European Commission

JRC SCIENCE FOR POLICY REPORT

Evaluation of the benefits and the costs generated by the Toy Safety Directive: a supply side analysis

Competence Centre on Microeconomic Impact Evaluation (CC-ME)

October 2019

Joint Research Centre

EUR XXXXX XX

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JRCXXXXXX

EUR XXXXX XX

PDF	ISBN XXX-XX-XX-XXXXX-X	ISSN XXXX-XXXX	doi:XX.XXXX/XXXXXX
Print	ISBN XXX-XX-XX-XXXXX-X	ISSN XXXX-XXXX	doi:XX.XXXX/XXXXXX

Ispra: European Commission, 2019

How to cite this report: Dumangane, M., Elia, L., Guthmuller, S. and Yoon, M., *Evaluation of the benefits and the costs generated by the Toy Safety Directive: a supply side analysis*, EUR (where available), Publisher, Publisher City, Year of Publication, ISBN 978-92-79-XXXXX-X (where available), doi:10.2760/XXXXX (where available), JRCXXXXXXX.

Contents

Abstract

The European Union introduced the EU Toy Safety Directive 2009/48/EC to ensure toys are safe for children to play with. The Directive sets minimum safety standards relating to toy features that impose obligations on manufacturers, importers, and distributors. This report provides a quantitative analysis of the Directive's effect on the supply of toys in the EU territory.

Foreword

Toys are essential for child development as play contributes in a unique way to the process of growing up and discovering the world. In the recent past, the demand for toys has shown to be remarkably resilient to periods of economic difficulties, which shows its importance in the households' spending decisions.

The toy industry has become an increasingly globalised and competitive one. EU toy manufacturers and retailers increasingly import toy products and parts from all over the world. Asian countries have dominated worldwide production and in particular, China who exhibits high growth rates. Their lower production costs and higher labour productivity have given a competitive advantage when the transportation costs are relatively lower. The EU and US industry have partially adjusted to this trend by focusing on the design and conception of new toys and offshoring and outsourcing production to those countries to reduce costs.

Since toys consumers are fairly price-sensitive, and the price is often negatively correlated with quality, child safety is a real concern. Ensuring that toys marketed in the EU regardless of their origin, do not put children at risk has long become a priority.

Whilst manufacturers are responsible for the safety of their products, importers, notified bodies and national authorities all have a role to play, in ensuring toys sold in Europe's shops fulfil all safety requirements.

The Toy Safety Directive 2009/48/EC is the EU legislative action that aims to ensure that toys meet the safety requirements able to guarantee child safety.

The Directive establishes minimum safety standards relating to toy features, flammability, substances, documentation, and others. These requirements apply to all toys marketed in the EU territory. They will impact not only EU producers but also authorised representatives, importers, and distributors who each have to comply with specific obligations.

Acknowledgements

This report was commissioned by DG GROW and its results will feed into the evaluation of the Toy Safety Directive (Directive 2009/48/EC). The writing of this report received the valuable help of: [redacted] and [redacted] (Unit JRC.[redacted], Consumer Products Safety), [redacted] ([redacted] European Injury Database, European Association for Injury Prevention), [redacted] [redacted], [redacted] [redacted] [redacted] (Unit JRC[redacted] Modelling, Indicators & Impact Evaluation).

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Executive summary

Policy context

Toy safety is important as there are around 70 million children aged under 14 years in the EU, consuming toys supplied by a worldwide industry. To achieve a correct functioning of the internal market of toys a legislative framework that protects consumers is required, that harmonises the safety characteristics of the products marketed in the EU territory.

The Toy Safety Directive 2009/48/EC (TSD) replaced the former Directive 88/378/EEC by strengthening provisions on enforcement and new safety requirements to ensure children continue to benefit from the required high level of protection.

The present report provides a contribution to the assessment of the impact of the Toy Safety Directive on some aspects of its benefits and costs. The report was commissioned by DG GROW and its results will feed into the evaluation of the Directive.

The purpose of this evaluation is twofold. Firstly, to assess the performance of the TSD in relation to its main objectives: guaranteeing a high level of safety of toys, with a view to ensure the health and safety of children and; safeguarding the functioning of the internal market. Secondly, to evaluate the Directive's impact on the cost of EU firms supplying toys in the EU territory.

Key conclusions

The analysis identified a causal link between the TSD adoption and an increase in the number of marketing restrictions on toy products entering the EU territory. The effect was restricted in time (between 2010 and 2012 and again in 2016), and geographically (for products originated from Asian countries). This effect may reflect the operational choice of the MS surveillance authorities of targeting the worldwide largest suppliers. However, guaranteeing the Directive's effectiveness calls for continuous surveillance activities.

As a result of the Directive, toy producers were to change the design, the materials, and in particular its chemical components, and the safety documentation that has to accompany each product. Such changes are likely to have a direct impact on the manufacturer and distributor costs.

The analysis on the cost of materials - the physical inputs for manufacturers and the final product for distributors - showed that both EU manufacturers and distributors experienced a permanent increase as a consequence of the TSD adoption. Since distributors are predominantly importers, and their cost increase may mostly be reflecting a higher acquisition price of their products from manufacturers, the results suggest that the extra-EU toy industry has also been affected.

The cost analysis also showed that with the introduction of the chemical requirements, medium-sized EU manufacturers increased the relative weight of the cost of materials with respect to the cost of employees. A similar effect, starting before the TSD adoption, was identified for larger firms. It is consistent with: (a) a greater specialisation of the EU based activities in the conception a design phases of the production process; (b) the outsourcing or relocation of EU manufacturer's production to Asian countries and; (c) to a lower extent to an increased automation of the manufacturing process. If this is the case, the competitiveness of EU medium-sized manufacturers could come at the expense of jobs in the toy industry, replaced by either automation or employment elsewhere.

Main findings

The TSD impact was investigated for two groups of outcomes. The first measured the potential benefit arising from the reduction in the supply of non-compliant products. Two outcomes were considered: the volume of imports, assuming that a fraction of which could not comply with the new requirements and; the number of toy marketing restrictions placed in the EU market.

Annual product-level trade data (Combined Nomenclature 8) from Eurostat for the period 2003-17 was used to evaluate the TSD impact on the EU28 imports. While the estimates suggest that there was a reduction in the volume of imports of toys, the necessary assumptions to claim a causal link between the TSD and this reduction were not satisfied.

The information available from the European Rapid Alert System for dangerous non-food products (Safety gate; previously RAPEX) was used to assess the TSD's impact on the number of toy marketing restrictions in EU countries. The analysis showed that the TSD introduction led to an increase between 63% and 88%, on the number of toy restrictions in the period between 2010 and 2013, when the toys' origin were Asian countries.

The second group of outcomes measured the impact on the cost of materials of EU suppliers of toys and games - manufacturers and distributors. Firm-level data from Bureau van Dijk on 17 European countries for the period 1997-2017 was used on this exercise. The analysis focused on identifying both the timing and the firm size dependence of the impacts.

Results showed that while the TSD impact on the group of distributors started in 2009, the year of its announcement, for EU manufacturers, the beginning of the effects occurred only in 2010. This difference could reflect the distributors' exposure to the import sector composed by extra-EU (mainly Asian based) firms. These are known to be quicker to adapt to changes in product specifications as the ones induced by the Directive.

The analysis identified an 11% increase in the distributors' cost of materials between 2009 and 2012, and a 13% increase after the introduction of the chemical requirements.

In the group of EU manufacturers, results show that the TSD led to an increase of 13% in the cost of materials of small and medium firms only, leaving unaffected large and micro firms. The absence of effects on large firms led to investigating the potential impact of the TSD on the combination of the inputs (materials and labour) used in the production process. The outcome was the ratio of the cost of materials to its sum with the cost of employees.

The results show that the potential TSD impact on the relative cost of materials depends on both the firm size and the time interval considered. A substantial effect was found for large and medium firms starting, respectively, before the TSD adoption and after 2013, in contrast with the smaller effect found for small and medium firms between 2010 and 2013. The dimension of these effects suggests a structurally different interpretation. While the small effect is a direct consequence of the increase in the cost of materials, the more significant impact indicates a change in the volume of labour used in the production process. These could result from the automation of the production process or/and the relocation of the manufacturing process. The analysis showed that only the effects found on small and medium firms can be attributed to the TSD while the trend on large firms was observed independently of its adoption.

Related and future JRC work

Measuring the TSD causal impact with respect to its main objective of guaranteeing child and health safety should consider as a priority outcome the number of toys-related injuries or accidents in children under 14 years old. This report had foreseen the development of such an analysis based on the conclusion of the feasibility study using the European Injury Database (IDB) (Guthmuller & Elia, 2018, JRC114569). However, a thorough investigation of the database concluded that the IDB could not be used to quantify the impact of the TSD on toy-related injuries.

Quick guide

The ex-post evaluation exercises provided in this report used Counterfactual Impact Evaluation (CIE) techniques. These quasi-experimental methods data are designed to quantify the counterfactual status of the outcomes variables. They provide an answer to the question: what would have happened to the number of market restrictions/cost of materials had the TSD not been adopted? Answering this question provides a quantification of the causal link between the Directive and the outcomes. The estimates of the net effects were computed using the Differences-in-Differences identification strategy. It relies on identifying two groups: those affected by the Directive - the treated group - and those similar in some sense but not affected by it - the control group. The causal impact results from comparing the differences in the outcomes between the groups, before and after its adoption. CIE methods provide a robust quantification of the net effects of policies and can be useful to guide further investigation of the policy transmission mechanisms.

1 Introduction

Toys are an essential part of every child's development process. They are the first interface of children with the world around them and, as such, stimulate all their senses. Each year many children are treated in hospital emergencies for toy-related injuries. Choking, suffocation, air obstruction, poisoning, and chemical burns are just a few of the risks children face when playing with unsafe toys. Because of this, toy safety requirements through the application of safety standards are vital to guarantee that children can play in a safe environment.

Toy safety is of particular concern as the toy industry is increasingly globalised and competitive. The demand for toys has, in the recent past, shown to be extremely resilient to economic adversity at the cost of being very price sensitive. Lack of consumer protection and awareness of the danger of certain types of toys may lead to increased risks to child safety.

Ensuring that toys marketed in the EU do not put children at risk has long been a political priority. The EU legislation aims to ensure that toys meet safety requirements that are amongst the strictest in the world, especially concerning the use of chemicals in toys.

Several regulations and directives apply to the toy sector within the EU internal market (see Annex 1). The first Directive on toy safety was adopted in 1988 (Directive 88/378/EEC) laying down safety requirements for toys. The new Toys Safety Directive published in 2009 (Directive 2009/48/EC) updated and extended the safety requirements for toys to be marketed in the EU territory.

The Directive was transposed by the EU Member States into their national legislation by January 2011 and has applied since July 2011. In 2013 stricter chemical safety requirements were added to the Directive.

The Directive requires manufacturers, distributors and importers to certify their products with a CE mark. This is an EC Declaration of Conformity (DoC) that demonstrates the toy complies with all safety standards and, therefore, can be market in the EU territory. These include compliance with limit values for chemical substances (heavy metals, allergenic fragrances, etc.), and electronic requirements, specific warnings on the packaging, and the existence of complete technical documentation based on a conformity assessment.

At the time of the adoption of the Directive, there were 2 000 companies employing over 100 000 people directly in the toys and games sector, mostly small and medium-sized enterprises (SMEs). Compliance with the safety requirements set by the Directive requires toy suppliers to modify several aspects of their production process, covering design, production, and marketing specifications. These changes are likely to induce an increase in the production costs of manufacturers, distributors, and importers that in turn, might trigger new strategic management solutions.

The present report provides an assessment of the impact of the Toy Safety Directive on the supply of Toys in the EU territory. The purpose of this evaluation is twofold. Firstly, to provide an assessment of the TSD performance in relation to its main objectives: guaranteeing a high level of toy safety, with a view to ensuring the health and safety of children; and safeguarding the functioning of the internal market. Secondly, to evaluate the Directive's impact on the cost of EU firms supplying toys and games in the EU territory.

The reminder of the report is structured as follows. Section 2 reviews the quantitative literature related to the costs and benefits of regulations in the toy sector on child health and safety, trade, product restrictions, and production costs. Section 3 presents the analysis of TSD impact on the supply of toys and on the manufacturers' and distributors' costs. Section 4 concludes.

2 Literature review

The objective of this section is to provide a complete overview of relevant studies related to toy safety with focus on quantitative analysis. Preliminary screening of published journals with keywords such as "toy safety" or "toy injury" returned very few studies related to toy safety. In order to offer better background to type of data sets and methodologies used to evaluate TSD, we include relevant studies that use representative data to evaluate cost and benefits related to toy safety or other similar policy interventions that promote child safety.

2.1 Methods

Search criteria

An extensive search on academic journals in the areas of medicine, health, economics, and public policy was carried out to identify relevant literature related to the topic of toy safety. In addition to the individual journals, institutional database including WHO and academic search engines (e.g. JSTOR, EconLit) have been used for identifying additional sources of literature. The complete list of journals and databases can be found in the references section. Any relevant studies from the bibliographies of the included studies were also identified.

Combinations of the following keywords were used to search for relevant scientific articles: "toy safety", "toy injury", "child injury", "injury cost", "injury prevention" and "youth injury". A separate search was conducted to find articles that deal with injuries related to consumer products but only few articles were added as a result. In 21 journals and search engines, the search criterion was "Title, Abstract or Keywords". For NBER papers, as the publication website did not allow search to be conducted in the same criterion, each keyword phrase was searched in full text of published papers. Similarly, the academic search engine, JSTOR, only had approximately 10% of articles with abstracts and therefore, articles were searched in full-text. This generated 2,416 search results with one keyword, "injury prevention". Consequently, subject area was restricted to "Economics", "Health Policy", "Public Heath", "Public Policy & Administration", and "Statistics" to filter relevant studies.

The search was limited to research articles, and only articles written in English were considered. For chronological restriction, we filtered for articles published after 2000. Lastly, since the aim of the report is to provide cost and benefit analysis of the TSD implemented in Europe, geographical focus of the search was on Europe. However, scholarly articles dealing with data from the United States were included as literature's data coverage of region was large enough to provide insights into comparative methodologies for quantitative analysis. Based on these search criteria, the queries were conducted on January 16th, 2019.

Selection for review

The keywords search resulted in a wide spectrum of academic publications related to child injury or policy intervention for injury prevention. In total, 6 keywords in the search criteria returned 1,023 studies. Of these studies, keywords directly related to toys, namely, "toy safety" and "toy injury", only returned 19 research articles. The list of articles was then screened by title and abstract after removing overlapping studies.

Finally, 36 studies were selected for full-text review. 987 articles were excluded from review as most of them were qualitative studies or had little relevance related to the topic of toy safety or child safety. Under the keyword "child injury", many observational case studies related to specific child injuries such as head damage or burn injuries were removed from the review. Also, studies linking child injuries to socioeconomic environments (i.e. parental income or regional districts) or maternal well-beings were discarded because of small geographical coverage (e.g. Community districts). Despite engaging in quantitative analysis, if injuries data sets did not include any data related to children (e.g. old population fall prevention), the studies were removed from the review. Other qualitative articles were excluded as they provided general review on guidelines for child safety or because they employed interviews or survey research methods.

Included studies

From the full text review, 12 studies were included in the final list and 23 studies were excluded. Then, the literature is analysed by topic and research approach. This approach allows us to categorise a broad range of studies and provide an easier way to understand methodologies and data employed by the different studies. In the order of highest frequency in topics, there were 5 studies on injury cost, 4 related to child injury, 3 on toy safety and finally 1 research article explicitly exploring the topic of toy injury.

In terms of research approach, the most employed method is descriptive statistics. 5 of 12 studies used injury or mortality statistics to describe frequency and distribution of epidemiological cases of child injuries or gave overall injuries statistics. Studies using injury cost base, especially National Electronic Injury Surveillance System (NEISS) in the United States, provided economic evaluation of injuries by estimating direct and indirect cost associated with injuries. Only 2 studies from Journal of Health Economics and Health Economics used either Difference-in-Differences (DiD) or Difference-in-Difference-in-Differences (DDD) methodologies to estimate child injuries and evaluated benefits of implementing bicycle helmet laws and child care regulations. Others engaged in text mining method (1) or comparative analytics (1).

2.2 Review of included studies

A list of academic journals on which the review was based is presented in the reference list of this report. For two studies that engaged in economic analysis with DiD or DDD methodologies we provide more in-detail review of the articles. The articles are organized by study topics.

Child injury caused by toys

Foltran et al. (2012) focuses on a particular child injury caused by toys and their risk using data from Susy Safe Registry[1]. The aim of the study is to characterise the risk of complications and prolonged hospitalisation due to toys inhalation, aspiration or ingestion according to age and gender of patients, foreign body (FB) characteristics and circumstances of the accident, based on the data available from Susy Safe Registry. The statistical analysis examined age and gender distributions of FB injuries caused by toys as well as data regarding adult supervision. Of a total of 16,878 FB injuries, 441 (2.6%) were due to toys. Almost 61% of toys related injuries happened under adults' supervision. More than two thirds of injuries (69%) involved children older than three years. 49 (12%) children needed hospitalisation due to toy-related injuries and no death was observed.

Child injury

Using data on children's injuries from the National Electronic Injury Surveillance System (NEISS) in the USA, Markowitz and Chatterji (2015) assess the effectiveness of bicycle helmet laws in preventing injuries for children aged 5-19. The authors select injuries that best represent potential injuries that can be prevented by the helmet laws. They only count injuries in which the most hurt part is the head, ear or all parts of the body (more than

[1] The Susy Safe Registry is an international surveillance registry for injuries due to organic and inorganic foreign body ingestion, aspiration, inhalation or insertion in children. 17 (EU and non EU) countries are participating. https://www.susysafe.org.

