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## **Quantification of Antitrust Damages**

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# Quantification of Antitrust Damages<sup>1</sup>

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## 1. Introduction

If a damages claim is presented in court and compensation of harm suffered is sought, quantifying the level of damages suffered becomes necessary. An economically founded quantification of the damages caused by competition law infringements has increased in importance in particular through the advancement of competition law damages actions in the EU. Damages claims are increasingly brought, in particular as follow-on claims, and it is very likely that this trend will continue in the future. If a damages claim is presented in court and compensation of the harm suffered is sought, quantifying the level of the damages suffered becomes necessary. On the basis of these developments several theoretical and applied studies investigating the fundamental economic principles and empirical-econometric methods to determine damages have been presented in the last few years with the aim to provide guidance to the courts on how the quantification of damages should be approached and what aspects have to be taken into consideration.<sup>2</sup>

Estimates of the magnitude of damages caused by competition law violations show that they are quite substantial. The empirical literature concerned with estimating aggregate damages has so far, however, exclusively focussed on cartel cases. Empirically estimating the total damages caused by all cartels is, however, conceptually very difficult, as the total number of cartels is unknown and only discovered cartels can be analysed. The damages caused by European and national cartels have therefore been estimated using simplifying assumptions.<sup>3</sup> Presuming a certain detection rate it is possible to estimate the number of existing cartels.<sup>4</sup> By further assuming a relationship between fines and damages caused, the harm inflicted by cartels in Europe was estimated.<sup>5</sup> The estimation led to a lower bound of the yearly damages of approximately 16.8 billion €. Measured as a percentage of European GDP, total cartel damages are 0.15%. An upper bound for the yearly cartel induced damages lies at 261.22 billion €. This corresponds to 2.3% of EU GDP. These numbers show that cartel induced damages are quite substantial.

In this chapter, the main conceptual and methodological aspects that are of relevance for an economically sound quantification of damages in the context of competition law infringements are presented. The chapter is structured as follows. Section two discusses the conceptual foundations for the quantification of damages. First, the types of damages caused by cartels and the economic actors affected by cartel activities are characterised in detail. A distinction is made between damages for the overall economy in the form of inefficiencies or welfare losses and the individual damages, that also include redistribution from the consumers to the cartel, for instance due to abnormally high prices, and that are therefore typically larger than the economic welfare losses. Second, the repercussions of cartel induced price increases on the value

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<sup>2</sup> See for example Bishop and Walker (2010) or Niels *et al.* (2011). For a German text see Inderst *et al.* (2013a).

<sup>3</sup> European Commission (2007).

<sup>4</sup> The underlying assumption being that undetected cartels are as damaging as detected cartels. The majority of EU cartel cases since the introduction of the first leniency program in 1996 are due to leniency applications. Excluding other reasons for triggering leniency applications such as due diligence in a merger for example, a data set based mainly on leniency applications may bias the results downward as the most profitable cartels will not find it attractive to go for leniency whereas leniency applications – if economically motivated – must be based on a change in the cartel incentive constraints, i.e. a leniency application will become attractive if cartel profitability decreases either due to a higher detection probability coupled with damages claims and fines or due to the fact that the cartel is inherently becoming less profitable. See Friederiszick and Maier-Rigaud (2007) and Friederiszick and Maier-Rigaud (2008) for a discussion of the EU leniency program and the need for *ex officio* cartel detection.

<sup>5</sup> European Commission (2007:96).

chain as well as on neighbouring markets are spelled out. Third, damages caused by abusive behaviour of dominant firms and the affected actors are described.

Section 3 deals with the methods employed in the quantification of damages in cartel as well as abuse of dominance cases. To estimate the damages, it is necessary to compare the factual situation with a hypothetical counterfactual scenario. The problem of choosing the appropriate counterfactual scenario is discussed as this has a crucial impact on the damages to be calculated. Also, the available economic and econometric methods for the calculation of damages, giving prominence in particular to comparator-based methods and approaches (yardstick or benchmarking) either relying on actual or on simulated, artificial markets are introduced. The quantification of damages in cases of abusive behaviour is illustrated by an example of an exclusionary abuse. In addition, further aspects in the quantification of damages as e.g. compounding and discounting damages and the consideration of after-effects are discussed. Also, the precision of the available statistical methods and problems of causality and the remoteness of damages with respect to the infringement are discussed. The final section concludes with a summary of the main results and an outlook.

## **2. Damages caused by cartels and abusive conduct**

The restriction of competition by a cartel or the abusive conduct by a dominant firm leads to economic welfare losses and also harms the purchasers and ultimately the consumers of the products or services through increased prices, lower quality and reduced variety.<sup>6</sup> If by illegal cartel agreements or by an abuse of a dominant position, the functioning of competition between firms is impaired or eliminated, the competitive mechanism no longer fulfils its allocative function and market outcomes are unsatisfactory from an economic point of view as they will generate welfare losses due to inefficiencies. In addition to these inefficiencies, competition law infringements lead to a redistribution of wealth from direct and indirect purchasers to the cartel, and affect also economic actors that are neither part of the supply chain nor purchasers of the goods or services provided by a cartel or directly affected by an abusive conduct.

The primary goal of cartels and abusive practices is to increase profits by softening competition. By cartel agreements, the intensity of competition between rival firms is either substantially reduced or fully eliminated. Such agreements can be based on different strategic parameters. In price-fixing cartels, competitors collectively decide on the prices of their products, in quota cartels, a collective agreement is reached concerning the quantities to be produced and marketed by the cartel participants. Other forms of cartel agreements include market sharing arrangements where firms geographically divide the market, for instance by determining regions that are served, or, in particular in case of public procurement auctions, agreements are reached concerning price and conditions of the bids to be submitted (bid-rigging cartel).

In all these instances, cartels generally result in higher prices and lower quantities than would have been observed in the absence of the cartel. In price-fixing or bid-rigging cartels the competitors explicitly agree on a price that generally is substantially above the price that would have obtained under competitive conditions. Quota cartels reduce the quantity supplied strategically in order to obtain a price increase

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<sup>6</sup> This chapter focusses on cartel and abuse of dominance cases. Of course also vertical agreements can cause damages and trigger damages claims.

indirectly. Market sharing agreements allocate geographic markets to individual competitors allowing the firm to act as monopolist, charging the monopoly price, in the respective region.

Abusive conduct by dominant firms can be either exploitative or exclusionary. Exploitative abuses work similarly to cartels by increasing prices directly while exclusionary abuses aim mainly at eliminating competitors by foreclosing the market or limiting competitors in their expansion. In addition, a dominant firm may aim at discouraging entry of potential competitors or limit the scale of market entry, that is, it may try to quell any beginning of competitive pressure or at least any increase in the intensity of competition. It may also attempt to leverage its market power into neighbouring markets.

From a conceptual point of view, damages are quantified by a comparison of the factual situation, i.e. the situation with the competition law infringement with a hypothetical situation, the so-called counterfactual or but-for scenario, a situation that would have obtained in the absence of an infringement.<sup>7</sup> First, the types of damages that are caused by cartels or abusive behaviour have to be specified and second, the victims, i.e. the economic actors that were negatively affected by the illegal conduct have to be identified. In the following subsections, the types of damages and the affected economic agents are specified for cartels and for abusive conduct respectively.

## **2.1 Damages caused by cartels**

### **2.1.1 Types of Damages caused by cartels**

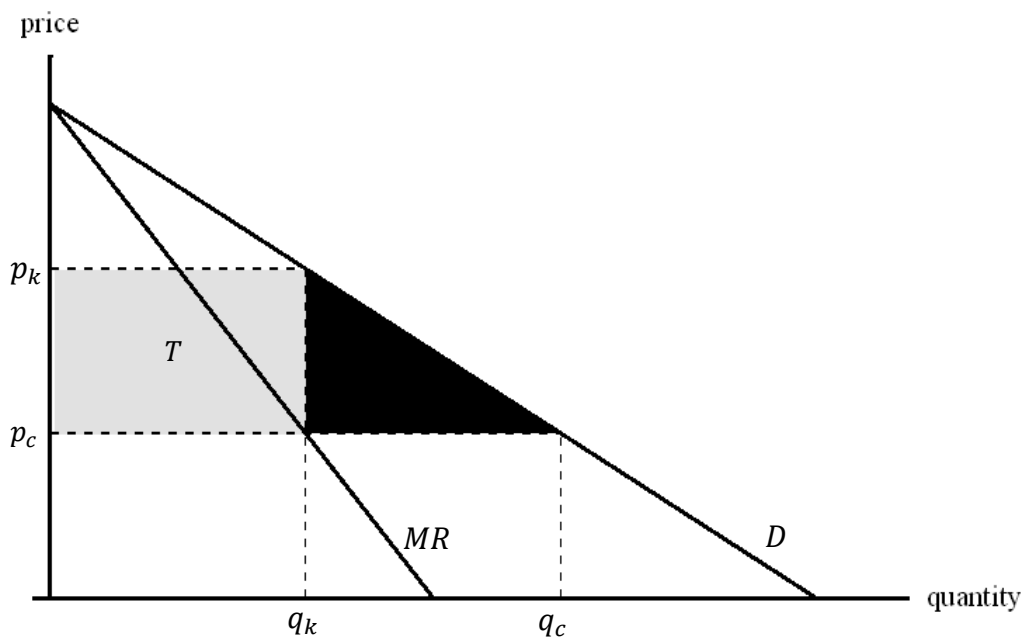
From an economic point of view, the cartelization of a market leads to two types of effects: a transfer of wealth and inefficiencies, both of which have to be considered as damages from the point of view of the affected economic actors. To illustrate the two types of damages by a simple example, a cartel on a final products market selling goods directly to final consumers is considered.<sup>8</sup> Concerning the allocation of resources, the cartel leads to a welfare loss due to non-exhausted gains from trade in form of lost utility for final consumers. This is called the dead weight loss (DWL) and represents an economic or allocative inefficiency. Due to the higher price induced by the cartel there is also a transfer of economic rent from consumers to producers. These two effects are shown in Figure 1 that depicts consumer demand for a cartelized product, the pre-cartel price of  $p_c$  and the cartel price of  $p_k$ , where  $c$  stands for competition and  $k$  for cartel. The quantities sold in the competitive and in the cartelized market are denoted by  $q_c$  and  $q_k$ .

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<sup>7</sup> More details on how to establish the appropriate counterfactual are provided in sections 3.1 and 3.3.

<sup>8</sup> Furthermore it is assumed here that all inputs of the cartel are produced in perfectly competitive markets so that no damages occur upstream of the cartel. It is also assumed that there are no effects outside the value chain, for example for producers of complements or buyers of substitutes. These assumptions are relaxed in section 2.2.

Figure 1: Transfers and (dead weight) welfare losses caused by cartelization



Based on a price  $p_c$  that would prevail under effective competition, i.e. the counterfactual or but-for price (here assumed to be the perfectly competitive price<sup>9</sup>), the cartel increases the price to  $p_k$ . This increase in price results in a deadweight loss of welfare depicted as black triangle and a redistribution of wealth in the form of a transfer of  $T$  (depicted as grey area). The welfare loss that is caused by the cartel that induced a price increase from  $p_c$  to  $p_k$ , results from the fact that for prices between  $p_c$  and  $p_k$  gains from trade are not exhausted. There exist consumers who would have been willing to pay a price  $p$ ,  $p_c < p < p_k$  for additional units of the product and there are firms that could produce these units and still cover their cost. Due to the cartel these transactions do, however, not occur. Consumers are thus damaged by a loss of utility as at the higher cartel price, a smaller quantity of the good is bought. This is the quantity effect which is the main economic rationale for the prohibition of cartels under competition law.

The transfer  $T$ , however, does not represent a welfare or efficiency loss as it is a pure redistribution of wealth and has no impact on efficiency. As the additional expenditure for the quantity bought at the cartel induced higher price is, however, a loss to consumers it has to be counted as damage.<sup>10</sup> This damage is known as the overcharge, or more generally, the price effect of a cartel. The total damages inflicted on consumers are thus composed of the transfer  $T$ , i.e. the price effect (grey rectangle) and the welfare loss, i.e. the quantity effect depicted as black triangle and is therefore higher than the economic efficiency losses and also higher than the profits generated by the cartel that correspond to the transfer. A cartel typically causes both types of harm and there are no convincing economic arguments that would suggest giving preference to either type of harm in estimating total damages. In practice, it may, however, be more difficult to estimate quantity effects with a high degree of accuracy. This is due to the fact that it is usually easier to demonstrate that a higher price has been paid on units of the good bought in contrast to demonstrating that a certain number of goods were no longer bought but would have been purchased had

<sup>9</sup> The price under effective competition is not necessarily the price that would prevail under perfect competition. In particular in oligopolistic markets, the price under effective competition may be substantially above the perfectly competitive price.

<sup>10</sup> In this particular setting where only final consumers are purchasing from the cartel, the price effect is also called overcharge which in turn is simply the illegal gain.

the price not increased. This holds in particular for those consumers who didn't buy the product at the high cartel price but would have bought at the lower price under effective competition.

The magnitude of cartel induced damages depends on a range of factors such as the duration and the market coverage of the cartel, as well as the magnitude of the price increase or the reduction in quantity. Obviously, the damages due to a cartel will be higher the longer the cartel is in place. Economic theory has also shown that the size of the cartel, that is the share of the market covered by the cartel, has a substantial impact on the welfare effects. Generally speaking the negative welfare effects and therefore also the damages increase with market coverage.<sup>11</sup>

A further essential determinant of the damages is the extent of the price increase or the quantity reduction. This in turn depends on several factors, for instance the intensity of competition that would have prevailed but for the cartel. Some markets are characterized by a relatively low intensity of competition even in the absence of a cartel whereas other markets may be subject to fierce competition.<sup>12</sup> In the first scenario, the damages created by the cartel would be relatively low as prices would have been comparatively high even in the absence of the cartel. In the second scenario, the damages are more important as without the cartel, prices would have been substantially lower due to the intense competition. An additional factor impacting the extent of the price increase is the degree of coordination in the cartel. Cartels will not always be able to achieve perfect coordination implying that they will not be able to fix the price or quantities at the level that maximizes total cartel profits. Under certain circumstances, perfect coordination cannot be achieved and only a partial coordination will be feasible so that prices will remain below the cartel profit maximizing price.<sup>13</sup> Damages therefore increase with the degree of coordination.<sup>14</sup> Finally, the slope of the demand curve has a substantial impact on the magnitude of the price increase and the welfare losses. This can be illustrated with an example where it is assumed that in the absence of the cartel, the market is perfectly competitive and firms produce with equal marginal and average cost. In this case, the competitive price is determined by the marginal cost and thus independent of the demand function. *Ceteris paribus*, a price inelastic demand will lead to a larger price increase than a price elastic demand. If demand is inelastic with respect to price, consumers have only a few options to substitute and can therefore not switch to alternative products once price increases, implying that a cartel can charge substantially higher prices before reductions in quantity demanded become important. If consumers, however, have many possible substitutes at their disposal, demand is price elastic and a cartel will not increase the price substantially as it would otherwise only sell a much reduced quantity. This

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<sup>11</sup> On welfare effects of cartels with partial market coverage see Schwalbe (2011). In this context so-called umbrella effects are relevant, i.e. price increases of firms active in the same relevant market but not participating in the cartel that can increase their prices under the umbrella of the higher cartel prices as well.

