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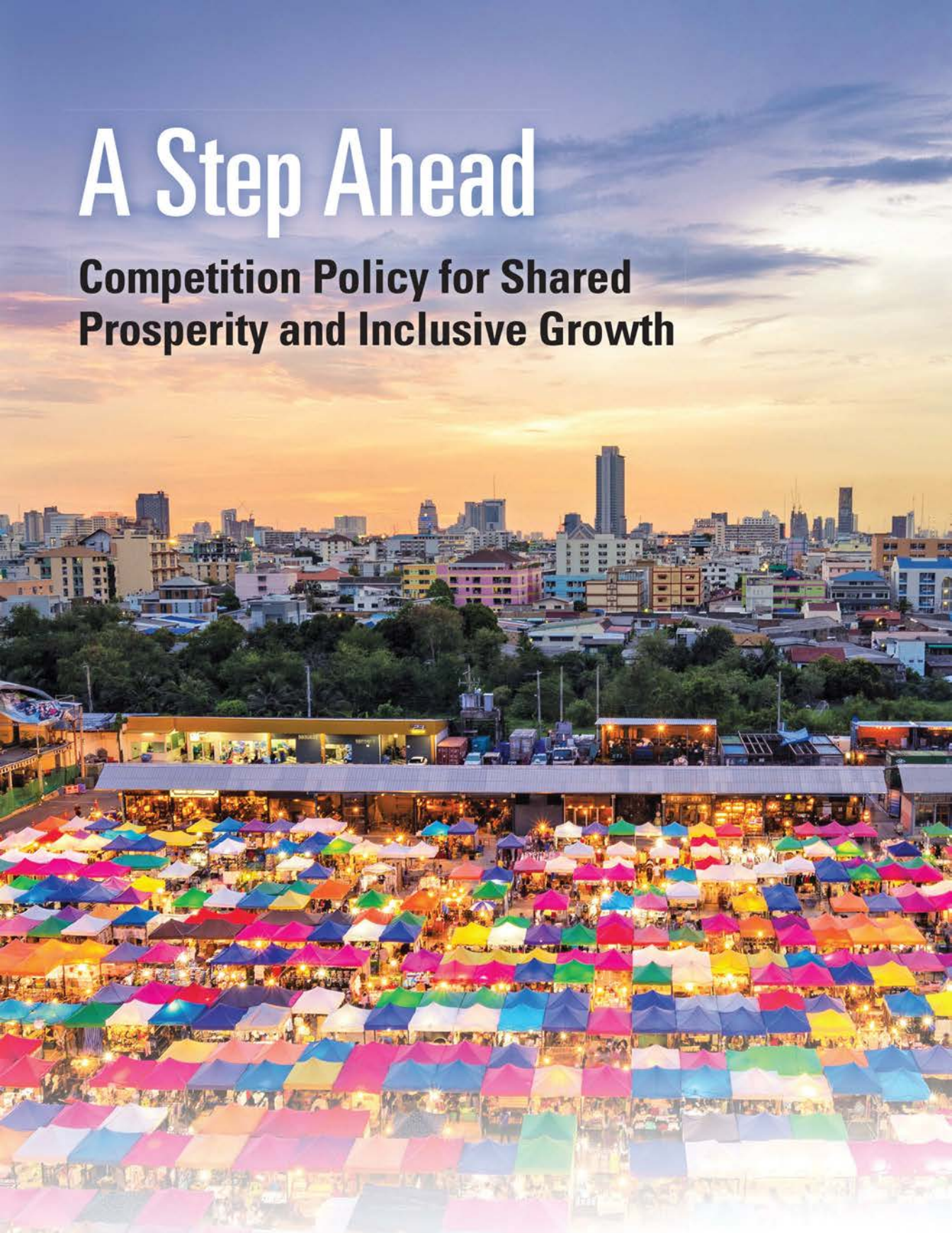

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3. Cartel Damages to the Economy: An Assessment for Developing Countries

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Competition policy implementation and enforcement, including cartel deterrence and detection, require substantial investments. Therefore, it is important to understand to what extent these investments are compensated in terms of prevented damages to consumers. The answer to this question is especially important for developing countries for which the decision to create or reinforce an antitrust authority largely depends on associated costs, while a sufficient and robust quantitative evaluation of potential benefits is still missing. The present chapter aims at providing the missing evidence by assessing the aggregate economic harm caused by cartels in developing countries. The authors find that the economic damage of cartels already detected in developing countries is substantial—in terms of affected sales related to gross domestic product (GDP), the maximum rate reaches up to 6.38 percent, while excess profits resulting from unjustified price overcharges reach up to 1 percent when related to GDP. Furthermore, if one wants to take into account cartels that were not detected, the total damage appears to be at least four times larger.

