

Ex-Post Evaluation of Competition Law Enforcement Effects in the German Packaging Waste Compliance Scheme Market

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Abstract We provide an ex-post evaluation of the impact of competition law enforcement activities in the German packaging waste compliance scheme market. Until 2003, the non-profit compliance scheme DSD enjoyed a monopoly in the market. Numerous antitrust cases, however, paved the way for competitive market structures. We show that these enforcement activities resulted in a series of market entries since 2004, a corresponding drop in DSD's market share, increased innovation and substantial efficiencies. Furthermore, we apply a difference-in-differences approach to show that prices decreased by 63% and to estimate the aggregated consumer welfare gains achieved by 2011 at a total of €13 billion. In the given case imposing a non-profit obligation on the monopolist did not substitute for the efficiency-enhancing effects of competition.

Keywords Ex post evaluation · Competition law enforcement · Compliance scheme · Packaging waste · Non-profit company · De-monopolization · Consumer welfare effects

JEL Classification D4 · L4 · L43 · L9

The article is based on the final report of the sector inquiry conducted by the Bundeskartellamt into the German packaging waste compliance scheme market; available (in German) at www.bundeskartellamt.de.

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1 Introduction

In recent years the ex-post evaluation of antitrust decisions has increasingly attracted the attention of academia, competition authorities and international organizations. The OECD, for instance, has declared the evaluation of competition interventions as one of the strategic priorities for the OECD's work on competition between 2012 and 2016. In that context, the OECD has collected information on existing best practices in such evaluations and tried to expand the range of techniques that can be used.¹ Furthermore, recent events such as the ex-post evaluation workshops organized by the OECD or the conference dedicated to impact assessment organized by the Netherlands Authority for Consumers and Markets have created a platform to discuss ex-post evaluation studies as well as general methodological issues when conducting those studies.

There is a common understanding that ex-post evaluations are valuable.² Ex-post studies contribute to an increase in the transparency of decisions and allow to uncover potential welfare benefits generated for consumers as a consequence of enforcement activities. Furthermore, conducting ex-post evaluations allows for an objective assessment of the impact of specific antitrust decisions on market outcomes. The results may be used for improving the quality of antitrust decisions as well as the general enforcement practice in the mid- and long-term. In addition, potential limits of existing rules and regulations may be identified and promote discussions on the necessity of policy reforms.

Against this background, we provide an ex-post evaluation of the impact of competition law enforcement activities of the Bundeskartellamt and the European Commission on the German packaging waste compliance scheme market. Until 2003, the non-profit compliance scheme DSD enjoyed a monopoly in the market. Numerous antitrust cases, however, paved the way for competitive market structures. We show that these enforcement activities resulted in a series of market entries since 2004, a corresponding drop in DSD's market share, increased innovation and substantial efficiencies. Furthermore, we apply a difference-in-differences approach to show that prices decreased by 63% and to estimate the aggregated consumer welfare gains achieved by 2011 at a total of €13 billion.

The article is structured as follows. Section 2 briefly summarizes how the German market for packaging waste compliance schemes functions today. Section 3 continues with a description of the creation of DSD as a monopolist, a discussion of the competition issues connected with its monopolistic position and a review of antitrust enforcement activities to enable market entry. Chapter 4 then provides the ex-post evaluation of enforcement activities. After a brief description of the underlying data in Sect. 4.1 we present in Sect. 4.2 several figures to show the impact of competition on the market structure, followed by a difference-in-differences estimation of consumer

¹ See, for example, the OECD "Reference guide on ex-post evaluation of competition agencies' enforcement decisions" (2016), the OECD "Guide for assessing the impact of competition authorities' activities" (2014) and the OECD "Factsheet on how competition policy affects macro-economic outcomes" (2014).

² See [European Commission \(2014\)](#), Ex-post economic evaluation of competition policy enforcement: A review of the literature, p. 11; [OECD \(2016\)](#), Reference guide on ex-post evaluation of competition agencies, p. 3f.

welfare effects in Sect. 4.3. Section 5 closes the paper with a discussion of the results and policy conclusions.

2 The German Market for Packaging Waste Compliance Schemes

In Germany, the disposal of waste from private households and businesses is meticulously regulated. Private households are generally requested to separate their waste according to six main different types of waste ('lightweight' packaging, paper, organic waste, residual waste, waste glass and bulky waste). Depending on the type of waste the collection and recycling is organized differently. The collection and disposal of residual waste, organic waste, paper waste and bulky waste is organized by the municipalities which enjoy local monopolies for these waste types throughout Germany. Packaging waste, by contrast, is nowadays organized by several competing compliance schemes. Packaging waste includes waste glass and 'lightweight' packaging, which comprises plastic, metal, and other non-glass packaging. The regulatory basis for the business activities of these compliance schemes was laid down in Article 6 of the German Packaging Ordinance ("Verpackungsverordnung") in 1991. It stipulated that a company (producer, importer, retailer) that puts a product with packaging into circulation needs to pay a compliance scheme for the collection and recycling of the resulting packaging waste. In return, the compliance scheme is responsible for collecting and recycling the corresponding amount of packaging waste nationwide and free of charge to households. The business activities of compliance schemes therefore primarily comprise the coordination of a large number of local waste disposal services. Figure 1 depicts the typical structure of contracts associated with this coordination, using the example of waste glass.

The bottler/importer assigns a compliance scheme to collect and recycle its nationwide amount of waste glass (e.g. wine bottles) and makes a corresponding payment (compliance service contract, see ①). The compliance scheme then engages local

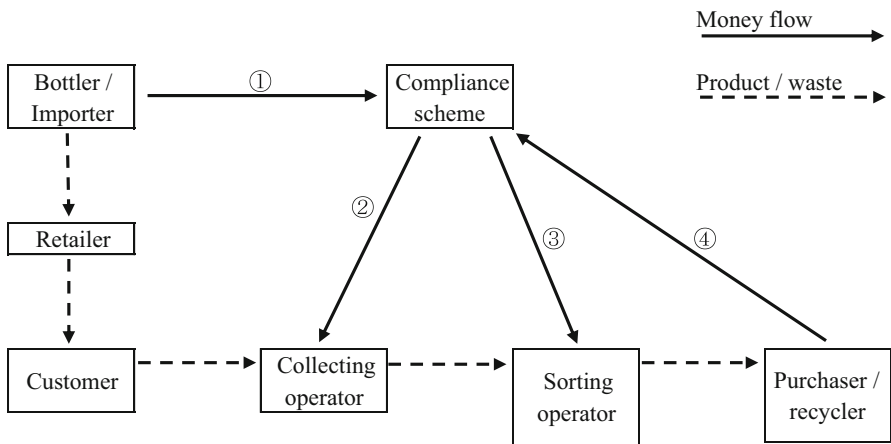


Fig. 1 Contract structure of a compliance scheme by the example of waste glass

operators to collect the waste glass (collecting contract, see ②). The waste glass gets transported to the sorting operator and processed within the plant such that it meets certain quality criteria (sorting-contract, see ③). Finally, the compliance scheme sells the processed glass to the purchaser (glass factory), which melts it down with the objective to produce new bottles (recycling contract, see ④). In addition to these service contracts, compliance schemes also commission municipalities (or the respective public waste disposal authorities) to provide, maintain and clean container locations as well as to offer waste consultancy services.