<sup>12</sup> On this see also section 3.1.

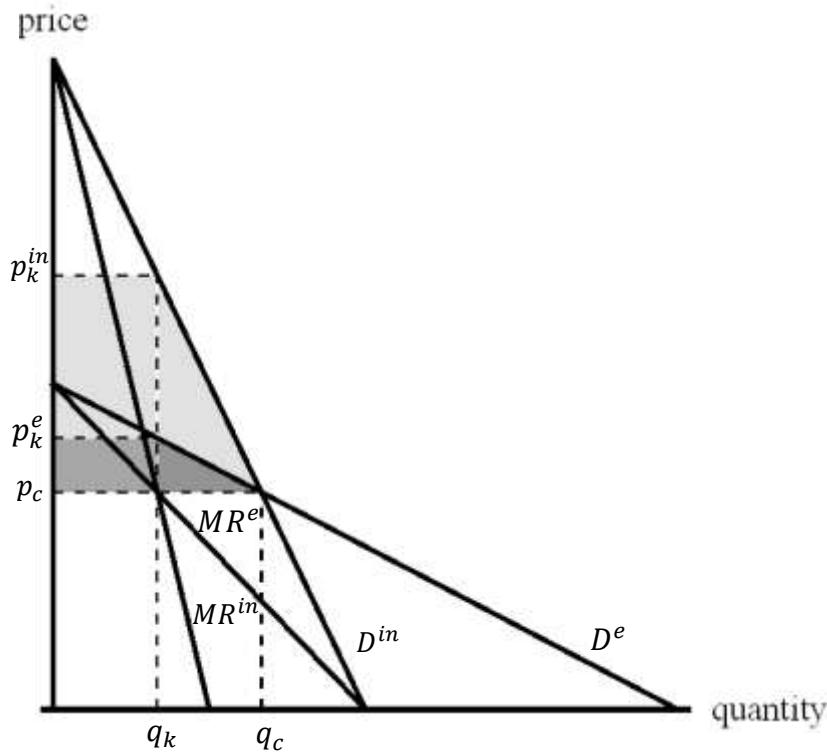
<sup>13</sup> The factors that may contribute to a cartel being able to set the profit maximizing cartel price are the same as the factors that have been identified as facilitating non-coordinated effects in a merger context. See the judgment of the then CFI of 6 June 2002 in Case T-342/99 *Airtours plc v Commission* [2002] ECR II-2585 and the judgment of the ECJ of 10 July 2008 in Case C-413/06P *Bertelsmann AG and Sony Corporation of America v Independent Music Publishers and Labels Association (Impala)* [2008] ECR I-4951. Intuitively it is clear that firms with different variable costs will find it difficult to agree on the quantity that will equate marginal revenue with their respective marginal cost as those will differ between firms.

<sup>14</sup> Note, however, that the same factors that will enable a higher degree of coordination are also factors that would tend to soften competition in the market naturally, implying that cartel coordination may be high but the cartel mark-up over the competitive price correspondingly low.



implies that under perfect competition the damages caused by a cartel are the higher the lower the price elasticity of demand is. This can be demonstrated based on Figure 2 below.<sup>15</sup>

Figure 2: Damages and welfare effects with demand functions of differing price elasticity



Again a scenario is considered where price in the absence of the cartel is given by  $p_c$  and the quantity demanded is  $q_c$ . With a price inelastic demand ( $D^{in}$  and a corresponding marginal revenue curve  $MR^{in}$ ), the cartel will increase the price to  $p_k^{in}$ , where *in* stands for *inelastic*, and the corresponding damages will be given by areas shaded in dark and light grey. If demand is price elastic ( $D^e$  and a corresponding marginal revenue curve  $MR^e$ ), the cartel will increase the price only to  $p_k^e$ , where *e* stands for *elastic*, and the damages for the consumer are thus given by the area shaded in dark grey, i.e. substantially lower than the damages incurred with a less price elastic demand. In contrast to the damages suffered by the consumer, the magnitude of the efficiency loss is not directly related to the price elasticity of demand. While the price increase given a price elastic demand function is relatively small, the quantity demanded is reduced substantially. If the demand function is price inelastic, the quantity effect is limited but the price increases substantially. As a result, the welfare loss may increase or decrease with the price elasticity of demand. Whether the quantity or the price effect prevails is an empirical question and depends on the specifics of the demand function.

In addition to the allocative inefficiencies captured by the dead weight loss depicted in Figures 1 and 2, cartels may also give rise to productive and dynamic inefficiencies. Productive inefficiencies may arise because cartelists, due to the softening of competition, face reduced incentives to produce efficiently or

<sup>15</sup> For a more detailed discussion of elasticities, emphasizing in particular that the concept is in itself not a suitable indicator for damages, see Inderst *et al.* (2013a).

search for the most cost efficient production technology.<sup>16</sup> As a result, a cartel can create a situation where inefficient firms producing with higher cost remain in the market although they would have been forced to exit under effective competition.<sup>17</sup> If a cartel leads to higher cost, this should be taken into account when quantifying cartel damages. In particular, when cost-based methods (see section 3.1.) are employed, higher cost induced by cartelization should be accounted for. Such inefficiencies could also give rise to after-effects that extend beyond the cartel period.

Cartels might also change market characteristics such as concentration or production capacities and could also have a negative impact on innovation. Usually, a cartel will try to foreclose the market to avoid market entry, to stabilize the cartel and to prevent an erosion of profitability. The softening of competition due to a cartel could also reduce the incentives for firms to innovate on both, products and services but also regarding the production process and the technology employed. This can lead to substantial dynamic inefficiencies in the long run, i.e. reduced R&D, and a lower rate of technological progress leading to substantial additional welfare losses. Theoretical results with respect to the impact of cartels on innovation are, however, ambiguous as on the one hand higher cartel profits allow for investments in R&D but on the other hand there are increased incentives for “business stealing”.<sup>18</sup> In addition, cartels may reduce product variety as it is in general easier to stabilize a cartel in a homogeneous product market. Also, all expenditures related to organizing the cartel and to protect the cartelists from detection by the competition authority have to be considered welfare losses.

Existing empirical studies on cartel damages have concentrated on mark-up and overcharge calculations. Quantity effects have often been neglected.<sup>19</sup> The results of these studies show some variance. In the study by Posner (2001) that considers 12 cartel cases, the median amount by which the price increased is estimated at 28%<sup>20</sup> whereas the OECD analysis of 2002, based on cases between 1996 and 2000 estimates a median increase in price of 16% to 18%. In a meta study due to Werden (2003) where 13 studies are analysed, a median increase of 15% is found. The most comprehensive study on cartel induced price increases is due to Connor and Lande (2008), who analysed more than 670 cases taken from approximately 200 studies. They conclude that the median price increase is about 20% of the cartel price and the average at about 23%. Based on this study the distribution of cartel induced price increases was calculated, whereas only those cartel cases were considered that were established after 1960 and that fulfilled several other selection criteria, so that 114 cartel cases were considered.<sup>21</sup> For this sample the median of the price increase was approximately 18% and the average at about 20% of the cartel price. The distribution of cartel induced price increases of this sample is depicted in Figure 3 below.

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<sup>16</sup> This type of inefficiency is known as X-inefficiency (Leibenstein 1996) often associated with the “quiet life” of a monopolist (Hicks 1938:8).

<sup>17</sup> In turn, a perfectly efficient cartel will imply that less efficient firms no longer produce and only receive transfers.

<sup>18</sup> See Schumpeter (1950) and Arrow (1962). There is yet no conclusive empirical evidence.

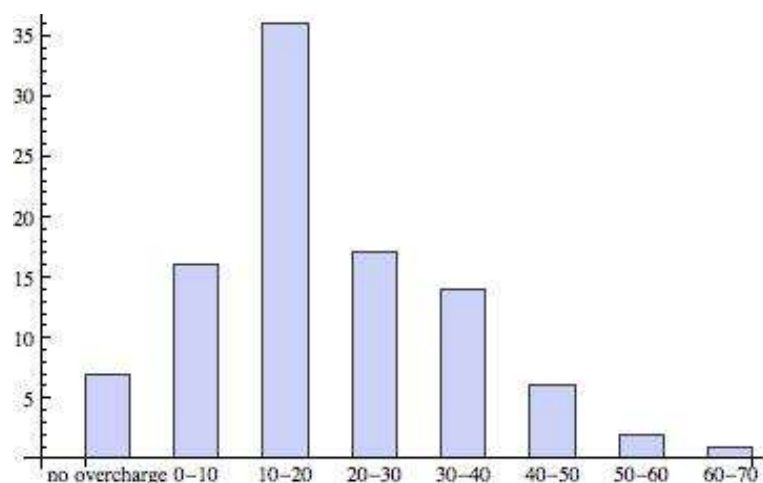
<sup>19</sup> The neglect of quantity effects is a general problem of the mostly US influenced literature on damages. In addition, the focus on the overcharge instead of the quantity effect is due to the fact that US damages actions on the federal level are brought by direct purchasers in the absence of the pass-on defence rendering the overcharge the only relevant damages category.

<sup>20</sup> The cartel-induced price increase or mark-up is normally expressed as a percentage of the cartel price.

<sup>21</sup> European Commission (2009:91).

It reveals the substantial variance of cartel induced price increases. Whereas in 7% of the cartel cases analysed no increase could be estimated, the increases can in certain cases exceed 50% implying a cartel price more than twice as high as the competitive price.<sup>22</sup>

Figure 3<sup>23</sup>: Distribution of cartel induced price increases in per cent



### 2.1.2 Economic actors damaged by cartels

Section 2.1 discussed the two basic effects through which firms or consumers can be harmed by anticompetitive conduct, namely price and quantity effects. This section will provide a more systematic analysis of the vertical, horizontal and other (non-vertical and non-horizontal) cartel effects in order to give a better understanding of how cartel damages percolate through the economy.

Horizontal effects are generated on the same antitrust market and therefore concern all producers of cartelized goods or services irrespective of whether they take an active part in the cartel or not. Also producers of products that only become substitutes at the cartel price are affected.<sup>24</sup> Vertical effects are effects along the different levels of the production chain and concern firms providing direct and indirect inputs to the cartelized firms as well as firms and consumers that act as direct or indirect purchasers. Non-horizontal and non-vertical effects accrue for example to firms that provide complements or firms and consumers purchasing from firms providing complements. Such effects also accrue to firms that purchase from some of the direct or indirect cartel input providers or some of the firms purchasing from firms offering substitutes to direct or indirect cartel inputs or firms offering substitutes to the products offered in the value chain of the cartelists.

Figure 4a and 4b set out 5 levels of a value chain, locating the cartel at level 3 in the chain. Correspondingly, there are also 5 separate horizontal markets of cartel affected inputs and cartel affected outputs as well as their substitutes. In addition, the Figures also capture 3 neither horizontal nor vertical effects, i.e. a producer of complements to the cartel product, a purchaser of substitutes to a direct cartel

<sup>22</sup> Other studies include Levenstein and Suslow (2006), Connor (2006) Connor (2006b), Connor and Bolotova (2005), Bolotova et al (2009), Griffing (1989), OECD (2003) and Combe and Monnier (2007).

<sup>23</sup> The analysis is based on underlying Connor and Lande (2008) data described above and selection criteria described in European Commission (2009).

<sup>24</sup> In that sense horizontal effects may also arise outside the relevant market as is intuitively clear if one considers the cellophane fallacy.

input and a direct and indirect purchaser of a cartel substitute. Furthermore, the Figures show some typical outcomes in terms of positive damages (dark grey) and negative “damages” or profit increases (light grey).

In principle, a whole range of economic actors can be affected by anticompetitive conduct. General equilibrium theory shows that all actors in an economy can potentially be positively or negatively affected by a cartel. By increasing the price of the cartelized product, the cartel changes the relative prices and thus causes substitution and income effects that can affect the whole economy, similarly to a stone that is thrown into a small pond will generate waves that will spread across the whole pond.<sup>25</sup> To realize that effects accrue not only downstream in the supply chain is important in an EU context as the US literature that focuses on direct purchaser standing may have obfuscated this point.<sup>26</sup> We first consider the effects of a cartel on the upstream levels of the supply chain and then discuss the effects on the downstream levels. Finally, we consider cartel effects on economic agents outside the supply chain.

### Upstream effects

Figure 4a depicts some possible upstream effects that could be generated by a cartel, i.e. level 1 of indirect input suppliers and level 2 of direct input suppliers as well as producers of substitutes for direct (firm A) and indirect (firm B and firm C) inputs.

The cartel induced price increase leads to a reduction in the demand of the cartelized product and therefore also diminishes the demand of the cartelized firms for direct inputs required to produce this good. It should be noted that the decrease in input prices due to the reduction in input demand is an aggregate effect and that indeed firms not participating in the cartel but producing the same products (firm E) or producers of substitutes to the cartel product (firm F) - to the extent that F requires the same inputs - may actually increase their production (e.g. in case of a market characterized by Cournot competition). This increase will, however, not compensate for the reduction in input quantities demanded by the cartelists.<sup>27</sup>

As a result of the reduced demand for the direct input<sup>28</sup> produced, level 2 firms’ profits are reduced despite the fact that their profit maximizing response results in a reduction of their own prices thereby mitigating the negative effect of the cartel. The lower prices charged by the level 2 firms benefit firms such as D (and

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<sup>25</sup> From a practical point of view damages claims will, however, realistically only be brought by a small subset of those actors affected. Similarly to the small pond metaphor, however, where the height of the wave is normally greatest near the point where the stone sank into the water but also depends on the depth topology of the pond, the economic effects or damages are not necessarily greater for direct as opposed to indirect purchasers or those that are even further removed from the actual economic dealings of the cartel. Indeed there are – empirically probably rare - constellations where direct purchasers may even benefit from the cartel to the further detriment of indirect purchasers.

