European Commission

JRC TECHNICAL REPORT

Impact of interventions regulating Endocrine Disruptors on trade dynamics for EU Member States

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2020

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EUR 30340 EN

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EU Science Hub
https://ec.europa.eu/jrc

JRC120335

EUR 30340 EN

PDF ISBN 978-92-76-21437-3 ISSN 1831-9424 doi:10.2760/59702

Luxembourg: Publications Office of the European Union, 2020

How to cite this report: Canzian, G., Giua, L. and Verzillo, S., *Impact of interventions regulating Endocrine Disruptors on trade dynamics for EU Member States*, EUR 30340 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-21437-3, doi:10.2760/59702, JRC120335.

Contents

1 Introduction

The recent scientific literature has proven that some chemicals, usually known as "Endocrine Disruptors" (EDs), may have harmful effects on humans' endocrine system. Given that EDs interfere with the human endocrine system, the exposure to these chemicals may have long-lasting effects on individuals and even have consequences on future generations (e.g. via in utero exposure). Moreover, EDs can have strong, negative and long lasting consequences for the environment and in particular for the reproduction of certain species.

The growing concern about the negative effects on human health and on the environment brought about by EDs has prompted the EU to take action and to introduce specific legislative provisions aimed at reducing human and environmental exposure.

Indeed, the implementation of restrictions on the use of certain chemicals might influence not only the production process but also the commercialization of the final products interested by the regulation. In particular, the ban could work as a non-tariff measure and potentially modify trade relationships between EU Member States and third countries not subject to the same regulatory interventions.

The aim of this study is to address the potential unintended consequences that EU Regulation on EDs could have had on trade patterns between Europe and the rest of the world. More precisely, the analysis sheds some light on the possibility that the regulation hampered the exporting capacity of European countries.

The analysis focuses on two legislative initiatives related to EDs, namely, the group of regulatory interventions implemented since 1999 to control the use of certain low-molecular weight phthalates misuse and the restriction on the UV-filter 3-benzylidene camphor (3-BC) under the cosmetic products regulation enforced in 2016.

The study considers trade flow patterns occurring between EU Member States and the rest of the world, before and after the onset of the EU regulatory interventions. The model accounts for various sources of heterogeneity, which might be due to importer- and exporter-specific characteristics, common temporal shocks and time-invariant qualities of each commodity, plus a set of geographical and socio-economic attributes which can vary across countries or pair of partner countries (e.g. distance, GDP, whether importer and exporter share a common language or a trade agreement, etc.). Thus, the estimates presented in this report are intended as net of these factors.

Since data on trade is aggregated at the level of commodity, the identification of the exact amount of goods containing low-molecular weight phthalates or 3-BC is not feasible.[1] For this reason, the estimates presented in this report identify changes in trade flows for a group of goods that is larger than the one actually addressed by the interventions, especially for 3-BC. The commodity used to capture changes in the use of phthalates is the one containing plasticisers. Variations in the flows of goods containing 3-BC are measured in terms of traded cosmetics and toilet preparations for the care of skin.

The first part of the study concerning phthalates shows that the volume of traded plasticisers involving EU Member States has decreased in the years following 1999, that is when a number of restrictions on the use of certain low-molecular weight phthalates were put in place. While the timing of the different regulatory policy changes does not allow a causal interpretation of this negative relationship, the results are consistent with a decrease in the amount of plasticisers traded among EU Member States (and with non-EU partner countries) during the early 2000s.

In the second part of the analysis, where the 3-BC ban under the Cosmetic Products Regulation is investigated, the volumes of traded cosmetics for EU Member States appear to increase significantly both with respect to the flows occurring among non-EU countries and to the intra-EU flows referred to a comparison commodity. The estimated positive and statistically significant effect is consistent both with manufacturers in Europe adjusting to the higher standards, and consequently boosting the value of the traded goods within this category, and with a change in the behaviour of European consumers, which might have increased their preferences for products made in the EU over those imported from outside Europe.

It is important to emphasize that the effectiveness and the efficacy of such interventions in addressing their primary goal, i.e. the protection of the environment and of European citizens' health, are not questioned. Instead, this report aims provides evidence on how legislative initiatives motivated by environmental and health concerns impact on the functioning of the internal market in the context of global trade flows.

The remainder of the report is organized as follows. The next section is devoted to the presentation of the gravity model, that is, the empirical framework adopted in the analysis. Section 3 describes the data used and Section 4 outlines the empirical methodology. Section 5 presents the details of the first case study - namely, the interventions limiting the use of phthalates - and the empirical evidence related to it. Section 6 briefly describes the restriction on the UV-filter 3-benzylidene camphor (3-BC) under the cosmetic products regulation and offers the quantitative results of its assessment. Finally, Section 7 concludes.

[1] This also implies that it is not possible to compute the share of these goods over the total value of the commodity, nor establishing whether this varies over time.

2 The gravity model with DiD

Since many years, the international trade literature has adopted the so-called gravity model to explain trade dynamics between countries and to estimate the trade impacts of various trade-related policies. Gravity models relate the magnitude of trade between countries to a series of country-specific characteristics - notably, their economic size and level of economic development - and to factors stimulating or discouraging the movement of products between countries. The latter include transportation costs, usually proxied by the presence or absence of a shared land border and by geographic distance, and informal and formal trade barriers, often proxied by the existence of a common language and by the presence of free trade agreements.

Among other applications, gravity models have been used to evaluate trade under Non-Tariff Measures (NTM, hereafter). Results on the effects of NTM on trade flows are mixed. Older contributions from the trade literature show that NTM are trade-impeding (Henson and Loader, 2001; Otsuki et al., 2001). However, recent studies suggest that NTM such as the introduction of product standards, do not have a consistently negative effect on trade and, on the contrary, they potentially enhance it (Colen et al., 2012; Shepherd and Wilson, 2013).

Even though the analysis of this report takes inspiration from this literature, the principal goal here is to shed light on the causal impact of the implementation of the interventions on two endocrine disruptors chemical on the trade flows of targeted countries (EU member states) with respect to non-affected ones.

Among the available econometric methods for non-experimental causal inference the Difference-in-Difference (DiD) approach is the one which better suits the institutional setting under investigation. DiD method compares the change from before to after the implementation of a policy on a selected outcome (e.g. trade flows) of a treated group of units/countries relative to the same change from before to after the policy of a control group of units/countries considered as a good counterfactual (Card and Krueger, 1994).

As detailed in Section 4, following some recent examples (Chen et al., 2018; Tello, 2015), this report aims at adopting the DiD methodology within a gravity framework in order to evaluate the effect of the introduction of the regulatory initiatives mentioned above on EU countries' trade flows.

3 The Data

Analyses are carried out on a panel dataset of worldwide bilateral import trade flows (in current US dollars) of some specific commodities that have been affected by ED-related interventions. In addition, we collect worldwide import trade flows of a few products within the same economic sector of those interested by the interventions, which may be considered completely unaffected because they do not include the restricted substance under consideration. The import data were retrieved from the United Nations Commodity Trade Statistics Database (UN COMTRADE) for the years running from 1995 to 2018.[2]

Additionally, we collect data on control variables that are typically included in standard gravity models, such as the GDP, the size and the population levels of both countries, the geographical distance between them, whether they share a common language or (past or current) colonial ties. These variables were collected from CEPII and the World Bank.

[2] UN COMTRADE provides data on both import and export flows. In theory, country A reported imports from country B would match with country B reported exports to country A. However, as suggested by the World Bank (see this report) this is not always the case for several reasons and the difference between the two measures is between 10% and 20%. In particular, imports are usually recorded with more accuracy than exports because imports generate tariff revenues while exports do not. For this reason the report focuses on import trade flows only.