Compared to other markets a special feature here is the legal obligation of compliance schemes to collect the packaging waste *nationwide*. The collection process therefore constitutes a bottleneck for existing compliance schemes and would represent an extremely high barrier to market entry if potential entrants had to duplicate the collection infrastructure. As a consequence, compliance schemes use a common collection infrastructure and may coordinate the collection process in conformity with antitrust principles. Furthermore, compliance schemes are legally obliged to meet specific recycling ratio targets for each material and to proof its compliance with this obligation on a yearly basis.

3 Competition Law Enforcement to De-Monopolize the Market

3.1 The Origins of a Monopolistic Waste Compliance Scheme in Germany

During the last two decades, the German packaging waste compliance scheme market has experienced a fundamental change from a competition perspective. The origins of the market go back to the German Packaging Ordinance introduced in 1991 as a consequence of increasing quantities of household waste and exhausted landfill capacities. The Packaging Ordinance was intended to counteract increasing packaging waste quantities by assigning waste disposal costs to the manufacturers and retailers. This represented a milestone in waste disposal policy in the sense that for the first time waste responsibilities were shifted to manufacturers and retailers. In addition, the Packaging Ordinance aimed at recycling the incurred packaging, especially plastics, metal and liquid packaging board. To this end, a new bin for packaging waste was introduced in addition to the existing waste containers, the ‘yellow’ bin, in which all non-glass/non-paper packaging is being collected since then. Extensive promotion campaigns with the trademark “the green dot” were launched with the objective to tag the affected packaging.

As regards the organization of the collection and recycling of packaging waste, industry and policy decided to establish “Duales System Deutschland” (“DSD”) as the exclusive compliance scheme in Germany. DSD as monopolist should act as a “non-profit” as well as a “no operations” company. Hence, DSD’s prices should equal costs and the local collection and recycling services should be performed by private and public waste management companies. By 1993 more than 500 shareholders—predominantly producers and retailers, but also waste management companies—had joined DSD.

DSD assigned the *collection* and *sorting* to one contract partner per collection district and waste type. The contracts were negotiated without tendering procedures and generally had a duration of 15 years (1993 until 2007). However, due to various mis-specifications resulting in high costs or low sorting quality the contracts were amended several times. The *recycling* of packaging waste was assigned by DSD independently of the collection and sorting process to firms some of which were participants in buyer cartels.

In 1993 DSD showed a massive cost deficit. As a consequence, DSD increased prices and could only be bailed out via grants that were provided by its clients as well as debt waivers and conversions of open claims into loans by waste disposal companies. In the course of these incidents waste disposal companies became dormant partners of DSD in 1995.

3.2 Antitrust Enforcement by the Bundeskartellamt and the European Commission

Having regard to the above, it becomes clear that several competition problems existed in the German packaging waste compliance scheme market in the 1990s. First of all, due to the fact that all significant producers, retailers and waste management companies were shareholders or dormant partners of DSD, DSD had a cartel-like ownership structure. As a consequence, the alignment of interests as well as the collectivization of costs impeded the incentives of producers and retailers to compete by trying to lower packaging disposal costs. Secondly, the green dot trademark as the symbol of the new packaging recycling system was owned by DSD and tied contractually to DSD's compliance service. Since the green dot was soon found on all packaging throughout Europe after DSD's inception, this implied that a manufacturer could only contract a potential competitor of DSD if it simultaneously changed the packaging design. Last but not least, potential competitors lacked the necessary collection infrastructure. Due to the exclusive contracts of DSD with collecting operators in around 450 collection districts and the legal obligation to collect the packaging waste nationwide at "each house", collecting operators were not allowed and not interested to contract with potential competitors of DSD.

In light of these major competition issues, the first amendment of the German Packaging Ordinance in 1998 clarified that the existence of several compliance schemes was generally possible and additionally introduced a tender obligation for the waste services contracted by a compliance scheme. From 1999 onwards the Bundeskartellamt and the European Commission started to bring cases in the compliance scheme market with the objective of enabling competition. In 2000, the Bundeskartellamt took the view that local collecting operators commissioned by DSD must accept parallel and non-discriminatory assignments of other (potential) compliance schemes because the local collecting operator represented a bottleneck towards potential competitors of DSD. Accordingly, in 2001 the European Commission prohibited DSD to use exclusivity agreements in its contracts with waste disposal companies that were intended to impede those parallel assignments.³ In another decision from 2001, the European

³ See decision 2001/837/EG, ABI. L 319/1-29.

Commission prohibited DSD from charging the same payment if a customer used “the green dot” on its packaging but did not use DSD’s waste disposal service.⁴ In 2001, the Bundeskartellamt carried out dawn raids on the suspicion that DSD and major waste disposal companies instigated other collecting operators to not conclude collection contracts with Landbell, the first company trying to enter the market. Furthermore, in 2002 the Bundeskartellamt initiated a prohibition proceeding regarding the cartel-like shareholder structure of DSD. As a consequence, DSD dissolved its cartel-like shareholder structure by December 2004. In 2003, DSD for the first time tendered the collection and sorting contracts. Shortly afterwards, the Bundeskartellamt carried out dawn raids on the suspicion that a number of waste disposal companies had cartelized in the course of this tender. DSD awarded new contracts only for those collection districts in which several bids were submitted and tendered the remaining districts—as suggested by the Bundeskartellamt—under improved tender conditions.

All these enforcement activities paved the way for market entries of compliance schemes other than DSD. The period from 1998 to 2003 can therefore be interpreted as the starting point for a change from monopolistic to more competitive market structures. A number of further cases brought by the Bundeskartellamt since 2004 have helped to remove several remaining anti-competitive restraints step-by-step.

4 Ex-Post Evaluation of Competition Law Enforcement Effects

4.1 Data

In order to ex-post evaluate the impact of the enforcement activities described in the preceding section we use publicly available data. The main source is data gathered in the course of a sector inquiry conducted by the Bundeskartellamt in 2012 in accordance with Section 32e of the German Competition Act (“GWB”). The sector inquiry was intended to examine the progress of market opening in the German waste compliance scheme market. For that purpose, all compliance schemes were asked to provide individual data on packaging quantities, turnovers, collection and recycling quantities for the period from 1993 to 2011 as well as cost data for the year 2011. The Bundeskartellamt provided a high degree of transparency to the public as the data aggregated for all compliance schemes were fully published in the final report of the sector inquiry.⁵ The quantitative data fully represent the German waste compliance scheme market over a time span of 19 years. There is no sampling error or other statistical errors in the data as all compliance schemes had to provide the full data according to compulsory requests for information by the Bundeskartellamt. In addition, the requested data was previously tested by auditing firms and other public authorities, as compliance schemes are obliged to provide waste authorities with a yearly proof of their packaging waste collection, sorting and recycling quantities. Thus, compared to other antitrust ex-post evaluation studies, this data set is extremely precise and rich. It allows for an in-depth analysis of the market development over time. However, the drawback of

⁴ See decision 2001/463/EG, ABI. L 166/1-24.