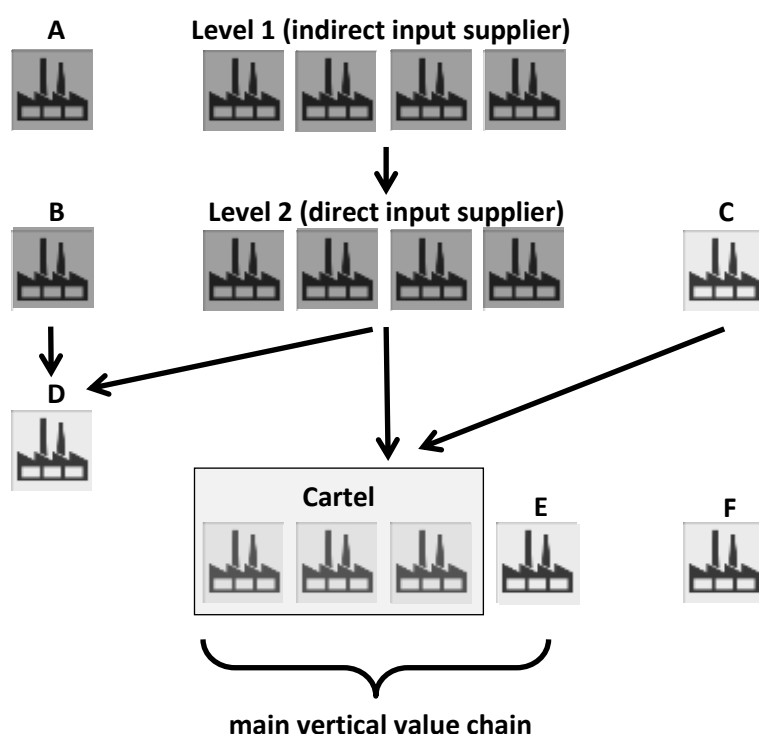
<sup>26</sup> See Chapter 3 for a discussion of standing in antitrust litigation in the EU and the US.

<sup>27</sup> Firms E and F are drawn with a light grey background as they benefit from so-called umbrella effects. The quantity reductions or price increases of the cartel allow both firms to increase prices or increase quantity depending on whether the market is characterized by Bertrand or Cournot competition. Indeed firm E and depending on the degree of substitutability also firm F benefit most from the cartel as their profits increase more than the profits of the cartelists. Under quantity competition these firms do not follow the cartel in restricting their output at the cartel price but expand production thereby mitigating cartel effects both up- and downstream, but also increasing their own profits. A similar free-rider effect exists under price competition where firms E and F follow the cartel in increasing prices but do not increase prices as much as the cartelists, again resulting in a quantity increase.

<sup>28</sup> Note that the Figure assumes that this input is solely used for producing the cartelized product and possibly also for the production of substitutes to the cartelized product. This does not need to be the case and depending on what fraction of total sales on level 2 go to other industries or are diverted into other industries as exemplified by firm D subsequent to the decrease in price that level 2 firms implement, the effect on the direct input suppliers relative to their total profits are mitigated.

of course any firm that may have been buying from level 2 producers but is not depicted in the Figure) for whom the input provided by level 2 direct input providers now becomes an attractive substitute. This has a negative impact on firm B, a producer of substitutes to level 2 direct input suppliers' product as B finds it profitable to adjust its price downward in a reaction to the price decrease of level 2 direct input suppliers. This in turn benefits firm D.<sup>29</sup> Level 2 firms are, however, not only negatively affected by the drop in demand induced by the cartel but may be further harmed if for instance this industry was experiencing economies of scale prior to the drop in demand. This may lead to firms such as C that use a different production technology and that were not competitive at the pre-cartel production levels, to become attractive suppliers of substitutes. Indeed, the reduction in demand by the cartelists and the undercompensating demand increase by firms E and F may lead to a partial shift for the remaining demand away from level 2 suppliers to firm C.

Figure 4a: Stylized vertical, horizontal and other cartel effects upstream of the cartel



So far level 2 firms have been considered equally impacted by the different effects discussed. This need not be the case. While market conditions for these firms change as described and lead to a decrease of prices for level 2 supplier products, some firms may in fact be more affected than others.

Similar arguments apply for the indirect input suppliers (level 1). Indeed, these indirect input suppliers face a reduced demand from level 2 firms and, as a result of their own profit maximizing response to this drop in demand, reduce prices to mitigate these effects. Overall prices and quantities decrease, resulting in lower profits also for producers of substitutes such as firm A. Again, the aggregate quantity and price effects are independent of whether only one or all four of the firms depicted are selling inputs to level 2 firms although the resulting damages may of course not be equally distributed and depend on the respective market shares.

<sup>29</sup> Firm D may therefore benefit from the cartel even if it does not substitute to products from level 2 firms.

## Downstream effects

Figure 4b depicts the effects downstream of the cartelized market. Clearly, the direct purchasers (level 4) as well as the indirect buyers (level 5) are negatively affected by the increase in price of the cartelists. The cartel, however, has an effect also on firms like E, producing the same product as the cartel and F producing substitutes to the cartel product. These firms do not participate in the cartel but profit from so called “umbrella effects”.<sup>30</sup> The cartel induced price increase leads to a diversion of demand to non-cartelized firms producing the same good as the cartel and to firms producing substitutes of the cartelized product. The increase in demand causes these firms to raise the prices of their products and to increase their supply. This increase in supply is, however, insufficient to compensate the reduction in supply by the cartel as otherwise the cartel would not be formed.<sup>31</sup> In case of a homogeneous product, the umbrella effect induced by the cartel leads to a price increase in the same amount as the cartel price, i.e. the damage that accrues to customers of non-cartelized firms is the same as for the customers of the cartel as both pay the same price. If products are differentiated, the increases in price and supply under the umbrella of the higher cartel price depend on the amount of demand diverted from the cartel to non-cartelized producers of substitutes. The higher the degree of differentiation, the less pronounced the reaction of the non-cartelized competitors will be. In addition, the relative magnitude of that effect crucially depends on the reaction of the indirect purchasers (level 5) as will be seen in the discussion below. In anticipation of that reaction, level 4 firms unintentionally mitigate the negative effects of the cartel by not increasing prices as much as the increase in input cost would seemingly warrant, simply in order to maximize profits. Nevertheless, there is an increase in price compared to the counterfactual price that prevailed absent the cartel and therefore the indirect purchasers and consumers (level 5) pay a higher price and buy a reduced quantity of the product.

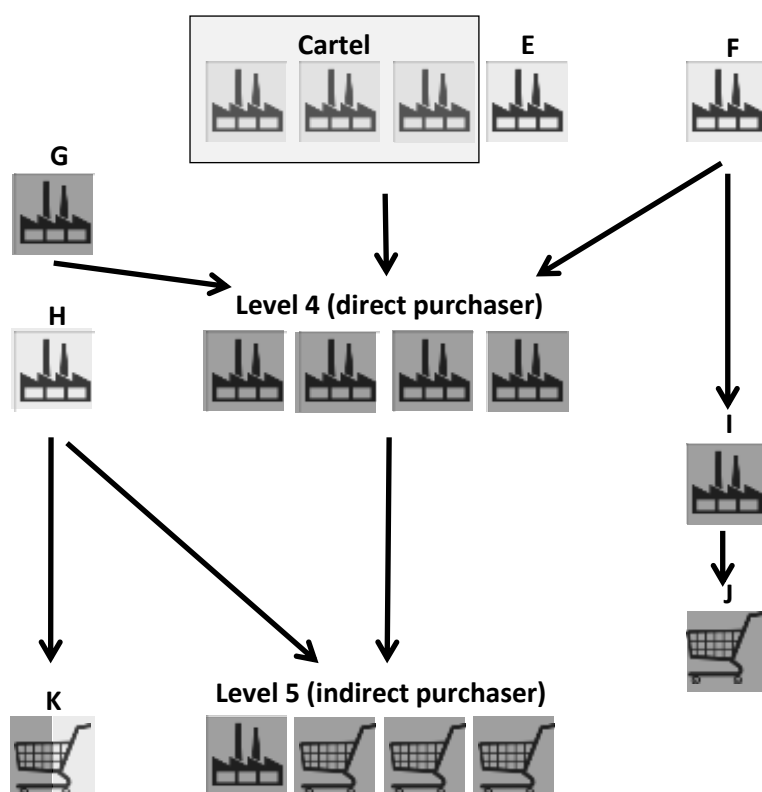
While the existence of the cartel results in positive effects for firm F as set out above, its direct and indirect customers I and J are harmed (see Figure 4b). The reason for this is that as the demand that firm F faces increases (due to substitution and the possibility to act as a price follower to the cartel), its profit maximizing prices increase as well. This is a notable result as it indeed shows that consumers on otherwise completely unrelated markets may suffer damages from the cartel. A further concern may be that the only, albeit indirect, link with the cartel is through firm F that actually benefits from the cartel and would therefore not have any incentive to disclose information on a possible cartelization to its own customers.

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<sup>30</sup> For a detailed discussion of umbrella effects see Inderst *et al.* (2013b).

<sup>31</sup> The assumption has to be that a sufficient amount of firms (or firms covering a sufficient share of the market) in a market are cartelized. If entry is easy or firms are not capacity or otherwise constrained it is not possible to form a profitable cartel.

Figure 4b: Stylized vertical, horizontal and other cartel effects downstream of the cartel



Similarly to the effects on firm F already discussed, the substitute producer H is positively affected as indirect purchasers partially substitute consumption away from the level 4 direct purchasers to firm H, which in turn sells a higher quantity at a higher price. The consumers K that were buying from H before are harmed in this case as the price is higher than in the absence of the cartel due to the fact that H is now also facing demand from level 5 consumers. Alternatively, one may envision that this increased demand allows the firm to produce at lower cost due to some increasing returns to scale technology. If that is the case, price may go down so that consumers K are benefitting from the cartel.

### Effects on producers of complements

Further effects of the cartel accrue for firm G, a producer of complements to the cartel products. With a reduced demand for cartel products, also the demand for complements decreases. As a result, the profits of firm G decrease despite a profit maximizing reaction consisting of lowering price to partially offset the quantity effect.<sup>32</sup> What is notable is that this firm is negatively affected by the cartel although its input prices are completely independent of the cartel and in that sense, no damages have been “passed-on”.<sup>33</sup> Nevertheless, G clearly is harmed by the cartel and may even stand good chances of demonstrating this harm if for example its complementary products are sold in a fixed proportion to the cartelized product.

<sup>32</sup> Note that price reductions will be more significant if the complement is not sold in fixed proportion to the cartelized product. If it is, the price reduction will be more mitigated as quantity reactions will only depend on the price of both, the complement and the cartelized product.

<sup>33</sup> This is another incidence demonstrating the problematic nature of the notion of “pass-on” for calculating damages in an EU context.

## Summary of effects analysis

This discussion has shown that while the total net effects of a cartel are necessarily negative due to the resulting welfare losses, the cartelization of an industry can have positive effects for some consumers and firms and negative effects for others.<sup>34</sup> It should also be clear that the notion of “pass-on” of damages is misguided as the cartel does not produce a certain fixed “quantity of damage” that is then passed up and down the different levels of the value chain. Rather, by changing relative prices, the cartel actually triggers responses up and down in the value chain and also outside (outside vertical or horizontal relationships) that while solely induced by profit maximizing behaviour, mitigate cartel damages.

In US cartel damages cases, the focus is mainly on price effects and on the value chain downstream of the cartel. In addition, damages claims on the federal level are restricted to direct purchasers who consequently are allowed to claim the total downstream damages based on price effects. As price effects are pure transfers, the sum of all price effects is equal to the overcharge which is the illegal gain. Using US terminology, the pass-on adjusted overcharges of all downstream levels sum to the entire overcharge. As in some US states also indirect purchasers are allowed to claim damages, the concept of pass-on is introduced in addition to the concept of overcharges. This allows the retrospective calculation of price effects on different levels of the value chain starting from the overcharge but creates the difficulty for courts to apportion damages across several claims pertaining to one infringement. These concepts are ill-suited for calculating damages when full compensation is the goal as quantity effects need to be taken into account and total damages are therefore not equal to the overcharge. From an economic point of view the concepts of overcharge and pass-on are therefore at best complicated methods of deriving price effects as they neither provide a basis for calculating total damages nor capture effects upstream of the cartel or outside the vertical value chain.<sup>35</sup>

The discussion of Figure 4a and 4b assumed certain typical industry responses and did not explicitly consider the reactions of firms to changes in demand and input prices. In the following a graphical analysis analogous to the one in section 2.1 is used to describe some of the reactions that were summarized in the discussion above. The presentation focuses on the special case where the direct purchasers are not harmed by the cartel, i.e. the case where all “damages” are “passed-on” so that only indirect purchasers and final consumers are affected. Modifying this case and assuming that there is only a monopoly direct purchaser

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<sup>34</sup> This is actually inherent in the notion of transfer although the Figures show that such transfers not only accrue to the cartelists but that there are transfers that benefit consumers or firms that are not in the cartel (firm E for example that will benefit more than the cartelists relative to its size) and may not even be active in the same industry.

<sup>35</sup> On the irrelevance of pass-on and the limited value of the overcharge approach in an EU context see Maier-Rigaud (2013a). In addition to the economic arguments presented here, the article also expresses doubts as to whether these concepts are compatible with European law as they are derived from a legal context that does not allow all victims standing and is not geared towards full compensation of harm suffered. This of course does not imply that these terms are absent in the EU debate and did not create confusion. For example the problem of unjust enrichment is solely a relic of the overcharge approach. Also the controversially debated US question on whether the pass-on defence should be allowed is no longer of relevance in Europe where all victims have standing. See Chapter 3 for a legal discussion of the regime in the US and the question of standing. The proposal of the European Commission concerning a directive on the rules governing actions for damages (see European Commission (2013) and Maier-Rigaud (2013b)) has not succeeded in overcoming these difficulties.



serving final consumers leads to another special case where almost no “damages” are “passed-on”.<sup>36</sup> With one possible exception all relevant cases lie in-between these two special cases.<sup>37</sup>

### 2.1.3 Illustration

The previous subsection discussed the effects that a cartel can have throughout the economy and the economic actors likely to be affected by a cartel. This subsection focuses on the price and quantity effects as they accrue in a vertical value chain in more detail. In explaining these, the sometimes inconsistently used concept of overcharge will also be discussed.<sup>38</sup> More specifically, as set out in Figure 5, a cartelized market for an intermediary product is considered. This intermediary product is an input for the production of a further intermediate good that is produced on a perfectly competitive market. The intermediate product on that market is finally sold to a monopolist who produces a final product sold to consumers. In order to simplify the exposition, it is assumed that no other inputs are required to produce the intermediate as well as the final product than the one impacted by the cartel. Furthermore, marginal cost for each firm in the value chain are assumed to be equal to  $c$  so that total production cost for the downstream monopolist are  $3c$  under perfect competition and  $2c+p_k$  in case there is a cartel on the first intermediate product market. It is further assumed that one unit of input is used to produce one unit of output throughout the value chain.