4 Empirical Framework

The empirical analysis consists in estimating the following gravity Difference-in-Differences (DiD) model:

$$ln(flow_{ijct}) = \beta_1 Post_{ijct} + \beta_2 Treat_{ijc} + \beta_3 Post_{ijct} \times Treat_{ijc} + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \sum \gamma_m X_{ijct} + \epsilon_{ijct} \quad (1)$$

where $flow_{ijct}$ denotes the trade flow of commodity c in year t between reporting country (importer) i and partner country (exporter) j. The $Post_{ijct}$ variable is a dummy indicator which takes value 1 in the years when the Regulation was in place. $Treat_{ijc}$ is a dummy variable that defines whether a given unit belongs to the treatment (in which case, it is equal to 1) or to the control group (in which case it takes value 0). The coefficient of interest is β_3, that is the one associated to the interaction between the $Treat_{ijc}$ and $Post_{ijct}$. This captures the average effect on given trade flow -between country i and country j- being subject to the intervention with respect to not being affected by it.

Heterogeneity is controlled for by including a comprehensive set of fixed effects: importer and exporter fixed effects (α_i and α_j); year fixed effects (α_t) to capture potential common shocks that hit all countries at the same time; and commodity fixed effects (α_c) which account for time-invariant heterogeneities that are specific to each commodity.

The set X_{ijt} comprises a number of variables that are typically included in gravity models to control for the characteristics of countries i and j and for the trade specificities of each partnership. These encompass measures of GDP, population levels, distance between countries, the relative size of the respective internal markets ($Area_i * Area_j$) and indicators for contiguity, common language and colonial ties.[3]

In addition, the set X_{ijt} includes a multilateral trade resistance term for both the importing and the exporting country which proxy the "remoteness" of i and j, respectively, compared to all other countries.[4] The set X_{ijt} also contains dummy variables for the most relevant Regional Trade Agreements in place during the period of analysis as it is standard in the gravity literature.[5]

The unbalanced sample used in the analysis could be subject to a non-ignorable selection rule (e.g. trade flows for a given country-pair might be zero in some years), thus introducing selection bias in the estimates. For this reason, we follow Verbeek and Nijman (1992) and adopt a correction method which approximates the Heckman Inverse Mills Ration (IMR) term by adding two variables that reflect each country-pair presence in the sample (Guillotin and Sevestre, 1994). These consist of the number of years of presence of the country-pair in the considered sample ($Pres_{ij}$) and a dummy variable for the presence of a non-zero trade flow in year $t-1$ (PA_{ijt}). Finally, ϵ_{ijct} is the error term.

This general framework is used to assess both case studies this report deals with, namely, the interventions regulating certain low-molecular weight phthalates and the EU-wide ban on 3-BC. In particular, the estimation strategy relies on the definition of two alternative control groups.

The first scenario contemplates trade flows occurring within the EU only and compares trade flows of the commodity affected by the intervention to those of a comparable commodity which was not subject to the same change in rules. Thus, the control group is composed of trade flows of this latter commodity within the EU.

In the second scenario, which only looks at the commodity that is affected by the intervention, world-wide trade flows are considered. Thus, the treated trade flows are those where at least one partner is a EU Member State, while the control group is made of exchanges among countries that do not belong to the EU.

The two specifications of the model are further described below.

4.1 First scenario: within-EU market only, affected vs non affected commodities

The first scenario considers trade flows among EU Member States only and two different commodities: one that is affected by the entry into force of the Regulation in a given year and another that is not subject to any change in rules.

[3] These latter indicators consist of dummy variables that take value 1 if the following occurs (and value 0 otherwise): i and j share a common border ($Contiguity_{ij}$); i and j share a common language ($CommonLanguage_{ij}$); i and j have had a common coloniser at any time after 1945 ($CommonColony_{ij}$); i and j have had a colonial relationship at any time after 1945 ($1945Colony_{ij}$); i and j are currently in a colonial relationship ($CurrentColony_{ij}$).

[4] Following Baier and Bergstrand (2002), we compute $R_{i(j)}$ as follows: $R_{i(j)} = [\sum_k^{(} N)Y_k(D_{ik})^{(}(1-\sigma)]^{(}\frac{1}{1-\sigma}$ where D_{ij} is the distance between country i and country j, Y_k is the log of GDP and $\sigma = 4$.

[5] These are: Andean, Mercosur, Cacm, Nafta, Efta, Apta, Caricom, Cefta, Eac, Eco, Cemac, Ecowas, Pafta, Safta, Sparteca, Sacu, Sadc, Cis and Waemu.

In this setting, the model in Equation 1 becomes:

$$\begin{aligned} ln(flow_{ijct}) = \beta_1 Post_{ct} + \beta_2 Treat_c + \beta_3 Post_{ct} \times Treat_c \\ +\alpha_i + \alpha_j + \alpha_t + \alpha_c + \sum \gamma_m X_{ijct} + \epsilon_{ijct} \end{aligned} \tag{2}$$

where $Treat_c$ flags the affected commodity and $Post_{ct}$ indicates whether this is regulated in any given year. The coefficient associated to the interaction $Post_{ct} \times Treat_c$ is the coefficient of interest. This represents the effect of the Regulation on the value of the trade flows that occur within the EU for the affected commodity, in comparison to the control.

4.2 Second scenario: world-wide market, affected commodities only

The first scenario outlined above consists of a standard Difference-in-Differences model, which offers a straightforward interpretation of the results. However, this approach only considers trade flows that occur within the EU and does not provide any information on the effects of the Regulation on trade among EU and non-EU countries. Given that, likely, there is some degree of substitution between exchanges and partner countries, it is important to observe the phenomenon from a more global perspective.

Thus, the second scenario considers world-wide trade flows of a commodity that is affected by an ED-related EU Regulation. This implies that all flows occurring within the EU and to/from EU Member States will be affected (i.e. will be treated), while trade among non-EU countries will not, making this latter category the control group. To this end, it is important to highlight that whenever a commodity is regulated under this type of rules, its production, use, trade and sale is completely banned in all EU countries.

According to this scenario, four types of trade flows are considered separately: intra-EU, from EU to non-EU countries, from non-EU to EU countries and extra-EU. Then, the variable $Treat_{ijc}$ of Equation 1 is unpacked into $Treat_{intraEU,ij}$, $Treat_{EUimp,ij}$ and $Treat_{EUexp,ij}$, which are defined as follows:[6]

- $Treat_{intraEU,ij} = 1$ if both reporter and partner countries belong to the EU, $= 0$ otherwise;
- $Treat_{EUimp,ij} = 1$ when the importer i is EU and exporter country j is non-EU, $= 0$ otherwise;
- $Treat_{EUexp,ij} = 1$ when the importer i is non-EU and exporter country j is EU, $= 0$ otherwise.

As a consequence, the model is extended to the following specification:

$$\begin{aligned} ln(flow_{ijt}) = \beta_1 Post_{ijt} + \beta_2 Treat_{intraEU,ij} + \beta_3 Post_{ijt} \times Treat_{intraEU,ij} \\ \beta_4 Treat_{EUimp,ij} + \beta_5 Post_{ijt} \times Treat_{EUimp,ij} \\ \beta_6 Treat_{EUexp,ij} + \beta_7 Post_{ijt} \times Treat_{EUexp,ij} \\ +\alpha_i + \alpha_j + \alpha_t + \sum \gamma_m X_{ijt} + \epsilon_{ijt} \end{aligned} \tag{3}$$

where coefficients β_3, β_5 and β_7 capture the effect of the Regulation on the trade flows occurring among EU countries, from EU to non-EU countries and from non-EU to EU countries, respectively, compared to the flows existing among countries in the rest of the world. In order to account for the impact of the Regulation on trade flows involving EU countries, regardless of the type of partner, the linear combination of β_3, β_5 and β_7 is also computed and presented in the tables. This is to be interpreted as the effect of the Regulation on the overall trade capacity of EU countries (including that with extra-European partners) with respect to flows existing in the rest of the world.