⁵ See Annex 2 of the final report of the sector inquiry, available at www.bundeskartellamt.de.

the data is its nationwide aggregation for all compliance schemes which is necessary because the Bundeskartellamt is not allowed to publish business secrets. Due to the aggregation it is not possible to perform econometric estimations with the data.

We complement these data with additional publicly available data provided by the German Federal Statistical Office regarding the price development of the collection and disposal of other residential waste fractions, i.e. household waste other than packaging waste. The official German index of consumer prices is composed of several items, one of which is the price for the municipal waste service (item no. CC0442). As explained above, the disposal of non-packaging household waste is organized by the municipality and therefore not part of the waste disposal service provided by compliance schemes. The German Statistical Office has published the price index CC0442 since 1995. This price index serves as control group for the difference-in-differences approach applied in Sect. 4.3.

4.2 Changes in Market Structure and Market Outcome

As described in Sect. 3, there were numerous competition law enforcement activities in the German packaging waste compliance scheme market since 1999 with the objective to remove anti-competitive restraints and thus enable competition. In this section we evaluate the impact of these changes. However, it is worth mentioning that our ex-post evaluation is not designed to measure the effect of an *individual* law enforcement activity, i.e. the impact of one specific antitrust case on market outcome. By contrast, we evaluate the impact of the bundle of the cases brought in this sector by analyzing the development of key market indicators over time.

Starting with the impact of competition law enforcement on the opportunities of compliance schemes to enter the market, Fig. 2 illustrates the chronology of market entries of competitors to DSD between 2004 and 2013. Until 2003, DSD was the exclusive compliance scheme operating in the market. In October 2004, Landbell successfully entered the market and started its business activities as the first competitor to DSD. The company had undertaken efforts to enter the market as early as in 1997. In the eight years following Landbell’s market entry, eight further compliance schemes consecutively entered the market. Thus, by 2013 there were ten competing compliance schemes operating in the market.

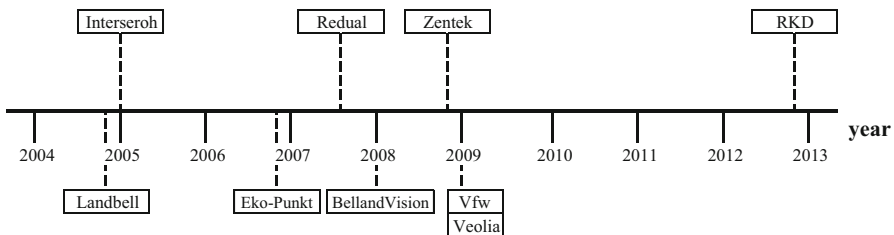


Fig. 2 Market entries in the German packaging waste compliance scheme market between 2004 and 2013. *Note* Dates of market entries are indicated as the dates when operational activities of the compliance schemes started

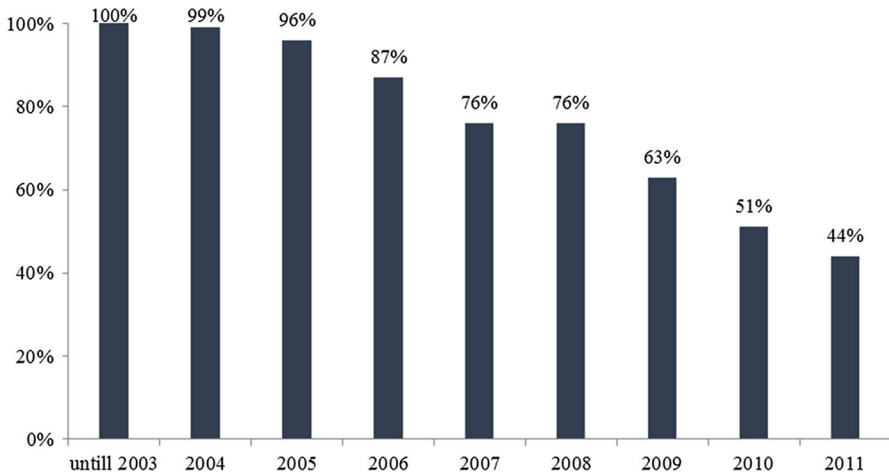


Fig. 3 Development of DSD's market shares. *Note* Market shares are calculated on the basis of turnovers and in practice identical to those based on quantities

As indicated by Fig. 3, the increasing number of competitors to DSD led to a continuous drop in DSD's market shares. Until 2003, DSD as a monopolist enjoyed a market share of 100% in Germany. In the period from 2004 to 2011 the market share continuously decreased by more than half to 44%. This clearly shows how antitrust enforcement paved the way for increasing competition in the market.

The increased competition unleashed a wave of innovation in recycling technologies. Significant investments in innovative sorting plants with optical recognition systems were undertaken that allowed for an improved and automated separation of materials. During the monopolistic period the use of this technology was scarce. With the market opening thirteen new sorting facilities based on optical recognition systems were put into operation and nine existing facilities were retrofitted. The impact of this change becomes visible, inter alia, in the development of recycling ratios between 1998 and 2011 for the 'yellow bin' (lightweight packaging, Fig. 4). The recycling ratio is calculated as the ratio of recycled waste to the quantity of waste put into circulation. The figure shows a decrease in recycling ratios during the monopolistic period until 2003 and an increasing trend after the first market entry in 2004. This improvement is particularly remarkable given the fact that an important change took place in the market in 2003 to the disadvantage of the recycling ratios. In 2003, a mandatory deposit ("Einwegpfand") was introduced for some drinks bottled in single-use beverage bottles and in 2006, this deposit was extended to more drinks. These bottles were no longer collected in the yellow bin but previously had a particularly high recycling ratio, suggesting that their detachment from lightweight packaging waste would significantly lower the overall recycling ratio.