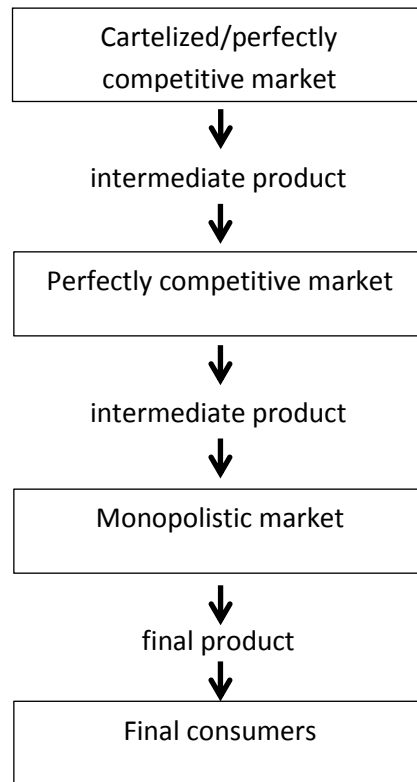
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<sup>36</sup> Of course there exist very realistic cases where no pass-on occurs. This is for instance the case if the cartelized product is part of the fixed cost of the downstream purchaser, as would be plausible for instance in an elevator cartel.

<sup>37</sup> The exception is a scenario in which direct purchasers actually benefit from the cartel. See Hellwig (2007). An alternative scenario in which the direct purchasers benefit is due to side payments and is discussed in Schinkel *et al.* (2008).

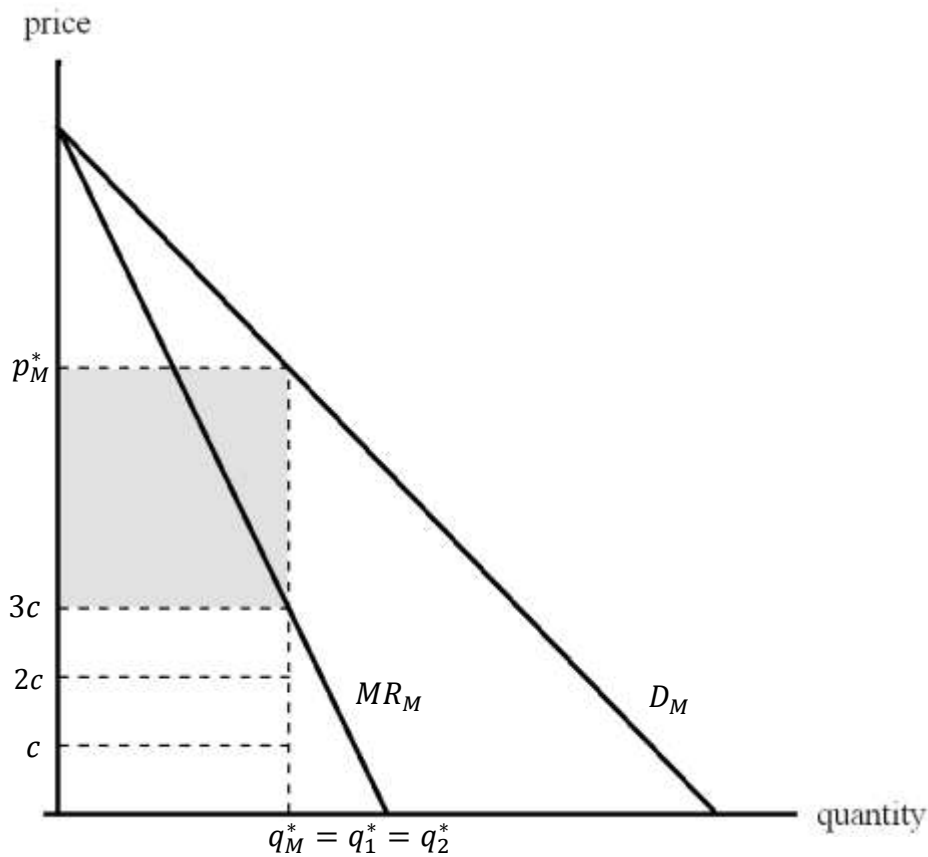
<sup>38</sup> Here, the term cartel induced price increase or mark-up is consistently used to describe the effect the infringement has on price, i.e. if the infringement results in a price of 15€ when the but-for price would have been 10€, the mark-up is 5€. The term overcharge is consistently used to denote the monetary amount obtained by multiplying the mark-up with the quantity bought by the purchaser under the infringement. This overcharge is identical to the price effect if no pass-on occurs, for example if final consumers are considered. The term overcharge is, however, sometimes also used in the literature to denote the mark-up. Some authors also use the term interchangeably contributing further to the confusion between price effects and overcharge as defined here. See for example European Commission (2009) that first defines overcharge as defined here to later on use the term as a synonym for mark-up. This approach is repeated in European Commission (2011) that also adopts the US terminology of overcharge and pass-on that is of limited use in an EU context. See also European Commission (2013).

Figure 5: Possible effects of a cartel on a downstream value chain



Consider first what happens in the absence of a cartel. If there is no cartel and given the demand function  $D_M$ , consumers are charged the price  $p_M^*$  corresponding to a quantity  $q_M^*$  depicted in Figure 6. This price is higher than the marginal cost curve of  $3c$  because the indirect purchaser (monopolist) has market power and charges a price higher than marginal cost. The monopolists pays  $2c$  for its input as the first intermediate supplier market is competitive charging a price  $p_1 = c$  and the second one is competitive as well charging a price of  $p_2 = c_2 = 2c$  so that total marginal cost are  $3c$ . As the production of the final product is assumed to occur in a monopolistic market, final consumers will be confronted with a price that corresponds to the quantity  $q_M^*$  where marginal revenue (depicted as  $MR_M$ ) equals marginal cost ( $3c$ ).

Figure 6: Situation in the absence of a cartel



The monopoly profits of the indirect purchaser are depicted in Figure 6 as the area shaded in light grey. As all other markets are assumed to be perfectly competitive, other firms make zero profits, i.e. only earn a normal rate of return.<sup>39</sup>

Consider now the situation with which the upstream producers are confronted if they want to form a cartel. Originally, that industry was perfectly competitive charging a price equal to marginal cost. Now the market is assumed to be perfectly cartelized and the cartelists produce a quantity where marginal cost equals marginal revenue and the resulting price is the monopoly price on that market. Clearly, marginal revenues depend on the demand that the cartel faces downstream in the competitive market which in turn depends on the demand of the monopolistic market which in turn depends on final demand. In order to be able to find the profit maximizing price, the cartel has to take into account all reactions throughout the value chain.

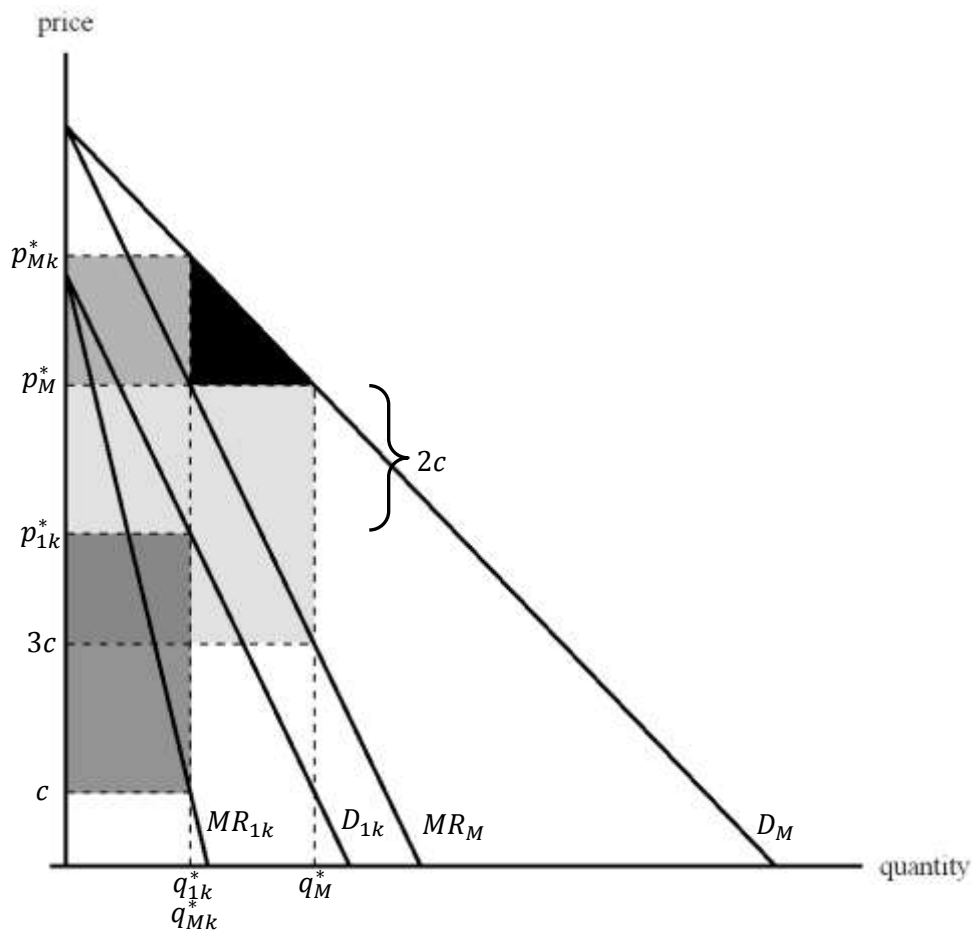
As discussed in section 2.1.1, the calculation of damages resulting from the cartel for final consumers is conceptually easy. Consumers are hurt as they no longer purchase a quantity  $q_M^*$  but reduce consumption to  $q_{Mk}^*$  at the corresponding prices  $p_M^*$  and  $p_{Mk}^*$  where  $k$  denotes the fact that this is the price-quantity-combination chosen by the monopolist under the cartel (See Figure 7 below). The deadweight loss (the black triangle) is the damages due to the reduction in quantity and the price effect is given by the transfer

<sup>39</sup> The zero profit result under perfect competition does not imply zero profits in an accounting sense but only implies that the firms do not earn more than a normal rate of return, i.e. they earn zero profits defined as any amount exceeding a normal return.

indicated by the area shaded in medium grey above the price  $p_M^*$ , i.e. the increase in price for all units that continue to be bought.<sup>40</sup>

The cartelized industry benefits from the cartel as it no longer earns the normal rate of return at  $p_1 = c$ , but realizes a profit indicated by the rectangular area shaded in dark grey below  $p_{1k}^*$  in Figure 7 below. The firms operating on the perfectly competitive intermediary product market continue to earn only a normal rate of return and are therefore not affected although they sell a lower quantity, i.e.  $p_{2k} = p_{1k}^* + c > p_2 = 2c$ . As marginal cost has increased, prices have increased as well and a lower quantity is being sold.

Figure 7: Situation with a cartel



The downstream monopolist is negatively affected by the cartel as its profits decrease. Instead of the rectangular area shaded in light grey depicted in Figure 6 and again in Figure 7, the monopolist now only earns the profits in the amount of the area shaded in medium grey above the price  $p_M^*$ .

Several aspects are noteworthy with respect to this stylized example. First of all, net cartel profits are given by the price increase multiplied with the quantity that continues to be sold at that price.<sup>41</sup> As was conveniently assumed, the benchmark used is a perfectly competitive industry so that there are no

<sup>40</sup> With final consumers, and only with final consumers, this price effect is equal to the overcharge of the firm(s) selling to the final consumers.

<sup>41</sup> This illegal gain is of course identical to the overcharge as faced by the direct purchaser.

negative quantity effects of the price increase to be taken into account.<sup>42</sup> Second, total damages far exceeds the cartel profits as the area shaded in dark grey in Figure 7 is smaller than the difference between the areas shaded in light grey and in medium grey above the price  $p_M^*$  (damages accruing to the monopolist) plus the area shaded in medium grey above the price  $p_M^*$  and the black triangle (damages accruing to final consumers). This also implies that the overcharge which is identical to the illegal gain substantially underestimates total damages. Third, while the damages to final consumers can conceptually be easily calculated by multiplying the price increase of the indirect purchaser (here the monopolist) with the quantity that consumers continue to buy and adding the quantity effect, this is not possible for the monopolist. The monopolist loses the profits on the quantity he no longer sells but generally also on the quantity he continues to sell as his own cost mark-up changes because he is pushed into a more elastic section of the demand function. This happens as soon as an imperfectly competitive market is considered and would therefore also have to be expected in oligopolistic markets.<sup>43</sup> It is thus incorrect to calculate the damages accruing to the monopolist by adding to the lost profits due to the quantity reduction an amount equal to the overcharge, i.e. the mark-up over the but-for price multiplied by the quantity it continues to sell as this would be a substantial overcompensation.<sup>44</sup> Fourth, the scenario demonstrates that damages may not accrue to direct purchasers but may concentrate on lower levels of the value chain. Although jurisdictions that only give standing to direct purchasers allow these firms to claim total damages, including those occurring further downstream, some scepticism may arise as to the potentially substantial informational problems that a direct purchaser would have to overcome to elicit the required information from indirect purchasers or, for that matter, from producers of complementary products. The scenario also shows that quantity effects can only be ignored if – as assumed here for the direct purchaser – the market is perfectly competitive or the cartel only affects fixed cost.<sup>45</sup> In perfectly competitive markets, however, there are also no damages so that in all relevant cases where variable costs are affected, quantity effects will play a role. Given these conditions, quantity effects are the more important the more market power the concerned firms have, i.e. approximately the more concentrated the industry is.

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<sup>42</sup> There are quantity effects but they do not result in harm as there is no profit loss.

<sup>43</sup> The most important factors determining the reduction in mark-up are generally the degree of competition downstream, whether all downstream firms are equally affected by the price increase, the shape of the demand function and the type and nature of the cost function. In addition, if the monopolist (in that instance it would be more appropriate to call it a single seller) or the oligopolists are constrained for instance by foreign importers that are not affected by the cartel, it becomes more difficult to maintain a higher mark-up as the cost increase may have to be fully absorbed.

<sup>44</sup> Of course, it is possible to decompose the damages suffered by a purchaser into an overcharge, a pass-on and a quantity effect as is done for example by van Dijk and Verboven (2008) and (2009) or Kosicki and Cahill (2006). Although artificial, such a decomposition may be justified in a jurisdiction where quantity effects are considered irrelevant. If in addition only direct purchasers have standing and the passing on defence is not allowed, it is sufficient to calculate the overcharge, i.e. the illegal gain and disregard both, the quantity effect and the price effect that would require adjusting the overcharge by subtracting pass-on. For an economically appropriate calculation of damages this is, however, not required.

<sup>45</sup> In economics, a distinction between fixed and variable cost is made. Fixed costs do not vary with changes in output whereas variable costs do. In a short term analysis, changes in fixed cost would not result in any quantity effect. From a business perspective it is crucial to determine how fixed costs are allocated to outputs.