4.3 Identifying assumption

In Difference-in-Differences models, a causal identification of the impact of an intervention is valid only if the parallel trends assumption holds. The assumption implies that the average change in trade flows for the treated units (commodities in the first scenario, countries in the second) is equal to the same change for the control units in the pre-intervention period. That is, differences between the two groups in the absence of the intervention are time-invariant: if this is the case, the estimated impact can be fully imputed to the intervention and not to pre-existing differences between the two groups.

In order to verify the assumption, the gravity DID regression analysis is integrated with an event-study. It could be expected that if the parallel trends assumption holds, the effect at each lead ($t - N$, i.e. N periods before the intervention) to be not statistically different from zero.

[6] The index c disappears due to the fact that only the treated commodity is contemplated in this specification of the model. For the same reason, α_c does not appear in Equation 3. The residual category $Treat_{extraEU,ij}$, which identifies trade flows among non-EU countries, is left as baseline category and for this reason it does not appear in the model.

5 The impact of the limitations in the use of phthalates

Phthalates are a group of chemical substances mainly used as plasticiser in plastic material to make it softer and more flexible. They are mainly used in polyvinyl chloride (PVC) to manufacture a wide range of product types, including building materials, packaging, films, detergents, toys, personal care products and medical devices. In particular, bis(2-ethylhexyl) phthalate, also known as DEHP, has been the most used general purpose plasticiser for the last 50 years and until recent times. In 1997, the estimated tonnage in Western Europe was of 595,000 t/y, of which 78% for indoor and 22% for outdoor applications (ECB 2008).[7]

Phthalates have proven to be chemicals that pose serious risks for human health because of their reproductive toxicity mediated by anti-androgenic endocrine effects. Moreover, evidence from mammalian and aquatic species has also raised concerns on potential risks on metabolic and immune systems and neurological development.[8]

Upon these evidences, the use of phthalates has been progressively restricted. In 1999 the European Commission first restricted its use in the production of toys and childcare articles made of soft PVC. In 2005 the ban was extended to all toys and childcare articles containing more than 0.1% w/w of the plasticiser material. Since the 1999 EU regulatory action the use of low-molecular weight phthalates has decreased significantly and production has gradually shifted to higher molecular volume phthalates. In 2011, the Commission decided to act even more incisively and to add four phthalates to the authorisation list REACH. As a consequence, the chemical industry was prohibited to adopt the four phthalates unless an application for derogation was presented before August 2013, with the final sunset date in February 2015.

In order to perform the analysis of the consequences of such legislation on trade flows the analysis focuses on plasticisers, which constitute the actual material subject to the intervention.[9] Indeed, this commodity contains phthalates as well as non-phthalate plasticisers but other kinds as well. In recent years industry has shifted from the restricted low-molecular weight to high-molecular weight phthalates and non-phthalates plasticisers. However, it is worth remembering that DEHP has been the most widely used plasticiser in the last 50 years and therefore it constituted a large part of the commodity under study. The control commodity in this case is the polyethylene polymer (PET).[10] This is the most commonly used plastic, but it does not contain plasticisers and hence - although belonging to a closely related industry sector as plasticisers - it is not affected by the intervention.

To begin with, some descriptive statistics are shown. Then, results deriving from the first scenario are presented for plasticisers and the polyethylene polymer and their trade within the EU. This is followed by the analysis under the second scenario, where only plasticisers and world-wide trade flows are considered.

It is worth noting that a causal implication for the parameter of interest is only attributable to the first intervention in 1999, while the coefficients referred to the post-2005 period are better intended as descriptive evidence. This is mainly due to the timing of the interventions related to phthalates. Indeed, the time intervals from one intervention to the other are too narrow to assume that the industry could have reached a steady-state equilibrium in between. This implies that when the period 2005-2011 is analysed, it is not possible to conclude that the coefficients are not affected at all by the change in rules that occurred in 1999.

5.1 Descriptive statistics

Table 1 informs about the yearly average value of trade flows within ij country pairs in the years when the intervention was not yet in force. The value of yearly transactions was decreasing worldwide, but it is interesting to note that the number of non-zero transactions (N) has been steadily rising among non-EU countries (i.e., Rest of the World trade), thus contributing to the dynamics of total trade values displayed in Figure 1. For the same reason, the total volume of trade among non-EU countries is larger than that occurring among EU Member States, despite the fact that the average yearly flows between EU countries are larger than the exchanges between non-EU pairs.

The first trading partner in the exchange of plasticiser for EU countries were other EU Member States. In fact, in 1998, 93% of the value of the good exchanged was among EU countries. By 2014 this percentage did not change substantially (89%). Moreover, in 1998 the first three non-European trade partners for EU countries were the USA, the Russian Federation and the Republic of Korea. In the following years, new chemical actors entered the market and this changed the trade patterns: by 2014 the first three non-European partners for EU countries became Argentina, the USA and Brazil.

[7] However, the data at hand does not allow determining the amount of phthalates per type of item (e.g. toys of soft PVC).

[8] See ECHA (2017). *Background document to the to the Opinion on the Annex XV dossier proposing restrictions on four phthalates (DEHP, BBP, DBP, DIBP)*. Retrievable from: https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e1806e7a36

[9] In the UN COMTRADE database the plasticiser corresponds to code 381220 (Plasticisers, compound; for rubber or plastics).

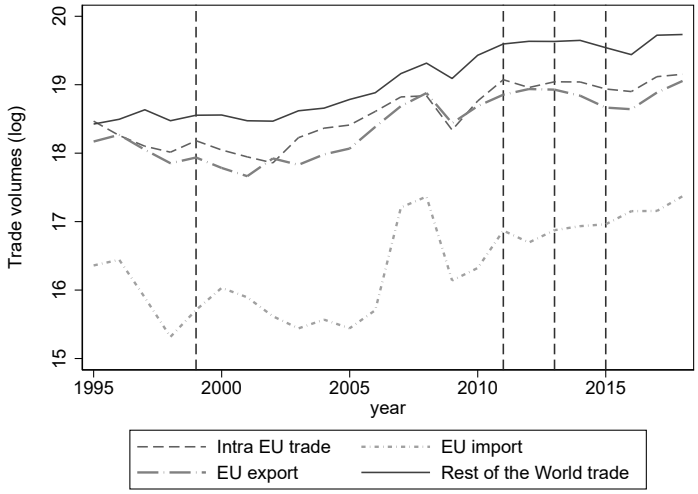
[10] The UN COMTRADE code for the polyethylene polymer is 3901 (Polymers of ethylene, in primary forms).

Table 1: Pre-intervention trade values of the plasticiser

	1995			1996			1997			1998		
	Mean	Sd	N	Mean	Sd	N	Mean	Sd	N	Mean	Sd	N
Intra-EU trade	1114.8	2152.3	94	1090.2	1928.5	78	932.0	1740.5	78	802.5	1563.9	83
EU import	363.9	1394.7	35	374.2	1120.5	37	249.1	500.4	32	118.1	240.9	38
EU export	425.5	1547.1	183	418.9	1523.9	205	326.0	1215.7	212	252.0	1005.4	225
Rest of the World trade	577.6	2588.0	174	520.5	2466.9	207	567.9	2688.6	218	460.7	2230.2	229

Note: figures refer to ij yearly averages and are expressed in thousands of US dollars.

Figure 1: Plasticiser: total value of trade flows trend



5.2 First scenario: impact of the intervention on plasticisers with respect to polyethylene polymer, intra-EU trade flows

Table 2 presents the results of the estimation of the model where within-EU trade flows of both the plasticisers and the polyethylene polymer are considered.[11] This corresponds to the specification outlined in Section 4.1.

The coefficient associated to the indicator for the enactment of the intervention suggests that on average trade flows of the plasticiser decrease significantly by around 244% due to the new rules, compared to the trade of polyethylene polymer, i.e. the commodity that is not subject to them.

