is a matter of concern.

There are environmental policies that, in the short term, induce costs on some sectors and typically, on the most polluting ones. The goal of such policies is reducing the environmental problems caused by the targeted products or sectors, and in some occasions the reduction of such problems goes parallel to the reduction of the economic activity that causes them. That may be the case when there is overproduction of some problematic materials, such as it is clear the case for some plastics. Of course, applying policies that may have an incidence on the overall production levels is likely to have an economic impact on that specific sector.

Another different question is whether that can be considered an undesired economic impact on the economy as a whole. Environmental externalities are commonly acknowledged as a cause of economic inefficiencies (Field, Field, 2006). Thus, the reduction of externalities that would imply the adoption of an environmental tax would not only reduce environmental impacts but make markets more efficient. Second, when properly designed, environmental policies generate innovation and new economic opportunities (Porter, van der Linde, 1995) (e.g. new materials).

Furthermore, not adopting environmental policies leads to other costs that are deemed to be higher than adoption costs, the so-called costs of inaction (OECD, 2008). Among these costs are environmental degradation and natural resources over-exploitation, which are fundamental to sustain the national economy, and which also affect industries that rely on a healthy and clean environment (e.g. some forms of tourism).

However, tackling environmental problems should try to minimise effects on competitiveness of the plastic industry within the EU. In this case, the effect of the tax on production inside the EU—as compared to production outside the EU—should be taken into account. In this sense, it has been noted that a tax levied at any stage prior to final consumption should be accompanied by tariffs on imports and tax exemptions/redemptions on exports in order to ensure a fair competition framework within the EU. Tariffs and exemptions should be applied to all the stages downstream the value chain after the point where the tax is applied (see section 3, figure 2).

6.2. Elasticity: behavioural responses to the tax

Elasticity refers to the responsiveness of demand to a change in prices of a product, so it indicates how consumers’ behaviour changes as prices increase/decrease. It is measured as the percentage change in the quantity purchased of a product divided by the percentage change in its price\(^4\). A product can be classified in terms of its elasticity as:

- **Inelastic**: when elasticity is less than 1 (in absolute terms), which means that the changes in prices are contested by changes in demand, but in a smaller proportion. In terms of a plastic tax, it would imply little behavioural changes in response to a tax.

- **Unit elastic**: demand changes at the exact proportion of prices (elasticity equals 1 in absolute terms). In terms of a plastic tax, it would imply a change in plastic demand proportional to the increase in prices driven by the tax. For example, if the tax increases leads to 20% price increases, it would be accompanied by 20% reduction in demand.

- **Elastic**: the demand is elastic when it changes in a greater proportion than prices, therefore elasticity is greater than 1 (in absolute terms). In terms of a plastic tax, it would imply that a low tax rate would lead to a dramatic drop in plastic demand.

Elasticity is therefore relevant because it gives an indication on the impact of the tax over consumption (i.e. also referred to as tax elasticity, referring to the behavioural change in terms of demand reduction, related to an increase in prices, for example driven by the introduction of a new tax or the increase of an existing one), so it should be taken into account in the design of the overall tax scheme, notably the tax rate. According to the previous explanation, the more elastic the demand, the lower the tax rate necessary to reach a certain demand reduction, and therefore the more effective environmental taxes are.

It should be noted that elasticity is non-linear, and thus might change at different price levels. Also, elasticity has to be defined for a timeframe. Generally, elasticity increases in the long term, as some of the alternatives that appear as a response to price increases need some time to develop (e.g. technological improvements).

In the case of a tax on plastic, elasticity should be referred to the product on which the tax is levied (e.g. resins, monomers, etc.). According to the possibilities presented in section 3, the elasticity of monomers, resins and final products is approached from a theoretical point of view. Further research will be needed in order to properly model the elasticity of plastics.