## **2.2 Damages caused by abusive conduct**

Abuse of a dominant position can take the form of exclusionary or exploitative conduct. Whereas an exploitative abuse directly increases the profits of a dominant firm through price increases<sup>46</sup>, exclusionary abuses increase profits indirectly. Through the abusive practice the competitive pressure emanating from actual or potential competitors is reduced. Practices such as predatory prices, retroactive rebates, margin squeeze, refusal to deal, or exclusive dealing aim at reducing the competitiveness of rivals in order to strengthen the market position of the dominant firm. While a particular practice is only considered abusive if anticompetitive effects can be demonstrated implying that consumers are made worse off, the increase in market shares of the dominant undertaking at the expense of competitors amounts to a transfer of profits from competitors to the dominant undertaking.<sup>47</sup>

### **2.2.1 Types of damages caused by exploitative and exclusionary conduct**

In the case of an exploitative conduct, similar welfare implications result as in a cartel context: The prices are higher and the quantities are lower than under functioning competition so that the resulting allocative inefficiencies take the form of profit or utility losses. Just as in a cartel context, there is also a transfer from purchasers to the dominant firm.

Whereas cartels generally entail higher prices<sup>48</sup>, reduced quantities and lower quality for customers and ultimately final consumers, abusive practices may - at least in the short run and to the extent that they entail profit sacrifices – also entail positive effects for the purchasers. With predatory prices for example, purchasers are better off in the first implementation phase of the predation strategy as prices decrease. Only once competitors have exited the market and the dominant firm can recoup its profit sacrifice will prices increase beyond the price that prevailed prior to the implementation of the predation strategy and the harm for purchasers and final consumers will become apparent. The repercussions of the abusive practice may therefore vary across phases, increasing the difficulties of estimating both, the welfare consequences of the practice but also the individual damages.

Many business practices of dominant companies that can be classified as abusive, however, also entail positive effects on competition. For instance, tying can be used to leverage market power from one market to another but may also entail substantial reductions in transaction costs for consumers.<sup>49</sup> The harm

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<sup>46</sup> See OECD (2012a) for a detailed discussion of excessive prices. Just as cartels, exclusionary conduct has as its primary goal to increase profits by softening or eliminating competition. Whereas a cartel reduces or eliminates the competition between firms, abusive conduct aims at foreclosing the market for actual or potential competitors or at least to limit their growth and development.

<sup>47</sup> It is important to bear in mind that a calculation of individual damages is distinct from an effects analysis that would be conducted to establish whether an infringement took place. An effects analysis aimed at establishing an infringement will focus on anticompetitive effects and in particular on consumer harm. It will not consider the loss of market shares of competitors as such as a problem. Once the infringement is established, however, the loss of market share, if it can be attributed to the abusive conduct, presents a clear individual damage. In other words and drawing on the welfare discussions above, the efficiency justifications for competition law leads to a focus on the overall welfare effects of a particular practice and therefore disregards pure transfers of wealth. From an individual damages perspective, however, these transfers are typically the most important part of the damages suffered even if they are not welfare losses.

<sup>48</sup> A caveat is of course indicated with respect to episodes of price wars in cartelized industries. During these price wars, prices are likely to be below cost and would therefore also fulfil a predation standard. See the model by Green and Porter (1984) and its empirical application in Porter (1983).

<sup>49</sup> Of course such efficiencies may be reached without anticompetitive effects by bundling instead of tying.

generated by abusive practices are therefore often much more difficult to pin down than in cartel cases. In contrast to the latter, they do not exclusively exhibit anticompetitive effects but also entail efficiency enhancing effects that are procompetitive. In addition, different types of purchasers may be affected differently. Under price discrimination for example, purchasers with a price elastic demand generally stand to gain as they are paying a lower price than under uniform pricing but purchasers with a less elastic demand are faced with a higher price. The total effect of the price discrimination on welfare may even be positive.

Under exclusionary abuse, the behaviour of a dominant firm usually changes over time. In the first phase of such an abuse, for example in case of predatory pricing, competition may be very intense up until the point where competitors leave the market and where competition will subsequently be substantially weakened. Some abusive practices may also lead to a permanent change of the market structure so that the negative consequences on the market structure become quasi-permanent and possibly irreparable, something that is more difficult to imagine in the context of cartelized markets. It may, however, also be possible to imagine a situation where remedies of the competition authority, in particular if structural remedies are considered, lead to a much more competition prone environment than prior to the abuse. This is discussed in more detail in section 3.2.1.

### **2.2.2 Economic actors damaged by exploitative and exclusionary conduct**

If the abusive practice is exploitative, the harmed parties are, in analogy to a cartel situation, the direct and indirect purchasers as well as the direct and indirect suppliers but also the producers of complementary products and the purchasers of substitutes. Under price discrimination, different consumer types are affected differently. If there are two groups of customers, some with an elastic and others with a less elastic demand for the product, those with an elastic demand will stand to benefit and those with an inelastic demand will stand to lose if prices are compared to a uniform price. This represents a substantial difference to cartel induced price increases that typically affect all purchasers uniformly.<sup>50</sup>

If the abusive practice is exclusionary, the bulk of the damage is borne by competitors of the dominant undertaking. Due to the exclusionary practice competitors lose market share and may eventually even have to exit the market. This could for instance be the case under a retroactive rebate scheme or under predatory pricing that have a direct bearing on the revenues of competitors. This could in turn result in damages for the suppliers of these firms as they can only sell a reduced quantity. If the abusive conduct stems from a vertically integrated undertaking, similar effects can be obtained through a margin squeeze or a refusal to deal strategy that successfully raises rivals' cost. In addition, also potential competitors may be part of the victims if the abuse is instrumental in erecting entry barriers that keep other, potentially even more efficient rivals out of the market.

While the bulk of the damage accrues to competitors, purchasers of the dominant firm are, in particular once the infringement takes effect, also harmed by higher prices, reduced quantities, lower quality and less

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<sup>50</sup> While a cartel induced price increase may be identical for all purchasers, the consequences of such a price increase for individual purchasers and therefore also the damages suffered can be quite distinct. Consider for example a situation where due to the cartel induced input price increase a firm's product is now substantially higher priced than before resulting in alternative products becoming viable substitutes for its purchasers. In an extreme case, this firm may have to exit the market in the long run whereas other purchasers of the cartel may only face reductions in profit due to much more mitigated price and quantity effects on their products.

innovation. If the abusive conduct is terminated prior to competitors losing substantial market share, the damages of purchasers are limited and they may even have benefitted from the increased competition.<sup>51</sup> In practice it seems therefore reasonable to expect competitors to be the key victims in such cases.

### **3. Quantification of damages**

Once the type of competition law violation is established in the context of a specific damage claim, the affected economic agents can be determined and the damages caused by the infringement can be assessed at least conceptually. In order to fully compensate victims, the specific level of damages for each victim has to be calculated. As discussed previously, the approach for determining the damage is based on a comparison of the actual wealth position as impacted by the competition law infringement with a wealth position in a hypothetical counterfactual situation that would have prevailed in the absence of the infringement.<sup>52</sup> In principle, the market outcome of a comparable factual or hypothetical market is the basis for estimating the damages that are caused by the competition law infringement. In that sense all methods employed for estimating damages are comparator-based and the main distinguishing feature is simply whether the comparator is theoretically constructed or taken from an existing market.<sup>53</sup> In the following subsections the different approaches for assessing the counterfactual scenario for the two basic competition law infringements of cartel agreements and abusive conduct are presented.

#### **3.1 Quantification of damages in cartel cases**

In the context of a cartel, the counterfactual scenario is given by the price, quantity and quality that would have prevailed if there had not been any cartelization in the industry and firms had competed within the structural conditions prevalent in the market.<sup>54</sup>

In order to construct a counterfactual scenario, an actual market that is similar or comparable to the cartelized market in terms of time, geographic location or in terms of products could be used. An alternative to a factual comparator market is the design of an artificial market based on models from industrial organization theory and empirical analysis that could be used to establish the but-for price, the corresponding quantity and finally the cartel-induced damages. A further possibility to estimate the counterfactual price consists in using the production cost and a “normal” mark-up, i.e. a mark-up that could have been realized on a market under competitive conditions. Alternatively, other factors as for

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<sup>51</sup> Note that this crucially depends on whether the abusive practice involves a profit sacrifice or not. This is the case with predation but may very well not be the case under retroactive rebate schemes or other abusive practices such as refusal to deal. For a discussion of whether rebate schemes involve a sacrifice, see Maier-Rigaud and Schwalbe (2013).

<sup>52</sup> Wealth position is a more general term than profit, which could wrongfully be construed as implying that losses in utility are not considered relevant. The term wealth position is, therefore, not used coincidentally as quantity effects for consumers are typically not expressed as profit losses but as utility losses but, nevertheless, can be expressed in monetary terms and should be counted as damages.

<sup>53</sup> This distinction seems more intuitive than the structure proposed by European Commission (2009:43) that distinguishes between comparator-based, financial-analysis based and market structure based. See also European Commission (2011) distinguishing between comparator-based and simulation, model and cost-based analysis.

<sup>54</sup> A cartel may also cause additional damages if for example the incentives to innovate are reduced or if firms explicitly agree on a reduction of product quality or product variety. In practice, however, quantification of these damages will usually be difficult as it is necessary to prove a causal relationship with the cartel infringement.



example the profitability of a firm could be used to assess the counterfactual scenario. The following sections discuss the different methods that have been proposed to estimate damages in the context of cartel cases. While most of these methods can also be employed in cases of abusive conduct, the specificities of estimating damages in these cases are relegated to section 3.2.

### **Time series analysis**

In many cases, it will be appropriate to use a comparison in time to estimate the cartel induced damages. This method typically consists in using the same market before and/or after the cartel period and is conducted with the help of regression analysis or other methods of time series analysis.<sup>55</sup> Such an approach has the advantage that the companies in the factual and counterfactual scenario are mostly the same, so that the counterfactual is a good comparator at least in that respect. It should be noted, however, that also with the use of a before-and-after method a number of problems can arise. In some cartel cases it is unknown when the cartel actually started, which creates difficulties in determining the period of time when the market was not cartelized.<sup>56</sup> The reason for the existence of a cartel may also be due to a period of fierce and ruinous competition so that the prices prior to the cartel do not reflect normal competition. In other instances the time period after the end of the cartel may be too short to allow a reliable estimation of competitive prices. In addition, it may well be the case that the end of the cartel is followed by a phase of fierce competition and price wars so that again the prices observed in that phase are not a good indicator of competitive prices.<sup>57</sup> Furthermore, it cannot be excluded that the preceding cartel agreements created a focal point that will allow the former cartelists to continue to charge prices that are very close to those agreed upon during the cartel phase and that are therefore not a good benchmark for prices under normal competition.

The main approach that has been proposed to estimate the counterfactual using a factual comparator market is the before-and-after method<sup>58</sup>, i.e. prices before and/or after the end of the cartel period are used to establish the appropriate benchmark prices within the cartel period had the infringement not taken place. The method is based on the simple idea that to the extent that cartel prices differ in a statistically significant way from the prices prior to the implementation of the cartel agreement and the prices once the cartel ceased to operate, the difference could be attributed to the cartel. The before-and-after approach is usually implemented within a multiple regression framework that is used to estimate the price over the entire period covering both non-cartel periods prior to the start of the cartel and after the cartel ceases to exist and includes a dummy variable, i.e. a binary indicator taking the values of 0 and 1 depending on whether the time window falls into the cartel period or not. Estimating the coefficient of this dummy variable then measures the amount of the cartel induced price increase. For this to be a valid inference, control variables accounting for other factors that may have impacted prices, for example increases in input prices, must be included.<sup>59</sup> Failure to include such controls may result in significant distortions in the calculation of damages as price effects are causally attributed to the cartel when they are in fact due to circumstances that are independent of the cartel.

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<sup>55</sup> On the empirical and econometric methods for calculating damages see for example Davies and Garcés (2010:347-381).

<sup>56</sup> As long as required data is available, an econometric analysis may be able to pin down the starting date of the cartel based on structural breaks but these methods are not error free for instance in cases where the cartel increased prices slowly.

<sup>57</sup> This type of price war probably occurred after the breakdown of the German cement cartel so that the prices of this phase were weighted down in the estimation of damages. See Friederiszick and Röller (2010).

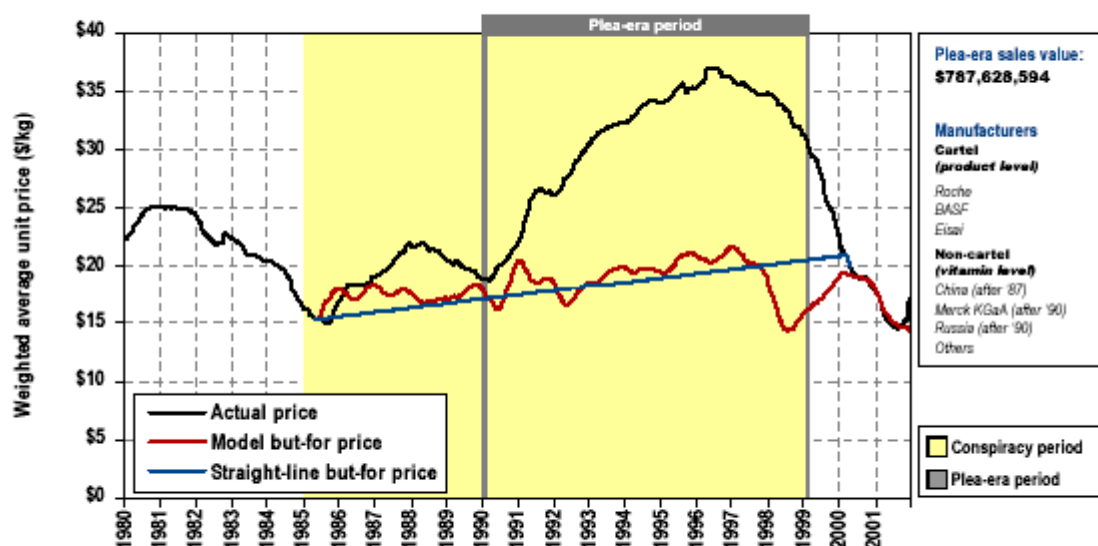
<sup>58</sup> Also called before, during and after method, see OECD (2011:14).

<sup>59</sup> This is particularly important if these factors are correlated with the cartel period.

Consider for example a situation where the before-and-after method is used to estimate the price effects of the cartel and that entry occurred at about the same time as the cartel ended.<sup>60</sup> Clearly, additional entry will tend to decrease prices in the market and if this aspect is not controlled for in the regression, the observed price reduction after the cartel ended will be taken as caused by the break-down of the cartel agreement, resulting in damages caused by the cartel being overestimated. As a result, it is crucial to include all factors that have an impact on price and that did change during the relevant time period in the estimation. This would call for instance for an inclusion of demand factors such as the price of substitutes and complements but also cost factors such as capacity utilisation and input prices.