In order to verify the parallel trends assumption and to describe the evolution of this effect over time, Figure 2 shows estimates corresponding to the coefficient presented in Table 2 for each year considered, i.e. the event study results. From the year 2000 onwards, coefficients suggest a rapid decline in the value of trade flows of plasticisers within the EU, relative to the comparison good. This trend seems to stabilize around 2004 and to continue being negative for the rest of the period. Interestingly, the announcement and the expiry of the so-called sunset dates (2011-2015) does not seem to affect the outcome significantly. Possibly, this could be due to the fact that the market had already adjusted to the prospects of a complete ban on phthalate plasticiser

Table 2: Effect of the intervention on plasticisers on intra-EU trade flows, affected vs non affected commodity

	(1)
Variables	ln(trade value in USD)
Regulation	-2.4380***
	(0.1507)
Observations	13,226
Number of ijc combinations	1,142

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.

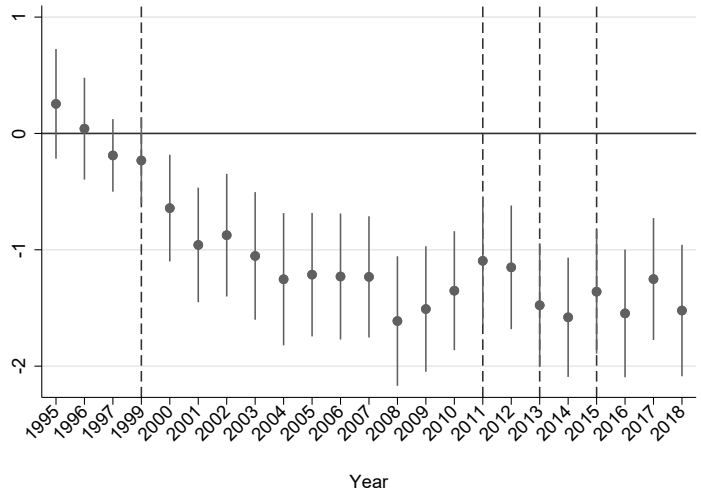
[11] For the full list of estimates, which are all in line with the predictions of economic theory, see Table 8 in Section 8.

in the early 2000s. In addition, this might reveal a substitution towards high-molecular weight plasticisers, which belong to the same treated commodity (i.e. plasticisers).

As a matter of fact, in the pre-Regulation period (1995-1997), all coefficients are not statistically different from zero and therefore the identifying assumption is verified. Nonetheless, the point estimates suggest that it might be the case that trade of plasticisers was already decreasing in comparison to the intra-EU exchanges of polyethylene polymer.

This might be explained by different reasons. First, it may be because of adjustments of the market that were antecedent to the first year of observation (1995) most probably due to the emerging scientific evidence and the growing regulatory scrutiny during the 1990s. Second, the comparison commodity might not correspond to the ideal control. Third, since this scenario only considers EU-wide trade flows, it could be that relevant exchanges occurring with countries located outside of the EU are confounding the estimates. The specification of the model presented in the next subsection aims at discarding these concerns.

Figure 2: Effect of the intervention on plasticisers on intra-EU trade flows, affected vs non affected commodity: event study



Note: The y axis expresses the difference in trade flows relative to the year before the implementation of the intervention. Black dots are the yearly point estimates, computed as the linear combination of intra-EU, EU import and EU export; the vertical lines represent the respective confidence intervals at 95% level. The vertical dashed lines identify the year of enforcement of the various interventions.

5.3 Second scenario: focus on plasticisers, EU vs Non-EU trade flows

Table 3 presents the results on plasticisers following the second model specification outlined in Section 4.2, where global trade flows are accounted for.[12]

Column 1 considers all trade flows world-wide (intra-EU, to and from the EU and among extra-EU countries), for a total of around $2,850$ pairs of countries. The estimated coefficients suggest that, compared to trade flows among non-EU countries and conditional on each type of trading partnership, the value of the plasticiser traded by EU countries drops significantly: intra-EU trade and exports by around 34% each and imports by 67%. The result should not come as a surprise considering the staggered implementation of the regulation, which has progressively tightened over time, thus, giving the possibility to the industry to adapt. It should also be noted that the United States, an important trading partner for European countries (as highlighted in Section 5.1), applied increasing restrictions to phthalates in 2008, 2009 and 2012. Therefore, it is possible that the estimated coefficient responds to changes in the difference in trade flows between EU and non-EU partners in the post-2008 period.

The overall effect of the regulating intervention on trade flows involving EU countries (i.e. intra-EU trade, EU import and EU export altogether) can be estimated by linearly combining the three parameters. This yields a coefficient that is negative and statistically significant at 1% level, which implies a drop in the overall value of trade for EU countries by 134% in comparison to non-EU trade for the same commodity.

[12] For the full list of estimates, which are all in line with the predictions of economic theory, see Table 9 in Section 8.

Table 3: Effect of the intervention on plasticisers on trade flows, EU vs Non-EU

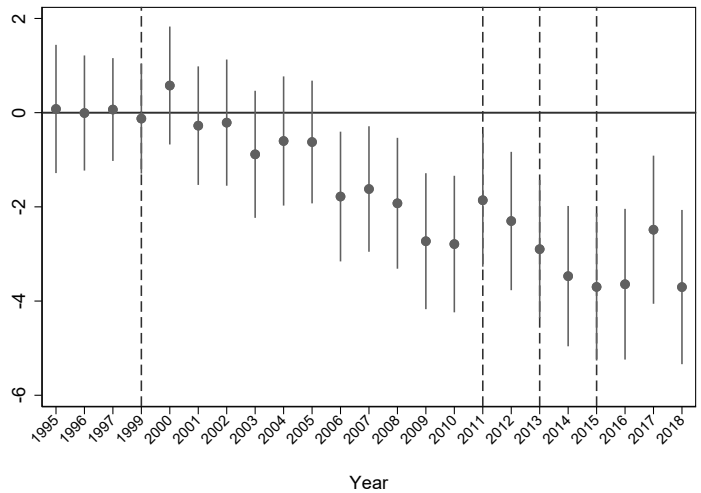
Variables	(1) General case	(2) Intra-EU VS RoW	(3) EU import VS RoW	(4) EU export VS RoW
Intra-EU trade	-0.3404**	-0.5330***		
	(0.1659)	(0.1934)		
EU import	-0.6691***		-0.5587***	
	(0.1641)		(0.1947)	
EU export	-0.3359**			-0.2619*
	(0.1394)			(0.1436)
Linear combination	-1.345***			
	(0.353)			
Observations	19,199	11,791	9,600	13,806
Number of ij couples	2,846	1,779	1,706	2,224

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Intra-EU trade: importer and exporter both belong to the EU. EU import: the importer is a EU country and the exporter is a non-EU country. EU export: the importer is a non-EU country and the exporter is a EU country. RoW: neither the importer nor the exporter belong to the EU.

Columns 2–4 report the same coefficients as Column 1, except that these are estimated unconditional on other types of trade, thus not considering potential substitution between trading partners. Coefficients remain negative and highly significant and are comparable to the ones shown in Column 1.

The development of the impact on trade involving EU Member States over time is illustrated in Figure 3, which shows the yearly estimated linear combination of the coefficients reported in Column 1 of Table 3. When comparing trade of EU Member States to that where only non-EU countries are involved, the plots clearly documents the existence of a parallel trend in the pre-1999 period, as all coefficients are well aligned on the zero line, and confirms the fall in trade volumes that emerged in Figure 2, which continues to be visible also in this case. Supporting the existence of parallel trade trends between Europe and the Rest of the World, Figure 3 suggests that indeed the regulatory action enacted in 1999 did change the dynamics of the global plasticiser trade flows, owing to the gradual phaseout of this material in Europe.