Since the recycling process allows compliance schemes to filter out material components with positive market values (e.g. tinplate, aluminium, plastics), the observation of increasing recycling ratios along with new innovative sorting facilities after demopolization confirms the expectation that competition fostered the economic

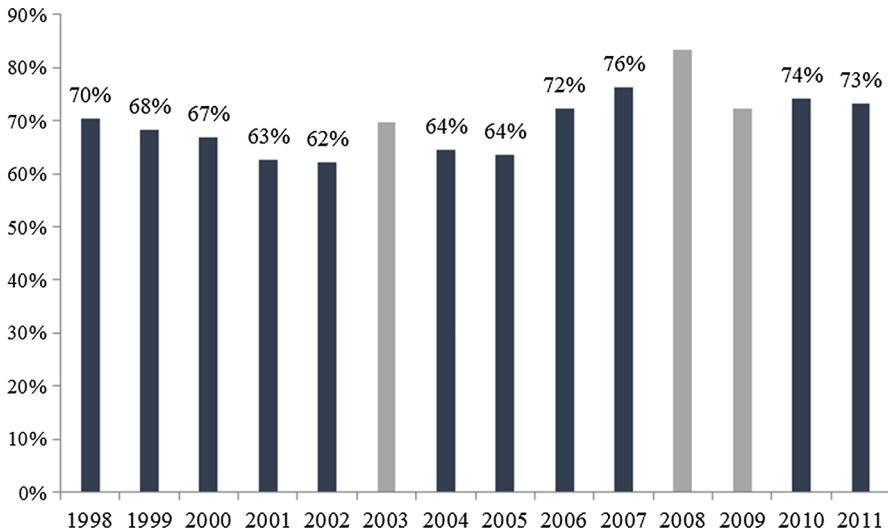


Fig. 4 Development of recycling ratios for lightweight packaging. *Note* The ratios for the years 2003, 2008 and 2009 are slightly distorted due to end of period effects associated with legislative changes

incentives of firms to improve the recovery of recyclable materials as well as to invest in innovative sorting facilities. The increasing recycling ratios rebut the arguments put forward by interested parties prior to de-monopolization who claimed that competition would lead to lower recycling ratios. In essence, they argued that under competition each compliance scheme would have an incentive to only implement the (rather low) statutory minimum recycling ratio as this would be the cheapest option. However, with positive market values of (some) sorted waste components there is a genuine economic incentive at place independently from the statutory requirements.

As a consequence of the decision by the European Commission, the initial contracts between DSD and its local waste service suppliers with durations of 15 years were terminated already in 2003 instead of 2007. From 2004 onwards, the Bundeskartellamt then closely accompanied the tenders of DSD to seek more efficient suppliers and the information collected in this context confirms significant reductions in DSD's costs since 2004.⁶

Table 1 compares the aggregated operational costs of all active compliance schemes between the years 2003 and 2011. The figure in 2003 consists of the operational costs of DSD only as it was still a monopolist in that year, whereas the figure in 2011 represents the sum of operational costs of all (nine) compliance schemes active in 2011. As illustrated by Table 1, aggregated operational costs decreased from €1.78 billion in 2003 to €824 million in 2011, corresponding to a drop of about 54%.

The distribution of costs shows remarkable differences between different cost components. Whereas sorting and recycling costs as well as collection costs substantially decreased by 76 and 44%, respectively, ancillary expenses merely slightly changed by

⁶ Although we do not have detailed cost data for the period 2004–2010, the collected information suggests reductions in waste disposal costs of around 20–30% between 2004 and 2006 (compared to 2003).

Table 1 Operational waste disposal costs of compliance schemes in 2003 and 2011

mio. €	2003	2011	Percentage change
Collection	Approx. 918 ^a	517	Approx. - 44%
Sorting and recycling	Approx. 715 ^a	173	Approx. - 76%
Ancillary expenses	Approx. 144 ^a	133	Approx. - 8%
Total	1.777	824	- 54%

^aApportionment of costs in 2003 is based on careful estimates

around 8%. These differences can be explained by different competitive conditions. The market opening had the biggest impact on the sorting and recycling as in this area full competition between compliance schemes developed. The collection of waste is organized jointly by compliance schemes⁷ so that there is less scope for competition. But collection also experienced a significant cost decrease due to the fact that after 2003 the local collection contracts were tendered in a systematic way. Ancillary expenses, by contrast, are basically fees charged by the municipalities to the compliance schemes and exposed to almost no competitive pressure which is why only a very low cost decrease is observable for this cost category.

Figure 5 illustrates the development of yearly aggregated turnovers generated by compliance schemes between 1995 and 2011. During the monopolistic period between 1995 and 2000 the turnovers are on a constant level of approx. €2 billion per year. Since 2001 the turnovers steadily declined from this level to slightly below €1 billion in 2008. From 2008 onwards, the turnovers remained at the same level of close to €1 billion per year.

Drawing on information provided in the Bundeskartellamt's sector inquiry report we can proceed to derive aggregated quantity and price indexes. The price that the customers (and ultimately consumers) pay for the packaging waste service is barely driven by the waste quantities collected. The contracts for the local collection service provide for a fixed lump-sum payment over three years to the collection operator, irrespective of the amount of packaging collected and/or the amount of packaging put into circulation. Thus, collection costs are basically fixed. The same is true for ancillary expenses. Therefore, roughly 80% of the aggregated operational costs (see Table 1) do not increase or decrease with quantity variations in the short- or mid-term. This is also visible in the time series. For example, in 1997 there is a significant increase in the packaging quantities (+17%) while the turnover remains basically unaffected, both in 1997 (+1%) and in 1998 ($\pm 0\%$). We run the t-test to see whether aggregated waste quantities and aggregated turnover of the compliance schemes are correlated and unsurprisingly do not find any correlation. Hence, due to the specifics of this market, aggregated turnover is a better indicator for the price development than turnover divided by quantity which is why we use the former as an indicator in the following (Fig. 6). Using turnover divided by quantity would introduce unnecessary

⁷ This is due to the fact that it would be inefficient if each compliance scheme would set up a parallel (duplicate) nationwide packaging collection infrastructure. Detailed information on the jointly organized collection infrastructure is provided in Bundeskartellamt, Case summary "Coordination of tenders for sales packaging waste collection services by compliance schemes", 2011.

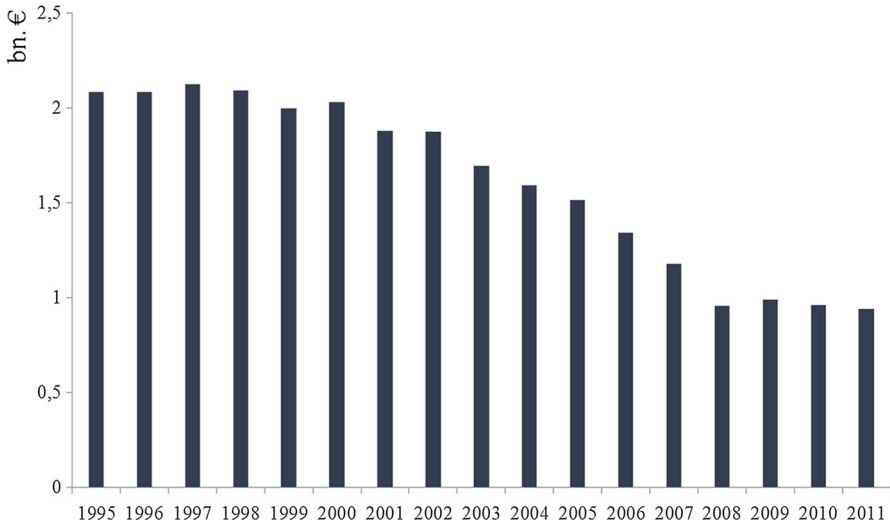


Fig. 5 Development of aggregated turnover (in bn €) generated by compliance schemes

(short-term) distortions in the price index, e.g. for the years 1997, 2003 and 2005. It should be noted that from a long term perspective it does not really matter which of the two options are chosen for the price index as quantities have remained rather stable in the long run. The decreases of waste quantities in 2003 and 2005 (caused by the introduction of the bottle deposit) were compensated for by the long-term trend of slowly increasing packaging quantities. For example, the quantities collected in the yellow bin 2011 roughly equal the quantities of the years 1998 and 1999.