An empirical example of this type of before-and-after estimation was performed in the context of the vitamin cartel in the 1990s. In his expert report for the Vitamin Antitrust Litigation, Bernheim (2002) estimated the prices that would have prevailed absent the conspiracy using reduced form regressions. This is depicted in Figure 8 below.

Figure 8: Vitamin E Acetate Oil USP price and counterfactual price



Source: 7-month centered moving average for U.S. "tel quel" food, pharma, and cosmetic price from Roche ROVIS data

In contrast to an analysis where the structural breaks, i.e. the beginning and ending phase of the cartel period are exogenously determined, endogenous structural break models allow for a statistical determination of the start and ending periods of a cartel, possibly also including gradual price changes at the beginning and end in a dynamic analysis.<sup>61</sup>

In general, caution may be required in focussing on prices after the cartel ended. There are essentially three reasons for this. First, former cartelists expecting damage claims in the aftermath of the cartel episode will find it in their interest to maintain higher prices than would otherwise be warranted to the extent that the profit loss associated with such higher prices is overcompensated by lower damage claims if

<sup>60</sup> It may even be that entry is in fact the very reason that the cartel broke down.

<sup>61</sup> On this topic see for example Harrington (2008).

post-cartel prices are used in the estimation of damages for example in the context of a before-and-after methodology. Second, the breakdown of a cartel could result in a price war and the exceptionally low prices during this period do not reflect prices that would prevail under normal competitive conditions.<sup>62</sup> Third, some cartel cases exist where the competition authority was not satisfied with fining the cartelists and implementing a cease and desist decision but also tried to reduce the future possibility of tacit collusion.<sup>63</sup> As a result, prices observed after the cartel ended may remain supra-competitive and it may be prudent to give such prices a lower weight than pre-cartel prices in estimating the counterfactual price.

### **Cross sectional analysis**

Alternatively to the before-and-after method, geographic comparator markets can be used to estimate the prices and quantities under normal competitive conditions. This type of cross-sectional analysis assumes that the market structure in another geographic market, for instance in another country or region, is sufficiently comparable, that is exhibiting a similar concentration, similar technologies and cost structures as well as similar demand conditions. In addition, such a geographic market can only be considered a valid benchmark if it can be ascertained that no restrictions to competition exist. This could be a problem insofar as to the extent that the geographic market is a good empirical fit, the same incentives to cartelize should prevail, so that prices in this market may similarly deviate from prices under normal competitive conditions. As a matter of fact, there will generally always be differences between the two geographic markets for instance concerning wages, input costs or demand that could subsequently be taken into account by adjustments in the prices. In practice it will, however, be difficult to pin down exactly what the appropriate corrections in prices should be.

Cross sectional models estimate the price effect of the cartel by comparing data in the relevant market with comparable unaffected markets. Cross sectional models do not have a time dimension and are typically based on a comparison of data taken from the same time period. The underlying assumption in a cross-sectional analysis is that the comparator geographic or product market have been chosen in such a way, that all differences identified in a comparison will be due to the cartel. Any remaining differences between the markets would need to be identified and controlled for in a similar fashion as discussed above in the context of time-series analysis. While such comparisons could be made between geographic markets or even distinct but comparable product markets, comparisons could also be made between individual firms.

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<sup>62</sup> This was presumably the case in the German cement cartel, see for example Friederiszick and Röller (2010).

<sup>63</sup> These instances are, however, rare. See for example the US case Detroit Automobile Dealers Association (DADA). In 1984, the FTC alleged that the automobile dealers violated federal antitrust laws through a conspiracy to limit competition in the sale of new cars in the Detroit area by closing dealerships on Saturdays and most week nights. In addition to a cease and desist order concerning the fixing of opening hours, the FTC also imposed a behavioural remedy requiring the dealers to be open a minimum amount of hours during the week in order to avoid that dealers would simply stick to the previously agreed upon opening schedules that at this stage were a natural focal point. In general the use of behavioural or structural remedies is rare in cartel cases despite the fact that tacit collusion may become much more practicable in the aftermath of a cartel phase as argued by Connor (2004). This is essentially the argument that a cartel agreement may reinforce or create focal points although one could legitimately inquire about the need to form a cartel structure based on regular meetings if indeed one initial meeting may have been enough to make a particular focal point salient.

Deriving the counterfactual price based on cross-sectional comparisons can take the form of simple comparisons of averages<sup>64</sup> or regression techniques. These regression models would proceed similarly to the regressions discussed in the context of time series analysis with the exception that the binary dummy variable would now identify the two comparator markets. The advantage of a regression approach is that it will allow controlling for identified differences between the comparators.

One of the problems of this method already touched upon previously is that if another geographic or product market is truly comparable to the cartelized one, there are good reasons to believe that the incentives to cartelize are also similar so that it cannot be excluded that one cartelized market is compared to another thereby substantially underestimating damages. An advantage of this method as compared to the simplest time series analysis that allows for structural breaks is that the beginning and end-phase of the cartel is determined endogenously.

### **Difference-in-differences method**

A superior alternative is the so-called panel data analysis that combines the before-and-after and the geographic comparator method for estimating the counterfactual price. This method is based on a simultaneous observation of price developments through time on the cartelized market and on one or several comparable but geographically separated markets. This method, that is also known as difference-in-differences method allows a more precise estimation of the cartel induced price increase. It analyses and compares the differences in the price developments in the cartelized and the benchmark market(s) allowing a more precise estimation of the cartel induced price effect as changes in price that are for instance identified in a time series analysis, may now no longer be attributed solely to the cartel but could for instance also be traced back to an increase in cost that affects all companies irrespective of the geographic market they operate in. Also, constant differences between the two geographic markets can be accounted for as in the case of different production technologies.

As the difference-in-differences method can be considered a combination of time series analysis and cross sectional analysis, either the average prices in the two markets can be compared or additional factors can be considered by using a regression analysis. Two dummy variables, one for the cartelized market and one for the cartel period are introduced as well as an interaction term that is defined as the product of the two dummy variables. The estimated coefficient of this interaction term gives an estimate of the cartel induced price increase. Application of the difference-in-differences method, however, often encounters data constraints so that the basis for a time series comparison across different geographic markets is not always given. Suitable comparisons between similar product markets, i.e. a comparison of markets for similar products in which the market is not distorted by cartel agreements can generally only be found in exceptional cases as the differences in production processes, cost structures and demand as well as competitive conditions will render a meaningful comparator market extremely difficult to find. In addition, the caveats mentioned in the context of a geographic market comparison also apply here, i.e. the problem that the market may also be cartelized.

### **Simulated comparator markets**

As a result, there will be a number of situations where neither a convincing geographic market nor product market can be found and also the application of the before-and-after method will not be fruitful. In such

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<sup>64</sup> The average or arithmetic mean is the sum of all observations divided by the total number of observations. Possible alternatives are comparisons based on median or mode prices, i.e. the price of the firm in the middle of a price ranked distribution or the price observed with the highest frequency respectively.

cases, one could resort to a simulated, that is, an artificially constructed counterfactual market. Similarly to simulation models used in merger control, a model from industrial organisation theory would need to be designed that reflects the competitive situation on the concerned market as precisely as possible. Depending on the cartelized goods, the central competition parameters and the allocation mechanism, one could resort to standard oligopoly models with homogenous or differentiated goods and quantity competition (Cournot models), oligopoly models with differentiated goods and price competition (Bertrand models) or auction models, that would typically need to be tailored to the specific parameters of the concerned markets, for example concerning entry barriers, capacity constraints or demand fluctuations.

Based on demand data, information on the quantities sold and on costs and prices, an empirically based model of the market could be designed that would allow the simulation of the market outcome, that is prices and quantities, that would probably have prevailed in the absence of the cartel. In addition to the question of data availability, such an approach is confronted with two fundamental conceptual problems. The first problem concerns the degree of coordination that the firms achieved in the cartel. Under perfect coordination, the cartel would choose a price that maximizes total cartel profits that is, it would act as a monopolist on the cartelized market. For various reasons, for example a possible market entry by potential competitors or an incomplete market coverage, a cartel might be able to achieve only a partial coordination so that the cartel price remains below the profit maximizing price a monopolist would charge.<sup>65</sup> As a result, it is important to explore whether and if so, to what extent the cartel price was below the monopoly price. The second conceptual problem lies in identifying what price would have prevailed in the market absent the cartel agreement. This in turn depends on the intensity of competition absent the cartel agreement. This intensity may have been relatively low in the first place, for instance if the market is characterized by a small amount of similar companies operating on a transparent and stable market with limited innovation and the existence of an effective punishment mechanism. In such a case, a relatively high counterfactual price would result and the cartel induced damages would correspondingly be limited. It is not appropriate to generally presume that the counterfactual is given by the maximum degree of competition that the oligopoly model adopted to simulate the market allows. If the damage is supposed to be estimated as accurately as possible, the possibility of a lower intensity of competition in the absence of the cartel needs to be considered. This is analogous to other areas of competition law such as merger control where coordinated conduct is taken into consideration.<sup>66</sup>

### **Cost-based and profitability-based approaches**

An alternative comparator-based method to determine the counterfactual scenario consists in using the variable cost of production and to add an appropriate mark-up in order to derive a counterfactual price in a “bottom-up” way.<sup>67</sup> The mark-up could be estimated using information on margins in comparable competitive markets or theoretically determined. Thus, these methods can also be considered as comparator-based approaches.

The use of variable cost raises some questions as cartelized firms may have inflated costs due to X-inefficiencies and/or may simply face higher variable costs due to the reduced cartel output and economies

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<sup>65</sup> Due to factors such as the existence of potential mavericks or a competitive fringe, the level of coordination will often be less than perfect. Even when firms are all interested in coordination, production technologies are likely to diverge sufficiently for marginal revenues not being equal to marginal cost for all cartelists implying that coordination is not perfect even if compensatory side-payments are envisioned.

<sup>66</sup> See Inderst and Schwalbe (2011).

<sup>67</sup> See Konings *et al.* (2001) on mark-ups.

of scale. With multiproduct firms there is the additional problem of common cost allocation. To solve these problems, variable costs would need to be compared and adjusted based on information on variable costs of firms in competitive markets which can be fraught with difficulties.

Whereas the presented methods emphasize the estimation of prices and quantities in the counterfactual scenario, other methods focus on profitability or price-cost margins directly. For a cartel on an input market, it will generally be the case that cartel profits increase whereas profits of purchasers decrease.<sup>68</sup> As the bulk of the cartel damages is based on the transfer of wealth from purchasers to the cartelists, increases or decreases in profits can be used as an indicator for damages.<sup>69</sup>

To measure profitability, two general concepts can be used. On the one hand an accounting approach focussing on the profitability of the firm based on the return on capital employed (ROCE) can be used or, on the other hand, a finance approach can be used that drawing on the capital asset pricing model (CAPM) is based on net present value (NPV) and the internal rate of return (IRR).<sup>70</sup>

An alternative method to estimate the profitability or the change in profitability is the calculation of the price-cost margin or, stated otherwise, the per cent mark-up. In this context, the cost concept is crucial and long run average incremental cost (LRAIC) are typically considered the most suitable cost concept.<sup>71</sup> These costs are defined as the average of all variable and fixed cost associated with the production and supply of a particular good in relation to the total quantity produced. Stated otherwise, the LRAIC denote the cost that could be saved if in the long run the production of the good would be stopped. Due to the long-run perspective, not only the variable cost but also the fixed cost that could be saved are taken into account. A change in the profitability as indicated by this method could equally be considered an indicator for the transfer and therefore for part of the damage caused by the cartel.

## **3.2 Damage quantification in abusive conduct cases**

### **3.2.1 Damages caused by abusive behaviour and the counterfactual scenario**

To estimate damages resulting from abusive conduct, the same basic conceptual framework as in case of cartels applies. The actual situation with the infringement has to be compared to the hypothetical counterfactual situation in the absence of the abuse. The damage is then the difference in wealth of economic actors in both scenarios. A practical application, however, is often fraught with severe difficulties. In what follows, the general problem of constructing a suitable counterfactual scenario in abuse of dominance cases is discussed. As this differs in cases of exploitative and exclusionary abuse, these two cases are dealt with separately. Section 3.2.2 discusses the practical problems in the quantification of damages in the case of an exclusionary abuse by means of some examples. Damage calculations in abuse of dominance cases are usually more difficult than in cartel cases and this may also be the reason that to the best of our knowledge there is no empirical study estimating the damages caused by abusive conduct.

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<sup>68</sup> As was explained in section 2.1, the change in profitability of the purchasers depends on the price and quantity effect which in turn depends on downstream demand.

<sup>69</sup> The increase in profits of the cartelists being the lower bound of total damages if no quantity effects are considered. As shown in section 2.1, this lower bound may be far off.

<sup>70</sup> See OECD (2012:63-66) and Gregory (2011).

<sup>71</sup> See OECD (2012:66-70).



## **Exploitative abuse**

If a dominant firm charges an excessive price, a comparable geographic market or the before-and-after method can be employed, as e.g. time series analysis or cross sectional data, provided that the data exist and that a suitable comparator market can be identified. The former could be an appropriate approach if the dominant firm is offering the product in question in another geographic market where it is confronted with competition at a lower price. Of course, differences in the geographic markets for example concerning the demand behaviour or supply cost would need to be considered. Alternatively, cost based methods could be used in order to determine the counterfactual price.<sup>72</sup>

From an economic point of view it is important to what extent the behaviour in a different market or, more generally, the terms for other buyers or suppliers can be considered a suitable counterfactual scenario. This can be illustrated using an example of retailers with different degrees of market power vis-à-vis producers. If retailers have different degrees of market power, they can negotiate different contract terms with the producer. This buying power may have been achieved by establishing strong customer loyalty or by serving certain regions. In these cases, a producer would be willing to accept inferior conditions as the retailer has a special position and cannot be substituted by a different retailer easily. Also, a retailer with buyer power could negotiate different contract terms for different suppliers or in different regions. If this depends on different substitution options, the different contract terms only reflect market forces. In this context the question arises whether the retailers were able to achieve a position of market power by competition on the merits or by abusive practices. Only in the former case, can such a market be considered a suitable comparator market.

In case of an exploitative abuse in the form of price discrimination, leading to price increases for purchasers with a less elastic demand, the question arises whether the higher price level is considered a breach of competition law or the price discrimination as such.<sup>73</sup> With respect to the damage quantification this could make a substantial difference. While in the first case, the higher price may have to be reduced to the level of the lower price, the second case requires determining the uniform price the firm would have charged in all markets and for all consumer groups. Furthermore, it has to be considered that under a uniform price the firm might not have served all markets given the uniform price constraint. A reasonable approach to quantify the damages could consist in deriving the appropriate counterfactual by using an empirically calibrated industrial organization model, for instance a model with a dominant firm and a competitive fringe, to determine the counterfactual price absent the discrimination. Also, the market prior to the introduction of differentiated prices or another geographic market where a single price prevails could be considered. It has to be examined, however, whether different market conditions could have been the reason why the firm has chosen a different pricing scheme.