25%). Hence, injuries like face injuries are not counted as wearing a helmet is not likely to prevent injuries on the face.

For specification of the model, the authors include hospital fixed effects to account for time-invariant hospital-specific characteristics. Furthermore, time-varying hospital characteristics such as the number of hospital beds are included to capture any factors that may influence injury rates at a specific hospital.

Since the bicycle helmet laws are reinforced differently by state, year, and age groups, the authors use difference-in-difference-in-differences (DDD) approach. The data covers 141 hospitals, 18 years and 15 ages, and the complete model would have 4700 interaction terms. To overcome computation difficulties, they reduce the location indicators to a single indicator variable for whether or not the hospital is in a state that reinforces a helmet law or not. The DDD model with hospital fixed effects is the most preferred model by the authors but they also present a three way fixed effects model as well as DDD models with different fixed effects for comparison. The models are estimated with Poisson regression analysis as there are a lot of zeros present in the injury count.

The estimation results from the most inclusive DDD model with hospital fixed effects show that having a bicycle helmet law reduces the bicycle-related head injury count by 13.7%. The authors check validity of the control groups by running simple DiD estimation and check the injury rates in the post period of those children who are within six years range to the control group. They find small and statistically insignificant coefficients for the control groups in the post period to support the validity of the control group.

However, the authors also find 9% reduction in non-head injuries related to the bicycle helmet laws as well as increase in injuries for other wheeled sports. They conclude that as a result of the helmet laws, children can be substituting from riding bicycles towards other wheeled sports like roller stake or skateboards.

Kyu et al (2016) estimate main causes of death among children aged 5-9 years and 10-14 years from 1990 to 2016, for 51 countries in the WHO European Region. They look at the distribution and trend of mortality rates among older children across Europe using data from vital registration systems, cancer registries, and policy records (for road injuries and homicide only). The authors find that the average mortality rate in children aged 5-9 years dropped by 58% from 1990 to 2016; that of children aged 10-14 years dropped by 47.1%. They also illustrate large variations in trends in cause-specific mortality rates in children across different countries and propose that the mortality rate can be even further reduced by injury prevention programs and policies.

In the Journal of Health Economics, Currie and Hotz (2003) analyse effects of child care regulations on childhood injuries for children using micro data on accidents at an individual level in the United States from the National Longitudinal Survey of Youth from 1987-1998. In addition, the authors conduct state-level, times-series analysis for accidents rates using the Vital Statistics Detail Mortality (VDSM) data and Census Population estimates. In this analysis, they use a diff-in-diff approach using children 5-9 years as a control group who are less likely to be affected by the child care regulations. The paper focuses on three specific measures of the regulation to study its impact: 1) ratios of children to caregivers; 2) the number of mandatory inspections of child care facilities per year; and 3) the education required of child care centre directors or of providers in family homes. In addition to estimating the regulation effects on childhood injuries, the paper also examines how the regulation also affects childhood care mode choices made by parents using multinomial logit methods.

For estimates of regulation effects on childhood accidents, the authors use state fixed effects to control for differences across states and child-specific fixed effects to control for regional differences as well as potential reporting biases in the regression.

The estimation results show that minimum education requirements for day care centre directors reduce childhood accidents at those centres. The results also demonstrate the indirect effect of crowding out children from regulated care as stricter regulation leads to parents abandoning the associated child care. The diff-in-diff analysis based on Vital Statistics data confirms the finding that the education requirement for day care centre directors reduces the likelihood of non-care accidents. However, the estimates for other regulations measures were inconsistent across data sets. Also, the authors acknowledge the limitation of the study as there could be other set of state policies related to child care and child safety that could have affected non-accidental injuries among children.

In their paper, Veisten, Nossum and Akhtar (2009) estimate aggregate cost of injuries in Norway from accidents in the home and during education, sports and leisure activities. To calculate the economic cost of injuries, the authors sum up ex ante valuation of risk reduction and ex post costs related to emergency operations and medical treatment, health and insurance administration. They use the injuries data from hospitals in 4 cities to estimate cost of national injuries and injuries data related to road accidents for the cost estimate of ex ante valuation (reduced quality life).

Toy safety

The selected three literature studies on toy safety focus on surveillance of toys and effective mechanisms to prevent hazard and promote toy safety. The paper by Liepiņa and Korablova (2014) studies why there are non-compliant toys available in the market despite the measures implemented by EU and the member states to prevent children from playing with dangerous toys. In Latvia, the Consumer Rights Protection Centre (PTAC) found that 35-50% of the tested toys were non-compliant with the regulation. The authors compared data on the non-compliant toys across different member states using the RAPEX data from 2009 to 2013. They found correlation of the number of non-compliant toys with the country of origin of toys available in the market and the number of activities carried out by market surveillance authorities. The paper concludes that improving market surveillance is the key to reducing non-compliant toys on the market.

On the other hand, Winkler et al. (2016) proposes analysing online reviews through a text-mining method to effectively uncover dangerous toys and to conduct surveillance of children's toy industry. To identify toys with safety concerns, the authors first construct 'smoke word lists' from the two sources: narratives on toy-related hospital admissions from the National Electronic Injury Surveillance System (NEISS), years from 2009-2014, and toy-related recalls narrative from CPSC Recall reports, years 1973-2015. Then, the authors run experiments with Amazon online reviews in the "Toys and Games" category. In one of the experiments, they score Top 400 reviews and Bottom 400 reviews that contain the words from the smoke work lists and manually code them to identify any safety defects or concerns were found in these sets. The results of the experiments show that smoke word approaches are highly effective in classifying toy reviews that mention safety concerns.

Guney and Zagury (2014) focus on specific toy items to analyse its hazardous dimensions. This paper characterises risk from children's oral exposure to seven potentially toxic chemicals in inexpensive jewelry and toys, namely As, Cd, Cr, Cu, Ni, Pb, and Sb. In addition, the authors propose a comprehensive approach to assess chemical safety of toys and jewelry for eight priority elements.

Injury prevention

The paper by Milkovich et al. (2003) suggests injury prevention criterion for children's injuries related to foreign body ingestion. Based on the RAM consulting data that collected foreign body injuries data points from 51 children's hospitals in 15 countries located in 5 continents, the authors suggest a specific size of a consumer product that results in injuries in children and proposes adoption of preventive mechanism. Also, the paper concludes that no national or cultural difference was identified in the child-object interaction.

Injury cost

Mulder, Meerding, and van Beeck (2002) develop incidence based cost model for calculating direct cost of injuries in the Netherlands. Taking nationwide database of the Dutch Injury Surveillance System (LIS) that records all injured patients who attended the emergency department of 17 hospitals in the Netherlands in 1997, the authors classify injury incidence by predefined patient groups based on medical cost determinants such as initial care, location/type of injuries, age, sex, and severity. For each patient, the average medical cost is estimated using three parameters: transition probabilities (ex. chance of hospitalisation), volume of care, and unit cost prices. Then, cost of injury is calculated by multiplying the injury incidence by average medical cost per patient then summing up the total costs of patients for a specific category. Rather than looking at the total health care costs caused by injuries, this model allows to identify a priority area for implementing specific injury prevention policy. For instance, for home and leisure, falls at home were responsible for 45% of the costs and 20% the incidence. Among the 0-14 age group, Home and leisure account for the majority of the total cost of injuries in this age group. For children under 5, the costs are mainly due to lower extremity injuries, excluding fractures of upper leg (37%) and superficial injuries and wounds.

Polinder, S. et al. (2016) also attempt to evaluate the economic burden of injuries using the same database. The paper estimates cost of injuries in two dimensions: the direct cost of injuries as in health care cost and indirect cost related to productivity loss due to work absenteeism. The authors use the incidence-based Dutch Cost of Injury model using injuries data in the Netherlands for 2012. They calculate the total societal costs of unintentional and intentional injuries to be 3.5 billion euros annually, of which 2.0 billion account for direct health care costs and 1.5 billion for productivity costs. They find that home and leisure injuries were responsible for 53% of total costs, of which 71% were direct health care costs. The paper also illustrates the cost variance by external cause category, nature of injury category, age and sex.

The paper by Lawrence, Spicer and Miller (2003) provides descriptive statistics on injury incidence and its related cost for non-fatal consumer product injuries including toys in the U.S. The paper uses data from National Electronic Injury Surveillance System (NEISS) that records all consumer product injuries treated in hospital emergency departments in the U.S. and integrated Injury Cost Model (ICM) which allows estimating the associated medical costs and other indirect costs such as work losses, pain and suffering costs, etc.

Based on data from 2008 to 2010, sports and recreation was the largest product category causing injuries and accounted for 30% of the annual cost of $909 billion. Toys, on the other hand, accounted for 2% of the non-fatal product related injuries and incurred $18 billion annual cost.

Miller, Romano and Spicer (2000) use national and state data sets to provide descriptive statistics and cost of unintentional childhood injuries in 1996. By presenting associated cost of unintentional childhood injuries, the authors call for governmental action to provide mechanisms to ensure safety of disadvantaged children (of families eligible to Medicaid, a means-tested program for low-income families in the US). The paper states that unintentional childhood injuries in 1996 resulted in an estimated $14 billion in lifetime medical spending, $1 billion in other resource costs, and $66 billion in present and future work losses. These injuries imposed quality-of-life losses equivalent to 92,400 child deaths.

Impact of marketing restrictions on product safety

Although there are number of academic literature studies on the effects of product recall, quantitative studies on the direct impact of recalls on product safety are scarce. Literature specifically dealing with toy recalls focus on the recalls' financial implication for firms. Ni et al. (2016) study stock market reaction to toy recalls in 2000-2014 worldwide and conclude that an announcement of a toy recalls is associated with negative stock market reaction. Wood et al. (2017) look at firms' operational strategies to mitigate the negative impact of toy recalls. The authors find that greater levels of business diversification and longer time to recall are associated with a less negative shock to the recalling firms' shareholder's value. In a different aspect, Hora et al. (2011) examine U.S. toy recalls and look at why it takes long time for firms to recall toys that pose safety hazard to children. They identified that the time taken to initiate a recall is linked to not only the type of defect but also to the firms' position along the supply chain. The lower the proximity the supply chain entity has to the end-customer, the longer the time to recall a defective product; retailers being faster than distributors and toy companies.

One study, in particular, provides insight into how consumers make inference about toy safety after recall announcements are made. Freedman et al. (2009) examine consumer response to the massive recall of U.S. toy in 2007 by comparing toy sales before and after the toy recalls were announced. The authors argue demand change following a particular toy recall will illustrate how consumers' perception on the safety of other toys has changed. They use data on monthly Infant/Preschool toy sales from January 2005 to December 2007 by manufacturer, category and property (i.e. licensed brand) type. Since toy sales are highly seasonal, where roughly half of toy sales occur around Christmas season, the authors look at the impact of the recalls on Oct-Dec sales. The standard difference-in-difference estimation results show that although the toy recalls in 2007 affected the sales of type of toys recalled more severely, the manufacturers who were not involved in the recalls also experienced decrease in sales, implying an industry-wide spill-over effect. In addition, even if one brand is involved in the toy recalls, it does not necessarily lead to disproportionate loss of sales in other types of toys by the same brand; rather it depended on the nature and type of toys offered by the brand. Lastly, although major recalled toys in 2007 consist of products manufactured in China, there was no indication of decrease in share of toys manufactured in China compared to those manufactured outside China following the recall announcement.

In the other industry sector, the association between product recalls and safety is more explicitly studied. Bae and Benitez-Silva (2011) try to provide quantitative evidence on the effects of automobile recalls on drivers' safety, measured by number of accidents. The authors construct panel data set using recall data from the National Highway Traffic Safety Administration (NHTSA) from 1988 to 2001, accident data from the General Estimation System (GES) based on policy reports, and vehicles' sales data from Ward's automotive yearbook. The GES data is collected from randomly selected police stations in the areas that represent geographic and demographic regions. Since panel data based on individual accidents is not available, the paper goes extra length to validate their use of grouping accidents data by driver type and vehicle model to construct synthetic panel data from repeated cross-sectional data. The authors group drivers by age, gender, and also by a specific vehicle model in order to control for individual specific behaviours on the road and an individual driver's response to recalls.

Based on random effects estimation of the panel data, Bae and Benitez-Silva (2011) conclude that vehicle recalls have positive effects on drivers' safety by reducing the number of accidents. They estimate that a 10 percent increase in the recall rate of a particular model reduces the accidents of that model by between 0.78 percent and 1.6 percent. Since not all recalled vehicles are fixed, the authors also estimate the effects of correction rate on the number of accidents after a recall. They find quantitative evidence that the higher correction rate leads to the lower number of accidents for the given vehicle year model in the three years following the recall.

Impact of safety regulation on trade

To the best of our knowledge, there is no literature that draws quantitative analysis on trade impact of the EU's toy safety regulation. However, considering the abundance of literature on trade impact of food safety regulation and how food safety regulation is closely tied to preventing food hazard and promoting safety of consumers, we will briefly summarise representative literature studying the impact of food safety regulation. Previous research has studied how food safety regulation affects trade based on gravity model estimation. It is commonly argued by economists that strict food regulation imposed by developed countries is trade-impeding for developing countries with lower standard (Otsuki et al., 2001; Wilson and Otsuki, 2004; Disidier et al., 2008). However, in their meta-analysis, Li and Beghin (2011) demonstrate that literature shows varying degree of trade effects by different methodologies or samples or aggregation level employed. And yet, for agricultural and food industries, technical measures tend to be more trade-impeding than in other sectors.

Looking at the trade impact when strict food safety regulations are introduced, Anders and Caswell (2009) find that introduction of Hazard Analysis Critical Control Point (HACCP) regulation in the U.S. resulted in decrease in imports from developing countries and increase in imports from developed countries, supporting the view that strict restriction imposed by developed countries act as barriers to trade. The EU is considered to have more stringent food safety regulation (Baylis et al. 2010). Disidier et al. (2008) look at the impact of Sanitary and Phyto-Sanitary measures (SPS) and Technical Barriers to Trade (TBTs) imposed by OECD countries on agriculture trade and find that European imports are more negatively affected compared to other OECD countries.

More specifically, to study the impact of strict EU food safety regulation on trade diversion and deflection effects, Baylis et al. (2010) analyse import refusals using the Rapid Alert System for Food and Feed (RASFF). The authors take the border refusal records of seafood products from 1998 to 2008 and match them with annual global bilateral trade flow data from COMTRADE database by six-digit Harmonized System (HS) code. Using the standard gravity model specification (Anderson and van Wincoop 2003), they estimate how the EU import refusals affect trade flows into the EU and to other non-EU countries. The authors find that in the seafood industry where potential for food safety hazard is serious, EU import refusals result in a significant decrease in exports to the EU from the country and for the product targeted. On the other hand, the authors observe an increase in exports amount of the same product category from the same export country to all other importing countries. However, they do not find evidence that refused imports are more diverted to developing countries with less strict regulation.

2.3 Conclusion

Whereas, for other types of products, such as cars or food, the literature on safety regulation and related injuries is abundant, the literature on toy safety and toy related injury is rather scared in Europe, most of the literature being US based. Few Europeans papers looked at toy related injuries and child injuries but these studies do not link the prevalence or the incidence of injuries to toy safety regulations.

3 Measuring the Directive's impact on the EU toys supply

3.1 Introduction

A Counterfactual Impact Evaluation exercise

This section of the report provides an evaluation exercise of the TSD effectiveness. The purpose of the analysis is the identification and quantification of the Directive's causal effect on selected outcomes related to the supply of toys and games in the EU territory.

Traditional evaluation techniques may provide valuable information on the nature of the impacts and hints on the transmission mechanisms of the policies. However, establishing true causation between a particular impact indicator and a policy intervention such as the TSD requires the use of evaluation techniques able to construct an appropriate counterfactual scenario.

In this section, Counterfactual Impact Evaluation (CIE) methods are used to bring causal evidence on the TSD effectiveness using micro-level data.

The outcomes

Two groups of outcomes will be considered. The first acknowledges that, if the TSD is to be effective in ensuring a high level of safety for children, toys not complying with the new requirements should no longer be marketed and be restricted or recalled from the EU market. This could induce two relevant indirect effects on the supply of toys.

The first effect accounts for the high volume of toys imported into the EU market, in particular from Asian manufacturers that need to comply with the new safety rules. The stricter safety requirements introduced by the TSD could have had a deterrent effect on the importers of such products, therefore potentially producing a temporary reduction on imports of toys.

The second effect could arise from the increased awareness brought by the TSD on the safety concerns attached to non-complying products and; the need to improve market surveillance. [2] Thus, the adoption of the TSD, would be expected to have, at least, a temporary impact on the number of toys withdrawn from the market.

Thus, given the availability of data the impact of the TSD requirements as a whole will be assessed in the following outcomes:

1. The number of toys entering the EU internal market: This can is measured as the number of toys traded in Europe or/and as the volume of toys imports as its majority originates from non-EU countries.

2. The number of unsafe toys restricted from the market

Figure 1 summarises the link between these two outcomes and the ultimate goal of increasing child safety by reducing the number of toy-related injuries and accidents.

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[2] According to article 40 - General obligation to organise market surveillance – "MS shall organise and perform surveillance of toys placed on the market in accordance with articles 15 to 29 of Regulation (EC) No 765/2008. In addition to those Articles, Article 41 of this Directive shall apply". Furthermore, the MEMO/11/448 from the EC's press release of 23 June 2011 emphasizes to importance of increased market surveillance for a successful implementation of the TSD.