**a) Price elasticity of monomers**

Each type of monomer has different properties and substitutes, so these can be considered independent products, therefore each monomer might have different price elasticities that should

\(^4\) For a brief explanation on price elasticity see: https://goo.gl/Y1Nu1R
be independently addressed (i.e. modelling the specific elasticity of ethylene, benzene, etc.). For example, Sengupta and Pike (2012, p 403)\(^49\) estimated the elasticity of ethylene (for all uses of ethylene, besides plastic manufacturing) to be -0.416 in 2009, which according to the above explanation entails an inelastic demand: increases in price would drive to limited reductions in consumption\(^50\).

Furthermore the elasticity of the demand for monomers devoted to plastic production should be approached independently from other monomers’ uses, in order to have a proper orientation. Some aspects to take into account are that in the short term, the elasticity of monomers devoted to plastic manufacturing can be affected by the storage capacity, as it is reflected in market reports\(^51\) (purchasing and storing monomers where these are cheap allows to stop buying monomers for a certain period of time where these are more expensive). Moreover, the effect of substitutes (bio-based feedstocks) is limited, according to its current market share.

The behavioural response to a tax on monomers would depend on to what extent the tax is passed through the next stages of the value chain, thus depending on the elasticities of the different types of plastics and their finished products.

b) Price elasticity of virgin resins

As in the case of monomers, each resin has different uses and substitutes, so the individual elasticity of each resin should be modelled on a resin per resin basis.

Assuming a theoretical close to unit elasticity for plastics\(^52\), a tax levied on virgin resins could have a significant impact on the demand for these products, and therefore curb plastic consumption. However, for a given tax rate, the effect can be expected to have dissimilar effects over the different types of resins. In any case, updated data on elasticities would be required to have a consistent view on the magnitude of behavioural responses to a tax on resins.

c) Price elasticity of plastic products and products containing plastics

The elasticity of plastic products should also be evaluated product by product. Similarly to the case of resins, their elasticity will rely upon substitutes plus the share of the costs of a product related to its plastic content.


\(^51\) See for example: www.plasticstoday.com

For example, the demand for plastic water bottles has been found to be inelastic\textsuperscript{53} because there are not suitable substitutes for PET bottles in the case of water. Another interesting case is plastic bags. In South Africa\textsuperscript{54}, elasticity was high in the short term (as a kind of “overreaction” for paying for a product that was formerly obtained for free), although it decreased over time since taxes rates were not sufficiently high. In Wales\textsuperscript{55}, after three years of the introduction of a single use carrier bag charge, results show a moderate behavioural change regarding plastic bags, at relatively high rates.

From a theoretical point of view, a given tax rate could increase the price of a toy made of plastic only, which could lead to a reduction in its demand. However, for the same tax rate, the demand for computers would hardly notice such price increase. In the case of films for food packaging, the demand could be also quite elastic, since a number of dairy products could be indeed sold without any packaging materials.

No specific assumptions can be made \textit{a priori} for the whole of plastic products and products containing plastics in terms of their price elasticity, besides theoretically, it can be expected to be positive.

\textbf{6.3. Most affected plastics and most affected uses}

The demand for resins has the structure shown in figure 3. Polypropylene is the most demanded individual polymer with 19.3\% of total resins demand, followed by the lighter and dense forms of polyethylene. These three groups of polymers add up to 49\% of the EU demand for resins.

Regarding international trade, the most relevant polymers are those derived from ethylene, polyacetals and propylene polymers for imports, whereas the polymers of ethylene, polyacetals, vinyl-chloride and propylene cover the largest share of exports.


The impact of the tax on the different plastics will depend upon the configuration of the tax (tax base, fix or variable tax rate depending on the monomer/polymer, etc.) and their relative elasticity (particularly the existence of alternative materials).

As for the different uses, packaging is the individual sector taking the largest share of the EU demand for resins with 39.9%, followed by building and construction (16.7%). Other relevant sectors are automobiles, electronic equipment and agriculture.
Again, the incidence of the tax on the different uses will depend completely on the structure of the tax and on the elasticity of these different plastic uses. For a given tax rate, those uses where plastic provides lower added value and where plastic has good alternatives will tend to show the largest reactions in demand reduction. Packaging seems an area where such circumstances might take place, thereby relevant reductions should be expected.