The price index shows that prices substantially decreased from an index level of around 100 points during the years 1995–2000 to approx. 46 points in 2008–2011. This indicates that antitrust enforcement indeed evoked noticeable price reductions. Turning to the quantity index it becomes obvious that the quantities steadily increased between 1995 and 2002, followed by noticeable decreases in 2003 and 2005, and then again steady increases until 2011. Thus, the quantity effects of the introduction of the mandatory deposit are clearly observable in the data.

4.3 Estimation of Consumer Welfare Effects

We now turn to the estimation of consumer welfare effects associated with the emerging competition as a consequence of market opening. Consumers may have profited from this change as the costs faced by producers and retailers for the collection, sorting and recycling of their incurred packaging waste is anticipated in the product prices paid by consumers. In the following we assume that these costs are simultaneously and fully passed on to consumers via product prices.⁸ As a consequence, when we refer to the

⁸ Retailers pay the fee to the compliance schemes as a per-article price which depends on the packaging weight. Therefore, from the point of view of the retailers, the packaging waste costs are to full extent marginal costs when selling packaged products to end consumers. As German retail markets are characterized by a

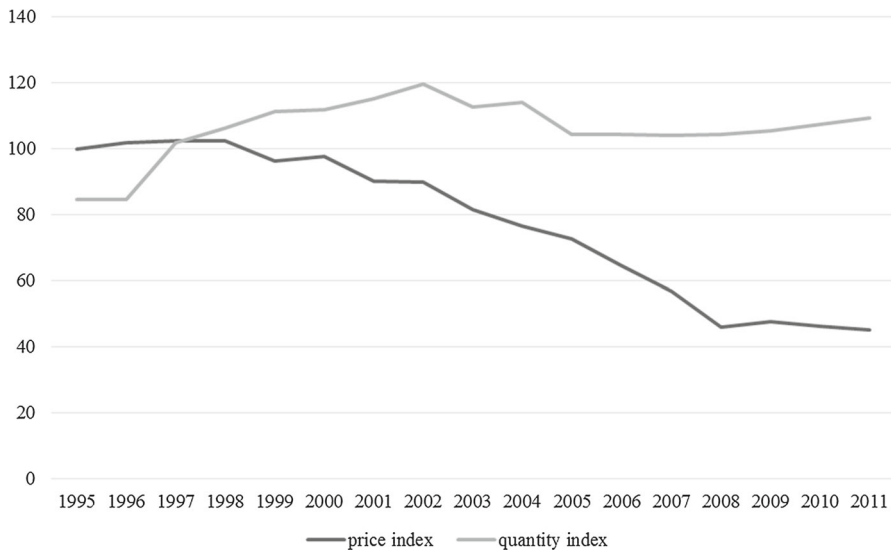


Fig. 6 Price and quantity index between 1995 and 2011

prices charged by compliance schemes for their waste disposal services (see Fig. 6⁹ for the corresponding price index) we analogously refer to the prices paid by consumers.

We estimate the consumer welfare effects with a difference-in-differences (“DiD”) approach which compares the development of prices in the packaging waste compliance scheme market (“treatment market”) with the price development in a control market which is comparable to the treatment market with the exception that no changes in the market structure took place. The DiD approach is the most widely used approach for the ex-post quantification of the effects of enforcement decisions.¹⁰ However, due to the high data aggregation which leads to a small number of observations (yearly data for the period 1995 to 2011, i.e. 17 observations), we do not implement the DiD approach econometrically but rather compare the average prices between the treatment group and a control group between the two periods of monopolization and competition. The concept of the DiD approach is illustrated in Table 2.

Let A be the average price in the packaging waste compliance scheme market during the monopolistic period and B the average price in the competitive state. The differ-

Footnote 8 continued

sufficient degree of competition (oligopoly), it seems safe to assume that, in reality, retailers will pass on more than 90% of these marginal cost variations to end consumers.

⁹ For the calculation of the quantity index the collection quantities of lightweight packaging for the years 1995–2011 are used. We solely use the quantities of lightweight packaging as reference values because 80% of the yearly turnovers are generated with lightweight packaging. If we would additionally include the quantities of waste glass and/or paper/paperboard, the overall quantities would strongly increase due to the higher weight of waste glass/paperboard, thereby distorting the small impact of these waste types on turnovers. The base year for both indexes is the average of years 1995–2000.

¹⁰ See OECD (2016), Reference guide on ex-post evaluation of competition agencies, p. 50.

Table 2 Idea of the difference-in-differences approach

	Monopolistic period	Competitive period	Difference	DiD
Compliance scheme market	A	B	B–A	(B–A)–(D–C)
Control market	C	D	D–C	

ence (B–A) then reflects the change in average prices between both periods. Since this change may not be completely driven by the changes in market structures but also by other factors such as exogenous changes that affect collection and recycling costs over time (e.g. wage costs), the control market functions as a benchmark. The difference (D–C) of the control market captures the average price development between both periods in the counterfactual scenario without emerging competition, i.e. in the hypothetical situation that DSD continues as a monopolist in the market. Calculating the difference in differences (B–A)–(D–C) separates the impact of de-monopolization from (hopefully all) other factors and thus reflects an estimation of the price decrease associated exclusively with the change from monopoly to competition.

The validity of the DiD approach crucially depends on the existence of a suitable control market. We use the German markets for residential non-packaging waste as control group and believe that it constitutes an appropriate (and also the best available) benchmark for two reasons. First, the disposal and collection of residential waste has been characterized by local monopolies throughout Germany for many decades. The market structure of each local market is therefore comparable to the monopolistic market position of DSD in the packaging waste compliance scheme market before the enforcement activities started. Non-packaging waste has remained a monopoly which implies that there was no de-monopolization during 1995–2011. Secondly, the markets are comparable from a technical perspective which means that the factors influencing costs (and ultimately prices) are comparable in both markets. Although waste processing (e.g. recycling, incineration, composting) differs to some extent between both markets due to the different types of waste, the collection of waste is basically the same task. Indeed, the waste is being collected at the same houses throughout Germany. The waste trucks take the same routes through the same streets. The compliance schemes are responsible for emptying the yellow bin, whereas the municipality is responsible for the other bins. Thus, changes in cost factors such as labor costs, costs of waste collection vehicles or fuel prices should affect both pricings similarly¹¹, so that—absent de-monopolization—they should follow a common trend. By using the price index of non-packaging residential waste we can therefore relate to an aggregated, nationwide price development of waste disposal services comparable to those conducted by packaging waste compliance schemes but not exposed to de-monopolization.