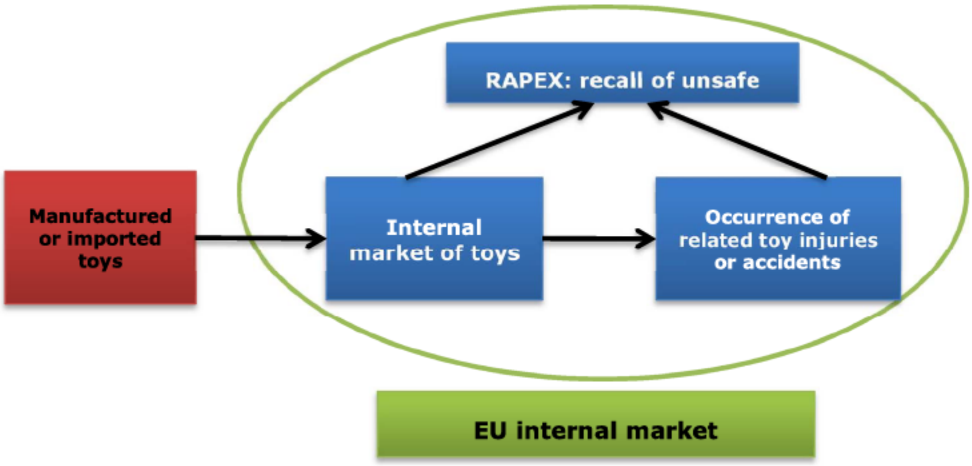


Figure 1 Measuring the impact of the TSD

The second group of outcomes emerges from recognizing that in order to comply with the new safety requirements, the TSD is likely to have an impact on production and distribution costs. In fact, the TSD set specific obligations for the economic agents along the production-distribution chain, that will impact both manufacturers – inside and outside the EU -, and EU distributors, which are, in most cases, importers.

Considering individually different cost-related outcomes could be of interest in this context (e.g. labeling, safety documentation or physical input costs). In this exercise, the availability of data constrains the analysis to the TSD impact on the "cost of materials". For manufacturers, this includes the cost of all physical inputs to the production process, while for distributors this is the cost of acquiring the final product from the manufacturers plus the labeling and documentation costs of their responsibility.

In addition, the analysis discusses to what extent the TSD may be associated to the EU toys manufacturing industry becoming less labour intensive. This could result from a greater focus of the EU based firms' activities on the conception and design of toys accompanied by a relocation of the manufacturing process to countries where costs are lower. Alternatively, such outcome could be the consequence of the automation of the production process.

Since this effect will change the way the inputs to the production are combined, a relevant outcome of interest for this analysis is the relative cost of materials, measured as the ratio of the cost of materials to the sum of the cost of materials and the cost of employees.

The timing of the Directive

The TSD was adopted in 2009 with the obligation of being transposed to the EU MS national legislation by 20 January 2011 and has applied since July 2011. In addition, the chemical safety requirements have applied since July 2013.

This calendar sets the time framework for the analysis of the TSD impact. In particular, the introduction of the chemical requirements in 2013 suggests testing whether the magnitude of the effects is beyond that date significantly larger.

Depending on the nature of the analysis, the TSD impacts can be assumed to start in different years. When considering the effects on the suppliers of toys and games, the publishing year (2009) should be regarded as it signals the need to adjust to the new requirements. If instead, the impact arises from the surveillance authorities, the year of its application (2011) is the appropriate time as it marks the beginning of its enforcement

The time representation of the effects

A related and essential dimension of the analysis is the time representation of the impacts. According to whether the expected impacts are assumed temporary or permanent, the study will estimate yearly specific effects or time interval effects.

The discussion above identified a first group of outcomes for which the Directive is to have an indirect effect. In fact, the potential impact on the volume of imports and the number of product restrictions depends on how importers, on the one hand, and surveillance authorities, on the other hand, react to the TSD. It can be assumed that both, for different reasons, will not necessarily be the same over the time considered.

The same reasoning does not apply to the cost-related outcomes. The changes induced by the TSD, on the cost of materials and its relative cost can be assumed to be permanent once they occur.

Heterogeneity of the effects: country of origin and firm size

An important consideration when analysing the TSD impacts regards the heterogeneity of the effects. In both groups of outcomes, the units of observation are not homogeneous with respect to relevant dimensions, and as such specific impacts should be computed.

In the first group of outcomes, toys products have different countries or geographical zones of origin. This is relevant because of the different volume of trade that might be implicit in the case of imports and because specific origins may be targeted from the surveillance authorities.

In the cost analysis for both distributors and manufacturers, firm size is an important dimension to consider when estimating the likelihood and dimension of the impacts. Market power considerations, greater management ability in the allocation of resources and in the adoption of new cost saving production techniques (such as automation) are characteristics of large (and medium) firms that can mitigate the Directive's impact.

The methods

The identification of the TSD impacts on the two groups of outcomes is performed by using the Differences-in-Differences (DiD) estimator.

DiD is a quasi-experimental design that makes use of longitudinal data from treatment (units affected by the Directive) and control groups (units not affected by the Directive) to obtain an appropriate counterfactual to estimate a causal effect.

The DiD estimator typically compares the changes in outcomes over time between a population that is subject to the treatment (the intervention group) and a population that is not (the control group). The DiD relies on the assumption that in absence of treatment, the unobserved differences between treatment and control groups are the same overtime.

3.2 Impact on trade

3.2.1 Theory of change

The EC press release of 23 June 2011 entitled "Toy safety is the European Commission's priority", sets the context within which the Toy Safety Directive adopted in 2009 has been issued:

"*The total retail market for traditional toys in the EU totalled €14.485 billion in 2009, [while] total imports of traditional toys from non EU countries to EU27 in 2010 were €6.96 billion (+20.3% compared to 2009). (…) China was the leading importer: it accounted for 86.2% of total imports. Chinese manufacturing is part of the global supply chain of both European and international manufacturers who have to ensure that their toys meet all EU safety requirements regardless of where they are manufactured."*

These figures show a trend where toy manufacturers and retailers increasingly contract with extra-EU suppliers to achieve production efficiencies and cost savings. Despite these advantages, however, there is the concern that products from these suppliers may fail to comply with prescribed quality and safety standards, increasing the risk to children.

The TSD is the EU legal framework that addresses the regulation and oversight regarding the safety of toys sold within its jurisdiction.

If complying with the rules set by the TSD requires time and entails adjustment costs, because extra-EU firms have to make changes to their production chain, this could produce a temporary drop in the import of toys until conformity is restored.

The reduction in trade would reflect a correct functioning of the directive and therefore it could be interpreted as an indirect benefit of the TSD. Yet, it might be thought of as an evidence of the effectiveness of the TSD and give insights into the extent to which the TSD has been pervasive in the EU economy.

3.2.2 Methods

The empirical strategy to assess the TSD impact used in the present study relies on the application of the DiD methodology, where the evolution of imports of toys is contrasted with that of similar products possibly within the same industry sector.

This strategy entails the estimation of a *gravity model of trade* (Tinbergen, 1962; Anderson and van Wincoop, 2003), where bilateral trade flows for toys and similar products among countries, are explained by several determinants and contextual factors, which have proven to influence the evolution of trade (e.g., geographical factors; distance, per capita GDP level, cultural affinity, etc.). Conditional on these factors, the impact of the TSD is then quantified by the possible changes in trends in imports between treated and control group and estimated by including in the model an indicator for the period since the introduction of the directive.

Identification of the Treated and Control Groups

The treated group consists of toys and games products classified under the category #9503 of Chapter 95 "Toys, games, and sports requisites; parts and accessories thereof" of the Combined Nomenclature (CN). These include "tricycles, scooters, pedal cars and similar wheeled toys; dolls' carriages; dolls; other toys; reduced-size ('scale') models and similar recreational models, working or not; puzzles of all kinds". This aggregate represents the closest category to toys and games subject to the Directive.

To construct the control group, products which share similar characteristics with toys but that are not presumably affected by the Directive were selected. Two different comparison groups comprised of products under the Chapter 95 of the CN were used:

- Control group A: This contains products classified under the categories #9504-5-6. These are "Articles for funfair, table or parlour games, including pin tables, billiards, special tables for casino games and automatic bowling alley equipment" (#9504), "Festive, carnival or other entertainment articles, including conjuring tricks and novelty jokes" (#9505) and "Articles and equipment for general physical exercise, gymnastics, athletics, other sports (including table tennis) or outdoor games, not specified or included in the two groups before above" (#9506).
- Control group B: It adds to control group A all products classified under the category #9600 of Chapter 96 of the CN. These additional items are miscellaneous plastic and wooden articles such as brooms brushes, buttons, Ballpoint pens, pencils, etc..

Econometric specification

This study uses annual product-level trade data (Combined Nomenclature 8) from Eurostat for the period 2003-17 and it assesses the impact of the TSD on EU28 imports through the following difference-in-differences (DiD) model:

$$Imports_{pijt} = exp^{x_i'\beta+(Treated_p*Post2009_t)\gamma+(Tre \quad _p*Post2013_t)\theta+f_i+f_j+f_t+\epsilon_{pijt}} \quad (1)$$

where $Imports_{pijt}$ are imports of product *p* (in thousands of euros) from country *i* to country *j* at time *t*; the parameters γ and θ are the coefficients of interest quantifying the effect of the TSD in two separate periods, i.e. 2009-2013 and 2013-2017, to distinguish the impact of the requirements introduced prior to the chemical requirements in 2013 and; the variables f_i ,f_j and f_t are country of origin fixed effects, country of destination fixed effects (EU28) and time fixed effects.

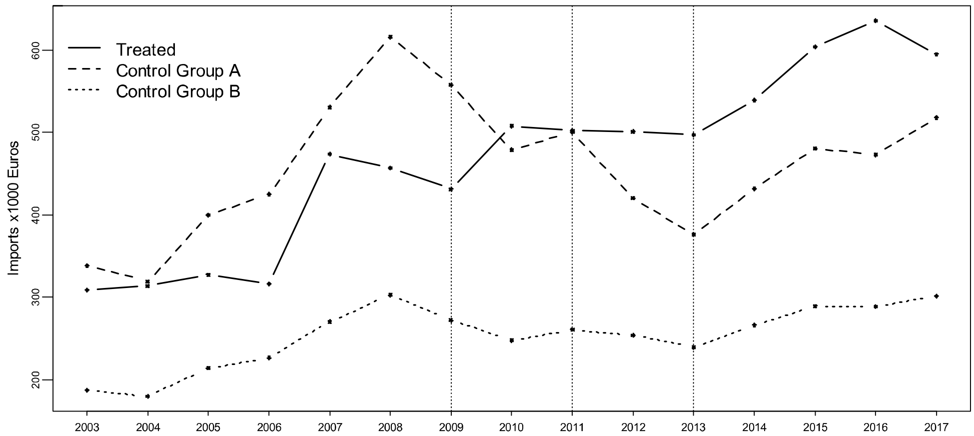
The vector x_i' includes time varying control variables such as the per capita GDP, population, and interactions between capital-to-capital distances (in km). The latter are meant to capture changes in transportation costs.

Since the potential effect of the TSD on the importing sector may be confined to the length of time necessary for the adjustment to the new rules, it is likely to have a temporary nature. As such, an econometric specification, that estimates year specific impacts for the period 2009-16, will be presented, allowing for the "speed of adjustment" to be traced over time.

Moreover, to test whether there are anticipatory changes in imports and to check for the presence of underlying trend not associated with the TSD, *placebo* impacts are estimated for the time interval 2006 to 2009. Statistical evidence of placebo effects might hinder the causal interpretation of possible identified impacts of the TSD.

Estimation of the parameters was done by Poisson regression model with fixed effects, which is appropriate when it comes to model dependent variable with non-negative values (Santos Silva and Tenreyro, 2006). The coefficients have a direct interpretation as semi-elasticities. Robust standard errors are provided.

Figure 2. Average import for treated and control groups



3.2.3 Results

Figure 2 shows the average level of imports for the treated and control groups over the time period 2003-17.

The time series of the control group's exhibit an increasing path in the periods before 2008 and after 2013 and a decrease between those years. In both cases the trend is steeper for control group A. On the other hand, the time series of the treated group displays an overall increasing trend, interrupted by a slight decrease between 2007 and 2009 and between 2010 and 2013 - following the application of the TSD.

Moreover, before the introduction of the TSD the two groups of time series have clearly different trends. This result points to possible violation of the parallel trend assumption underlying the DiD – i.e. the assumption under which the outcomes in both groups before the policy intervention ought to grow at the same rate.

The results from different specifications of model (1) are reported in Table 1. Column (i) and (ii) use as control group all products under categories #9504-5-6 (control group A). While column (iii) and (iv) uses as control group the product under categories #9504-5-6 and #9600 (control group B). Moreover, column (ii) and (iv) report time specific impact of the TSD.

The results from the time constant specification, columns (i) and (iii), suggest that the introduction of the TSD in 2009 and, the application of its chemical requirements in 2013 induced a reduction on the imports of toys. The effect is more pronounced between 2009 and 2013.

The same negative effect is more visible by looking at the year-specific estimates in columns (ii) and (iv), which also report estimated coefficients for years 2006-08, before the implementation of the Directive. These are meant to investigate whether the difference in imports between treated and control group was also present before the Directive came into force and, thus, they inform on whether the identified effects are indeed caused by the Directive or can be contaminated by underlying trends.

Table 1. The impact of the TSD on imports

	Control Group A		Control Group B	
	Constant (i)	Year specific (ii)	Constant (iii)	Year specific (iv)
Treated *1(t=2006)	---	-0.961***	---	-0.617***
	---	(0.127)	---	(0.133)
Treated* 1(t=2007)	---	-1.085***	---	-0.797***
	---	(0.132)	---	(0.144)
Treated * 1(t=2008)	---	-1.232***	---	-0.986***
	---	(0.139)	---	(0.154)
Treated * 1(2009 ≤ t < 2013)	-0.991***	---	-0.647***	---
	(0.065)	---	(0.073)	---
Treated * 1(t=2009)	---	-1.171***	---	-0.924***
	---	(0.157)	---	(0.178)
Treated * 1(t=2010)	---	-0.919***	---	-0.613***
	---	(0.127)	---	(0.137)
Treated * 1(t=2011)	---	-0.928***	---	-0.613***
	---	(0.120)	---	(0.131)
Treated * 1(t=2012)	---	-0.961***	---	-0.437***
	---	(0.116)	---	(0.123)
Treated * 1(t ≥ 2013)	-0.885***	---	-0.360***	---
	(0.054)	---	(0.061)	---
Treated * 1(t=2013)	---	-0.897***	---	-0.317***
	---	(0.113)	---	(0.123)
Treated * 1(t=2014)	---	-0.906***	---	-0.365***
	---	(0.121)	---	(0.139)
Treated * 1(t=2015)	---	-0.874***	---	-0.359***
	---	(0.122)	---	(0.139)
Treated * 1(t=2016)	---	-0.827***	---	-0.299**
	---	(0.122)	---	(0.139)
Treated * 1(t=2017)	---	-0.924***	---	-0.442***
	---	(0.118)	---	(0.134)
N	88657	88657	81635	81635

* p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard errors are shown in parenthesis. Models include country of origin fixed effects, destinat on country fixed effects, time dummies, per capita gdp, population, interact ons of capital-to-cap tal distance w th time dummies. The ind cator function 1(.), dentifies the time interval associated to the estimated coefficient.

Both models identify significant differences in the period 2006-09, i.e. the treated group has lower level of imports than the control group, pointing to persistent underlying differences in the two groups of products. This is an evidence of violation of the parallel trend assumption which is key for internal validity of the DiD estimates.

Overall, while the estimates suggest that the TSD had reduced imports of toys in EU-28, there is also statistical evidence of threats to identification of these effects and as consequence the results should be interpreted with caution.

Box 1: Impact of the TSD on imports

Analysis design:

Data: Product-level trade data (Combined Nomenclature 8) from Eurostat, 2013-17.

Method: Difference-in-Differences Design (DiD).

Outcomes: Import of goods under categories 9503-6 and 9600

Main result: Evidence of a decrease in import of toys as compared to other products in the period 2009-2017.

Robustness: Evidence of threats to identification and results cannot be interpreted as causal

3.3 Impact on restrictions of toys placed on the market

3.3.1 Theory of change

With the application of the TSD in 2011, toys not compliant with the new safety requirements were restricted, by information on the risks, recalls from end users, and withdrawals from the market.

The introduction of the ban, however, does not prevent all non-compliant toys to be suddenly removed from the market. That calls upon a strict and effective enforcement of the TSD, which requires the allocation of resources and the improvement over time of the surveillance systems.

The MEMO/11/448 from the EC's press release of 23 June 2011 - "Toys safety is the European Commission's priority"- identifies market surveillance as a fundamental tool in creating confidence in the European market and its legislation:

"Toys that comply with Europe's stringent toy safety requirements and other EU legislation are safe but market surveillance must be stepped up to ensure that rogue traders cannot put inferior products on the market. It is imperative to concentrate on the points of entry into the EU as it is difficult to detect non-compliant or unsafe toys once they are on the market. Increased market surveillance would also help to combat the problems of counterfeiting and parasitic copying, which are of particular concern to the toy sector and consumers alike, as counterfeit products can compromise the safety of children."

If effective this priority should lead to a stronger enforcement of the TSD and, as a consequence, to an increase in the number of notifications reflecting the higher level of scrutiny of toys.

3.3.2 Methods

In this part, the TSD impact on preventing children injuries related to toys as measured by the number of toys presenting a risk and removed from the market is assessed. The outcome of interest is then the number of toys recalled or restricted from the market, and a DiD identification strategy will be used to quantify the TSD impact.