6.4. **Environmental effects**

As it has been mentioned before, there is a large number of types of plastics, and their environmental impact may differ in terms of resources need for their production (energy, water, etc.), and in terms of impact when they are disposed of or littered on the environment. Besides, the impact also depends on the type of additives included in the plastic (e.g. some flame retardants, inks containing heavy metals, etc.) and even on the size and shape of the products, which may induce more littering (e.g. microbeads).

The environmental effects of the tax will obviously depend on which plastics and uses will be most affected by the tax (section 6.3), and on the response adopted by the plastic sector and by sectors providing alternative materials.

It is expected that for those uses where the tax has the highest effect (that is, where the effect is highest compared to the price of the product) and where the demand is more elastic, a tax on
plastic will turn into a decrease of the overall plastic consumption and, for some uses, a shift to other materials that can substitute it.\footnote{In some cases, where the use of plastic is more essential, an increase in the efficiency is likely to occur (i.e. to reduce the amount of plastic used for the same purpose), in some cases, where the use of plastic is less (e.g. some packaging), a change in the design is likely to occur. And in other cases, there can be a substitution of plastic by other materials (e.g. cardboard or glass).}

This could be the case of the packaging sector. As it has already been experienced, during the last years packaging manufacturers have already taken lightweighting actions to reduce the amount of plastic used for a single packaging. These have been voluntarily approaches that could be intensified with the application of a plastic tax.

One possible scenario for the packaging sector is the substitution of plastic packaging by other materials such as aluminium or glass that would provide better economic performance. For other sectors where the demand is more inelastic (which could be the case of the construction and automobile sectors) the tax would foster research aimed at improving ecodesign of the products, and a reduction of the overall consumption of virgin resins. However, the effect in those sectors would be smaller, at least in the short-term.

In any case, where plastic is substituted by other materials, it has to be taken into account that the environmental impact of the alternatives could occasionally be higher, which would be a clear drawback of the measure and something to carefully consider during the design of the instrument. Although application of LCA is necessary to conclude on the comparison of different alternatives, some possible substitutes (like, for example, aluminium cans) are unlikely to perform better in environmental terms. Rather than this being a case not to tax plastic externalities, this should be understood as a case to also tax the externalities of other raw materials.

Another desired effect of the tax on plastic would be fostering the recycled materials market, which is far from its potential. The European market of recycled plastic is foreseen to increase, which in turn would foster job creation in this sector and would increase the security of supply. This could be also fostered by the Chinese ban on imports of plastic from Europe which has recently been passed.

However, in order to fulfil the needs of the plastic sector, improvements in the current waste collection systems should take place. This is because the quantity and quality of the materials collected is currently rather low, which makes it difficult for plastic to be recycled and used for some purposes. Therefore, one of the likely effects of the tax is the plastic industry fostering the improvement of waste management in Europe, and particularly the improvement of plastic separate collection, in order to increase the quality of the recycled plastic.

Finally, this, in turn, could lead to a reduction of plastic littering, which is widely acknowledged as one of the most worrying environmental effects of plastic use and one of the main reasons why environmental organisations foster the introduction of such a tax on plastics.
7. Recommendations

This section builds on the learnings derived from the previous ones and analyses several aspects to consider when defining the main constituent elements of the tax, particularly the tax base and the tax rate. The idea is not to present a unique configuration for the possible tax, but an array of possible options, and some considerations to narrow down the number of most feasible solutions. Finally, some estimation of possible revenues are presented.

7.1. Tax base

The tax base could be either the weight or the value (i.e. the same tax base as for VAT) of the product on which the tax is levied (see section 3). Both options have general advantages and disadvantages:

- If the tax were levied on monomers, the tax base could be either the weight or the value of the monomers (ethylene, propylene, etc.) where they are purchased by plastic manufacturers.

- If the tax were levied on resins, the tax base could be levied on either the weight or the value of resins where they are sold by plastic manufacturers or where they are purchased by converters.

- If the tax were levied on the final consumption of plastic products, the tax base would be formed by the weight of the plastic contained in the product placed in the market. In this case, an ad valorem tax would be unmanageable in practice, as the price of the products is not closely related to the plastic content.