## **Exclusionary abuse**

To calculate the damages caused by an exclusionary abuse, the situation that would have occurred in the market absent the exclusionary abuse will have to be assessed in order to address the question what

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<sup>72</sup> Under an excessive price abuse, the finding of an excessive price implies the definition of an appropriate counterfactual price at least implicitly. While competition authorities will try to avoid indicating the threshold price at which the price would no longer be considered excessive, the decision of the authority in case of a follow-on claim for damages will contain more clues as to the counterfactual price than for example a cartel decision. On excessive price abuses and the available methods to determine whether a price is excessive see again OECD (2012).

<sup>73</sup> Buccirossi (2010) emphasizes that it is crucial to determine what anticompetitive practice generated the damages so that it becomes central to develop a full theory of harm in the context of damages claims if they are not follow-on actions.

profits competitors would have been able to obtain in the counterfactual scenario and what prices the purchasers would have had to pay.

In terms of comparator-based methods, the primary candidate generally is the before-and-after method, i.e. a consideration of the market prior to the initiation of the exclusionary strategy.<sup>74</sup> As an exclusionary abuse typically unfolds in time and in different phases, a comparison with a unique moment in time only provides an incomplete picture of the effects. Normally, the question would need to be answered how the market would have developed, had the anticompetitive conduct not taken place. This could for instance be highly relevant in a market with network effects. In case the dominant firm prevented another company from winning a critical mass of consumers and taking over the market, considering the situation prior to the abuse may not be a particularly meaningful counterfactual scenario as the other company would have earned substantial profits in the absence of the abuse in the meantime.

In all likelihood there will also be no comparable geographic or product markets that come close to the market at hand. In order to guarantee a minimum degree of comparability the market would need to exhibit a similar concentration, comparable cost structures as well as similar demand conditions, something that will be rather rare. Therefore, many of the empirical methods discussed in the context of cartels cannot be applied because the necessary data are not available.

A further conceptual problem consists in establishing what is implied by “in the absence of the exclusionary abuse”. This is unclear as there are a multitude of possible scenarios that a dominant firm could have followed in order to achieve competition law compliance and these different scenarios are likely to have entailed very different market outcomes. For instance, in case of exclusion through a retroactive rebate, several possibilities ranging from a linear price to a two part tariff or an incremental quantity discount could be appropriate counterfactual pricing schemes, all entailing potentially different market outcomes. In principle, the counterfactual scenario would have to be characterized by an oligopolistic equilibrium in which the dominant firm maximizes profits under the constraint of complying with competition law.<sup>75</sup> In some cases the possibility may exist to develop such a counterfactual scenario, as for example in case of tying. In such instances the question would need to be answered what profits the competitors of the dominant firm would have made absent the tying, i.e. in case the products had also been sold independently. In other cases of exclusionary abuses, however, as for instance in case of entry barriers, the construction of an economically well founded counterfactual is likely to be difficult. A possible solution in these cases could be a simulation-based approach. Here, a simulation model of the market would have to be developed that might give an indication of the possible development of the market absent the abusive behaviour. However, to apply simulation techniques, the relevant data have to be available to calibrate the model. If these data are lacking, they have to be substituted by reasonable assumptions.

For these reasons, estimating damages in exclusionary abuse cases often has to rely on a more or less rough estimation of the lost profits of competitors and the damages that accrued to the purchasers as opposed to a comparison between the actual and a fully developed hypothetical counterfactual. When using such a rough estimate, the conditions of the relevant market should be taken into account such as

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<sup>74</sup> Focusing on the market prior to the introduction of the exclusionary strategy may turn out to be problematic as the market structure may have completely changed as a result of the abuse.

<sup>75</sup> It should, however, be noted that the doubts voiced earlier with respect to the likelihood of a profit maximizing equilibrium being reached in a cartel context, equally applies here. In particular if the firm reaches a high level of independence, one will not be able to rely on (evolutionary) market forces “pushing” the firm to such a profit maximizing equilibrium.



the size and geographic extent of the market, the importance of entry barriers, the type of products traded (homogenous, differentiated, intermediate or final goods), the market development, the degree of innovation etc.

All things considered, it becomes clear that the type of abuse plays a central role in the derivation of the counterfactual and therefore also in the precision with which damages can be estimated. Whereas it is relatively clear what scenario would have obtained but for the infringement in cartel and exploitative abuse cases, the determination of the appropriate counterfactual scenario may be much more difficult in exclusionary abuse cases.<sup>76</sup> First, it will be difficult to find suitable comparator markets and secondly, a multitude of alternative business strategies conforming to competition law conduct exist. Thirdly, the market may have developed very differently in the absence of the abuse.

### **3.2.2 Illustration: Quantification of damages in case of an exclusionary abuse**

As demonstrated in section 3.2.1, the damage estimation in an exclusionary abuse context is generally much more complex than in cartel cases or cases of exploitative abuse.<sup>77</sup> On the one hand, exclusionary abuses typically unfold in different phases some of which will potentially affect economic actors positively and others negatively. This considerably increases the complexity of the analysis. In addition, it has to be considered that usually different exclusionary practices will have different competitive effects. A predatory strategy for example may result in the exit of a competitor whereas other practices may result in entry being barred. In what follows, the complexity of the quantification of damages is illustrated using an example of an exclusionary abuse that aims at the market exit or at least the marginalization of an actual competitor.

The actors affected by an exclusionary abuse are primarily the direct competitors and the purchasers of the products of the dominant company. In addition, suppliers of firms that were forced to exit the market are affected. In the following, the quantification of damages is analysed in the context of an exclusionary abuse aiming at the foreclosure or at restricting the expansion of a competitor. An exclusionary abuse typically proceeds in several phases. In phase one a competitor is forced to exit the market. The increase in market power is then exploited by the dominant firm in phase two by higher prices and increased profits. In the following phase three after the abusive behaviour has ceased, new (or re-)entry may occur. This phase is therefore characterized by a restoration of competitive conditions. An important aspect of phase 3 also concerns the remedies that the competition authority may impose. In contrast to cartel cases that typically end with a cease and desist order and the imposition of fines, abusive practices trigger behavioural or structural remedies. As a result, assessing harm in the context of such cases may involve taking into account potential benefits that are due to remedies imposed by the competition authority.

#### **Phase 1**

In the first phase of an exclusionary abuse, the profits of competitors and their market shares would decline. This phase would continue until the competitor(s) leave(s) the market or, if there is no exit, until the market shares stabilize on a comparatively low level implying the marginalization of the competitor(s).

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<sup>76</sup> This difficulty is exacerbated by the fact that competition authorities will only indirectly have investigated the relevant aspects in bringing their infringement case, something that is typically done in exploitative cases.

<sup>77</sup> This may be one of the reasons that there is almost no literature focusing on the calculation of damages in exclusionary abuse cases. A notable exception is the contribution by Fumagalli *et al.* (2010) that introduces the notion of different damages relevant phases that we will partially follow here.

The dominant firm can, depending on the strategy adapted, continue to earn profits, as is for instance the case in retroactive rebates. It is, however, also possible that the dominant firm is realising losses in the first phase as would be the case under a predatory strategy.<sup>78</sup>

The repercussions for purchasers of the firms depend in this phase on the type of abuse. In case of a predatory strategy, the repercussions on purchasers are in all likelihood positive. They pay lower prices for the products as they would have paid in the absence of the predatory strategy. Similar arguments apply in case of a margin squeeze where low prices will also be observed. These effects can propagate and reach also indirect purchasers that would equally benefit from the predatory prices. Different repercussions on purchasers arise if the abuse is focussing on an increase in input prices (raising rivals' cost) or refusal to deal. In such instances the cost of competitors increase so that the price level on the downstream market tends to increase so that purchasers pay higher prices than in the absence of the infringement. Repercussions on indirect purchasers are also likely in this case.

## *Phase 2*

In case the abuse led to exit, the competitor is unable to realise any profits in the second phase but may under certain circumstances even have to bear sunk costs.<sup>79</sup> The bulk of the damages to the firm therefore comes from lost profits. In case the competitor remains in the market albeit with lower market shares, it would be able to realize profits in the second phase but the profits are substantially lower than in the absence of the abuse. Also in this case the damages are in the form of lost profits. The dominant firm in contrast has reached its goals in the second phase and is able to reap the benefits of increased market power by setting higher prices and earning higher profits.

Concerning the repercussions of the abuse on the purchasers, they are analogous to those of a cartel or an exploitative abuse. Direct and indirect purchasers pay higher prices. In addition to this there are also damages in the form of reduced choice. In particular in markets with differentiated products the elimination of competitors reduces the product variety and thereby reduces consumer welfare.<sup>80</sup> Proving and quantifying such damages is, however, difficult. Suppliers of the dominant company face a lower demand due to the reduced quantities supplied by the dominant firm. This results in damages in the form of lost profits.

## *Phase 3*

The third phase starts with the end of the abusive practice, typically, at least in follow-on suits, roughly before the decision to cease the abuse by the competition authority. The third phase is in some sense the reversal of the first phase although the damages calculation in this phase is likely to be extremely difficult already due to the added complications in form of very likely behavioural or structural remedies imposed by the competition authority. Generally speaking, the third phase will see a return to competitive conditions, implying the entry of new competitors or the re-entry of the firms that exited or corresponding increases in market shares of the firms that were marginalized. As a result of these developments the profits of the dominant firm decrease irrespective of any potential fine imposed by the competition

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<sup>78</sup> The question is not necessarily whether overall profits are positive or negative but rather whether there is a profit sacrifice that would require at least probabilistic future recoupment to make the strategy profitable or whether exclusion may be compatible with profit maximization considering only the first phase. Both scenarios are possible and depend on the abuse.

<sup>79</sup> Of course it would be incorrect to add the sunk costs to a calculation of damages based on lost profits. A firm can either claim the sunk costs or the lost profits but not both.

<sup>80</sup> Fumagalli et al (2010:209).

authority and the profits of competitors would increase. The third phase can be considered as terminated once a situation obtains that approximates the situation that would have existed in the absence of the infringement. It is an approximation of that situation as some competition authorities, notably the European Commission, are obliged to effectively end the infringement which also implies taking away the possibility of any future recurrence of abuse which may preclude the return to a situation as it existed prior to the abuse.<sup>81</sup>

In particular outside the context of follow-on claims, the abusive practice may have resulted in permanent changes of the market structure that are not impacted by compensatory payments so that the third phase does not lead to an approximation of the situation prior to the infringement. Even if a decision by a competition authority exists, a dominant firm may have been able to build up a reputation of fighting market entry with predatory prices.<sup>82</sup> In such a case entry would not be observed immediately and may eventually occur only after a long time has passed.

A similar problem exists in case of an exclusionary abuse that does not aim at the foreclosure of a competitor already active in the market but targets potential competitors that are kept from considering entry. In such a case potential competitors are harmed in the form of lost profits that they may have been able to realize after entry. Possibly this led to entry in another, less lucrative market, where a lower profit was realised. In this context it is also important to consider the technology a potential competitor would have used upon entry, i.e. whether it would have deployed a superior, inferior or identical technology. Without additional information or proof that the company could have produced more efficiently, it may be useful to assume that such a competitor would have entered using the same technology, exhibiting a similar efficiency as the dominant undertaking.

In order to estimate the damages that accrued to the different actors in the different phases, a comparison to the counterfactual is necessary. As already discussed in section 2.2, this is considerably more complicated in exclusionary abuse cases than in cartel or exploitative abuse cases. In order to fully utilize all available information, it seems appropriate to consider several realistic counterfactual scenarios that are compatible with the underlying characteristics of the markets in question. Different scenarios could be generated by utilizing different approaches from the tool kit of factual and hypothetical comparator methods. They could also be generated by varying some of the crucial determinants of the outcome in a simulation model used in the hypothetical comparator approach which would further increase the robustness of results derived with these methods. In order to explain the quantification of damages in this context, a particular counterfactual scenario is considered. For the competitors, the profits obtained during the different phases would need to be compared with the profits obtained in the counterfactual scenario. As an exclusionary abuse can target the revenues or costs of competitors, it may be useful to estimate the change in profits of the competitors through a separate analysis of the development of revenues and costs. Such an approach could facilitate the distinction between changes in profit that are not due to the abusive

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<sup>81</sup> The obligation of the European Commission to effectively end an infringement implies that any future recurrence needs to be prevented. While it is not possible to develop the details concerning behavioural and structural remedies as well as the Commissions mandate here, it is clear that the European Commission has imposed structural remedies so far only in case behavioural remedies were unlikely to be effective in terminating the abuse *and preventing any future recurrence of the abuse*. As the situation prior to phase 1 clearly was not a situation that prevented the future abuse, the Commission will be bound to choose remedies that exclude the possibility that the end of phase 3 results in the same situation as existed prior to phase 1. Any remedy falling short of this could actually not be considered a suitable remedy. On the issue of remedies see Maier-Rigaud (2012).

<sup>82</sup> See the classic paper by Selten (1978).

conduct and those that are due to the abusive conduct. Generally speaking, reduced sales result in cost changes so that changes in profit can be derived from the difference between revenues and changes in cost.

As discussed in section 3.1, when quantifying damages, all those factors have to be controlled for that bear no causal relationship with the incriminated behaviour. The extent to which the factors have an impact on the profits follows from the respective multivariate regressions. The quantification of damages is thus corrected for the effects of these factors. An important factor in this context could be the business model used by the firm, which may differ in situations with and without abusive conduct. In principle the econometric methods allow an estimation of the impact of these factors on cost, revenues and profits and to determine to what extent the changes in profits can be explained by these factors. Depending on the case at hand, however, this may be difficult. For an as precise as possible estimation of the damages it is, however, of central importance to identify all these factors and to control for them in an econometric analysis. Otherwise, it cannot be excluded that changes in profits are attributed to the abusive conduct although the changes had – at least in part – different causes.

### 3.3 Further aspects of damages quantification

#### Compounding and discounting damages

In general, the harm caused by a competition law infringement usually occurs at a different point in time than the compensation paid to the injured party. In particular, to compensate the injured party also for the financial means that it would have had available otherwise, it is necessary to calculate the present value of the damages at the time of compensation. From an economic point of view, the choice of the rate of interest used for compounding is non-trivial. It depends mainly on the question whether an *ex-ante* or an *ex-post* consideration is used.

Consider for example the case of a firm that has been forced to exit a market. To simplify the analysis, we assume that the infringement occurred at a single point in time. The damages in the form of lost profits, however, accrued until the time of compensation. *Ex-ante*, i.e. at the time of the infringement, the profit that the injured party might have realized if it were not forced to exit the market, was uncertain as for example business fluctuations or the market entry of other firms could not be predicted with certainty. According to an *ex-ante* analysis, the damages should not be computed retrospectively, but from the point of time of the infringement as the expected lost profit. This ensures that the injured party is in the same position as it would have been in the absence of the infringement. The expected profits that may have been realized without the infringement have to be discounted to the point of time of the infringement using a risk-adjusted rate of interest. This rate of interest is based on the cost of capital of the injured party. Finally, this amount is then compounded to the point of time when the compensation is paid. As this amount is no longer subject to any uncertainty, the risk-free interest rate is proposed for the compounding.