Identification of the Treated and Control Groups

Several data sources on product recalls are available. In Europe, risk alerts and recalls of non-food products are collected and made available to the public through the European Rapid Alert System for dangerous non-food products (RAPEX). The OECD Global portal on product recalls collects similar information including recalls in non-EU countries. However, information is only recorded from 2012. Australia, Canada, Japan or the United States have for instance their own portal on product recalls portal.

In the present report, the impact of the TSD on the number of toys removed from the market is assessed based on information collected by RAPEX. In particular information from 2008 on the product category, the country from which the alert originates, the country of origin of the product, and the risk level is used.

The sample is composed of product restrictions with serious risks (95% of all alerts) for which all restrictive measures imply a recall or withdrawal from the market. The product categories "Motor vehicles" and "Electric devices", are excluded, since they are, respectively, regulated by specific European Directives and Regulations, and by a new Directive in 2011 (Directive 2011/65/EU).

The *treatment group* is defined by the product category "Toys" and three different control groups are defined, ranging from a group including a broader range of product categories to a narrower group composed by child products, not in the scope of the TSD:

- Control group A: includes "Chemicals", "Childcare articles", "Cosmetics", "Clothing" and "Other" -which includes sports equipment, decorative articles, furniture, etc;
- Control group B: excludes "Cosmetics" from the product categories in A and;
- Control group C: excludes "Chemicals" from the product categories in B.

Econometric specification

The following model is estimated

$$restriction_{cpt} = exp^{x'_{cpt}\beta+(Treated_c * f_t)\gamma_t+f_c*f_p+f_t+\epsilon_{ict}}$$

Where restriction_{cpt} is the number of restrictions in each EU country participating in RAPEX c, year t and product category p. $f_c * f_p$, f_t are respectively country of alert-product fixed effects, and year fixed effect.

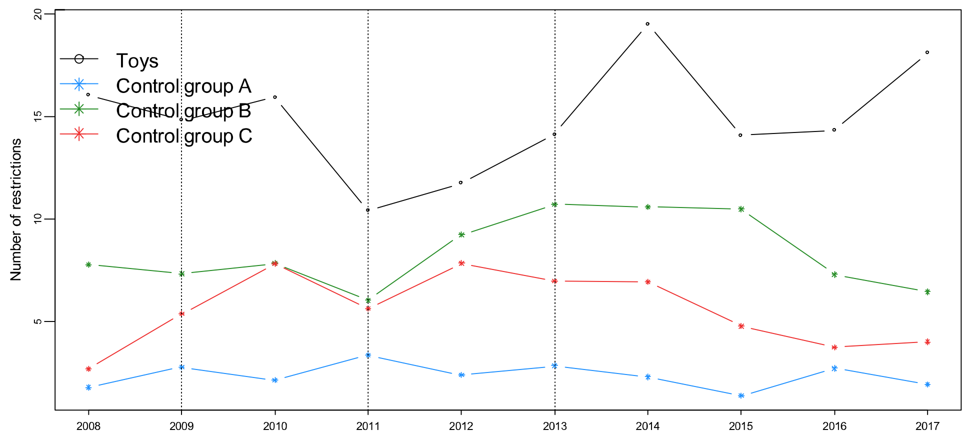
The vector x_{cpt} includes the total number of restrictions in a given country c and the total number of a given product p in a year t, in order to control for differences in the activities of the market surveillance authorities across countries and products.

The coefficients γ_t are the main parameters of interest as they measure the TSD impact in year t. The year specific representation of the effects, assumes an a priori assumption that the nature of the effects might be temporary and/or of different magnitude over time, since it is the combined effect of the authorities' surveillance intensity and the inflow volume of non-complying products.

For the time period before 2011, γ_t are placebo tests that aim at testing whether the effects found can be attributed to the TSD.

Separate models are estimated according to the origin of the products: from all countries; products "Made in Europe"; and products "Made in Asia" only.

Figure 3. Average number of restrictions in each country of alert for treatment and control groups



Note: yearly average number of restrictions in each EU country participating in RAPEX by treatment and control groups. The treatment group is the product category "Toy". Control group A includes "Chemicals", "Childcare articles", "Cosmetics", "Clothing" and "Other" product categories. Control group B is composed of the product categories of A excluding "Cosmetics", and control group C includes the product categories of B excluding "Chemicals".

3.3.3 Results

Econometric **specification**

The following model is estimated

$$restriction_{cpt} = exp^{x'_{cpt}\beta+(Treated_c * f_t)\gamma_t + f_c * f_p + f_t + \epsilon_{ict}}$$

Where $\mathrm{restriction}_{\mathrm{cpt}}$ is the number of restrictions in each EU country participating in RAPEX c, year t and product category p. $f_c * f_p$, f_t are respectively country of alert-product fixed effects, and year fixed effect.

The vector x_{cpt} includes the total number of restrictions in a given country c and the total number of a given product p in a year t, in order to control for differences in the activities of the market surveillance authorities across countries and products.

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For the time period before 2011, γ_t are placebo tests that aim at testing whether the effects found can be attributed to the TSD.

Separate models are estimated according to the origin of the products: from all countries; products "Made in Europe"; and products "Made in Asia" only.

Figure 3 displays the yearly averages across EU countries reporting unsafe toys, of the number of restrictions in the treatment and in each control group and, in the period 2008-2017.The number of toys restrictions is higher than any other products for the whole period and seems to increase after the introduction of the TSD in 2011 until 2014. In 2011, there were 11 toy restrictions on average in EU countries and in 2014 this figure was 19.

Table 2. Impact of the TSD on toy restrictions

	Full Sample			Asia			Europe		
	A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
2008	0.067	0.080	0.211	0.203	0.205	0.372	-0.076	-0.069	-0.068
	(0.266)	(0.275)	(0.317)	(0.213)	(0.218)	(0.347)	(0.575)	(0.603)	(0.666)
2009	-0.140	-0.099	0.127	0.120	0.128	0.274	0.105	0.166	0.277
	(0.267)	(0.275)	(0.305)	(0.230)	(0.235)	(0.349)	(0.395)	(0.416)	(0.465)
2010	0.033	0.069	**0.536***	**0.409***	0.393	**0.728***	0.157	0.189	0.295
	(0.234)	(0.250)	(0.286)	(0.241)	(0.248)	(0.378)	(0.381)	(0.405)	(0.466)
2011	-0.147	-0.079	0.296	**0.434***	0.407	**0.627***	0.071	0.095	0.216
	(0.258)	(0.267)	(0.292)	(0.253)	(0.258)	(0.361)	(0.400)	(0.424)	(0.523)
2012	0.063	0.119	**0.821****	**0.526***	0.501	**0.888***	0.179	0.185	0.437
	(0.301)	(0.322)	(0.361)	(0.309)	(0.315)	(0.458)	(0.417)	(0.451)	(0.522)
2013	-0.126	-0.079	0.425	0.243	0.239	0.570	0.075	0.068	0.190
	(0.253)	(0.266)	(0.290)	(0.255)	(0.259)	(0.356)	(0.415)	(0.447)	(0.554)
2014	-0.205	-0.182	0.110	-0.209	-0.219	0.014	0.016	0.037	0.144
	(0.223)	(0.230)	(0.255)	(0.208)	(0.210)	(0.276)	(0.447)	(0.476)	(0.650)
2015	-0.103	-0.110	0.184	0.197	0.164	0.338	-0.057	-0.091	0.006
	(0.197)	(0.206)	(0.238)	(0.188)	(0.191)	(0.279)	(0.338)	(0.348)	(0.409)
2016	-0.004	0.033	0.163	0.243	0.246	**0.434***	-0.113	-0.088	-0.111
	(0.165)	(0.173)	(0.220)	(0.172)	(0.176)	(0.236)	(0.424)	(0.434)	(0.495)
N	1680	1400	880	1520	1310	870	1520	1270	780

Note: * p < 0.10, ** p < 0.05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include country of alert-product fixed effects, year fixed effect, the total number of restr ct ons in a given country c and the total number of a given product p in a year t. A, B, C are the respective control groups used in each regress on

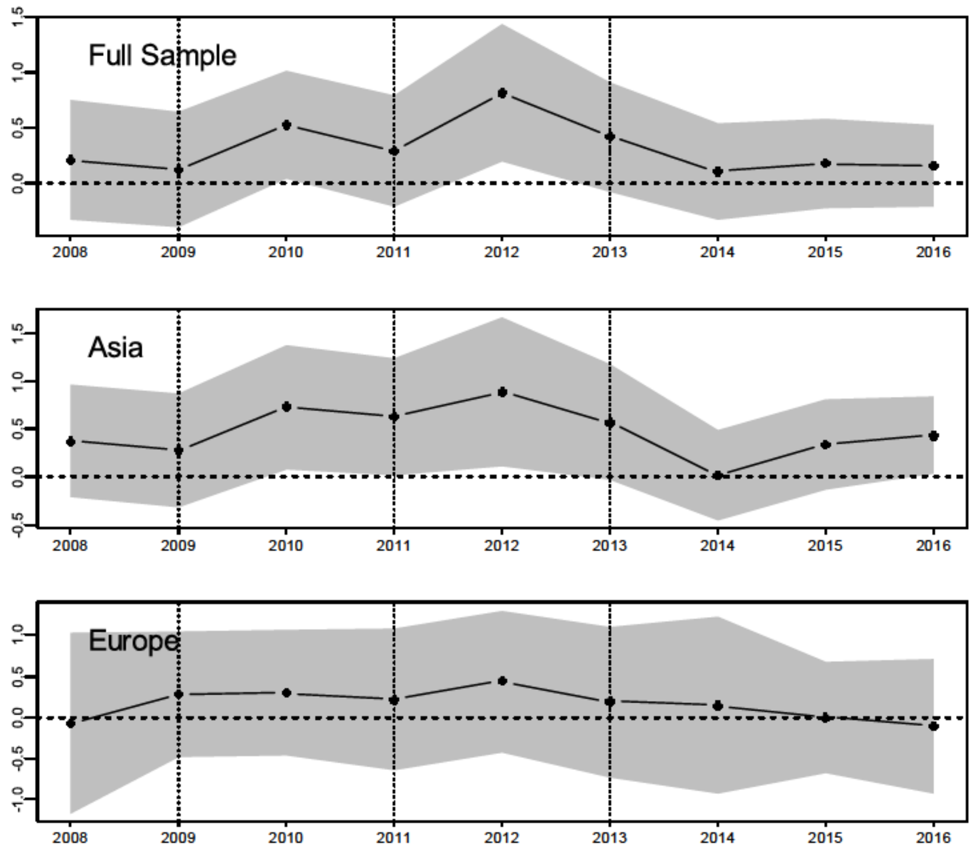
Table 2 shows estimated yearly impacts of the TSD on toy restrictions for several specifications. In the period before the application of the Directive (2011), there is no evidence of a difference between treated and control group in 2008 and 2009, but a significant effect is found in 2010. Despite having been published in 2009 and being applied as of 2011, it can be assumed that products were already recalled before the official application date, under the legal framework in force.

When considering the entire sample, the introduction of TSD seems to have had a transitory impact, restricted to the period 2010-12, in the range of 54-88%. This transitory positive impact is only significant different from zero when using the most restrictive sample (C).

In addition, the impact is driven by toys manufactured or produced in Asia, where China is the first country importing toys to Europe. The effect is stronger when the treatment group is the number of other child related products not affected by the TSD.

Figure 4 reports the estimated impact on the number of toy restrictions under the control group C. While for toys made in Asia, the TSD increased significantly the number of toy restrictions between 2010 and 2012, for toys made in European countries the impact is positive but not significantly different from zero.

Figure 4. Year-specific impacts of TSD on toy restrictions



Note. The Figure reports the estimated coefficient (semi-elasticities) of models with control group C in Table 2 the confidence intervals are at the 90% level. Multiplying the coefficients by 100 gives the percentage change.

Box 2: Impact of the TSD on product restrictions

Analysis design:

Data: European Rapid Alert System for dangerous non-food products (RAPEX) 2008-2017.

Method: Difference-in-Differences Design (DiD).

Outcomes: Number of product restrictions by year and by country of alerts

Main result:

The Toy Safety Directive seems to have a transitory positive impact on the number of toys restrictions in the range of 40-88% between 2010 and 2012.

Robustness:

The identification assumptions of the method are met. The significance of the results hold with the most restrictive control group.

3.4 Measuring the impact of the directive on costs

This section investigates the effect of the TSD in the production function of the EU based firms from the toys sector, and in particular its impact on costs. The analysis considers separate empirical models for distributors/importers of toys (distributors henceforth) and manufacturers of toys, since the two groups of enterprises face different production functions. The analysis is based on firm-level data from Bureau van Dijk (Orbis) from 17 European countries for the period 1999-2017.[3]

3.4.1 Impact on the cost of materials of manufacturers and distributors

3.4.1.1 Theory of change

In order to comply with the safety requirements introduced by the TSD, manufacturers had to adjust the design and modify the materials used in the production process. In addition, both manufacturers and distributors/importers had to comply with new labelling requirements related with the safety features of their products. Furthermore, for both types of actors the name, registered trademark and address must be indicated either on the toy's surface (and/or packaging), or in the accompanying documentation. These requirements are likely to have had an impact on the cost of materials of manufacturers and distributors.

This section quantifies the impact of the TSD on the cost of materials of EU manufacturers and distributors in the toys and games sector. The cost of materials in the Orbis data set is defined as the "purchases of goods - raw materials and finished goods - excluding services"[4].

For the distributors, the cost of materials comprises not only the cost at which the final product is purchased from the manufacturers, but also the additional costs induced by the new labelling requirements. These include the cases foreseen in the directive where the obligations on manufacturers also apply to this group.

For the manufacturers instead, the cost under investigation is the total cost of the materials used in the final product, including the packaging[5].

An issue to be taken into account when estimating the likelihood and size of the impact of the TSD is firm size. There are at least two reasons why firm size should be considered a relevant determinant of the magnitude of the TSD impact on the cost of materials: First, the analysis of changes in costs is obviously related to the market relation of firms with their suppliers (current or new). It is reasonable to assume that larger manufacturers/distributors are more likely to exert market power over their suppliers, thus mitigating, compared to their smaller counterparts, the potential cost increase induced by the directive. Secondly, larger manufacturing companies often offer a wider range of products and are more intensively involved in the upstream phases of the production process, namely the design and conception of the toys. Furthermore, larger firms have the management ability to exploit different combinations of resources allocation between the upstream and the manufacturing phases of the production process. In particular, the globalisation of the manufacturing process allows larger firms to consider solutions where internal production can be shifted or re-located to countries where productivity is higher and costs are lower.

[3] Countries included in the sample are: Belgium, Bulgaria, the Czech Republic, Germany, Estonia, Spain, Finland, France, Hungary, Croatia, Italy, Luxembourg, Latvia, Poland, Portugal, Romania and Sweden.

[4] A particular type of services of interest not considered here are the safety testing procedures. Nevertheless, these costs are considered to be transitory and eventually negligible compared with the increased costs induced by the change in materials and chemicals.

[5] The impact associated to the re-design of the toys is an important outcome to be considered, but difficult to isolate from the need to use new materials.

Evidence of this has been found in the 2013 report by DG Enterprise and Industry "Study on the Competitiveness of the toy industry", which states:

"*Other firms choose to design and develop toys close to their home markets, and link up with large Asian production facilities and Hong Kong liaison offices to increase capacity for fast response to changing product specifications, and to implement and further develop technical aspects of the production process and manage quality and safety effectively. (…) Consumers are fairly price sensitive. In combination with a low concentration in the market, this means that producers face cost and price competition to a significant extent. This competition on costs is reflected in the production strategy of producers, with many producers offshoring and outsourcing production to China to reduce production costs.*"

Although the TSD was to be applied as of 2011, it is likely that the changes in the costs of both manufacturers and distributors may have been triggered by its adoption in 2009. The timing of the impact reflects a strategic option, but also the ability of the firms - and in particular of manufacturers - to adjust the production process to the new specifications. Competition for market shares in a highly competitive industry motivates firms to anticipate the implementation of the changes required by the TSD.

The ability to quickly adjust to changing product specifications is, as stated above, a characteristic of the "large Asian production facilities". As a consequence, since many distributors are importers that buy from extra-EU countries, this group of players may have been affected by the TSD before the EU based manufacturers.

The analysis identifies, for the two groups of enterprises, the moment in time when the effect on the costs of materials induced by the TSD occurred. In addition, it investigates whether a differential effect on costs might have occurred from 2013 onwards, following the entering into force of the chemicals requirements of the TSD.

3.4.1.2 Methods

The identification of the TSD impact on the cost of materials of manufacturers and distributors in the Games and Toys sector is achieved by using a DiD strategy on firm-level data from Bureau van Dijk.

Identification of the Treated and Control Groups

The quantification of the TSD impact requires identifying the following sets of enterprises: firms likely to have been affected by the directive's requirements - the treated group; and firms that share a common trend in the outcome variable (i.e. cost of materials) before the introduction of the directive, but are not affected by it - the control group.

For the analysis on distributors, the treated group comprises companies in the "Wholesale of other household goods" activity sector (NACE classification 46.49), which includes, among others, firms operating in the wholesale of games and toys. For the manufacturers, the sector of activity "Manufacture of Games and Toys" (NACE classification 32.40) is the relevant source.

However, not all firms in those economic classifications are targeted by the directive. In fact, the Annex I of the TSD – "List of products that, in particular, are not considered as toys within the meaning of this Directive" – identifies products that could be associated with toys but are out of the scope of the directive. Being in the same activity sector and therefore likely to have experienced a common trend, these companies have the required properties of a control group.