Table 2. Summary of the pros and cons of the different tax bases

<table>
<thead>
<tr>
<th>Type of tax base</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
</table>
| Price (ad valorem tax) | ● Easy to manage, particularly when the tax base is the same as for VAT.  
● Directly related to tax elasticity.  
● Automatic adjustment by inflation/income. | ● Difficult to relate to environmental pressures.  
● Revenues are not stable for products with high price volatility.  
● Very difficult to manage in products containing plastic, when charged at the consumption stage.  
● Incentive for manufacturers to produce low-priced products. |
| Weight | ● Easier to relate to environmental effects of the product, although weight is a far from being a perfect indicator of environmental impact (e.g. small and light | ● Difficult to manage in products containing plastic.  
● Non-sensitive to inflation/income. |

[57] https://goo.gl/mmLx2t
items are more likely to cause littering).
● Revenues are predictable for products with high price volatility.

Table 3 shows the main figures for some of the considered tax bases.

**Table 3. Production, imports and exports of virgin resins; imports and exports of plastic products and products containing plastics; and imports and exports of plastic waste.**

<table>
<thead>
<tr>
<th>Flow</th>
<th>Amount</th>
<th>Year</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converters demand (for resins)</td>
<td>49 Mt</td>
<td>2015</td>
<td>Plastics Europe, 2018; referred to EU28+Nw+Sw</td>
</tr>
<tr>
<td>Converters demand (for resins)</td>
<td>49.9 Mt</td>
<td>2016</td>
<td>Plastics Europe, 2018; referred to EU28+Nw+Sw</td>
</tr>
<tr>
<td>Production (of resins)</td>
<td>58 Mt</td>
<td>2015</td>
<td>Plastics Europe, 2018; referred to EU28+Nw+Sw</td>
</tr>
<tr>
<td>Production (of resins)</td>
<td>58 Mt</td>
<td>2016</td>
<td>Plastics Europe, 2018; referred to EU28+Nw+Sw</td>
</tr>
<tr>
<td>Production (of resins)</td>
<td>60 Mt</td>
<td>2017</td>
<td>Plastics Europe, 2018; referred to EU28+Nw+Sw</td>
</tr>
<tr>
<td>Imports (extra EU) of plastics in primary forms (categories 3901 to 3914 of the combined nomenclature)</td>
<td>7.9 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Exports (extra EU) of plastics in primary forms (categories 3901 to 3914 of the combined nomenclature)</td>
<td>12.8 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Imports (extra EU) of plastics products (categories 3916 to 3926 of the combined nomenclature)</td>
<td>5.3 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Exports (extra EU) of plastics products (categories 3916 to 3926 of the combined nomenclature)</td>
<td>4.9 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Imports (extra EU) of plastics waste (category 3915 of the combined nomenclature)</td>
<td>0.4 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Exports (extra EU) of plastics waste (category 3915 of the combined nomenclature)</td>
<td>3.2 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Imports (extra EU) of products containing plastics</td>
<td>1 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
<tr>
<td>Exports (extra EU) of products containing plastics</td>
<td>0.4 Mt</td>
<td>2014</td>
<td>Eurostat. ComExt database, referred to EU-27</td>
</tr>
</tbody>
</table>
Estimating the tax base for a tax levied on monomers where these are purchased by plastic manufacturers

Data on monomers sold to plastic manufacturers could not be found. The trade of monomers devoted to plastic production could not be calculated from trade statistics, since non-energy uses of these are not reported separately.

The production of resins in 2016 was 58 Mt, to which recycled resins were estimated to contribute with 1.9 Mt\(^{58}\) to the EU domestic production of resins. Assuming no significant losses in the plastic manufacturing process, the demand for monomers by plastic manufacturers should be similar to the production of virgin resins minus the input of recycled resins: 56.1 Mt in 2016.

Taking the last available data on extra EU trade from Eurostat, which is referred to 2014:

- Imports: 7.9 Mt of resins, 5.3 Mt of plastic products and at least 1 Mt of products containing plastic could be potentially subject to tariffs.
- Exports: 12.8 Mt of resins, 4.9 Mt of plastic products and at least 0.4 Mt of products containing plastic could be potentially subject to exemptions.