3.1 Introduction

Detecting and punishing cartels come first on the agenda of antitrust authorities in developed countries because of their potential harm to consumers' welfare and the economy as a whole. Cartels are considered damaging per se because colluding firms have strong incentives to overcharge customers for products or services, without adapting quality, or to block the entry of new rivals. From a sample of international cartels

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operating since 1990 in primary product markets, Connor (2011a) draws a conclusion that cartels' prices have been at least 25 percent higher than their competitive benchmark.

Because implementation of the antitrust enforcement requires substantial investments, it can be questioned to what extent those costs are outweighed by consumer gains. This is especially relevant for developing competition authorities that often experience tough budget constraints, but struggle to find the supportive evidence that could advocate their efforts. The research on these questions in developing countries is scarce and has mainly followed a qualitative approach. Among the few relevant studies—for example, those of Jenny (2006); Connor (2011a); and Levenstein, Suslow, and Oswald (2003)—only the latter offers a relatively comprehensive quantitative assessment of the aggregate economic impact of cartel agreements. Based on international trade flow data and a list of 42 detected international cartels operating in developing markets and prosecuted in the United States and the European Union (EU) in the 1990s, the authors estimated that imports affected by cartel agreements constitute 3.4–8.4 percent of total imports to developing countries—an amount equivalent to 0.6–1.7 percent of the GDP in these countries. The authors suggested that the actual impact is more significant due to the hidden nature of cartels and various methodological problems that did not allow taking all the observations in the dataset into account.

This chapter takes into account both international and local cartels that were prosecuted in more than 20 developing countries from 1995 to 2013 and measures the aggregated cartel excess profits resulting from price overcharges. It, therefore, provides a better understanding of the actual damage suffered by consumers in developing countries. Competition authorities in developing countries may have a practical interest in the respective results for the advocacy of their efforts.

The chapter will conform to the following outline. Section 3.2 comprises a description of the data mining process and a discussion of the descriptive statistics of the collected sample of cartels. In section 3.3 we present our original methodology that was developed to estimate the price overcharges resulting from cartel agreements and that we applied on some cases from our database. While quite simple and intuitive, this methodology can be implemented with a very limited set of data. Competition authorities may wish to take advantage of the proposed methodology for their own cartel investigations because it will reduce the data required to estimate the damages in terms of price overcharge. Overall, the collected data do not have any strong evidence for the widespread idea that cartel price overcharges in developing countries are more significant than those in developed countries. We show, however, that the impact on prices is at least of a similar scale, which calls for adequate antitrust measures.

In section 3.4 we focus on several indicators aggregated on a country level. First, as in Levenstein, Suslow, and Oswald (2003), we calculate aggregate sales affected by collusive practices. Second, and more innovatively, we calculate aggregated

cartels' excess profits that result from unjustified price overcharges. Both measures are then related to GDP to take into account different scales of the considered economies. We supplement the discussion with a simplified cost-benefit-like analysis of the antitrust enforcement by relating aggregated cartels' excess profits to the budget of the corresponding competition authority. We find that in terms of affected sales related to GDP the rate reaches up to 6.38 percent. The direct harm to consumers in terms of cartels' excess profits related to GDP is also significant, reaching almost 1 percent. The results also demonstrate that, in a majority of considered countries, excessive profits significantly exceed competition authority budget expenses aimed at preventing them.

Our estimates reflect the minimum bound for the economic harm caused by cartels. One of the major reasons is that quantitative information on detected cartels in developing countries is very limited, but also because a potentially large number of cartels remain undetected. In section 3.5 we assess the extent to which our aggregated estimates of harm are underestimated due to the hidden nature of cartels. Specifically, we adopt the methodology proposed in Combe, Monnier, and Legal (2008) to estimate the annual probability of a cartel to be uncovered. We find that at least three out of four existing cartels remain undetected, implying that the actual damage is at least four times larger than suggested by our estimations. Section 3.6 concludes the chapter.