An additional strategy to identify a control group for the manufacturer analysis selects firms from sectors that use the same "physical" inputs in the production process as the games and toys industry, namely, plastic and wood. However, this additional analysis did not lead to relevant results and is not reported in the present study[6].

Control group: Firms within the Toys and Games sector

The selection of firms in the treated and control groups was performed, by exploiting the textual information on a set of variables in the Orbis data set that describe the firms': "Main Activity"; "Main products" and; "Trade description"[7]. Two sets of keywords were considered: the first includes objects/expressions related to toys and games under the scope of the directive - "toys", "games", "dolls", etc., and derivations of these words; the second set of keywords includes other objects/expressions within the sector that are not affected by the directive - "bicycles", "sports", "video-games", "consoles" "transformers", "computer", and so on.

Firms can present more than one keyword from any of the above lists, hence creating some degree of overlap. Therefore, in order to distinguish clearly the treatment group, only enterprises having at least one keyword from the first set and not having any from the second set are identified as treated. The control group is defined as the complementary set[8].

This procedure relies on the existence of textual information and on the ability of the keywords to correctly identify the two groups.

Control group: Firms outside the Toys and Games sector

For the manufacturers analysis an additional control group can be constructed by sampling firms from other industries that use in their production process the same inputs (materials) as the toys and games industry. Two categories of products were considered: those made by plastic - NACE 22.29 "Manufacture of other plastic products"-, and those made by wood - NACE 16.29 "Manufacture of other wood products". The description in those classifications specifically excludes firms that manufacture plastic games and toys and wooden toys. This suggests that these industries share common features with the toys and games industry, therefore providing a possible control group since they are not targeted by the directive.

Imputation of Number of Employees

As discussed above, firm size is believed to be an important determinant of the TSD impact. Several different criteria can be used to classify firm size. In this report firm size is defined by the number of employees leading to the commonly acknowledged categories: Large (more than 250 employees); Medium (from 50 to 249 employees); Small (from 10 to 49 employees); and Micro (fewer than 10 employees). An additional category is often defined by considering the group of Small and Medium enterprises (SME) defined as all firms with less 250 employees.

The Orbis data set provides information on the number of employees over time, although for a significant number of firms this variable is missing. Given the relevance of this information, and the need to preserve a meaningful sample size, an imputation procedure was adopted to estimate the number of employees, for the purpose of inferring firm size as defined above. Two cases were considered:

A. Firms for which data on the number of employees was partially missing. For these, the missing values were made proportional to the cost of employees, where the proportionality rule was given by the previous data point where both variables were

6 The fact that these firms use the same inputs may not be enough to guarantee that they share a common trend before the introduction of the TSD.

7 The statistical software R was used to do the text mining analysis.

8 This procedure was implemented for both the manufacturers and distributors. However, in the first group an inspection of the firms identified as controls was possible due to the smaller sample size, leading to the reclassification of some firms.

observed. If the first observation was missing, the proportionality rule was deduced from the first data point where both variables are observed;

B. Firms for which no data on the number of employees was available: A matching procedure for the first time observation was performed based on the year, cost of employees, sales and group (treated or control). The subsequent time observations were imputed based on the proportionality rule described in (1).

For the purpose of the analysis firm size is defined as the average number of employees before the implementation of the TSD to avoid potential endogeneity issues.

Econometric specification

In order to account for the non-negative nature of the variable 'costs of materials', all results are based on a difference-in-differences (DiD) exponential regression, including versions with firm size heterogeneity, and two potential time intervals for the impact. The regression is given by:

$$Y_{it} = exp^{x_{it}'\beta+(Treated_i*Post2009/10_t)\gamma+(Treated_i*Post2013_t)\theta+f_i+f_t+\epsilon_{it}}(3)$$

where Y_{it} is the cost of materials for manufacturer/distributor *i* at time t; γ and θ are the coefficients of interest, quantifying the effect of the TSD, represented by semi-elasticities ,in the 2009/10-2012 and the 2013-17 interval, respectively; the vector x_{it} includes firm characteristics detailed below; and f_i and f_t represent firm and time fixed effects.

The cost of materials reflects the firm production volume which may be affected by cyclical events like the economic crisis or any other structural change affecting the industry. Therefore, the outcome of interest when analysing the TSD impact should be a relative cost measure (e.g. the unit cost of materials). Alternatively, the regression equation for the cost materials must be a function of some measure of the production volume. In the absence of the quantity sold, this can be approximated by sales. For that reason, the vector x_{it} includes as time varying control variables, the log of sales and, where relevant, the log of cost of employees - both lagged one year to mitigate issues of simultaneity between dependent and independent variables.

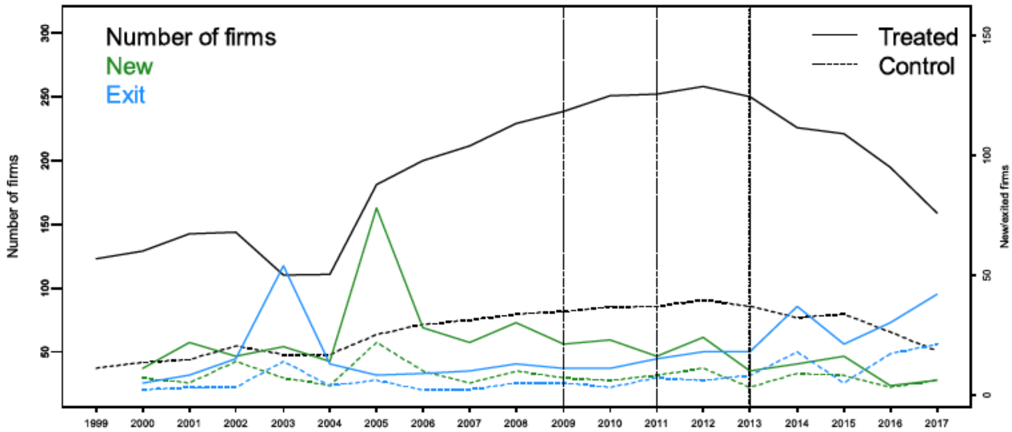
In all specifications, firm specific effects f_i are considered, which allow controlling for unobservable time constant firm characteristics, as well as, year specific effects f_t, which control for aggregate demand shocks (e.g. induced by the economic crisis) or other changes in macroeconomic conditions.

Estimation of the parameters was done according to a Poisson regression model with fixed effects (see for example Greene, 2004).

For simplicity, in all tables, only estimates of the impacts of the TSD in the relevant firm categories and time periods are reported, while full estimation results are provided in the Appendix.

Results from several specifications are presented, addressing key issues for the quantification of the TSD impact on the firms' cost of materials. The criteria for model selection privileged the most parsimonious specification that addresses the following questions on the nature of the impacts: is the impact dependent on firm size? Can firms be grouped (based on the data) to compute the firm-size specific effects? What is the relevant time interval for the estimation of the impacts? Are the impacts different in the two periods associated with the implementation of the TSD? Is there evidence of year specific effects? Can the effects be attributed to the TSD or are the differences found between treated and control firms prior to the directive's reference period?

Figure 5. Firms' demographics: manufacturers



3.4.1.3 Results

Results for manufacturers

Figure 5 shows the demography of the firms in the manufacturers sample used in the estimation. The sample is an unbalanced panel with a yearly rate of entry and exit of firms of around 10%. The yearly variation in the number of firms reflects the firm demographics in the period but also the change in the reporting obligations. Throughout the analysis it is assumed that the exit and entry of firms in the sample is not related with the outcomes and can be treated as random. The total number of manufacturers firms in the treated and control group is respectively 300 and 105.

Table 3 shows descriptive statistics from the sample of manufacturers for the periods before and after the adoption of the TSD in 2009. The table reports the number of firms, by firm size; the average cost of materials and; the ratio of the cost of material to sales for both treated and control group.

Overall, while the average cost of materials in the treated group reduced significantly, the relative (to sales) cost increased after the TSD. Furthermore, for all size subgroups except for large firms, the average relative cost of materials for the treated did not reduce after the TSD, while in the control group it either decreased or remained constant.

Table 3. Descriptive statistics manufacturers' sample before and after the TSD announcement

	Treated Group					
	No. of firms		Average Cost of Materials		Average Cost of Material/Sales	
	Before 2009	After 2009	Before	After	Before	After
All firms	287	264	5086	2860	0.439	0.512
Large	12	12	51781	56975	0.458	0.433
Medium	39	38	5374	4755	0.366	0.398
Small	79	73	3634	2271	0.474	0.472
Micro	157	151	508	503	0.429	0.448
	Control Group					
	Before	After	Before	After	Before	After
All firms	102	97	2048	2462	0.429	0.44
Large	3	3	34766	46548	0.606	0.569
Medium	8	7	5831	7988	0.508	0.461
Small	29	26	819	747	0.442	0.436
Micro	64	55	346	226	0.417	0.417

Average cost of materials in 1000 euros

Figure 6 shows the average cost of materials for the treated and the control group of manufacturers over time. Both groups display an increasing trend in the period under scrutiny. Despite the volatility induced by the entry and exit of firms in the sample, and the fact that this cost measure does not take into account the volume of production, there is enough evidence of parallel evolution between treated and controls in the period 1999-2009, suggesting that the parallel trend assumption underlying the DiD is satisfied.

Figure 6. Average cost of materials for treated and control groups of manufacturers

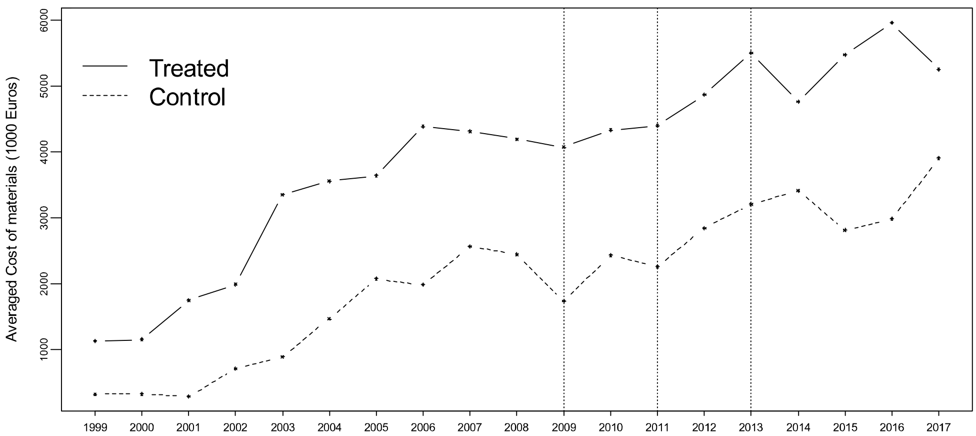


Table 4 shows the results from the DiD regression in the manufacturers sample under different specifications for the firm size representation of the effect. The different assumptions aim at testing whether: (i) there is evidence of firm size related impacts; (ii) firms can be grouped with respect to size; (iii) there is evidence of a differential impact of the TSD in the two time intervals considered – 2010-12 and 2013-17.

The first column shows an estimated impact of a 9.3% increase in costs when the effect is assumed to be firm size homogenous, i.e. when all firms are assumed to be equally affected by the TSD. A comparison with the specification in column two reveals that this assumption does not hold as the only significant coefficient is the one for small firms. Even though the medium firms' parameter is not significant, the equality between the coefficients on medium and small firms cannot be rejected, as shown at the bottom of column two.

Table 4. Impact on manufacturers' cost of materials: firm size heterogeneous models

Homogeneous		Heterogeneous		Heterogeneous Small & Medium		Heterogeneous Small & Medium 2010-12		Heterogeneous Small & Medium 2013-17	
All	0.093*	Large	-0.138	Large	-0.138	Large	-0.147	Large	-0.131
	(0.051)		(0.138)		(0.138)		(0.170)		(0.135)
		Medium	0.094	S&Med	0.130**	S&Med	0.131*	S&Med	0.130*
			(0.122)		(0.065)		(0.067)		(0.073)
		Small	0.133*						
			(0.075)						
		Micro	0.077	Micro	0.077	Micro	0.057	M cro	0.095
			(0.074)		(0.074)		(0.072)		(0.090)
		H_0: $b_{Medium} = b_{Small}$				H_0: $b_{S\&Med;2010-12} = b_{S\&Med;2013-17}$			
		(0.79)				(0.99)			

* p < 0.10, ** p < 0.05, *** p < 0.01. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis.

The third column shows the estimated impacts when these two groups of firms are considered together. The magnitude of the effect remains constant but the estimate is now more precise.[9]

Finally, the specification in column four tests whether there is evidence of a differential effect in the two intervals considered. As confirmed by the Wald test below the two coefficients are statistically equal.

These results bring statistical evidence of an increase of 13% in the cost of materials for small & medium manufacturers, which is constant over the reference period for the TSD. The analysis finds no statistically significant effect on both large and micro firms, despite the estimated impact being positive in the latter case.

Table 5 shows a second set of estimated impacts for small & medium firms only, which aim at investigating: (i) the existence of time specific effects and; (ii) to what extent the effects found above can indeed be attributed to the TSD, i.e, the difference between treated and control is significant only in the reference period of the directive.

Table 5. Impact on manufacturers' cost of materials: year specific effects for small & medium firms

Constant		Time specific 1st Interval		Time specific 2nd Interval		Time specif c Pre TSD	
2010-17	0.130**	2010	0.131*	2013	0.087	2006	0.265
	(0.065)		(0.069)		(0.078)		(0.173)
		2011	0.132	2014	0.038	2007	0.208
2010-12	0.131*		(0.097)		(0.105)		(0.162)
	(0.067)	2012	0.130	2015	0.194*	2008	0.068
2013-17	0.130*		(0.088)		(0.105)		(0.129)
	(0.073)		---	2016	0.206**	2009	0.168
			---		(0.093)		(0.132)
			---	2017	0.167		---
			---		(0.121)		---
		H_0:b_t=0.13, t=2010,…,2012 (1.0)		H_0:b_t=0.13, t=2013,...,2017 (0.58)		H_0:b_t=0, t=2006,...,2009 (0.40)	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis.

The first column shows the estimated impacts on small & medium firms as in Table 5. The specifications in the second and third columns extend the model in column four of Table 5, by replacing the estimate for the time interval with year specific effects.

The year specific effects in the first period are indistinguishable from the overall effect – as confirmed by the Wald test - but estimated with less precision. The year specific effects in the interval 2013-2017 exhibit a departure in magnitude and statistically significance from the interval estimate. However, the joint test of equality of the time specific coefficients to the interval estimate reveals that assuming a time constant effect is a statistically valid assumption.[10]

Finally, the specification in the fourth column extends the model with constant impact of on small & medium firms, to include year specific effects before the TSD reference period. This is referred to as a placebo regression and aims at investigating whether the impact found can indeed be attributed to the TSD, by testing if the differences between treated and control group are prior to a reasonable anticipation effect.

The results show that none of the coefficients representing a difference between treated and control before the TSD reference period is statistically significant. Furthermore, the p-value of the joint test of nullity of the yearly impacts supports this assumption, bringing

[9] A specification where micro firms were added to the group of small and medium was considered, but the resulting coefficient became smaller and estimated with less precision.

[10] Despite the strong significance of the individual coefficients, in particular in 2015 and 2016, the interval representation of the effect can also be preferable in this context since identifying year specific effects on the sub-sample of small & medium firms can be statistically challenging with the current sample size.

evidence that the effect of 13% increase on small & medium firms is indeed specific to the TSD reference period.

Results for distributors

Figure 7 shows the firms' demographics in the distributors sample used in the estimation. The total number of firms in the treated and control group is respectively 1153 and 3328. Again the sample is an unbalanced panel, with an average yearly rate of entry and exit of firms of around 10% in the treated group, and an average yearly entry and exit rate of 14% and 11% respectively, in the control group.

Figure 7. Firms' demographics: distributors sample

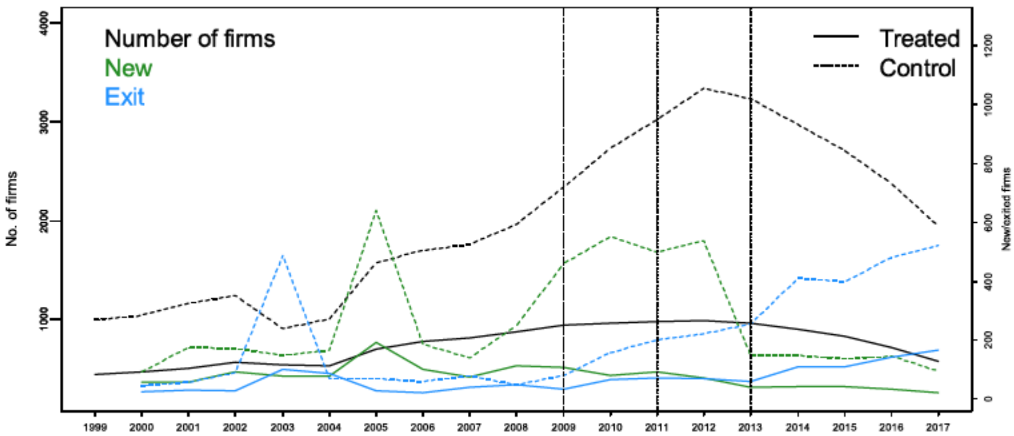


Table 6 shows descriptive statistics by firm size for the period before and after the announcement of the TSD.