An estimate for a tax base levied on the weight of virgin resins where these are sold by plastic manufacturers would be between 52.2 and 56.1 Mt depending on tariffs and exemptions. This estimate assumes no amount of recycled monomers entering plastic manufacturing and tariffs and exemption only on certain products\(^{59}\), easily traceable through the combined nomenclature.

Estimating a tax base levied on the weight of monomers where these are purchased by plastic manufacturers has not been possible due to lack of data.

Estimating the tax base for a tax levied on virgin resins where these are sold by plastic manufacturers

An estimate for a tax base levied on the weight of virgin resins where these are sold by plastic manufacturers would be between 52.2 and 58 Mt depending on tariffs and exemptions.

The value of production could not be calculated due to lack of data on its structure (e.g. the share of each type of resins produced).

The value of imports for resins (categories 3901 to 3914) in 2014 was: 13.7 billion €, whereas the value of export of resins in 2014 was: 23.69 billion €.

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\(^{58}\) Bio Intelligence Services, 2013. Study on an increased mechanical recycling target for plastics, Final report prepared for Plastics Recyclers Europe.

\(^{59}\) Those mentioning “made of plastic” within its denomination in the combined nomenclature.
The value of imports of plastic products (categories 3916 to 3926) in 2014 was: 20.1 billion €, whereas the value of exports of plastic products in 2014 was: 24.6 billion €.

**Estimating the tax base for a tax levied on virgin resins where these are purchased by converters**

Resins demand was estimated to be 49.9 Mt in 2016. Recycled resins were estimated to contribute with 1.9 Mt\(^{60}\) to the EU domestic production of resins.

Taking the last available data on extra EU trade from Eurostat, which is referred to 2014:

- **Imports**: 5.3 Mt of plastic products (categories 3901 to 3914) and at least 1 Mt of products containing plastic could be potentially subject to tariffs.
- **Exports**: 4.9 Mt of plastic products and at least 0.4 Mt of products containing plastic could be potentially subject to exemptions.

An estimate for a tax base levied on the weight of virgin resins where these are sold by plastic manufacturers would be **between 48 and 49 Mt** depending on tariffs and exemptions. This estimate assumes tariffs and exemption levied only on certain products easily traceable through the combined nomenclature.\(^{61}\)

According to the breaking down of demand into types of resins (plastics Europe), and prices of virgin resins (Plastics News Europe), the market value of the EU demand for resins could be close to 59 billion € in 2016.\(^{62}\)

The value of imports of plastic products in 2014 was: 20.1 billion €, whereas the value of exports of plastic products in 2014 was: 24.6 billion €.

**Estimating the tax base for a tax levied on plastic products**

As the combined nomenclature for foreign trade does not allow for a thorough identification of products containing plastics, it is not possible to have a sound estimation of the tax base in this case. Therefore, if the tax was to be charged at this stage a revision of the combined nomenclature would be needed.

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\(^{60}\) Bio Intelligence Services, 2013. Study on an increased mechanical recycling target for plastics, Final report prepared for Plastics Recyclers Europe.

\(^{61}\) Those mentioning “made of plastic” within its denomination in the combined nomenclature.

\(^{62}\) Calculated as the averages price between September 2017 and February 2018 (Plastics Europe, 2018) multiplied by the demand for resins in 2016 (Plastics Europe, Plastic Facts REF) for PE-HD, PE-LLD, PE-LD, PE-HD, PP, PS, PVC and PET in 2016, which add up to some 73% of demand. Assuming a conservative average price for the rest of resins of 500 €/t.
7.2. The theoretical approximation to defining tax rates

There are basically two theoretical approaches when it comes to defining tax rates in environmental taxes. Environmental economists favour the idea of pigouvian taxes, which means defining tax rates at the level of the externality caused by the element that is taxed. Conversely, ecological economists defend setting the tax rate at a level whereby the tax reduces the demand for the taxed product to a target level previously defined.