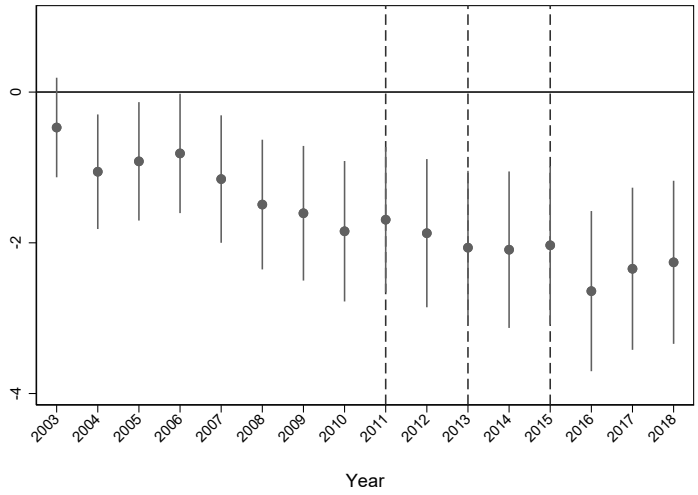
Figure 3: Effect of the intervention on plasticisers trade flows, EU vs Non-EU



Note: The y axis expresses the difference in trade flows relative to the year before the implementation of the intervention (1998). Black dots are the yearly point estimates, computed as the linear combination of intra-EU, EU import and EU export; the vertical lines represent the respective confidence intervals at 95% level. The vertical dashed lines identify the year of enforcement of the various interventions.

Additional evidence of the decreasing plasticisers trade flows can be found when considering flows of the functional material which encompasses most intermediate goods that contain the plasticiser.[13] Data for this outcome are only available starting from 2002, that is after the entry into force of the 1999 intervention. For this reason, it is not possible to attribute a causal connotation to the relationship between the regulatory intervention of 1999 and the trends in trade flows for this commodity. Yet, Figure 4 supports the results shown above by giving descriptive evidence of a decreasing trend in trade flows of the functional material involving EU countries, which closely follows the patterns observed for the input (i.e. plasticiser) in Figure 3.

Figure 4: Effect of the intervention on plasticisers on functional material trade flows, EU vs Non-EU



Note: The y axis expresses the difference in trade flows relative to the first year available (2002). Black dots are the yearly point estimates, computed as the linear combination of intra-EU, EU import and EU export; the vertical lines represent the respective confidence intervals at 95% level. The vertical dashed lines identify the year of enforcement of the various interventions.

[13] This corresponds to code 392043 (Plastics; polymers of vinyl chloride, containing by weight not less than 6% of plasticisers; plates, sheets, film, foil and strip (not self-adhesive), non-cellular and not reinforced, laminated, supported or similarly combined with other materials) in the UN COMTRADE database.

6 The impact of the ban on 3-BC use

3-Benzylidene camphor (3-BC) is a UV filter which has been mostly used in sunscreens and other whitening skin care cosmetic products. It poses serious risk for human health because of its estrogen adverse effect. Moreover, wildlife is exposed to the substance through down-the-drain emissions and the scientific literature has demonstrated that this exposure impairs the reproduction of aquatic species.[14]

The regulatory framework dealing with the risks presented by chemicals in cosmetic preparations is the Cosmetic Products Regulation (CR). It dates back to 1978, and it was meant to regulate the use of dangerous substances in cosmetics by limiting the use of certain chemicals proven to be harmful for the human health. UV filters allowed for use in cosmetic products are listed in Annex VI of the regulation. In 2015 3-BC was removed from Annex VI, thus prohibiting its use in cosmetics, including the export and the import of cosmetics containing it.[15]

Differently from the phthalates case, the sharp intervention on the 3-BC clearly splits the time interval between 1999 and 2018 in two periods, that is, before and after the 2015 intervention. This set up enables the straightforward implementation of a DiD model, and therefore it allows a causal interpretation of the estimates. Here, the commodity chosen as the affected one is "Cosmetic and toilet preparations", while the comparison commodity is "Oral and dental hygiene preparations".[16] The rationale for selecting such commodity is that it belongs to the same broader category as the treated good (that is, cosmetic and toilet preparations) but it excludes products containing UV filters.

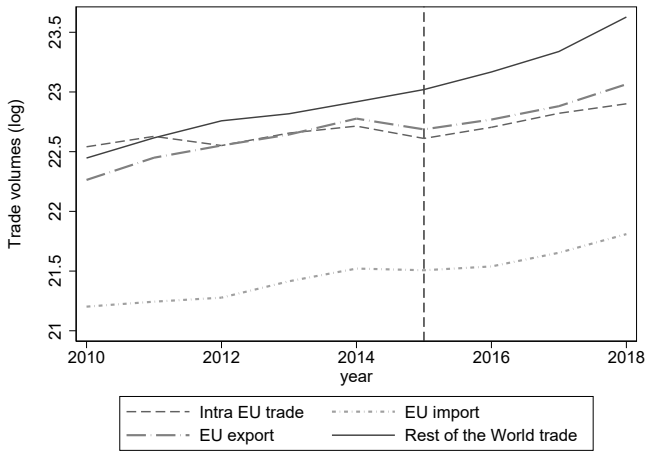
In what follows, an overview of the data is presented. Then, the results concerning the first scenario are shown. Here, intra-EU trade flows of cosmetic and dental preparations are compared to each other before and after the entry into force of the Regulation. Finally, the results deriving from the second scenario are displayed, where world-wide flows of cosmetic products are considered and trade involving EU countries is compared to trade among non-EU countries.

6.1 Descriptive statistics

The descriptive statistics provided by Table 4 show that both the yearly average value of trade flows within ij country pairs as well as the number of transactions (N) have been increasing in the years immediately before the ban of the 3-BC. Total trade value dynamics presented in Figure 5 are coherent with average figures.

As in the phthalates case, it is interesting to look into the major trade partners of European countries. By 2014, the trade of cosmetic preparations happened mostly within Europe itself with 82.6% of the overall value

Figure 5: Cosmetic preparations: trade flows trend



[14] See: ECHA (2016). *REACH registry of SVHC intentions until outcome (3-BC)*. Retrievable from: https://echa.europa.eu/registry-of-svhc-intentions/-/dislist/details/0b0236e180e4b445; *SCCS 2013 Opinion on 3-BC*. Retrievable from: https://publications.europa.eu/en/publication-detail/-/publication/1c6a44ae-b016-4c78-b5c1-e03e607734e7/language-en

[15] It should be noted that, with regard to Annex VI (UV filters positive list), 9 amendments were put in force since 2013. These include 3 additions and 6 modifications of existing entries (e.g., lowering concentration limits). However, 3-BC is the only case of substance removed from the Annex since 2013.

[16] These correspond, respectively, to UN COMTRADE code 330499 "Cosmetic and toilet preparations; n.e.c. in heading no. 3304, for the care of the skin (excluding medicaments, including sunscreen or sun tan preparations)" and to UN COMTRADE code 3306 "Oral and dental hygiene preparations; preparations for oral or dental hygiene, including denture fixative pastes and powders; yarn used to clean between the teeth (dental floss), in individual retail packages".

Table 4: Pre-3-BC ban trade values of cosmetic preparations

	2010			2012			2014		
	Mean	Sd	N	Mean	Sd	N	Mean	Sd	N
Intra-EU trade	9301.9	33549.5	662	8849.6	33074.6	703	10385.9	37731.0	705
EU import	1693.7	11871.4	953	1685.0	12173.5	1033	1991.3	14790.8	1115
EU export	3204.1	19878.8	1456	4188.5	24369.9	1486	4906.0	31368.8	1589
Rest of the World trade	2036.4	14814.2	2752	2693.7	19017.5	2841	3042.0	21755.5	2951

Note: figures refer to ij yearly averages and are expressed in thousands of US dollars.

exchanged among EU Member States. In 2017, this percentage only slightly changed to 81.7%. Additionally, in 2014 the first three non-European trade partners were the USA, China and Japan. In 2017 the USA and China maintained their position, whilst the Republic of Korea substituted Japan.