The overall figures for the average cost of materials and the relative cost of materials in the treated group do not reveal any trend before and after the TSD. Within the firm size categories, there is an increase in the average cost of materials in the period after the implementation of the TSD, in particular in medium and small firms. However, when the cost of materials is measured relatively to sales there are no substantial differences between the two periods. Again, the change in the sample composition and the size and quality effects induced by other factors affecting the toys and games industry might in this simple analysis offset the effects of the directive.

Table 6. Descriptive statistics distributors sample before and after the TSD announcement.

	Treated Group					
	No. of firms		Average Cost of Materials		Average Cost of Material/Sales	
	Before	After	Before	After	Before	After
All firms	1106	1023	4889	5281	0.623	0.629
Large	3	3	86087	42823	0.793	0.82
Medium	54	50	34333	39752	0.637	0.631
Small	234	231	6033	10778	0.664	0.661
Micro	894	787	1417	1476	0.607	0.619
	Control Group					
	Before	After	Before	After	Before	After
All firms	3500	3141	2626	5620	0.611	0.61
Large	13	9	841448	208702	0.711	0.689
Medium	89	77	22891	25455	0.692	0.683
Small	431	406	5756	5566	0.685	0.695
Micro	3117	2773	706	669	0.595	0.595

Average cost of materials in 1000 euros

Figure 8 shows the average cost of materials for the treated and the control group of distributors over time, excluding large firms.[11] Both groups display an increasing trend in the period under scrutiny. The common trend assumption seems to be challenged around 2005, as the average cost of materials in the control group register a substantial reduction. This effect might be induced by the large number of firms entering this group in that year. Since the change in the sample composition is most likely responsible for the change in the time trend in 2005, the parallel assumption required to identify the impact of the TSD with a DiD strategy can be assumed to be satisfied.

Figure 8. Average cost of materials for treated and control group of distributors

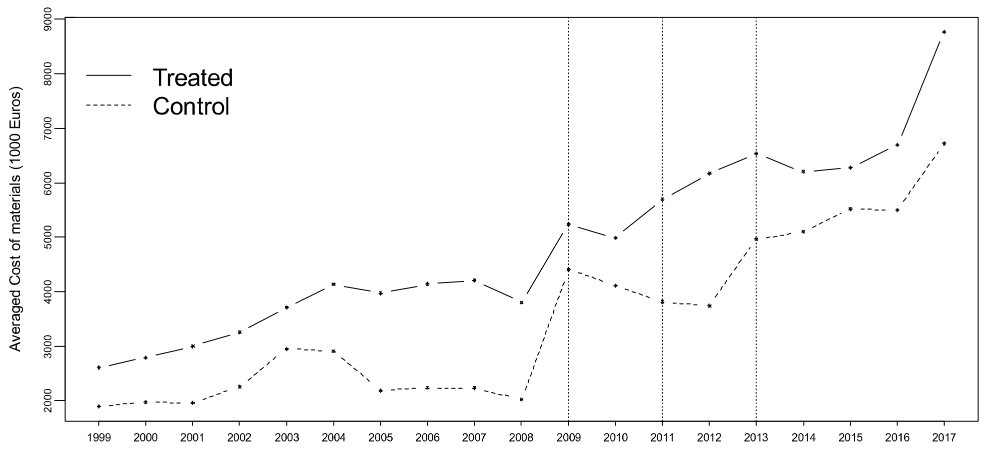


Table 7 shows results for a set of specifications that investigate the firm size heterogeneity nature of the effects and the time interval representation of the impacts. The analysis starts by assuming that the effect of the directive on the distributor's costs begins in the same year as for the EU manufacturers.

Table 7. Impact on distributors' cost of materials: firm size heterogeneous models

Homogeneous			Heterogeneous		Heterogeneous Small & Micro		Heterogeneous Small & Micro			
2010-17	2010-12	2013-17					2010-12		2013-17	
0.105***	0.094***	0.115***	Medium	0.078	Medium	0.081	Medium	0.088	Medium	0.080
(0.020)	(0.019)	(0.022)		(0.069)		(0.069)		(0.068)		(0.074)
			Small	0.079***	S&M c	0.101***	S&M c	0.089***	S&Mic	0.111***
				(0.021)		(0.020)		(0.019)		(0.023)
			M cro	0.101***		---		---		---
				(0.025)		---		---		---
	H_0: $b_{2010\text{-}12}$= $b_{2013\text{-}17}$		H_0: b_{Small} =$b_{M\ cro}$				H_0: $b_{SMI;2010\text{-}12}$=$b_{SMI;2013\text{-}17}$			
	(0.10)		(0.47)				(0.092)			

* p < 0.10, ** p < 0.05, *** p < 0.01. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis. S&Mic: Small and Micro firms.

Again the different specifications aim at investigating whether: (i) the effects are different in the two time intervals; (ii) the effects are firm size heterogeneous; (ii) there is statistical evidence of similar effects for small and micro firms and; (iv) if these differ in the two time intervals.

[11] Because there are only three large firms in the treated group this typology will be dropped from the analysis. In fact, it is likely that such large firms are also involved in the distribution of products beyond the toys and games in the sense of the directive.

The first set of results identifies an increase of 10% on the cost of materials of all firms over the entire reference period. When two periods are considered (second set of results) the increase is larger in the second period, which is confirmed by the rejection of the equality of the two coefficients test at a 10% significance level.

The third set of results finds significant effects for small and micro firms; these in turn are found to be statistically equal, leading to consider the fourth set of results - where these firms are jointly considered. Finally, the last set of results suggests that the effects found on small and micro firms differ across the two time intervals.

Table 8. Impact on distributors' cost of materials: year specific effects for small & micro firms

Constant		Time Specific 1st Interval		Time specific 2nd Interval		Time Specific Pre TSD	
2010-17	0.101***	2010	0.081***	2013	0.112***	2006	-0.022
	(0.020)		(0.021)		(0.026)		(0.031)
		2011	0.086***	2014	0.108***	2007	-0.028
2010-12	0.089***		(0.023)		(0.026)		(0.033)
	(0.019)	2012	0.100***	2015	0.128***	2008	0.050
2013-17	0.111***		(0.025)		(0.029)		(0.038)
	(0.023)		---	2016	0.086***	2009	0.120***
			---		(0.029)		(0.035)
			---	2017	0.123***		---
			---		(0.034)		---
		H_0: b_t=0.089, t=2010,…,2012 (1.0)		H_0: b_t=0.111, t=2013,…,2017 (1.0)		H_0: b_t=0, t=2006,...,2009 (1.4e-11)	

* p < 0.10, ** p < 0.05, *** p < 0.01. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis.

Table 8 shows a second set of estimated impacts for small & micro firms only that aim at investigating: (i) the existence and timing of the year specific effects and; (ii) to what extent the effects found above can indeed be attributed to the TSD.

The first set replicates the estimated impacts for small & micro firms in the entire period and in the two time intervals considered. The year specific effects in the second and third columns replace the time interval representation of the impacts. Both the estimates and the Wald test clearly reject the hypothesis of year specific effects in both time intervals.

The last column tests for differences between treated and control group before the reference period of the directive. While no time specific effects are found in the periods between 2006 and 2008, a statistically significant effect is found in 2009. In fact, the joint test of nullity of the coefficients in the pre-TSD period is clearly rejected, suggesting that the anticipation effect in the distributors is stronger than in the manufacturers.

As such the analysis for distributors is replicated but now considering that the effect of the directive starts in the year of its announcement, i.e. in 2009.

Table 9. Impact on distributors' cost of materials: firm size heterogeneous models

Homogenous			Heterogeneous		Heterogeneous Small & M cro		Heterogeneous Small & M cro			
2009-17	2009-12	2013-17					2009-12		2013-17	
0.126***	0.117***	0.136***	Medium	0.088	Medium	0.088	Medium	0.084	Medium	0.084
(0.021)	(0.020)	(0.024)		(0.070)		(0.069)		(0.066)		(0.077)
			Small	0.098***	S&M c	0.122***	S&M c	0.112***	S&Mic	0.132***
				(0.024)		(0.021)		(0.020)		(0.024)
			Micro	0.119***		---		---		---
				(0.026)		---		---		---
	H_0: $b_{2009-12}$= $b_{2013-17}$		H_0: b_{Small} =b_{Micro}				H_0: $b_{SMI;2009-12}$=$b_{SMI;2013-17}$			

(0.15)	(0.53)	(0.13)

* p < 0.10, ** p < 0.05, *** p < 0.01. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis. S&Mic: Small and Micro firms.

Table 9 presents results that investigate the firm size heterogeneity nature of the results. The estimates of the impacts are under this assumption larger but similar with respect to firm size heterogeneity and, to the differences found between the two periods: the TSD impact is statistically significant for small and micro firms; these firms can be assumed to have equal impacts and; despite rejection of the null hypothesis at the conventional critical levels (5% and 10%) the evidence on the equality of the two time interval coefficients is poor (p-value of 0.13).

Given the precision with which these coefficients are estimated, it can be sustained that the directive increased the cost of materials of distributors by 11% between 2009 and 2012 and by 13% after 2013.

Table 10 shows results for the year specific effects for small & micro firms only. Results now show that there is neither evidence of year specific effects in both first and second intervals, nor of differences between treated and control group before 2009.

Table 10. Impact on distributors' cost of materials: year specific effects for small & micro firms

Constant		Time Specific 1st Interval		Time specific 2nd Interval		Time Specific Pre TSD	
2009-17	0.122***	2009	0.119***	2013	0.133***	2006	-0.022
	(0.021)		(0.026)		(0.027)		(0.031)
		2010	0.102***	2014	0.129***	2007	-0.028
2009-12	0.112***		(0.023)		(0.027)		(0.033)
	(0.020)	2011	0.107***	2015	0.149***	2008	0.051
2013-17	0.132***		(0.025)		(0.030)		(0.038)
	(0.024)	2012	0.120***	2016	0.106***		---
			(0.027)		(0.030)		---
			---	2017	0.144***		---
			---		(0.035)		---
		H_0: b_t=0.112, t=2009,…,2012 (0.92)		H_0: b_t=0.132, t=2013,…,2017 (0.73)		H_0: b_t=0, t=2006,...,2008 (0.051)	

* p < 0.10, ** p < 0.05, *** p < 0.01. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis.

This analysis supports the conclusion that the TSD induced an increase in the cost of materials of small and micro firms from 2009, the year of its adoption. As discussed earlier, because distributors are mainly importers, this stronger anticipation effect could have been driven by their high degree of exposure to global producers (mainly Asian firms) that are known to be quicker to adapt to new technical requirements.

Despite the difference not being statistically significant, results suggest an increase in the cost of materials of 11% in the first interval (2009-2012) and of 13% in the second time interval (after 2013). This is confirmed by the difference in the magnitude of the year specific estimates in both intervals.

Although the effect on medium firms is not statistically significant, in all specifications the magnitude of the effect is stable around 9%. Furthermore, the homogenous specification, in which no firm size heterogeneity is assumed, delivers estimated impacts which are similar to those found for small and micro firms. This might suggest that all firms in the industry, including medium sized firms, could have been equally affected by the TSD.

3.4.2 Impact on the relative cost of materials of manufacturers

3.4.2.1 Theory of change

The previous analysis provided statistical and robust evidence of an increase in the cost of materials of small and medium manufacturers induced by the TSD of around 13%, leaving unaffected large firms.

An absence of effects on large firms could be explained by several factors: (i) market power considerations vis-à-vis the suppliers of materials; (ii) by the ability of large firms to accommodate cost increases given the larger scale of production or; (iii) by structural changes in the scope of these firm's activities leading to a change in the production function.

To bring further insight into the changes induced by the directive, taking into account the structural changes occurring in worldwide toy industry in the recent decades, an additional impact evaluation exercise has been considered on the sample of manufacturers.

The motivation comes from the fact that the manufacturing of toys is a process comprising two distinct phases: First, the conception and design of toys, followed by the manufacturing process. The 2013 DG-ENTR report, emphasises the growing importance of innovation activities in the worldwide toys industry:

"The short product life cycle of toys drives the need for innovation and research and development (R&D). Innovation is widely acknowledged in the sector as essential to maintain a competitive position. In addition, it allows manufacturers to experience (temporarily) reduced price competition for the innovative toys."

While the first stage is executed by few highly skilled employees, the second - transformation of materials to produce the final product - is more intensive in unskilled labour. Changes over time in the composition of the labour force in EU manufacturers could be revealing of an industry trend characterised by a (partial) relocation of the production process to countries where costs are lower and (unskilled) labour productivity higher.

For this purpose, the impact evaluation analysis has been extended to the relative cost of materials with respect to the cost of employees. The outcome of interest is now the ratio of the cost of materials to the sum of the cost of materials and the cost of employees (r). The ratio can vary as a result of an increase in the costs of materials, but also as a consequence of changes in the production function, i.e., the way labour and materials are combined to produce the final product. Thus variations over time can measure changes in the degree of specialization of firms in one of the two phases of the production process.

In the present context, increase over time in this ratio can arise in two distinct settings: (i) by considering fixed the combination of materials and labour, and assuming an increase in the cost of materials; and (ii) by reducing both the cost of materials and cost of employees, provided the reduction in the former is proportionally larger (e.g. because firms focus more on the design and conception of toys and games to the detriment of the manufacturing process.)

The first case is consistent with the direct impact of the directive, while the second is consistent with a relocation process of the manufacturing phase. In fact, the 2013 DG-ENTR report suggests that where order volumes are above a certain threshold, the savings in the production process outweighed the transportation costs from Asian countries, while toys automation in EU factories are an important source of price competitiveness. These are strategic choices that are available to large firms only which can exploit these economies of scale.

3.4.2.2 Methods

All results are based on the exponential DiD regression specification of the previous section for the transformed variable r/(1-r), where r is the relative cost of materials, to account for the fractional (between zero and one) regression nature of the model. The coefficients of this model do not have a direct economic interpretation but its signal determines the sign of the impact.

3.4.2.3 Results

Table 11 shows descriptive statistics for the average relative cost of materials for the treated and the control group. No particular trend seems to arise from these statistics that can be informative about the effect of the directive.

Table 11. Descriptive statistics average relative cost of materials

	Treated		Control	
	Before	After	Before	After
All	0.612	0.617	0.570	0.593
Large	0.582	0.558	0.798	0.697
Medium	0.549	0.566	0.690	0.638
Small	0.661	0.676	0.593	0.552
M cro	0.602	0.611	0.573	0.549

Averages have been computed excluding the 99-th percentile of observations.

Figure 9 shows the average relative cost of materials for the treated and the control. Both time series show a slightly decreasing trend over the period considered. Apart from the years 2004 and 2005 in which there is substantial change in the sample composition of the treated group (see Figure 5), there is evidence of parallel growth in the time period before the introduction of the TSD that supports the validity of the assumption underlying the DiD identification strategy.

Figure 9. Average relative cost of materials for treated and control group of manufacturers

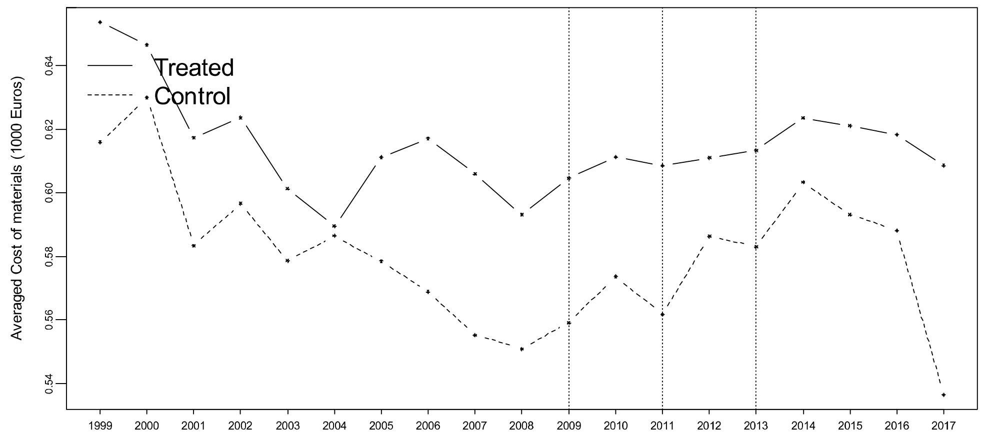


Table 12 shows results for specifications that investigate both the firm size and the time interval representation of the effects. Since the effect on the cost of materials of manufacturers was found to initiate in 2010, the same assumption will be considered.

The results from the first specification show the need to take into account firm size heterogeneity, as no impact is found when the effect is assumed to be equal across firms.

The second specification allows for constant firm size specific effects, and shows a significant effect on large firms only.

When the firm size effects are allowed to differ in the two time intervals (third column) the estimated coefficients reveal significant differences across the two periods. This is confirmed with the rejection of the null hypothesis of joint pairwise equality of the coefficients of each firm size in the two intervals. In addition, there is statistical evidence that the effect on medium and small firms in the interval 2010-12 and the effect on large and medium firms in the 2013-17 interval can be assumed to be equal.

The specification in the fourth column provides a more parsimonious and efficient representation of the potential impact of the TSD on the relative cost of materials of the firms in the sector.

Two remarks are in order: first, contrarily to the cost of materials analysis, an effect is found on large firms and; second, no effect is found on micro firms, which may confirm the absence of effects on the analysis on the cost of materials.