3.2 Collected Data: Cartels' Profiles in Developing Countries

3.2.1 Data Collection Process

Given the complexity of possible reasons for collusive behavior among firms and consequent welfare effects, we focus only on so-called "hard-core" cartels, that is, cartels with participants who aim at increasing their profits by the means of collective price or market share fixing. These agreements between firms are assumed to be harmful for consumers per se and, therefore, are illegal in the majority of antitrust jurisdictions. Hence, the database does not include buyers' cartels, collective predatory pricing cases, or collusive agreements that were given an exemption by competition authorities.[1]

Our analysis is based on the original dataset containing information on 249 major hard-core cartels that were prosecuted in more than 20 developing countries from 1995 to 2013. In annex 3A we provide a reduced version of this dataset, containing the list of countries, identified cartels, and their respective periods of existence. We restrict our attention to the period from 1995 to 2013 because many developing countries have established their competition authorities just recently, if at all; hence no data, or only very poor data, could be collected for earlier years. Nevertheless, we find the 1995–2013 time period to be sufficiently long to obtain a representative sample of cartels.

The list of countries chosen to participate in the study was created according to whether the country is officially classified as developing and whether its competition authority (i) exists, (ii) is active, and (iii) has sufficient experience in terms of cartel detection.[2] This selection process excluded many of the developing countries from consideration. However, they can still profit from the current study to advocate for the introduction of antitrust law or its enforcement.

For every defined hard-core cartel, we aimed at collecting quite substantial descriptive data, including:

a. *Relevant market(s)*. When a cartel operated in several markets, we considered those as separate cartel cases whenever the available data allowed doing so;
b. *Number of colluding firms;*
c. *Cartel duration*. When no exact dates but only year of creation or breakdown of a cartel was known, we assumed that the cartel's duration comprised the complete year from January to December, similar for months;
d. *Cartel sales.* Cartel sales were calculated as revenues of all colluding firms during the considered period in the relevant market only;
e. *Applied penalties*. Collected data on penalties include all applied fines (both for companies and responsible executives) as well as finalized settlements; and
f. *Estimated price overcharges*. Given the lack of information on losses in output or consumers' welfare, we have chosen price overcharge as a measure of the economic harm caused by cartels.

To perform the cost-benefit analysis we also collected data on budgets of the selected competition authorities.

When provided in different currencies, a cartel's sales were converted into U.S. dollars by using average exchange rates corresponding to the period of a cartel's operations, while for penalties we used the exchange rate that corresponded to the period when the final decision on the case was made.

The collected pieces of data were obtained from numerous sources such as competition authorities' websites, companies' annual reports, reports of international organizations such as the Organisation for Economic Co-operation and Development (OECD), the United Nations Conference on Trade and Development (UNCTAD), and so on. A significant piece of information came from the existing database on international cartels.[3] However, our sample would not be so rich without cooperation from local competition authorities.[4] For this purpose, they were asked to fill out a special questionnaire (see annex 3B). In addition to the above-mentioned target data, this questionnaire requested some additional inputs required for our methodology, developed to estimate price overcharges. These include prices, market shares, and sales of colluding companies at least for one period during the cartel's existence. All the other cartel-specific information requested in the questionnaire is

not mandatory to implement the methodology, but helps to better calibrate market parameters and, eventually, improve the estimation results. We explain the methodology in more detail and report obtained estimates in section 3.3.

Our database makes a substantial contribution in summarizing and, most important, enriching the existing knowledge on price overcharges caused by cartels. It comprises not only international cartels (as, for instance, in Levenstein, Suslow, and Oswald 2003) but also cartels formed locally. Cartels' industrial profile in our sample is similar to the one described extensively by Jenny (2006); therefore we do not go deeper into this aspect, but instead focus on the quantitative assessment of cartels' activities.

3.2.2 Descriptive Statistics of the Sample

We provide some descriptive statistics of the collected data in table 3.1.

In our sample, the median number of colluding firms is equal to 5, while the median duration of a cartel is 27 months.[5] Analogous calculations for a sample of cartels in developed economies (see Connor 2011b) indicate similar results for the number of cartel participants but, surprisingly, a higher level of median cartel duration—around 50 months in North America and 70 months in the EU. These results may seem to be in conflict with the popular opinion that collusion is sustainable for longer periods in developing countries because of stronger market imperfections and weaker antitrust enforcements. However, they are in line with theoretical results in Motta (2004), demonstrating that in unstable but growing markets—which developing markets are—cartel life can be shorter than in stable markets as deviations from the collusive agreement can indeed be very attractive.