By comparison, compliance scheme markets in other countries or one or a subset of local residential non-packaging waste markets in Germany are no suitable control

¹¹ As can be seen from Table 1 (p. 9), in 2011 the collection costs accounted for 63% of total operational costs.

groups. When using other countries as a control group we would neglect the fact that other countries show remarkable differences compared with Germany concerning the collection and recycling of household packaging waste. In some countries the households are obliged to bring the packaging waste to recycling centres on their own, whereas in Germany the household packaging waste is collected “at the front door” (just as non-packaging waste) and this collection service accounts for the major part of the fee. Furthermore, countries differ *inter alia* with regard to which materials are considered as packaging waste, to which degree households are supposed to separate waste, whether non-household (i.e. industrial or commercial) packaging is also included in the compliance scheme, whether all costs (especially collection costs) are borne by the compliance schemes and thus the composition of cost components included in the prices. These differences directly impact the prices charged within a country which implies that cross-country price level¹² or price trend comparisons are no viable option if not controlling for these abundant differences (which, on top, may change over time in a country). Due to the lack of in-depth data for other countries,¹³ this would be a futile exercise. Likewise, using one local residential non-packaging market in Germany (or a subset of several local markets) instead of the aggregated nationwide index as control group would be inappropriate as well. Prices for the packaging waste compliance scheme service do not differ by regions because compliance schemes are legally obliged to collect and dispose the waste nationwide. Costs and prices of compliance schemes therefore follow nationwide cost- and price-trends. When using an index of one or several local non-packaging markets as control group one would lose this nationwide link. The cost structure for non-packaging waste differs considerably between regions (e.g. due to different wages, population density, settlement structures, etc.) and additionally depends on local changes. By using one or several local markets we would therefore have regional aspects included in the control group for which it would be very difficult to control. By using an aggregated index of all local monopolies throughout Germany those regional specifics should be represented in the control group in the same way as in the treatment group.

Figure 7 illustrates the price development of residential non-packaging waste (control market) and residential packaging waste (treatment market) between 1995 and 2011. Looking at the packaging waste index, two structural breaks in the time series become visible. The first break appears in 2000/2001 and marks the date when the first proceedings by the Bundeskartellamt und the European Commission were brought (see Sect. 3.2). Due to these cases DSD was exposed to potential competition and also some fringe competition. We therefore classify the preceding period from 1995 to 2000 as the “monopolistic period” since DSD was the exclusive compliance scheme operating in the market and there was not even the threat of market entry by any competitor. Likewise, we see 2001 as the year in which the “transition period” began and the monopolistic state gradually changed to a more competitive market environment.

¹² If compared to other countries, the German system is characterized by high-cost features with regard to the elements mentioned so that we would expect a much higher price level in Germany if compared to other countries.

¹³ Monier et al (2014), p. 13, Development of Guidance on Extended Producer Responsibility, Report by Deloitte Bio Intelligence Service, commissioned by the European Commission.

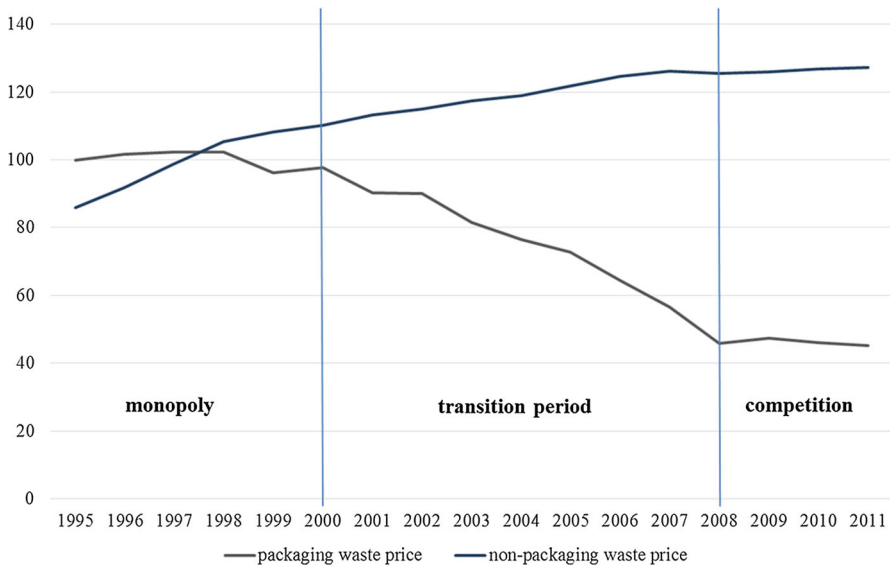


Fig. 7 Price indices of non-packaging waste and packaging waste. *Note* The base year for both indices is the average of years 1995–2000

The first antitrust decisions were issued in 2001 and numerous enforcement activities were conducted (see Sect. 3.2) and competitors to DSD consecutively entered the market. The transition period ends with the second structural break identifiable in 2007/2008 where several compliance schemes became fully operational throughout Germany. Therefore, we classify the period from 2008 to 2011 as the “competitive period” which is characterized by a market environment in which nine competing compliance schemes—DSD as well as eight competitors to DSD—provide the same packaging waste compliance services and prices seem to have reached a constant (competitive) level for four years in succession.

In contrast to the decreasing trend of the packaging waste index the development of the index of residential waste shows a steady upward trend between 1995 and 2007. As for packaging waste, we scale the index to 100 for the average of the period 1995–2000. The residential non-packaging waste price index increased up to 127 points in 2011. This impressively demonstrates the differing price development in a market comparable to the packaging waste compliance scheme market but not exposed to similar competition law enforcement activities.