6.2 First scenario: 3-BC ban-affected commodities and non 3-BC ban-affected commodities, intra-EU trade flows

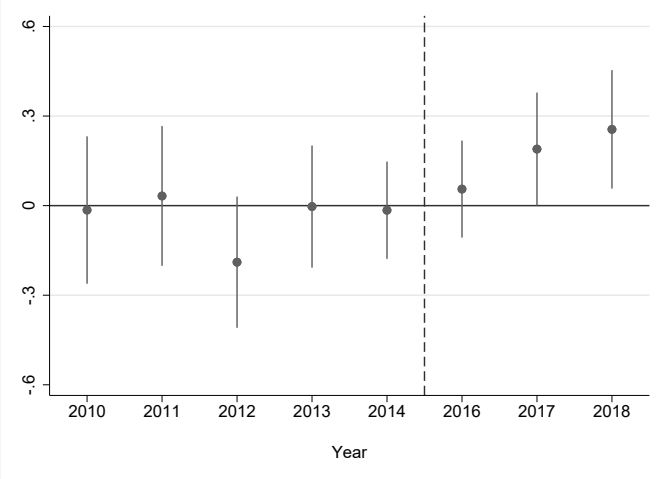
Table 5 presents the results of the estimation of the model where within-EU trade flows of both CR-affected and non-affected commodities are considered.[17] This corresponds to the specification outlined in Section 4.1.

Table 5: Effect of regulatory intervention on 3-BC on intra-EU trade flows, affected vs non affected commodities

	(1)
Variables	Ln(trade value in USD)
Cosmetics Regulation	0.1969**
	(0.0803)
Observations	9,976
Number of ijc combinations	1,362

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.

Figure 6: Effect of regulatory intervention on 3-BC on intra-EU trade flows, affected vs non affected commodities



Note: The y axis expresses the difference in trade flows relative to the year before the implementation of the intervention (2015). Black dots are the yearly point estimates, computed as the linear combination of intra-EU, EU import and EU export; the vertical lines represent the respective confidence intervals at 95% level. The vertical dashed line identifies the year of enforcement of the 3-BC ban (2015).

[17] For the full list of estimates, which are all in line with the predictions of economic theory, see Table 10 in Section 8

The coefficient associated to the indicator for the enactment of the regulatory intervention suggests that trade flows of the commodity affected by it increase significantly by around 20% due to the 2015 restriction, compared to the commodities not directly affected by the intervention.

Figure 6 displays the yearly estimated effect corresponding to the coefficient presented in Table 6. In the pre-intervention period, all coefficients are aligned on the zero line, suggesting the existence of a parallel trend in trade flows of the two commodities. Only one coefficient (namely, the one referred to 2012) deviates from this pattern possibly due to the unilateral ban on 3-BC introduced by France in that year. Yet, the confidence intervals corresponding to this coefficient suggest that this is not statistically different from zero.[18] As far as the post-2015 years, the point estimates imply a gradual increase in the value of the intra-EU trade flows of the impacted commodities with respect to trade of control goods. This amounts to around 5% in 2016 and grows to 19% in 2017 and to 25% in 2018.

6.3 Second scenario: 3-BC ban-affected commodities, EU vs Non-EU trade flows

Table 6 presents the results according to the second scenario, where only commodities affected by the intervention are considered.[19] This is the specification of the model outlined in Section 4.2.

Column 1 refers to the general case where all trade flows (intra-EU, to and from the EU and among extra-EU countries) are considered, with a sample of around $10,000$ pairs of countries. The reported coefficients suggest the following. First, with respect to the trade flows among non-EU countries, the value of the intra-EU trade of impacted commodities increases by around 34% due to the intervention, conditional on the import and the export that EU countries have with non-European partners.

Second, conditional on the flows exchanged within the EU, the value of the goods EU countries import from the rest of the world and the value of those that EU countries export to non-EU partners does not seem to be affected by the intervention, as the estimates are not statistically different from zero. However, the signs of the coefficients are coherent with the existence of a EU-wide ban. Thus, import flows seems to have slightly decreased, as certain products containing 3-BC can no longer be introduced within the EU starting from 2016. As exports are concerned, the estimated coefficient implies a slight increase in trade flows, which might be due to an overall increase in the volume of the affected commodities produced within the EU and a consequent increase in supply of these goods following the intervention.

Third, the linear combination of the three coefficients is positive and statistically significant at 1% level, implying an increase in the overall trade for EU countries by 34% in comparison to non-EU trade for the same commodities.

Table 6: Effect of regulatory intervention on 3-BC on trade flows, EU vs Non-EU

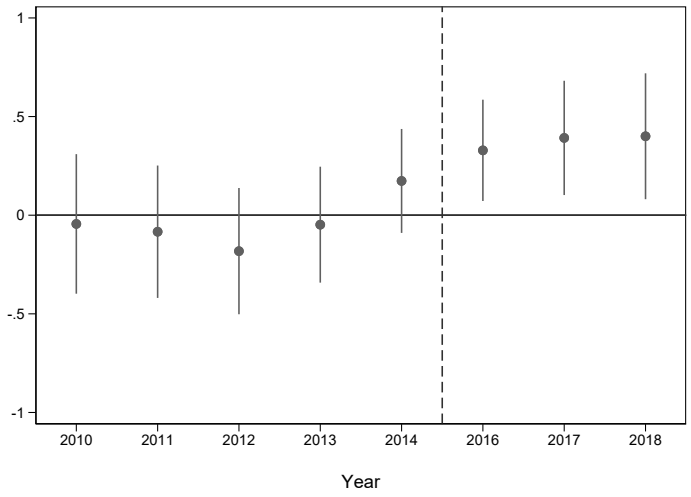
	(1)	(2)	(3)	(4)
Variables	General case	Intra-EU VS RoW	EU import VS RoW	EU export VS RoW
Intra-EU trade	0.2779***			0.3434***
	(0.0572)			(0.0564)
EU import		-0.0037		-0.0575
		(0.0501)		(0.0489)
EU export			0.0854**	0.0502
			(0.0419)	(0.0415)
Linear combination	0.3362***			
	(0.1086)			
Observations	50,726	28,968	32,506	35,442
Number of ij couples	10,008	5,906	7,060	7,326

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Intra-EU trade: importer and exporter both belong to the EU. EU import: the importer is a EU country and the exporter is a non-EU country. EU export: the importer is a non-EU country and the exporter is a EU country. RoW: neither the importer nor the exporter belong to the EU.

[18] As a matter of fact, when trade flows to and from France are excluded from the sample, the coefficient associated to the year 2012 is closer to zero.

[19] For the full list of estimates, which are all in line with the predictions of economic theory, see Table 11 in Section 8.

Figure 7: Effect of regulatory intervention on 3-BC on trade flows, EU vs Non-EU



Note: The y axis expresses the difference in trade flows relative to the year before the implementation of the intervention (2015). Black dots are the yearly point estimates, computed as the linear combination of intra-EU, EU import and EU export; the vertical lines represent the respective confidence intervals at 95% level. The vertical dashed line identifies the year of enforcement of the ban on 3-BC (2015).

While Column 1 considers all trade flows at once, columns 2–4 report the estimates where intra-EU, EU-to-non-EU and non-EU-to-EU are considered one at a time, respectively, the baseline being extra-EU trade flows. The number of observations, therefore, varies accordingly across the three columns. Reassuringly, the size and the magnitude of the estimated coefficients are comparable to the ones reported in Column 1 in all three cases.

Figure 7 displays the yearly estimated effect as from the linear combination of the three coefficients reported in Column 1 of Table 6. The plot confirms the existence of a parallel trend in the trade of the ban-affected commodities across the group of EU countries (i.e. considering flows within the EU and to and from the EU, altogether) and the pool of non-EU countries in the period preceding the entry into force of the intervention. This is because the point estimates and the corresponding 95% confidence intervals cross the zero line in time periods to the left of the vertical dashed line. Conversely, in the post-intervention years the estimated effect is positive and statistically different from zero. This implies that the intervention induced an increase of 34% circa in the trade flows experienced by EU countries in comparison to the trade flows existing among non-EU countries. The pattern shown in the graph suggests that the increase was substantial in the first year after the enactment of the regulation (32% in 2016) and that this persisted in the following years (39% in 2017 and 40% in 2018).