We do not provide descriptive statistics for the absolute values of cartels' sales and penalties because the considered countries, their economies, and, eventually, cartels are much diversified in scale. Instead, we find it important to report descriptive statistics of some relative measures, such as the ratio between penalties and excess profits, as well as

TABLE 3.1 Descriptive Statistics of the Collected Sample of Cartels

Variable	Number of observations	Mean	Median	Standard deviation	Minimum	Maximum
Duration (months)	185	46	27	50	1	420
Number of cartel members	200	15	5	37	2	300
Price overcharge (%)	83	23.1	20.0	14.6	2.4	75.0
Penalties/excess profits ratio (%)	72	51.8	19.0	118.2	0.0	950.5

Note: We measure the price overcharge as a percentage of the cartel price. When minimum and maximum bounds for the price overcharge were both known, we used the average between the two.

the price overcharge ratio that we measure with respect to the cartel price. We define a cartel's excess profits as the extra margin resulting from sales at unreasonably higher prices, taking cartel unit sales as a basis.[6]

As table 3.2 shows, the median price overcharge rate in our sample is of the same range as the one estimated for the EU countries (20 percent versus 19.50–22.48 percent) and is only slightly higher than the 16.7–19.0 percent estimated for the United States and Canada.

We also observe that the ratio between penalties and excess profits in our sample has quite extreme ends—it varies from 0 to 950 percent. The lower end can be explained by the fact that not all of the detected cartels were subject to the fine. The reason for the extremely high upper end is that, depending on jurisdiction, penalties can be calculated as a percentage of the total sales of cartel members instead of sales in the relevant market only. Nevertheless, the average for developing countries' ratio remains very low compared to the U.S. level (19 percent against 57 percent) and is just slightly below the EU level of 26 percent (see figure 3.1).

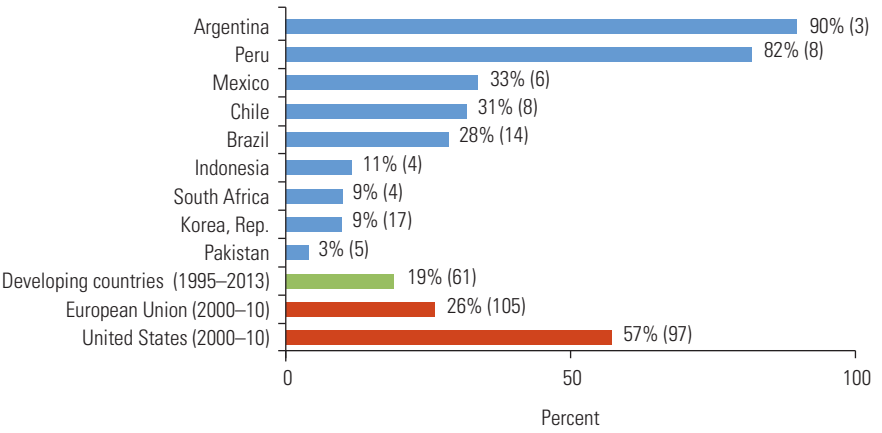
A cartel's stability depends on its ability to prevent deviation by firms, while the benefits of deviation depend, in part, on fines to be imposed in case of detection. Remarkably, on average neither developing nor developed competition authorities recoup excess profits gained by cartel members. According to Hammond (2005) and

TABLE 3.2 Comparison of Cartel Price Overcharges from Existing Studies

Country/group and respective period	Number of observations	Mean (%)	Median (%)
Developing countries (our sample), 1995–2013	83	23.10	20.00
Developing countries (Connor 2010b), up to 2009	33	—	—
China	2	17.42	17.42
Egypt, Arab Rep.	4	20.26	19.61
India	1	16.67	16.67
Korea, Rep.	22	24.01	14.89
Mexico	1	15.25	15.25
Pakistan	1	42.53	42.53
Turkey	2	53.49	53.49
European Union (Connor 2011b), 1990–2010	105	—	19.50
European Union (Connor 2010b), 2000–09	11	28.16	22.48
United States (Connor 2011b), 1990–2010	97	—	19.00
United States and Canada (Connor 2010b), 2000–09	29	39.61	16.67

Note: Estimates from Connor 2010b were originally provided with respect to "but-for" prices, that is, prices that would be observed in the absence of the cartel. These were recalculated with respect to the cartel price to be comparable with the other data in the table.
— = not available.