Table 12. Impact on manufacturers' relative cost of materials: firm size heterogeneous models

Homogeneous	Heterogeneous		Heterogeneous				Heterogeneous			
							Small & Medium		Large & Medium	
2010-17	2010-17		2010-12		2013-17		2010-12		2013-17	
0.002	Large	0.313**	Large	0.389**	Large	0.289**	Large	0.392***	L&M	0.322***
(0.073)		(0.135)		(0.153)		(0.144)		(0.137)		(0.114)
	Medium	0.242	Medium	0.159	Medium	0.295*	S&Med	0.155**		---
		(0.156)		(0.151)		(0.174)		(0.072)		---
	Small	0.049	Small	0.146*	Small	-0.020		---	Small	-0.017
		(0.099)		(0.083)		(0.121)		---		(0.119)
	Micro	-0.076	Micro	-0.144	Micro	-0.016	Micro	-0.144	Micro	-0.015
		(0.110)		(0.123)		(0.118)		(0.123)		(0.118)
			H_0: $b_{2010\text{-}12;j} = b_{2013\text{-}17;j}$, j Large, Medium, Small, Micro							
			(0.048)							
			H_0: $_{2010;Med} = b_{2010;Small}$		H_0: $_{2010;Large} = b_{2010;Med}$					
			(0.94)		(0.98)					

* p < 0.10, ** p < 0.05, *** p < 0.01. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis. S&Med: Small and Medium firms. L&M: Large and Medium firms.

These results suggest that, while in the first period of the TSD all firms (except micro) experience an increase on the relative cost of materials - which is bigger for large firms, in the second period only large and medium firm are affected. Furthermore, the impact on large and medium firms in the second period is of the same magnitude as the impact on large firms in the first period. This suggests that the nature of these two effects could be the same.

A possible explanation for this typology of effects can be found in the theory of change discussed above. While the effect found for small and medium firms just after the implementation of the TSD is likely to be a consequence of the increase in the costs of materials experienced by these firms, the larger increase experienced by large firms suggests a change in the production function associated with the reduction of the relative weight of the cost of employees. The latter effect is consistent with the relocation strategy of the manufacturing process and a greater specialization in the design and conception phases of the production process. While initially followed by large firms only, in the second period this strategic behaviour could have been extended to medium firms.

More insight regarding this interpretation can be found from the time specific effects specification shown in Table 13. These allow investigating the existence of year specific effects, and in particular, if the effects found can be attributed to the TSD, in the sense that they are significant only in its reference period. This is particularly relevant in this discussion, as it allows distinguishing the different nature of the effects found for large firms, with respect to the effect found in small & medium firms.

The first two set of results compare the year specific effects in the first interval with the constant effect model. The Wald tests in the bottom of the table sustain the hypothesis that the time specific effects are statistically equal to the constant effect for both large and small & micro firms.

Table 13. Impact on manufacturers' relative cost of materials: year specific effects small & medium firms (1st interval and pre-TSD) and large firms (2nd interval)

Constant 2010-12			Time Specific 1st Interval		Constant 2013-17		Time specific 2nd Interval		Time Specific Pre TSD	
Large	SME		Large	SME	LM		LM		Large	SME
0.392***	0.155**	2010	0.415***	0.101	0.322***	2013	0.190	2006	0.576***	0.017
(0.137)	(0.072)		(0.113)	(0 086)	(0.114)		(0.128)		(0.147)	(0.292)
		2011	0.447**	0.161	---	2014	0.289	2007	0.751***	0.153
			(0.214)	(0.103)	---		(0.201)		(0.192)	(0.14)
		2012	0.371	0.198**	---	2015	0.363***	2008	0.805*	0.098
			(0.233)	(0 088)	---		(0.13)		(0.47)	(0.127)
			---	---	---	2016	0.399***	2009	0.649***	0.174
			---	---	---		(0.132)		(0.167)	(0.127)
			---	---	---	2017	0.399***		---	---
			---	---	---		(0.139)		---	---
		H_0: b_t=0.392, t=2010,…,2012 (0.99)		H_0: b_t=0.155, t=2010,…,2012 (0.79)		H_0: b_t=0.322, t=2013,…,2017 (0.63)			H_0: b_t=0, t=2006,…,2009 (0.0001)	(0.57)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models include firm fixed effects and year fixed effect. Robust standard errors are shown in parentheses. The bottom of the table shows p-values in parentheses from Wald tests for the null hypothesis. SME: Small and Medium firms. LM: Large and Medium firms.

The third and fourth columns investigate the nature of the time specific effects in the second time interval. Again despite the non-statistical significance of some individual coefficients, the hypothesis of a constant effect in that time interval is strongly sustained.

Finally, the last column extends the constant effect model to include year specific effects before the reference period of the TSD. The results support the argument that the effect found on large firms is not TSD induced, but is the continuation of a trend starting much before its announcement. In fact, the magnitude of the time specific coefficients between 2006 and 2009 suggest that, the increase on the relative cost of materials of the treated group was in that earlier period even larger. On the other hand, no effect before the reference period of the TSD is found for small and medium firms, as confirmed by the Wald test of joint nullity of the time specific effects between 2006 and 2009. This brings statistical evidence that the effect found in this group of firms is induced by the TSD.

Box 3: Impact of TSD on costs of materials for distributors/importers and manufacturers.

<u>Analysis design:</u>

Data: Firm-level data from Bureau van Dijk on 17 European countries and for the period 1997-2017.

Method: Difference-in-Differences Design (DiD)

Outcomes: Cost of materials and proportional cost of materials (analysis on manufacturer only)

Main result: The Toy Safety Directive seems to have increased substantively the cost of materials for distributors in the period 2009-2013 (11%) and after 2013 (13%). It also increased the cost of materials of for small and medium-sized manufacturers (13% in 2010-17).

Robustness: The identification assumptions of the method are met and the impact can be attributed to the introduction of the Toy Safety Directive.

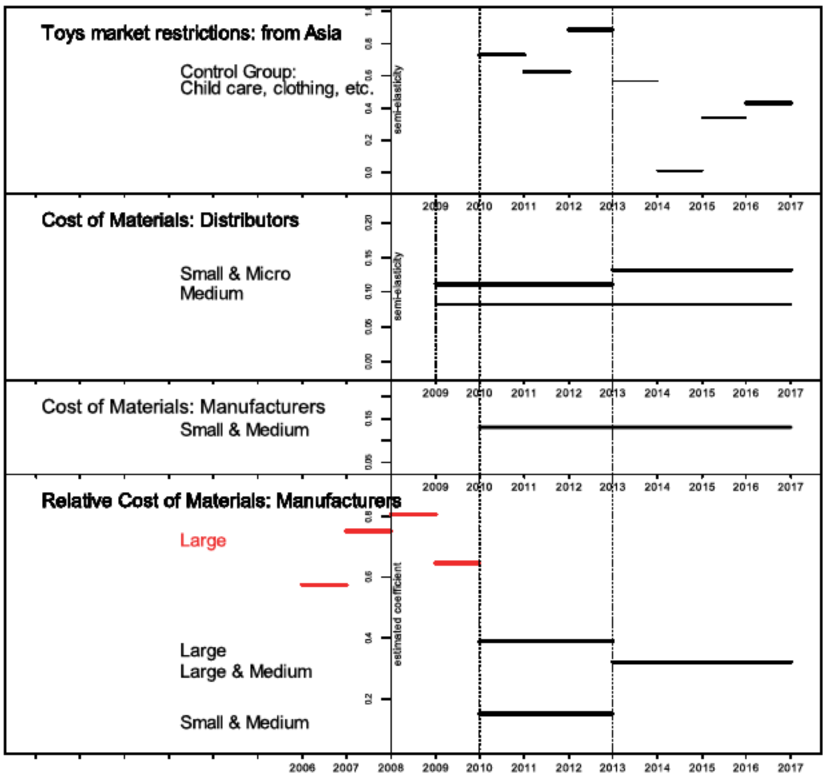
4 Conclusion

The analysis of the Toy Safety Directive's (TSD, Directive 2009/48/EC) impact conducted in this study provides a partial but relevant assessment of the performance of the TSD, in relation to its objectives of guaranteeing a high level of safety of toys, with a view to ensure the health and safety of children, and of safeguarding the functioning of the internal market.

The present report provides a contribution to the scarce literature on the quantification of the effects on costs and benefits of regulations in the toy sector. The report constitutes a first step towards providing a cost-effectiveness analysis of the directive.

The TSD impact on benefits was investigated by considering, as potential outcomes, the number of product marketing restrictions - improved market surveillance should lead to an increase in the number of non-complying toys withdrawn from the market.

Figure 10. Summary of the TSD impacts: Trade and Cost analysis



Note: Thick lines represent statistically significant estimates at 5% significance level. Thin lines represent non-statistically significant estimates at 10% significance level. Red lines represent significant effects not attributed to the TSD.

The cost analysis focused on the quantification of the TSD impact on both EU distributors and EU manufacturers. Since the first group is mainly composed of importers, and given the important share of imported toys in the EU markets, the impact on distributors reflects also the impact of the directive on the extra-EU manufacturers.

The new requirements introduced by the TSD impose restrictions on the design, materials and labelling of toys, affecting both groups of enterprises. In order to comply with the requirements, firms had to adjust their production function, generating an impact on the materials used in their final products. For manufacturers, these include the inputs used in the production process; and for both groups, the effects relate to the materials used to comply with the labelling requirements.

Figure 10 illustrates the main findings of the analysis. [12] The TSD impacts were estimated using a Differences-in-Differences (DiD) identification strategy, requiring the definition of a treatment and a control group.

The estimation of the TSD impact on the number of toy restrictions in EU countries used data from the European Rapid Alert System for dangerous non-food products (RAPEX), from which three product categories were used as control groups, and three geographic areas were considered.

The first panel Figure 10 shows the estimated impact for the group of toys products manufactured in Asia, which is responsible for the most of the overall effect, when the control group is restricted to child care articles. The introduction of the TSD had a statistically significant impact on the number of toy restrictions from 2010 to 2013. In particular, in Asia, this transitory effect ranged from an increase between 63% and 88% in this period. A significant increase is observed again in 2016.

The cost analysis selected as relevant outcome the cost of materials, and used firm-level data from Bureau van Dijk on 17 European countries for the period 1997-2017. The control groups were defined by firms in the toys and games sector not affected by the TSD requirements (such as video-games and electronic games manufacturers and distributors). The TSD effects on both groups of enterprises was analysed for the firm size and time dimension.

The time dimension of the effects investigated on: (1) the timing of the beginning of the effects after the adoption of the directive; (2) two time intervals for the impacts, delimited by the entering into force of the chemical requirements of the directive in 2013; and (3) evidence for year-specific versus time-interval effects.

The firm size dimension of the effects was investigated on: (1) the existence of specific effects on large, medium, small and micro firms; (2) the grouping (based on the data) of firm-size categories to compute firm-size-specific effects; and (3) evidence of year (interval) specific effects for each firm-size category.

The second panel of Figure 1 shows the TSD estimated impacts on costs in the group of distributors. Results show statistically significant effects for small & micro firms from 2009 onwards, the year of the TSD adoption. The directive led to an 11% increase in the cost of materials in the interval 2009-12, and to an increase of 13% after the application of the chemical requirements. Despite not being statistically significant, the analysis identified an increase in costs of 8% in the group of medium sized firms.

The TSD impact on the cost of materials of EU manufacturers is illustrated in the third panel of the figure. The analysis identified an increase of 13% in small & medium sized firms only, which was found to be constant from 2010 onwards.

The absence of significant effects for large and micro firms motivated extending the analysis to a cost-related outcome that captures changes in the production function beyond the cost of materials. In particular, changes arising from a shift in the weight between the two phases of the production process: conception and design of toys and manufacturing process.

This is more likely to occur in larger firms, which have the ability to explore management solutions such as the relocation of the manufacturing phase of production to countries where costs are lower and labour productivity is higher.

[12] Regarding the impact of the TSD on imports, using product-level trade data from Eurostat the study reports a decrease in import of toys as compared to other products in the period 2009-2017. However, the hypothesis that such decrease is solely due to the TSD is rejected.

The outcome of interest for this analysis was the relative cost of materials, measured as the ratio of the cost of materials to the sum of the cost of materials and the cost of employees.

The results for this analysis identified impacts of two different orders of magnitude: larger impacts for large firms throughout the entire period, and for medium firms in the time interval after 2013; smaller impacts for small & medium firms in the interval 2010-2012 only. In addition, the effect found on large firms was shown to be present, and stronger, before the reference time period of the directive.

This suggests that the nature of the effect on smaller and larger firms is qualitatively different. While the effect on small & medium firms is likely to be a direct consequence of the increase in the cost of materials, the stronger effect, initially on large firms and then followed by medium firms, could be explained by a reduction on the relative weight of the cost of employees induced by a more drastic change in the production process consistent with the relocation theory.

This evaluation exercise does not exhaust all the dimensions of the TSD impact, which may in many cases require access to qualitative information. The focus of this analysis is the usage of the available data to estimate the causal effects of the directive on a selection of relevant outcomes. The estimates delivered in this report are derived from Counterfactual Impact Evaluation methods, which provide answer to the question: what would have happened in the absence of the directive? Or equivalently, what was the exact contribution of the directive to the variation of the observed outcomes? Thus providing guidance to the effectiveness of the policy making process in this area.

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List of abbreviations and definitions

CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
DG-ENTR	DG Enterprise and Industry
DiD	Difference-in-Differences
EconLit	Academic Literature Abstract Database service by the American Economic Association
EU-IDB	European Injury Database
ICD	International Classification of Diseases
JSTOR	Journal Storage digital library
MS	Member State
NACE	Nomenclature Statistique des Activités Économiques dans la Communauté Européenne (Statistical Classification of Economic Activities in the European Community)
NEBER	National Bureau of Economic Research
RAPEX	EU Rapid Alert System for dangerous non-food products
TSD	Toy Safety Directive
WHO	World Health Organization Library Database

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Annexes

Annex 1. Regulations and Directives related to toy safety

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast).

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.

Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators.

Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.

Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment.

Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste.

Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food.

Regulation (EC) No 1223/2009 of the European Parliament and of the Council of 30 November 2009 on cosmetic products (recast).

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

Regulation (EC) 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC.

Annex 2. Cost analysis: full estimation results

Table 14. Impact on manufacturers' cost of materials: full estimates firm size homogenous model

	One period	Two periods
Treated * 1(t ≥ 2010)	0.093*	---
	(0.051)	---
Treated * 1(2010 ≤ t < 2013)	---	0.081
	---	(0.050)
Treated * 1(t ≥ 2013)	---	0.104*
	---	(0.061)
Log cost of employees (t-1)	-0.050	-0.050
	(0.064)	(0.064)
Log Sales (t-1)	0.731***	0.731***
	(0.146)	(0.146)

* p < 0.10, ** p < 0 05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include firm fixed effects and year fixed effect.

Table 15. Impact on manufacturers' cost of materials: full estimates firm size heterogeneous models

	Heterogeneous		Small & Medium	
	2010-17	2010-17	2010-12	2013-17
Medium * 1(t ∈ Interval)	-0.192	---	---	---
	(0.162)	---	---	---
Small * 1(t ∈ Interval)	-0.244	---	---	---
	(0.152)	---	---	---
Small & Medium * 1(t ∈ Interval)	---	-0.236	-0 227	-0.238
	---	(0.146)	(0.156)	(0.159)
Micro * 1(t ∈ Interval)	-0.239*	-0.238*	-0.202	-0 263*
	(0.141)	(0.14)	(0.152)	(0.155)
Treated * Large * 1(t ∈ Interval)	-0.138	-0.138	-0.147	-0.131
	(0.138)	(0.138)	(0.17)	(0.135)
Treated * Medium * 1(t ∈ Interval)	0.094	---	---	---
	(0.122)	---	---	---
Treated * Small * 1(t ∈ Interval)	0.133*	---	---	---
	(0.075)	---	---	---
Treated * Small & Medium * 1(t ∈ Interval)	---	0.13**	0.131*	0.13*
	---	(0.065)	(0 067)	(0 073)
Treated * Micro * 1(t ∈ Interval)	0.077	0.077	0 057	0 095
	(0.074)	(0.074)	(0 072)	(0 09)
Log cost of employees (t-1)	-0.052	-0.052	-0 051	---
	(0.065)	(0.065)	(0 065)	---
Log Sales (t-1)	0.732***	0.732***	0.732***	---
	(0.149)	(0.149)	(0.149)	---

* p < 0.10, ** p < 0.05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include firm fixed effects and year fixed effect.