An *ex-post* assessment, however, considers only the realized damages, i.e. the profit that the firm would have realized given the factual situation without the infringement. In the case of an on-going infringement as for example in the case of a price cartel, the differences between the two approaches disappear. The computed damages for the respective period are compounded to the point of time of the compensation. In this case, the use of the risk-free rate of interest is again recommended.

Under an *ex-post* approach it might be necessary to take those damages into consideration that might be caused by after-effects as in the case of cartels. Also, abusive practices can exhibit considerable after-effects that may lead to future damages that have to be discounted to their present value. These damages should be considered using the *ex-ante* approach by discounting the expected damages with the cost of capital of the damaged firm.<sup>83</sup>

### Estimation of after-effects

In the context of damages caused by cartels or abusive behavior, it has been pointed out that after-effects caused by a competition law infringement may extend beyond the period when the infringement occurred. In some cases the after-effects might even extend beyond the point in time of the compensation. As these damages bear a causal relationship with the infringement they should be included in the calculation of damages. As it can be assumed that the injuring party at the time of compensation and further on will refrain from the incriminated behavior, these after-effects are not equally relevant for all types of anticompetitive behavior. As an example, the after-effects of a price cartel are considered.<sup>84</sup> Here, prices could be above the competitive level even after the cartel has been abandoned as the explicit collusion during the cartel period could help to establish an implicit collusion or the higher prices might continue because of long-term contracts. Also, the former cartel members could have an incentive to charge higher prices than under competitive conditions to artificially increase the estimation of the counterfactual price and to reduce thereby the damages claims.<sup>85</sup>

If these after-effects are not taken into account, the damages that occur after the cartel period is disregarded and there is also the danger to underestimate the damages during the cartel period. This happens if the time after the cartel has been detected is considered as part of the comparator market. As the prices are above the competitive level due to the after-effects during this time period, the counterfactual price is too high and thus the damages during the cartel period are underestimated. There are, however, methods available that avoid this problem. For example, when using the “dummy approach” the cartel dummy gets a weight of 1 during the cartel period, but is not immediately set to 0 after this period, but only gradually reduced.<sup>86</sup> If there are after-effects because of long-term contracts and lagged price adjustments, these can be estimated using price data from periods before the cartel ended. This includes the cartel period if it is assumed that prices are adjusted with a comparable lag if for example costs have changed. This lagged price adjustment is taken into account in a regression by letting the current price level depend to a greater or lesser extent on the past price level.<sup>87</sup>

### Accuracy of statistical methods

Of central importance when considering the different econometric methods discussed above are the properties or the theoretical accuracy of the respective models or estimators used to calculate for example

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<sup>83</sup> Note, however, that eventual remedies imposed by the competition authority may mitigate or fully reverse these after-effects.

<sup>84</sup> The discussion is based on Inderst and Jakubovic (2013).

<sup>85</sup> See Harrington (2004).

<sup>86</sup> See for example Hüschelrath *et al.* (2012) for an application. The functional form this reduction takes has to be assumed according to the facts of the individual case.

<sup>87</sup> This can be estimated by first considering a model for the profit maximizing price which is then combined with a model that describes the price adjustment process. This price adjustment model can be interpreted in a way that only some firms adjust their prices and all other firms keep their prices unchanged. For details see Gujarati (2002:673).

the counterfactual price. Statistical theory is concerned with the properties of different estimators or models and their robustness. An important empirical trade-off exists for instance between using an unbiased estimator with a low precision versus a biased estimator with a high precision. In order to understand what is meant by biased (or unbiased) and by the precision of the estimate, consider the estimate derived from an unbiased estimator. This estimate may have a very low precision, i.e. be very far away from the true value despite the fact that the method, i.e. the estimator was unbiased. The reason for this is that an unbiased estimator leads to unbiased estimates *on average*. This can be visualized by considering a normal distribution with a high variance around the true mean. If the distribution has a high variance but the mean is the true mean, the estimator is unbiased. This unbiased average could, however, be obtained solely by estimates that over and underestimate the true value substantially so that (and here we leave the example of a normal distribution) no estimate actually reflects the true value and the estimator is only unbiased because the deviations from the true value cancel each other out. As a result it may be preferable to take recourse to biased estimators such as structural empirical models with a high precision, i.e. a low error in individual estimates although the estimator is biased, than to resort to an unbiased estimator that generates estimates with large errors, i.e. is less precise.<sup>88</sup> In the context of the discussion of methods above, the more the economic model is enriched with assumptions that are imposed on the estimation, the more precise the estimates are likely to be although results may be biased if not all relevant effects are taken into account or some assumptions are incorrect.

An additional consideration in the empirical analysis of damages is the concept of practicality as for instance developed in OECD (2011:22). A methodology is practical when it yields a verifiable and transparent estimate within a reasonable timeframe and the proportional use of resources. Verifiability and transparency depend largely on data submission and presentational format, i.e. the submission of raw data together with any documentation of adjustments and the statistical procedure used that would allow a replication of the results presented.

Regarding the significance of statistical results, higher than usual p-values could be considered as the *a priori* probability of the but-for price in the context of a condemned cartel being significantly lower than the cartel price, for example, is not 50% but substantially higher, as has been pointed out by Fumagalli *et al.* (2010).<sup>89</sup> It may therefore make perfect sense to take the fact that an infringement was established into account in follow-on damages claims.

### **Remoteness and causality**

In addition to the effects that a cartel or abusive behaviour causes, the aspects of remoteness and causality have to be considered. Remoteness often refers to the “distance” between the harmed party and the infringement, for example in a value chain, where an indirect purchaser or indirect supplier of a cartel would be considered more “remote” or “distant” than a direct purchaser or supplier, but it may also relate to the types of effects constituting the harm suffered.

Regarding the former, it has already been noted in section 2.1.2 that the quantification of damages may not necessarily be easier for those occurring e.g. in a direct interaction with cartelized firms as opposed to

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<sup>88</sup> This trade-off is considered using the weighted square error criterion.

<sup>89</sup> The statistical bases for hypothesis testing using the usual significance levels rest on a high data quality and the additional assumption of an *a priori* equal probability of rejecting or not rejecting the null hypothesis, for instance to find a statistically significant difference between actual and counterfactual prices. As both these assumptions are typically not fulfilled in follow-on damages claims, lower significance levels could be considered.

firms that are more remote. Nevertheless, the more remote the damages caused by the infringement either within or outside the value chain, the more difficult it is usually to demonstrate causality.<sup>90</sup> While damages do not necessarily decrease with distance from the cartel or the abusive behaviour (the example in section 2.1.3 demonstrated that damages may substantially increase), proving causality may also not necessarily become more difficult, as demonstrated for instance in case of products that are complementary to the cartel product. In any case, remoteness is certainly not a criterion that would allow discrediting damage claims of more remote firms *a priori*. So while remoteness understood in this way may be one of the indicators that could be used to predict the chances of winning a damage claim, economic causality will be fulfilled irrespective of whether claimants are direct or indirect purchasers, suppliers or competitors or may be harmed by the cartel or the abusive behaviour in an even more indirect way.

Remoteness and the idea that a causal relation may be less likely to be satisfied for different types of harm usually refers to the damages attributed to price and quantity effects. As the US courts do not award damages for quantity effects, or opportunity cost in terms of lost profits except under specific circumstances, one may get the idea that price effects are less “remote” than quantity effects not least as price effects are normally evidenced by transactions of a certain volume at the higher prices caused by the infringement whereas quantity effects can typically not directly be evidenced. As the presentation in section 2 demonstrated, this is economically unfounded. In all but special circumstances will a firm that has been harmed by a price effect also have been affected by a quantity effect. Indeed, the harm from the quantity effect may be more substantial than the harm from the price effect. From that point of view, it is hardly tenable to award damages based on price effects and deny damages for quantity effects on the basis that these are supposedly more remote.

In practice, price effects can be calculated based on the quantity purchased and the difference between the factual and counterfactual price. If this is done on every level of the value chain, one gets the respective price effects. To calculate quantity effects one requires in addition information on the counterfactual quantity. At least theoretically the calculation of the counterfactual price implies knowledge of the corresponding quantity so that the informational requirements are similar.<sup>91</sup> *A priori* it is therefore unclear why it should be considered much more difficult to estimate damages based on quantity effects as opposed to price effects.<sup>92</sup>

Overall, one should therefore exert a certain level of caution regarding the idea that distance or remoteness, irrespective of whether it is understood as distance of the victim to the cartelized market or referring to price and quantity effects, will have a bearing on causality. While there may be practical and empirical considerations that will render “remote” damage claims statistically less likely to be successful *ex post*, there is no economic basis for discarding such “remote” claims *ex ante*.

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<sup>90</sup> Generally speaking causality refers to the requirement that all estimated damages have to be linked to the infringement in the sense that they would not have occurred in the absence of the infringement (the so-called ‘but-for’ test). If for instance important inputs to the dominant firm increase in price during the excessive price period, these input price increases would have resulted in increased prices even in the absence of an excessive price abuse. As a result these effects need to be separated from the pure excessive price effects for which causality can be demonstrated. See Chapter 3 for a discussion of the legal notion of causation.

<sup>91</sup> The calculation of quantity effects for final purchasers (firms or consumers) requires additional information concerning the shape of the demand function and the cost curve between the relevant price/quantity combinations.

<sup>92</sup> Even if one is willing to accept concepts as crude as the illegal gain as an approximation for reasons of simplicity or procedural efficiency for example, it is not clear why quantity effects could not similarly be approximated.

## 4. Conclusions

The estimation of damages to individual consumers or firms is a difficult task, fundamentally requiring a comparison between the wealth position of a firm or consumer in the presence and absence of an infringement. The preceding sections analysed damages in terms of price and quantity effects rejecting the division of price effects into an overcharge and a pass-on calculation. Clearly, it is possible to reconcile an estimation of damages based on an overcharge calculation that would only subsequently net out what has been “passed-on” with a price effect analysis but in the absence of a legal regime making such distinctions, there is no convincing argument why such an approach would be superior to a direct calculation of price effects. As a matter of fact any argument advanced in favour of such a subdivision of price effects could only take recourse to the argument that such an approach may empirically be easier to follow. The information requirements for calculating overcharge and pass-on are, however, identical to those for calculating price effects.<sup>93</sup> In addition, the focalisation on price effects divided into overcharge and pass-on has led to an asymmetric treatment and ultimately a neglect of quantity effects in the analysis.<sup>94</sup> The justification advanced for such a stepmotherly treatment of quantity effects has been that the estimation of quantity effects is more difficult than the calculation of price effects. As has been shown, calculating quantity effects requires only insignificantly more information than calculating price effects but assures that all damages are taken into account in the calculation. The calculation of both, price and quantity effects should therefore also be used if a rebuttable presumption is introduced as was recently suggested by the European Commission.<sup>95</sup> A further benefit of such an assessment of damages is that it automatically dispenses of the debates surrounding pass-on and standing that have unnecessarily muddled the waters of the literature on damage claims in EU competition law.<sup>96</sup>

While estimating damages in cartel and exploitative abuse cases is, at least on a conceptual level, relatively straightforward, it is much more complicated to quantify individual harm in exclusionary abuse cases. In particular the construction of one (or several) realistic counterfactual(s) in exclusionary abuse cases will require further economic research.

Questions with respect to the appropriate counterfactual also arise with respect to market developments when the infringement has been terminated. It is not clear how to incorporate any future reduction in

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<sup>93</sup> Calculating price effects is more difficult than estimating the overcharge, but calculating the overcharge is meaningless unless the cartel only sells directly to final consumers allowing the pass-on problem to be ignored. In addition, if claims are brought by indirect purchasers or firms outside the value chain, establishing the overcharge is likely to be more difficult than calculating price effects directly.

<sup>94</sup> See European Commission (2013).

<sup>95</sup> See European Commission (2011) and (2013). A rebuttable presumption focusing on the overcharge endangers the Commission’s accomplishment of treating price and quantity effects equally. Should a rebuttable presumption solely focusing on price effects or overcharge be introduced this would likely result in quantity effects vanishing in actual damages cases. The normative power of a rebuttable presumption focusing exclusively on price effects together with the US approach influencing the EU debate may be sufficient to assure that quantity effects will play no role also in the EU, thereby undermining the goal of compensation.

<sup>96</sup> It is for instance not clear at all why the European Commission devotes a whole chapter on passing-on of overcharges (see European Commission (2013), chapter IV of the proposal for a directive) in light of the compensatory goal of damages that by definition excludes an award of the overcharge and thereby naturally requires a focus on price effects, irrespective of whether these are calculated by adjusting an overcharge by pass-on or not. See Maier-Rigaud (2013b).



competition due for example to focal points in cartel cases. Similar difficulties exist with assessing damages in abusive conduct cases as effects may continue to play a role even if the conduct ceased. An analysis of effects in such cases is further complicated by the effect of remedies imposed by competition authorities. Generally speaking, competition law infringements that entail both positive and negative effects, such as tying that also reduces transaction costs, generates the need to net the harm and the gains that typically emerge across time in abusive conduct cases.

All these considerations imply that damages cannot be estimated precisely. It is for this reason that it would be sensible to move away from point predictions generating a particular number that is supposed to characterize the total damage to the individual consumer or firm.<sup>97</sup> The alternative is to state damages in intervals using upper and lower bounds that may naturally emerge from different estimating methods or underlying assumptions. The robustness of the estimation can be further increased by methodological pluralism and a variation of key factors in hypothetical comparator markets in the context of simulation methods.<sup>98</sup> It may even be possible to state the damage intervals in terms of confidence intervals<sup>99</sup> indicating a certain probability for damages to lie within a certain range.

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<sup>97</sup> Point predictions are pretentious, as they suggest precision, and are very likely to be incorrect. They are very likely to be incorrect as the probability that a particular point estimate of damages corresponds to the actual damages is very close to zero.

<sup>98</sup> This would include a careful consideration of whether slight changes, for example in the underlying model or other assumptions, will entail substantial changes in the estimates.

<sup>99</sup> Confidence intervals in the context of damages claims would consist of a range or interval of damages estimates that act as good estimates of the unknown damages. The level of confidence of the confidence interval, expressed as a percentage, indicates the probability that the range or interval of damages estimates capture the true damages suffered by the victim. By definition, 100 per cent minus the level of confidence would indicate the probability that the true damages lie outside the interval i.e. are either larger or smaller than the damages indicated in the interval. In the context of a corresponding hypothesis test, this value is called the significance level.

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