Table 7 shows the result of three additional robustness checks. First, France introduced the ban on 3-BC earlier compared to other EU countries. Therefore, in order to ensure that results are not driven by trade flows to and from France, this is excluded from the sample (Column 1). Even in this case, results are coherent with the main specification.

In the second column, the period considered spans from the year 2001 onwards. All three coefficients are now significantly different from zero, however their magnitude is similar to the main specification's one and the overall conclusions remain unchanged. In fact, the linear combination of the three estimated coefficients implies that the intervention yields an increase in the trade flows for EU countries by about 36%. Moreover, the plot of the coefficients over time referred to this enlarged sample confirms a rise by 31% in 2016 and the persistence of the increase in trade flows by around 40% in the following two years (Figure 8).

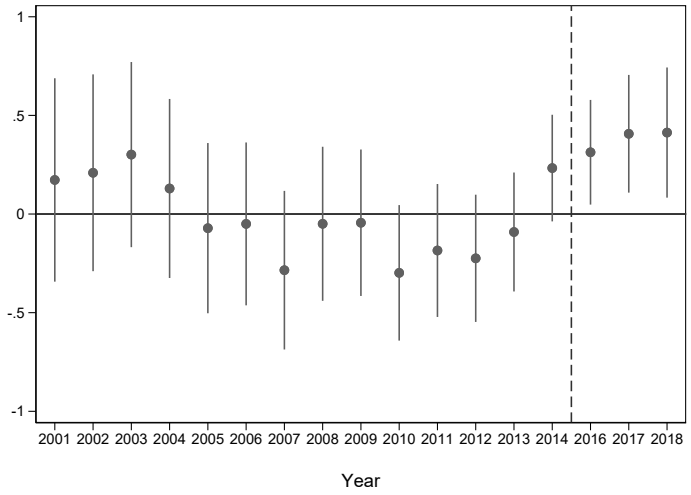
Finally, Column 3 refers to a balanced sample where only country pairs that are always observed in the years 2010-2018 are retained. Here, the magnitude of the coefficients is lower due to the exclusion of some positive values among the pool of extra-EU flows, which implies an underestimation of the overall effect. Yet, the sign of the estimates is coherent with the main specification.

Table 7: Effect of regulatory intervention on 3-BC on trade flows, EU vs Non-EU: robustness checks

Variables	(1) Without France	(2) Post-2001 sample	(3) Balanced sample
Intra EU trade	0.3545***	0.4033***	0.1729***
	(0.0590)	(0.0623)	(0.0579)
EU import	-0.0663	-0.1466***	-0.0076
	(0.0505)	(0.0528)	(0.0572)
EU export	0.0524	0.1090**	-0.0214
	(0.0430)	(0.0450)	(0.0491)
Linear combination	0.3407***	0.3658***	0.1438
	(0.1113)	(0.1169)	(0.1244)
Observations	48,745	90,060	25,587
Number of ij pairs	9,718	11,160	2,905

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Intra-EU trade: importer and exporter both belong to the EU. EU import: the importer is a EU country and the exporter is a non-EU country. EU export: the importer is a non-EU country and the exporter is a EU country. RoW: neither the importer nor the exporter belong to the EU.

Figure 8: Effect of Cosmetics Regulation on trade flows, EU vs Non-EU: post-2001 sample



Note: The y axis expresses the difference in trade flows relative to the year before the implementation of the intervention (2015). Black dots are the yearly point estimates, computed as the linear combination of intra-EU, EU import and EU export; the vertical lines represent the respective confidence intervals at 95% level. The vertical dashed line identifies the year of enforcement of the ban on 3-BC (2015).

7 Conclusions

This report provides an assessment of the potential unintended consequences that EU regulatory interventions on EDs has had on trade patterns between European countries and the rest of the world. The analysis focuses on two case studies and for this reason should be taken with some caution in generalizing the obtained results as the impact of the Regulation on the whole market. The first case study concerns specifically the rules governing the use of certain low-molecular weight phthalates as plasticisers in the production of plastics, which were made increasingly stringent starting from 1999. The second evaluates the case of the 2015 ban on the use of 3-BC as UV filter in cosmetic products (namely, sunscreens). The analysis combines a gravity model and a Difference-in-Differences setting in order to obtain a causal interpretation of the obtained estimates.

The evidence on the interventions addressing the use of certain phthalates in plastics shows that these have negatively and substantially affected the volume of traded plasticisers for EU Member States. This is true both when the selected trade flows are compared to intra-EU exchanges of a specific comparison commodity that does not contain phthalates (i.e. polyethylene polymer) and when they are confronted to trade flows occurring among non-EU countries.

The analysis on the 3-BC ban under the Cosmetic Products Regulation, conversely, reveals that the intervention has led to an increase in the amount of trade flows involving EU countries, at least on cosmetics containing this substance. On the one hand, intra-EU trade flows of cosmetics increase significantly by around 20% due to the intervention, compared to the non-affected commodity. On the other hand, the estimates suggest that in comparison to extra-EU flows, the volume of cosmetics traded by EU countries has intensified substantially, especially due to an increase in the exchanges among EU Member States and a rise in exports.

The two pieces of evidence presented in this report, coherently with the predictions of the economic theory, suggest that the non-tariff measures put in place by the EU over the past decades to limit the use of EDs have had the following repercussion on trade flows of the affected commodities.

First, as the analysis on phthalates suggests, they have green substantially decreased the amount of plasticisers that are exchanged across the EU. Whether this has also had an effect on similar types of plastics that do not contain phthalates (i.e. whether there has been substitution over products) cannot be in any way assessed with the data at hand.

Second, the positive effect that the ban of 3-BC from cosmetics has had on this commodity is consistent with the idea that EU-based producers have adjusted their production to the new standards therefore enhancing the exchange of goods meeting higher safety standards. This is also qualitatively confirmed by a general shrinkage of imports from non-EU countries and a rise in exports.

It should be noted that the classification of the commodities employed does not allow to exactly identify the goods that are affected by the regulatory interventions under scrutiny. Yet, this makes the estimates likely to correspond to a lower bound with respect to the 'real' ones.

Moreover, these results, although referred to the impact of regulatory interventions on two specific commodities only, provide an interesting first evidence of the impact of non-tariff measure on trade flows. Based on this first attempt further studies may provide more comprehensive results (e.g., by extending the analysis to a wider set of commodities affected by the regulations) on the whole market.

8 Additional tables

Table 8: Effect of phthalate regulating interventions on intra-EU trade flows, affected vs non affected commodities: full table

Variables	(1) ln(trade value in USD)
Regulation	-2.4380*** (0.1507)
ln(GDP$_{it}$)	1.1245*** (0.3814)
ln(GDP$_{jt}$)	-0.0404 (0.0512)
ln(Pop$_{it}$)	-3.2005*** (0.8733)
ln(Pop$_{jt}$)	0.0526 (0.0568)
ln(Distance$_{ij}$)	-0.4022** (0.1775)
ln(Multilateral resistance term$_{jt}$)	-2.7439 (1.7471)
ln(Multilateral resistance term$_{it}$)	-1.3317*** (0.4574)
ln(Area$_i$*Area$_j$)	1.7277* (0.9292)
D(Contiguity$_{ij}$)	0.3738 (0.2688)
D(Common language$_{ij}$)	-0.0192 (0.3648)
D(Common colony$_{ij}$)	-0.1600 (0.3601)
D(Colony 1945$_{ij}$)	-0.1012 (0.5645)
D(Current colony$_{ij}$)	0.5090 (0.6841)
Years of presence of ij couple	0.2576*** (0.0130)
Persistence of the ij couple	0.4304*** (0.0498)
Observations	13,226
Number of ijc combinations	1,142

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.