Looking at the different trends of the control- and treatment group during the monopoly period one might doubt whether the chosen control group constitutes a suitable benchmark as the common trend assumption seems not to be fulfilled during 1995–1999. This deviation, however, can be reduced to a major change in waste regulation specifically affecting non-packaging household waste. In 1993, the Technical Instruction on Residential Waste (German acronym TASI) was introduced which basically obliged municipalities to no longer dispose of household waste in landfills. Municipalities throughout Germany thus had to change from landfill disposal towards incinerating household waste which is far more expensive. This change led to

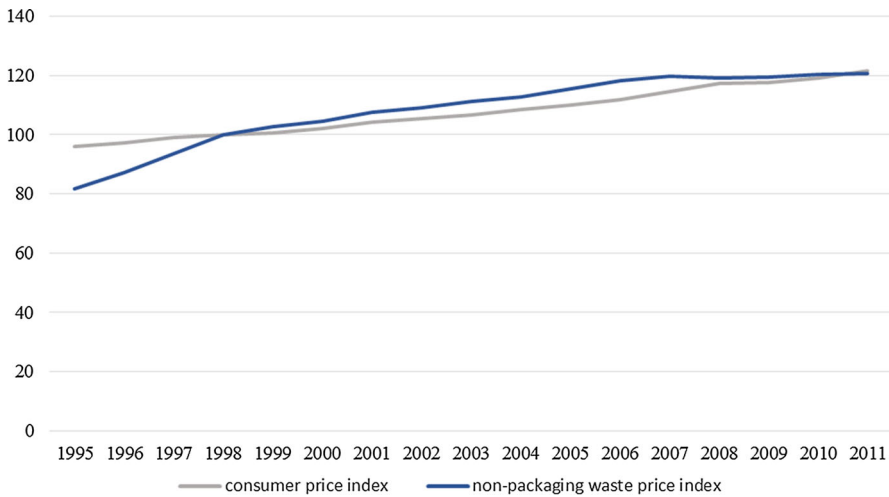


Fig. 8 Consumer price index and price index of non-packaging waste. *Note* The base year for both indices is 1998

corresponding price increases for non-packaging waste disposal during 1993–1999. However, after 2000, there was no major regulatory change in Germany for both packaging and non-packaging waste, so that the common trend assumption holds after 2000.

Given this explanation we believe that non-packaging waste prices still constitute a suitable control group despite the deviation of both trends during the monopoly period. In particular, it is worth mentioning that the increasing prices of the control group over time closely follow the development of the general consumer price index. As can be seen in Fig. 8, both indexes show an almost identical development. The larger slope of the non-packaging price index during the period 1995–1999 can again be explained by the aforementioned TASI. From 2000 onwards, however, both indexes are almost identical, suggesting that by using non-packaging waste prices as control group we merely compensate for inflation.

As regards the three different periods identified between 1995 and 2011 (see Fig. 7), it is important to note that we do not include the transition period in the application of the DiD concept. Otherwise, we would wrongly assume that the market environment rapidly changed from monopoly to competition, thereby neglecting the long-lasting process of market opening and market entries described in Sect. 3. We therefore implement the DiD approach by comparing the average price developments in the compliance scheme market and the control market solely between the two periods of monopoly and competition.

Table 3 summarizes the results of the DiD approach.¹⁴ On average, prices in the compliance scheme market decreased by 54% between the monopolistic and the com-

¹⁴ Please note that we do not calculate with absolute values but with index values. In order to calculate the DiD, we apply the following formula: $\text{DiD} = \frac{(\text{Avg. Index Value packaging } 2008\text{--}2011)}{(\text{Avg. Index Value non-packaging } 2008\text{--}2011)} - 1$.

Table 3 Difference-in-differences estimation of yearly consumer welfare effects for 2008–2011

	Monopolistic period Ø Index value 1995–2000	Competitive period Ø Index value 2008–2011	Price change	DiD	Estimated consumer savings per year (2008–2011)
Packaging waste compliance scheme market	100	46	– 54%	– 63%	1.670.000.000 €
Control group (residential non- packaging waste)	100	126	+ 26%		

petitive period. This price change, however, should be put into perspective since it does not take into account the price change that might have occurred between both periods in the counterfactual situation, i.e. under continuation of DSD as a monopolist without antitrust enforcement. The average price change in the control market is therefore used as the hypothetical market development and it shows an average price increase of +26% between both periods. The difference between both indexes results in an average price decrease of 63% ($= 1 - 46/126$). Thus, based on our DiD approach we estimate the enforcement induced a price drop in favor of final consumers of around 63%. According to the DiD approach, we use the non-packaging waste disposal price index to extrapolate the packaging waste disposal prices which prevailed in 1995–2000 to the period 2008–2011. We then take the difference between these extrapolated ('assumed monopoly') prices and the prices observed in reality. This difference represents the estimated consumer savings. Based on the information on prices and quantities between 2008 and 2011 we calculate an estimated average monetary consumer welfare gain of around €1.67 billion per year. While this number refers to the period between 2008 and 2011, it can reasonably be assumed that it applies to a similar extent even after 2011. The overall consumer savings during the period between 2008 and 2011 amount to €6.68 billion.

In addition to the welfare effect between 2008 and 2011, it is straightforward to quantify the consumer savings that occurred during the transition period from 2001 to 2007 when the (final) competitive price level had not been achieved but prices were already decreasing. For this quantification, we can use the same logic to assume that the packaging waste index would have followed the development of the control market index during the transition period. The estimation of the aggregated consumer savings between 2001 and 2007 amounts to around €6.36 billion. Taking additionally into account the above calculated consumer savings of €6.68 billion during the competitive period, the overall consumer welfare effect between 2001 and 2011 is estimated to amount to a total of €13 billion.

Although the estimated welfare effect is very high, we still believe that it constitutes a careful estimate of the true consumer gains because the chosen control group in

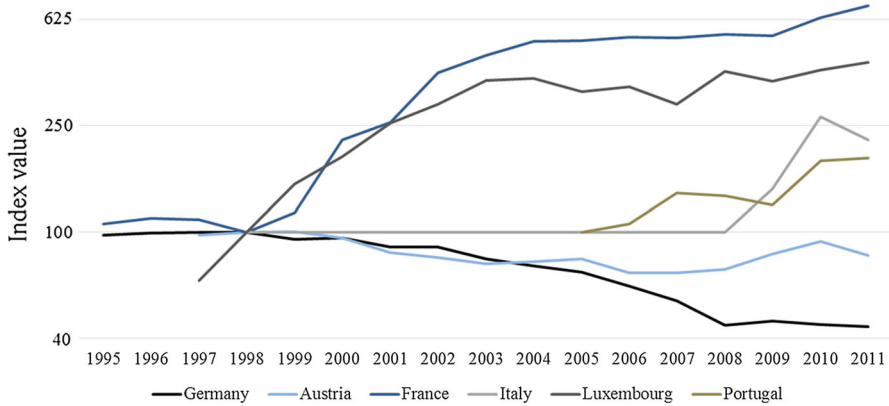


Fig. 9 Estimated price index of compliance schemes from different countries. *Note* Logarithmic scale. With the exception of Portugal the base year for all indexes is 1998. Due to the short observation period (2005–2011) the base year for Portugal is 2005

effect merely accounts for inflation (see Fig. 8). Structural aspects such as the fact that mismanagement within DSD absent de-monopolization—as during the 1990s, see Sect. 3.1—could have led to further substantial price increases, are not taken into account.