However, both approaches have practical limitations. As for the pigouvian approach, it is virtually impossible to assess the cost of externalities and express it in monetary terms. In the case of plastic, the impacts depend on the type of plastic, but particularly on its uses and on where the impacts take place. The ecological economics approach would require a significant understanding of the price-elasticity of plastic demand, which again is different for each plastic and for its different uses; and it also changes through time (section 6.2).

Although advancing in understanding the external costs of plastic production and consumption, and the price-elasticities of its demand, may inform the debate on where to set the tax rates, one should acknowledge that defining the tax rates will be essentially a process of negotiation. Two elements would be crucial in this negotiation: defining possible reduction targets for plastic production and consumption, and defining revenue targets. The more ambitious these are, the higher the tax rate will need to be.

7.3. The practical dimension of tax rates and related revenue in the context of the Brexit gap

In the case of an EU tax on plastic, further considerations beyond environmental motivations should be considered, since the proposal of such tax is made in the context of the UK leaving the EU, and the corresponding financial gap. Indicatively, assuming a financial gap of 12 to 13 billion € annually, an average tax rate of approximately 287 €/t would fill the gap, being the tax base the weight of resins purchased by converters, applying tariffs on imports of plastic products and products containing plastic, considering recycled plastic not subject to the tax, and exempting the exports of plastic products and products containing plastic. This amount could be a starting point for negotiations and further considerations (e.g. ad valorem vs weight-based tax scheme, modulation of the tax rates, etc.).

This represents 15% of the average price of virgin PS between September 2017 and February 2018, and 25% of virgin PET for the same period. Price volatility for the main resins in that period:

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63 Estimate based on: https://goo.gl/1eJ8ny
64 This figure has been calculated by subtracting the UK share on resins demand (7.5% in 2016 according to Plastics Europe REF) from the overall tax base.
65 In the case of plastic products and products containing plastic, the weight of imports and exports has been used for calculating the tax rate, although the correspondence between the weight of these products and the equivalent weight of resins should be carefully taken into account. Otherwise, both imports and exports would be penalised. Assuming that the transformation of resins into plastic product would have 10% losses, the resulting average tax rate would remain similar.
66 http://www.plasticsnewseurope.com/topics/1039/opinions
ranged from 5% for virgin PE-LD and 19% for virgin PS. Therefore, an average tax rate aimed at filling the Brexit gap would have an impact over resin prices similar to the variability of prices in the market (see figure 5).

On the question of a possible modulation of the tax rates according to the type of resin, this could be acceptable in principle if this modulation is backed on a different environmental performance of the different resins, based on LCA. This could be done both in the case of an *ad valorem* tax (defining different percentage rates) or in case of using weight as the tax base (in this case defining different tax rates -€/t- for the different resins).

The table below shows some rough calculations on the revenue and change in demand obtained by several tax rates and considering several hypothetical elasticities, assuming a tax base of 50 Mt (an acceptable proxy for several of the tax bases commented in section 7.1) and an average price for virgin resins of approximately 1,300 €/t (Figure 5).

**Table 4. Revenue under different scenarios of tax rates and elasticities (billion €)**

<table>
<thead>
<tr>
<th>Elasticity / Tax rate (€/t)</th>
<th>100</th>
<th>250</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.5</td>
<td>4.81</td>
<td>11.30</td>
<td>16.92</td>
</tr>
<tr>
<td>-1</td>
<td>4.62</td>
<td>10.10</td>
<td>13.85</td>
</tr>
<tr>
<td>-1.5</td>
<td>4.42</td>
<td>8.89</td>
<td>10.77</td>
</tr>
</tbody>
</table>

**Table 5. Change in demand under different scenarios of tax rates and elasticities (%)**

<table>
<thead>
<tr>
<th>Elasticity / Tax rate (€/t)</th>
<th>100</th>
<th>250</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.5</td>
<td>-3.85</td>
<td>-9.62</td>
<td>-15.38</td>
</tr>
<tr>
<td>-1</td>
<td>-7.69</td>
<td>-19.23</td>
<td>-30.77</td>
</tr>
<tr>
<td>-1.5</td>
<td>-11.54</td>
<td>-28.85</td>
<td>-46.15</td>
</tr>
</tbody>
</table>