Table 9: Effect of phthalate regulating interventions on trade flows, EU vs Non-EU: full table

Variables	(1) General case	(2) Intra-EU VS RoW	(3) EU import VS RoW	(4) EU export VS RoW
Intra-EU trade	-0.3404**	-0.5330***		
	(0.1659)	(0.1934)		
EU import	-0.6691***		-0.5587***	
	(0.1641)		(0.1947)	
EU export	-0.3359**			-0.2619*
	(0.1394)			(0.1436)
ln(GDP$_{it}$)	0.3514	0.4718	0.4181	-0.1420
	(0.2147)	(0.3022)	(0.3056)	(0.2686)
ln(GDP$_{jt}$)	0.0164	0.0503	0.0079	0.0009
	(0.0292)	(0.0378)	(0.0407)	(0.0308)
ln(Pop$_{it}$)	0.6834*	0.7487*	1.3477***	0.8560**
	(0.3525)	(0.4528)	(0.4682)	(0.3858)
ln(Pop$_{jt}$)	-0.0323	-0.0302	-0.0320	-0.0072
	(0.0314)	(0.0398)	(0.0436)	(0.0327)
ln(Distance$_{ij}$)	-0.2339***	-0.1486	-0.0422	-0.1481*
	(0.0709)	(0.0997)	(0.0975)	(0.0795)
ln(Multilateral resistance term$_{jt}$)	-1.1452	-0.7560	0.1678	-1.7875**
	(0.7440)	(1.0034)	(1.0245)	(0.8043)
ln(Multilateral resistance term$_{it}$)	0.9034	0.8091	1.8278**	1.9890**
	(0.5787)	(0.6877)	(0.8615)	(0.8160)
ln(Area$_i$*Area$_j$)	0.0566	0.0222	-1.3171	0.2555
	(0.1292)	(0.1460)	(1.6340)	(0.1718)
D(Contiguity$_{ij}$)	0.2515	0.2596	-0.1545	0.1275
	(0.1536)	(0.1625)	(0.1847)	(0.1734)
D(Common language$_{ij}$)	-0.0471	-0.0676	-0.1699	-0.1730
	(0.1301)	(0.1647)	(0.1671)	(0.1385)
D(Common colony$_{ij}$)	-0.0806	-0.0055	0.2102	0.0077
	(0.1419)	(0.2439)	(0.2597)	(0.1591)
D(Colony 1945$_{ij}$)	-0.0107	-0.0425	0.1738	-0.1048
	(0.1956)	(0.2045)	(0.2046)	(0.1943)
D(Current colony$_{ij}$)	-0.2049	1.5393		0.4383
	(0.5479)	(1.0912)		(0.7045)
Years of presence of ij couple	0.1169***	0.1221***	0.1400***	0.1269***
	(0.0071)	(0.0097)	(0.0105)	(0.0076)
Persistence of the ij couple	0.7974***	0.8033***	0.8598***	0.7932***
	(0.0459)	(0.0605)	(0.0647)	(0.0523)
Linear combination	-1.345***			
	(0.353)			
Observations	19,199	11,791	9,600	13,806
Number of ij couples	2,846	1,779	1,706	2,224

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Intra-EU trade: importer and exporter both belong to the EU. EU import: the importer is a EU country and the exporter is a non-EU country. EU export: the importer is a non-EU country and the exporter is a EU country. RoW: neither the importer nor the exporter belong to the EU.

Table 10: Effect of Cosmetics Regulation on intra-EU trade flows, affected vs non affected commodities: full table

Variables	(1) Ln(trade value in USD)
Cosmetics Regulation	0.1969** (0.0805)
ln(GDP$_{it}$)	-0.0106 (0.4063)
ln(GDP$_{jt}$)	-0.0323 (0.0393)
ln(Pop$_{it}$)	-0.1436 (1.1045)
ln(Pop$_{jt}$)	0.0197 (0.0441)
ln(Distance$_{ij}$)	-1.1072*** (0.1331)
ln(Multilateral resistance term$_{jt}$)	-3.8688 (3.3476)
ln(Multilateral resistance term$_{it}$)	0.4830 (0.4650)
ln(Area$_i$*Area$_j$)	5.8275*** (1.8878)
D(Contiguity$_{ij}$)	0.9732*** (0.1899)
D(Common language$_{ij}$)	0.6267** (0.2645)
D(Common colony$_{ij}$)	-0.0713 (0.2545)
D(Colony 1945$_{ij}$)	1.8936*** (0.3244)
D(Current colony$_{ij}$)	2.2063*** (0.7067)
Years of presence of ij couple	0.3251*** (0.0324)
Persistence of the ij couple	0.1973*** (0.0426)
Observations	9,976
Number of ijc combinations	1,362

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.

Table 11: Effect of Cosmetics Regulation on trade flows, EU vs Non-EU: full table

Variables	(1) General case	(2) Intra-EU VS RoW	(3) EU import VS RoW	(4) EU export VS RoW
Intra-EU trade	0.3434***	0.2779***		
	(0.0564)	(0.0572)		
EU import	-0.0575		-0.0037	
	(0.0489)		(0.0501)	
EU export	0.0502			0.0854**
	(0.0415)			(0.0419)
ln(GDP$_{it}$)	0.8576***	0.6968***	0.9914***	0.9361***
	(0.1859)	(0.2467)	(0.2372)	(0.2297)
ln(GDP$_{jt}$)	-0.0139	-0.0005	-0.0074	-0.0085
	(0.0162)	(0.0214)	(0.0200)	(0.0192)
ln(Pop$_{it}$)	-0.5718*	-1.1386***	-0.6131	-0.7789**
	(0.3102)	(0.4099)	(0.3993)	(0.3495)
ln(Pop$_{jt}$)	0.0024	-0.0144	-0.0038	-0.0075
	(0.0175)	(0.0230)	(0.0216)	(0.0206)
ln(Distance$_{ij}$)	-1.0835***	-0.8680***	-0.8567***	-0.8668***
	(0.0366)	(0.0540)	(0.0476)	(0.0472)
ln(Multilateral resistance term$_{jt}$)	0.0386	-0.1602	-0.3197	0.1805
	(0.4764)	(0.5760)	(0.5366)	(0.5324)
ln(Multilateral resistance term$_{it}$)	0.0600	-0.2313	-0.0098	-1.0293
	(0.2752)	(0.4962)	(0.3228)	(0.6336)
ln(Area$_i$*Area$_j$)	0.3681***	0.4402	0.1784	0.2090
	(0.1106)	(1.0356)	(0.1350)	(0.1375)
D(Contiguity$_{ij}$)	0.7697***	0.7730***	0.6338***	0.5200***
	(0.1328)	(0.1418)	(0.1705)	(0.1647)
D(Common language$_{ij}$)	0.2218***	0.2297**	0.1960**	0.2495***
	(0.0770)	(0.0901)	(0.0852)	(0.0843)
D(Common colony$_{ij}$)	0.4641***	0.9314***	0.5428**	1.0174***
	(0.1428)	(0.2924)	(0.2195)	(0.1993)
D(Colony 1945$_{ij}$)	0.4950***	0.1704	0.2658***	0.3406***
	(0.0936)	(0.1068)	(0.1004)	(0.0998)
D(Current colony$_{ij}$)	0.7075	1.7634***	0.5100	-0.1518
	(0.7445)	(0.5851)	(1.0369)	(1.3900)
Years of presence of ij couple	0.3361***	0.3727***	0.3610***	0.3781***
	(0.0106)	(0.0139)	(0.0124)	(0.0123)
Persistence of the ij couple	0.4875***	0.4790***	0.4803***	0.4461***
	(0.0329)	(0.0445)	(0.0391)	(0.0379)
Linear combination	0.3362***			
	(0.1086)			
Observations	50,726	28,968	32,506	35,442
Number of ij couples	10,008	5,906	7,060	7,326

Note: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses. Intra-EU trade: importer and exporter both belong to the EU. EU import: the importer is a EU country and the exporter is a non-EU country. EU export: the importer is a non-EU country and the exporter is a EU country. RoW: neither the importer nor the exporter belong to the EU.

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KJ-NA-30340-EN-N

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doi:10.2760/59702

ISBN 978-92-76-21437-3