Of course, it is possible to additionally quantify the welfare effect based on even more conservative assumptions. Under the assumption that in the counterfactual situation the price level between 2001 and 2011 would have been equal to the average price level during the monopolistic period (1995–2000), which is equivalent to performing a before-and-after comparison under the assumption of the absence of inflation, the consumer welfare effect during the competitive period from 2008 to 2011 amounts to a total of €4.5 billion. Taking additionally into account the cost savings of €3.5 billion during the transition period from 2001 to 2007, the overall welfare effect amounts to a total of €8 billion.

To further plausibilize the DiD-estimate, we provide data on price trends for packaging waste compliance schemes in other European countries for which data are available. In those countries, the national compliance scheme market remained a monopoly. Figure 9 illustrates the best available estimate of the price development in countries where the national monopolist published meaningful data over a sufficiently large time span. As price lists are composed of a large number of individual items, we look for the aggregated fees that the customers of the compliance scheme paid (often labelled as “licence revenues”) as a proxy for the weighted average price.¹⁵ As explained above, it is not possible to directly compare the compliance schemes of

¹⁵ For Austria and Luxembourg we use the “licence revenues” as published in the annual reports of ARA (Austria) and Valorlux (Luxembourg). For France and Portugal we use the turnover as published in the annual reports of Sociedade Puntoverde (Portugal) and EcoEmballages (France). The turnovers of EcoEmballages might contain some revenues from sales of secondary resources for some years. Those revenues, however, should only account for a low proportion of total turnovers, i.e. the general picture does not change without those revenues. For Italy, data on turnovers/licence revenues are not available. We therefore use the license prices for plastic waste reported by CONAI.

different countries due to country specific differences. The following figure should thus be viewed only as a further robustness check.

As can be seen in Fig. 9, prices in France, Italy, Luxembourg and Portugal increased strongly during the observation period, and prices in Austria decreased to a much lesser extent than in Germany.¹⁶ It can thus be excluded that the strong price decreases in Germany were due to some European-wide or global developments that affected packaging waste collection and recycling in general, such as for example global technological progress, lower input prices (e.g. oil) or higher output prices (e.g. secondary raw materials).

5 Discussion of the Results and Policy Conclusions

The striking feature of this ex-post evaluation study are the extremely high consumer welfare effects that competition law enforcement evoked in this market, both in absolute and relative terms. The authors are not aware of any other antitrust case worldwide which was followed by an in-depth ex-post documentation of such a high consumer welfare gain. The estimated welfare gain of €13 billion equals roughly $500 \times$ the Bundeskartellamt's yearly budget. But the consumer welfare effect is also very high in relative terms. The price drop of 63% ($= 1 - 46/126$) corresponds to a monopoly overcharge of 174% ($= 126/46 - 1$). In comparison, average hard-core cartel overcharges are typically estimated at 10–30% and the highest relative overcharge included in the data set e.g. of the survey of Smuda (2014) was 82%.¹⁷

Although the ex-post evaluation derives rather spectacular figures, these results seem reliable for several reasons. First, market conditions in the German packaging waste compliance scheme market are almost ideal for conducting an ex-post evaluation. The market is characterized by clear market boundaries and a homogeneous service because the waste service is defined by the Packaging Ordinance. The customers (retailers and producers) are obliged to procure the service and focus on price only, as they view the obligation to contract with a packaging waste compliance scheme akin a tax. Furthermore, there is no negative distortion by quality effects in the time series as the quality of the service slightly improved over time. The collection service level is defined by the municipality and minimum recycling quotas are defined by the Packaging Ordinance. In addition, there is no distortion by quantity effects over time as quantities of collected waste have remained roughly constant. All in all, market conditions therefore have remained basically unchanged for more than 20 years (with the exception of the de-monopolization). Second, as explained in Sect. 4.1., the underlying data set is of exceptional quality compared to other ex-post evaluation studies in which data sets are often limited and prone to sampling error and statistical noise. Last but not least, our data set is complemented and confirmed by a number of qualitative

¹⁶ Austria, is no “unaffected” market because there were some antitrust enforcement activities as well (although the monopolistic market structure remained unchanged). In addition, there are structural differences if compared to Germany as the compliance scheme in Austria comprises not only household waste but also waste collected from commercial sources (industry).

¹⁷ See (Smuda 2014), Cartel Overcharges and the Deterrent Effect of EU Competition Law, *Journal of Competition Law and Economics* 10(1), 63–86.

information published by the Bundeskartellamt in its sector inquiry report. The report provides several details (cost data, bidding data, etc.) that make it highly plausible that competition could indeed reduce prices in this market to the extent indicated. For example, the report shows how inefficiencies (excessive operating costs) were greatly reduced during 2003–2006 through improved tendering routines of DSD. The Bundeskartellamt's report is thus able to establish causality directly, whereas in other ex-post evaluations causality is typically established only indirectly.¹⁸

Turning to the policy conclusions, there are several interesting observations that can be drawn from our results. One helpful insight might be that when government and industry created DSD, they wrongly assumed that by setting a non-profit rule, this would prevent DSD from charging excessive prices to its customers. Indeed, the non-profit rule is frequently invoked to defend all kinds of persisting monopolies, especially for state-owned firms. It is true that a non-profit rule may effectively prevent a monopolist to make (excessive) profits, but it cannot prevent the monopolist from producing inefficiencies. The case study highlights that in the given case these inefficiencies were extremely high and led to excessive prices and corresponding welfare losses. Another interesting observation is that the high consumer welfare gains were achieved by enforcing non-hardcore antitrust provisions. In recent years, the enforcement focus of competition authorities worldwide was clearly on fighting hard-core cartels and merger control. Cases dedicated to non-hardcore cooperations, abuse of dominance and vertical restraints have received much less priority by competition authorities. The present ex-post evaluation puts this prioritization in question. The DSD example shows that enforcement of such 'grey zone' cases can result in enormous consumer welfare gains. Last but not least, the DSD example challenges environmental or other sustainability arguments which are used to justify cartels or monopolies. Several private sustainability initiatives have recently been formed and there is an ongoing policy discussion on how to deal with such initiatives.¹⁹ The present ex-post evaluation suggests that such initiatives should not be treated with undue leniency. The study provides evidence that—in hindsight—the environmental arguments to defend DSD's monopoly lacked substance. When examining sustainability cartels it should be borne in mind that the cost of regulatory oversight in order to achieve the desired environmental or social standard is tiny if compared to the costs resulting from monopolistic inefficiencies.

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¹⁸ It is worth mentioning that in its sector inquiry, the Bundeskartellamt also included a very conservative estimation of consumer welfare gains of €5.6 by using a before-and-after comparison. This was meant to be a lowest bound estimate. In contrast, in this article we provide a more realistic—"best guess"—estimation relying on the standard methodology of ex-post evaluation, which is the difference-in-differences approach.

¹⁹ See, for example, Schinkel (2017), Can collusion promote sustainable consumption and production?, *International Journal of Industrial Organization* 53, 371–398.

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