It is also interesting to illustrate the effect on some specific items of a tax rate defined per ton. As an example, a rate of 280 euros per ton of plastic, would translate into a value of 0.009 euros per bottle or 0.002 € per bag\(^67\), which would be hardly noticeable for the final consumer and which is orders of magnitude lower than some of the taxes tackling these products (e.g. 0.1308 €/unit for disposable bottles in Norway or 0.22 € per bag in the Irish plastic bag levy\(^68\)). In other cases, e.g. a


toy containing 100 g of plastic, the amount corresponding to the tax would be higher (0.028 €, considering the same tax rate), but its price is also much higher, and therefore the effect on the consumer would again be low.

These examples show how taxing plastic resins would reduce the overall demand and would have an incidence on the type of resins used, but would have a rather limited effect on influencing the behaviour of final consumers. This also illustrates that if the tax was to be charged at the consumption stage, the tax rates would probably need to be higher.

![Figure 5: Prices of different virgin resins (€/t, Sept 2017-Feb 2018)](source)

**7.4. Possible tax credits and exemptions**

Recycled plastics should not be subject or should be exempt of the proposed plastic tax. This would be coherent with the environmental objective of reducing resource consumption and foster the circular economy.

More controversial is whether the proposal should include tax credits or exemptions for certain types of plastics according to their level of [bio-based feedstock and biodegradability/compostability](#).
The so-called bio-based plastics are made from bio-based polymers such as vegetable fats and oils or corn-starch. Most bio-based plastics biodegrade faster than fossil-fuel derived plastics, so they are at the same time renewable and compostable. But this is not the case for all bio-based plastics.

Tax credits could thus potentially be considered for bio-based plastics, justified because they are based on non-fossil, biomass resources. However, the production of bio-based plastics has also environmental impacts, such as the occupation of lands that could be used for food production, the associated energy and water requirements, etc.69 Besides, bio-based plastics are not necessarily compostable, so they also produce an environmental impact when littered.

Potentially, a tax reduction could also be considered for fossil-fuel derived plastics if they are compostable, since their impact on the environment when littered is lower than for conventional plastics.

As a general conclusion, any possible tax credit on bio-based/compostable plastics should be backed by specific life cycle assessments, including an assessment on the compostability of the material.

Some common difficulties for applying these tax credits and exemptions should be taken into account:

- If the tax is applied at a monomer stage, there are no substitutes based on recycled plastic, so they would be out of scope of the tax
- If the tax is applied at a polymer stage, mixtures of different kinds of plastics can be found (e.g. recycled-non recycled, bio-based/fossil plastic)
- For taxes applied to imports, a certification scheme would be needed in order to identify the composition of the product.
- For already manufactured products, which may include a certain content of recycled materials, they would need to be certified, making the application of the tax more complex.

In any case, these possible tax credits and exemptions would be additional to the already mentioned exemption on exports of plastic resins and possibly plastic products.

**7.5. Other recommendations**

The tax should be introduced progressively (e.g. growing tax rates over a transitional period of time). The tax scheme, schedule and details should be shared in advance in order for the industry to make the necessary arrangements and adaptations to the new framework.

Although environmental taxes have proved in numerous occasions that they can be effective in changing the behaviour of companies and individuals, there are also clear indications that sound...
combinations of policy mixes are most adequate when dealing with complex environmental problems,\textsuperscript{70} like the ones caused by a generalised use of plastic. In this sense, any action in relation to plastic taxes should be compatible with other regulatory or economic measures already in place (such as EPR for certain uses like packaging or tyres), deposit-refund schemes ensuring high capture rates, etc. Rather, a plastic tax could possibly foster an improvement in the performance of some of these schemes, as it would be more attractive to capture high quality materials for the recycling markets.

Moreover, the proposed tax should not be contradictory with some more strict measures, such as bans, if such measures were considered to be adequate to address the pollution problems caused by certain very specific uses or products (e.g. microbeads, already banned in some countries, or plastic straws). The polluter pays principle should not be confused with a right to pollute.

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References