Table 16. Impact on manufacturers' cost of materials: full estimates year specific effects models

	Control			Treated		
	2010-12	2013-17	2006-09	2010-12	2013-17	2006-09
Large * 1(t ≥ 2010)	---	---	---	-0.142	-0.128	-0.127
	---	---	---	(0.137)	(0.139)	(0.138)
Small & Medium * 1(t=2006)	---	---	-0.084	---	---	0.265
	---	---	(0.112)	---	---	(0.173)
Small & Medium * 1(t=2007)	---	---	-0.115	---	---	0 207
	---	---	(0.132)	---	---	(0.161)
Small & Medium * 1(t=2008)	---	---	-0.056	---	---	0 068
	---	---	(0.12)	---	---	(0.129)
Small & Medium * 1(t=2009)	---	---	-0.164	---	---	0.168
	---	---	(0.122)	---	---	(0.132)
Small & Medium * 1(2010 ≤ t < 2013)	---	-0.239*	-0.298*	---	0.13*	0.229*
	---	(0.142)	(0.165)	---	(0 067)	(0.12)
Small & Medium * 1(t=2010)	-0.298**	---	---	0.131*	---	---
	(0.133)	---	---	(0 069)	---	---
Small & Medium * 1(t=2011)	-0.213	---	---	0.132	---	---
	(0.159)	---	---	(0 097)	---	---
Small & Medium * 1(t=2012)	-0.246	---	---	0.13	---	---
	(0.16)	---	---	(0 088)	---	---
Small & Medium * 1(t ≥ 2013)	-0.231	---	-0.277	0.13*	---	0.229*
	(0.154)	---	(0.177)	(0 073)	---	(0.125)
Small & Medium * 1(t=2013)	---	-0.242*	---	---	0 087	---
	---	(0.14)	---	---	(0 078)	---
Small & Medium * 1(t=2014)	---	-0.182	---	---	0 038	---
	---	(0.18)	---	---	(0.105)	---
Small & Medium * 1(t=2015)	---	-0.192	---	---	0.194*	---
	---	(0.18)	---	---	(0.105)	---
Small & Medium * 1(t=2016)	---	-0.276*	---	---	0 206**	---
	---	(0.165)	---	---	(0 093)	---
Small & Medium * 1(t=2017)	---	-0.217	---	---	0.167	---
	---	(0.178)	---	---	(0.121)	---
Micro * 1(t ≥ 2010)	-0.243*	-0.23	-0.224	0 077	0 078	0.076
	(0.140)	(0.141)	(0.142)	(0 074)	(0 074)	(0.075)
Log cost of employees (t-1)	-0.051	-0.052	-0.051	---	---	---
	(0.065)	(0.065)	(0.065)	---	---	---
Log Sales (t-1)	0.732***	0.734***	0.734***	---	---	---
	(0.149)	(0.149)	(0.149)	---	---	---

* p < 0.10, ** p < 0.05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include firm fixed effects and year fixed effect.

Table 17. Impact on manufacturers' relative cost of materials: full estimates firm size heterogeneous models

	Full Hetero	Full Hetero		Hetero SME & LM	
	2010-17	2010-12	2013-17	2010-12	2013-17
Medium * 1(t ∈ Interval)	0.312	0.397*	0.277	---	---
	(0.224)	(0 219)	(0.238)	---	---
Small * 1(t ∈ Interval)	0.535**	0.399**	0.655**	---	0.461***
	(0.22)	(0.188)	(0.256)	---	(0.165)
Small & Medium * 1(t ∈ Interval)	---	---	---	0.299**	---
	---	---	---	(0.144)	---
Micro * 1(t ∈ Interval)	0.553***	0.621***	0.513**	0.534***	0 323**
	(0.206)	(0 202)	(0.229)	(0.176)	(0.154)
Treated * Large * 1(t ∈ Interval)	0.313**	0.389**	0.289**	0.392***	---
	(0.135)	(0.153)	(0.144)	(0.137)	---
Treated * Medium * 1(t ∈ Interval)	0.242	0.159	0.295*	---	---
	(0.156)	(0.151)	(0.174)	---	---
Treated * Large & Medium * 1(t ∈ Interval)	---	---	---	---	0.322***
	---	---	---	---	(0.114)
Treated * Small * 1(t ∈ Interval)	0.049	0.146*	-0.02	---	-0.017
	(0.099)	(0 083)	(0.121)	---	(0.119)
Treated * Small & Medium* 1(t ∈ Interval)	---	---	---	0.155**	---
	---	---	---	(0.072)	---
Treated * Micro * 1(t ∈ Interval)	-0.076	-0.144	-0.016	-0.144	-0.015
	(0.11)	(0.123)	(0.118)	(0.123)	(0.118)
Log Sales	0.27	0.27	---	0.266	---
	(0.195)	(0.195)	---	(0.193)	---

Table 18. Impact on manufacturers' relative cost of materials: full estimates year specific effects models

	Control			Treated		
	Large	Small & Medium	Large & Medium	Large	Small & Medium	Large & Medium
	2010-12	2010-12	2013-17	2010-12	2010-12	2013-17
Large * 1(2010 ≤ t < 2013)	---	---	---	---	0.397***	0.39***
	---	---	---	---	(0.139)	(0.137)
Large * 1(t=2010)	---	---	---	0.415***	---	---
	---	---	---	(0.113)	---	---
Large * 1(t=2011)	0.03	---	---	0.447**	---	---
	(0.165)	---	---	(0.214)	---	---
Large * 1(t=2012)	-0.055	---	---	0.371	---	---
	(0.199)	---	---	(0.233)	---	---
Small & Medium * 1(t ≥ 2010)	0.302***	---	0.3**	0.155**	---	0.154**
	(0.105)	---	(0.145)	(0.072)	---	(0.072)
Small & Medium * 1(t=2010)	---	0.273*	---	---	0.101	---
	---	(0.151)	---	---	(0.086)	---
Small & Medium * 1(t=2011)	---	0.359**	---	---	0.161	---
	---	(0.163)	---	---	(0.103)	---
Small & Medium * 1(t=2012)	---	0.278*	---	---	0.198**	---
	---	(0.161)	---	---	(0.088)	---
Micro 1(2010 ≤ t < 2013)	0.538***	0.537***	0.534***	-0.144	-0.143	-0.144
	(0.149)	(0.177)	(0.177)	(0.123)	(0.123)	(0.123)
Large & Medium * 1(t ≥ 2013)	---	---	---	0.324***	0.325***	---
	---	---	---	(0.114)	(0.114)	---
Large & Medium * 1(t=2013)	---	---	---	---	---	0.19
	---	---	---	---	---	(0.128)
Large & Medium * 1(t=2014)	---	---	-0.008	---	---	0.289
	---	---	(0.169)	---	---	(0.201)
Large & Medium * 1(t=2015)	---	---	-0.198	---	---	0.363***
	---	---	(0.133)	---	---	(0.13)
Large & Medium * 1(t=2016)	---	---	-0.11	---	---	0.399***
	---	---	(0.12)	---	---	(0.132)
Large & Medium * 1(t=2017)	---	---	-0.204	---	---	0.399***
	---	---	(0.129)	---	---	(0.139)
Small * 1(t ≥ 2013)	0.463***	0.464***	0.364*	-0.017	-0.016	-0.017
	(0.165)	(0.164)	(0.187)	(0.119)	(0.119)	(0.119)
Micro * 1(t ≥ 2013)	0.325**	0.325**	0.226	-0.015	-0.015	-0.015
	(0.154)	(0.154)	(0.176)	(0.118)	(0.118)	(0.118)
Log Sales	0.266	0.266	0.267	---	---	---
	(0.193)	(0.193)	(0.193)	---	---	---

Table 19. Impact on manufacturers' relative cost of materials: full estimates pre-TSD year specific effects models

	Control		Treated	
	Small& Medium	Large	Small & Medium	Large
	2006-09	2006-09	2006-09	2006-09
Small & Medium * 1(t=2006)	-0.083	-0.402***	0.017	0.576***
	(0.289)	(0.113)	(0.292)	(0.147)
Small & Medium * 1(t=2007)	-0.205	-0.284***	0.153	0.751***
	(0.145)	(0.098)	(0.14)	(0.192)
Small & Medium * 1(t=2008)	-0.262*	-0.271**	0.098	0.805*
	(0.141)	(0.127)	(0.127)	(0.47)
Small & Medium * 1(t=2009)	-0.282**	-0.551***	0.174	0.649***
	(0.135)	(0.122)	(0.127)	(0.167)
Large * 1(2010 ≤ t < 2013)	---	---	0.422***	0.682***
	---	---	(0.141)	(0.178)
Small & Medium * 1(2010 ≤ t < 2013)	0.229	0.435***	0.213*	0.169**
	(0.149)	(0.16)	(0.119)	(0.073)
Micro * 1(2010 ≤ t < 2013)	0.572***	0.679***	-0.142	-0.144
	(0.183)	(0.194)	(0.123)	(0.123)
Large & Medium * 1(t ≥ 2013)	---	---	0.364***	0.428***
	---	---	(0.137)	(0.13)
Small * 1(t ≥ 2013)	0.436***	0.523***	0.037	-0.013
	(0.165)	(0.172)	(0.16)	(0.119)
Micro * 1(t ≥ 2013)	0.402**	0.388**	-0.013	-0.016
	(0.179)	(0.164)	(0.118)	(0.118)
Log Sales	0.268	0.267	---	---
	(0.192)	(0.19)	---	---

Table 20. Impact on distributor' cost of materials: full estimates firm size homogenous model (t_0=2010)

	One period	Two periods
Treated * 1(t ≥ 2010)	0.105***	---
	(0.02)	---
Treated * 1(2010 ≤ t < 2013)	---	0.094***
	---	(0.019)
Treated * 1(t ≥ 2013)	---	0.115***
	---	(0.022)
Log cost of employees (t-1)	-0.031*	-0.031*
	(0.018)	(0.018)
Log Sales (t-1)	0.614***	0.614***
	(0.049)	(0.049)

* p < 0.10, ** p < 0 05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include firm fixed effects and year fixed effect.

Table 21. Impact on manufacturers' cost of materials: full estimates firm size heterogeneous models (t_0=2010)

	Hetero	Small & Micro		
	2010-17	2010-17	2010-12	2013-17
Small * 1(t ∈ Interval)	-0 06	---	---	---
	(0 057)	---	---	---
Micro * 1(t ∈ Interval)	-0.163***	---	---	---
	(0 057)	---	---	---
Small & Micro * 1(t ∈ Interval)	---	-0.136**	-0.128**	-0.137**
	---	(0.056)	(0.055)	(0.058)
Treated *Medium * 1(t ∈ Interval)	0.078	0.081	0.088	0.08
	(0 069)	(0.069)	(0.068)	(0.074)
Treated *Small * 1(t ∈ Interval)	0.079***	---	---	---
	(0 021)	---	---	---
Treated *Micro * 1(t ∈ Interval)	0.101***	---	---	---
	(0 025)	---	---	---
Treated *Small & Micro* 1(t ∈ Interval)	---	0.101***	0.089***	0.111***
	---	(0.02)	(0.019)	(0.023)
Log cost of employees (t-1)	-0 03*	-0.031*	-0.031*	---
	(0 018)	(0.018)	(0.018)	---
Log Sales (t-1)	0.612***	0.614***	0.614***	---
	(0 049)	(0.049)	(0.049)	---

Table 22. Impact on distributors' cost of materials: full estimates year specific effects models (t_0=2010)

	Control			Treated		
	2010-12	2013-17	2006-09	2010-12	2013-17	2006-09
Medium * 1(2010 ≤ t < 2013)	---	---	---	0 082	0.083	0.113*
	---	---	---	---	---	---
Small & Micro * 1(t=2006)	---	---	-0.09*	---	---	-0.022
	---	---	(0.054)	---	---	(0.031)
Small & Micro * 1(t=2007)	---	---	-0.091*	---	---	-0.028
	---	---	(0.047)	---	---	(0.033)
Small & Micro * 1(t=2008)	---	---	-0.107**	---	---	0.05
	---	---	(0.046)	---	---	(0.038)
Small & Micro * 1(t=2009)	---	---	-0.21***	---	---	0.12***
	---	---	(0.046)	---	---	(0.035)
Small & Micro * 1(2010 ≤ t < 2013)	---	-0.131**	-0.17***	---	0.089***	0.111***
	---	(0.055)	(0.066)		(0 019)	(0.032)
Small & Micro * 1(t=2010)	-0.141**	---	---	0 081***	---	---
	(0 056)	---	---	(0 021)	---	---
Small & Micro * 1(t=2011)	-0 095	---	---	0 086***	---	---
	(0 059)	---	---	(0.023)	---	---
Small & Micro * 1(t=2012)	-0.161***	---	---	0.1***	---	---
	(0 061)	---	---	(0 025)	---	---
Medium * 1(t ≥ 2013)				0 074	0.082	0.107
				(0.074)	(0 074)	(0.075)
Small & Micro * 1(t ≥ 2013)	-0.143**		-0.178***	0.112***		0.133***
		---		(0 023)		(0.035)
Small & Micro * 1(t=2013)	---	-0.116*	---	---	0.112***	---
	---	(0.06)	---	---	(0 026)	---
Smal & Micro * 1(t=2014)	---	-0.137**	---	---	0.108***	---
	---	(0.063)	---	---	(0.026)	---
Small & Micro * 1(t=2015)	---	-0.149**	---	---	0.128***	---
	---	(0.061)	---	---	(0 029)	---
Small & Micro * 1(t=2016)	---	-0.122*	---	---	0.086***	---
	---	(0.065)	---	---	(0 029)	---
Small & Micro * 1(t=2017)	---	-0.155**	---	---	0.123***	---
	---	(0.071)	---	---	(0 034)	---
Log cost of employees (t-1)	-0 031*	-0.031*	-0.031*	---	---	---
	(0 018)	(0.018)	(0.018)	---	---	---
Log Sales (t-1)	0.614***	0.614***	0.613***	---	---	---
	(0 049)	(0.049)	(0.049)	---	---	---

* p < 0.10, ** p < 0.05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include firm fixed effects and year fixed effect.

Table 23. Impact on distributor' cost of materials: full estimates firm size homogenous model (t_0=2009)

	One period	Two periods
Treated * 1(t ≥ 2010)	0.126***	---
	(0.021)	---
Treated * 1(2010 ≤ t < 2013)	---	0.117***
	---	(0.02)
Treated * 1(t ≥ 2013)	---	0.136***
	---	(0.024)
Log cost of employees (t-1)	-0.031*	-0.031*
	(0.018)	(0.018)
Log Sales (t-1)	0.614***	0.614***
	(0.049)	(0.049)

* p < 0.10, ** p < 0 05, *** p < 0.01$. Robust standard errors are shown in parentheses. All models include firm fixed effects and year fixed effect.

Table 24. Impact on manufacturers' cost of materials: full estimates firm size heterogeneous models (t_0=2009)

	Hetero	Small & Micro		
	2009-17	2009-17	2009-12	2013-17
Small * 1(t ∈ Interval)	-0.062	---	---	---
	(0.056)	---	---	---
Micro * 1(t ∈ Interval)	-0.185***	---	---	---
	(0.057)	---	---	---
Small & Micro * 1(t ∈ Interval)	---	-0.156***	-0.153***	-0.163***
	---	(0.056)	(0.053)	(0.059)
Treated *Medium * 1(t ∈ Interval)	0.088	0.088	0.084	0.084
	(0.07)	(0.069)	(0.066)	(0.077)
Treated *Small * 1(t ∈ Interval)	0.098***	---	---	---
	(0.024)	---	---	---
Treated *Micro * 1(t ∈ Interval)	0.119***	---	---	---
	(0.026)	---	---	---
Treated *Small & Micro* 1(t ∈ Interval)	---	0.122***	0.112***	0.132***
	---	(0.021)	(0.02)	(0.024)
Log cost of employees (t-1)	-0.03	-0.031*	-0.031*	---
	(0.018)	(0.018)	(0.018)	---
Log Sales (t-1)	0.612***	0.613***	0.613***	---
	(0.049)	(0.049)	(0.049)	---

Table 25. Impact on distributors' cost of materials: full estimates year specific effects models (t_0=2009)

	Control			Treated		
	2009-12	2013-17	2006-08	2009-12	2013-17	2006-08
Medium * 1(2009 ≤ t < 2013)	---	---	---	0 097	0.095	0.134**
	---	---	---	(0 065)	(0.066)	(0.066)
Small & Micro * 1(t=2006)	---	---	-0.075	---	---	-0 022
	---	---	(0.054)	---	---	(0.031)
Small & Micro * 1(t=2007)	---	---	-0.08*	---	---	-0 028
	---	---	(0.048)	---	---	(0.033)
Small & Micro * 1(t=2008)	---	---	-0.12***	---	---	0 051
	---	---	(0.046)	---	---	(0.038)
Small & Micro * 1(2009 ≤ t < 2013)	---	-0.143***	-0.147**	---	0.112***	0.114***
	---	(0.053)	(0.062)	---	(0.02)	(0 031)
Small & Micro * 1(t=2009)	-0.117**	---	---	0.119***	---	---
	(0.05)	---	---	(0 026)	---	---
Small & Micro * 1(t=2010)	-0.155***	---	---	0.102***	---	---
	(0.056)	---	---	(0 023)	---	---
Small & Micro * 1(t=2011)	-0.114*	---	---	0.107***	---	---
	(0.059)	---	---	(0 025)	---	---
Small & Micro * 1(t=2012)	-0.18***	---	---	0.12***	---	---
	(0.061)	---	---	(0 027)	---	---
Medium * 1(t ≥ 2013)	---	---	---	0 092	0.097	0.132*
	---	---	---	(0 077)	(0.077)	(0.078)
Small & Micro * 1(t ≥ 2013)	-0.157***	---	-0.159**	0.132***	---	0.134***
	(0.06)	---	(0.068)	(0 025)	---	(0 035)
Small & Micro * 1(t=2013)	---	-0.133**	---	---	0.133***	---
	---	(0.061)	---	---	(0.027)	---
Small & Micro * 1(t=2014)	---	-0.153**	---	---	0.129***	---
	---	(0.064)	---	---	(0.027)	---
Small & Micro * 1(t=2015)	---	-0.165***	---	---	0.149***	---
	---	(0.063)	---	---	(0.03)	---
Small & Micro * 1(t=2016)	---	-0.139**	---	---	0.106***	---
	---	(0.067)	---	---	(0.03)	---
Small & Micro * 1(t=2017)	---	-0.171**	---	---	0.144***	---
	---	(0.072)	---	---	(0.035)	---
Log cost of employees (t-1)	-0.031*	-0.031*	-0.031*	---	---	---
	(0.018)	(0.018)	(0.018)	---	---	---
Log Sales (t-1)	0.613***	0.613***	0.613***	---	---	---
	(0.049)	(0.049)	(0.049)	---	---	---

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doi:XX.XXXX/XXXXXX
ISBN XXX-XX-XX-XXXXX-X

Publications Office of the European Union