FIGURE 3.1 Comparison of Penalty-Excess Profits Ratios



Source: Data on the European Union and the United States are obtained from Connor 2011b.

Note: In parentheses we provide the number of cartel cases used to calculate each ratio. Country-level data are given only when the number of observations is more than 2.

Connor (2011a), such a situation should be characterized as "under-punishment" because optimal deterrence of cartel formation requires penalties to be higher than the extra profits resulting from collusive arrangements. At the same time, Allain et al. (2011) argue that the majority of fines imposed by the European Commission can nevertheless be considered as "optimal." The authors' understanding of the optimal deterrence relies on the idea that, for a given probability of detection, the fine should be high enough to wipe out any *expected* profit from the infringement, even if the eventual ratio between the fine and *realized* excessive profits is well below one.

The optimality of a penalty rule that does not require a 100 percent recoupment of the excess cartel profits can be also supported by the following reasoning: on the one hand, by imposing fines, competition authorities try to deter formation of cartels or make it more risky for existing collusion to continue, expecting that a more severe penalty rule will result in a stronger deterrent effect. On the other hand, a penalty that is too high can undermine the firm's ability to be an efficient market player, cutting against the initial goal of restoring fair competition. If a cartel was operating on the market for many years, it might be impossible for the firms to pay back all the extra profits that they have obtained by overcharging.

This chapter does not aim at assessing whether penalty rules in developing countries are optimal or not, nor does it claim that they should follow the example of developed antitrust jurisdictions. What we want to highlight here is that factors that define the optimal antitrust deterrence policy are quite numerous, starting from the very definition of the optimality. Therefore, effective penalty rules indeed can (and, most probably, should) be country specific.

3.3 Estimation of Price Overcharges

3.3.1 Description of the Methodology

The study data on price overcharges constitute a departure point toward the measure of the aggregated economic harm induced by cartelization. We acknowledge that, in the context of developing countries, estimations of price overcharges appear to be very scarce. One of the reasons is that this kind of estimation is usually demanding in terms of time and expertise—this represents a serious constraint for a young competition authority. Besides, to condemn a cartel, antitrust authorities rely mostly on the evidence of coordination activities (such as phone calls, meeting notes, and so on) rather than on economic indications (such as parallel pricing or constant market shares, and the like). To address this issue and to estimate some of the missing price overcharges, we have developed an original methodology that is simple enough to implement in a context of limited data, while having a solid economic basis.

The methodology employs the following approach, applied on a case-by-case basis. Based on the collected cartel data, one first performs the calibration of the supply and demand parameters that are specific to the relevant market. If the cartel operates on several markets, calibration should be performed for each of them separately, given that collected data allow doing so. Having the calibrated demand and supply parameters at hand, one then proceeds with the simulation of hypothetical (counterfactual) competitive equilibrium, that is, market absent cartelization. Finally, by comparing realized and counterfactual (competitive) states, one is able to assess the effect of each particular cartel in terms of price overcharges, volume losses, or even consumers' welfare. Below we explain each of these steps in more detail.

We consider a model that describes the observed equilibrium outcomes (that is, prices and volumes) on the differentiated product market, where firms compete in prices. Differentiating product characteristics—such as, for example, quality—do not depend on prices or volumes and are assumed to be fixed.

Specifically, market demand is derived from a general class of discrete choice models of consumer behavior. The logit specification that we have chosen is simple and flexible enough to obtain the desirable structure of demand. We assume that there are N potential consumers in the relevant market, each of them considering buying one unit of the product from one of J firms that form a cartel. Consumers can also choose the so-called "outside option," which can represent a substitute offered by firms not participating in the cartel, or a decision not to buy at all. We denote the "outside option" with index "0."

The utility of consumer i buying product j is defined as $U_{ij} = \delta_j - \alpha p_j + \nu_{ij}$, where $\delta_j, j = \overline{1,J}$ are parameters of product differentiation (for example, quality or postsales services) that are specific to each product, and p_j is the price of product j. α is the

marginal utility of money, common for all products and consumers, that reflects the sensitivity of consumers to the price relative to how they value quality. Higher α would mean that consumers put a higher weight to the price, rather than the quality characteristic of the product. v_{ij} is the consumer i's idiosyncratic utility component that is specific to product j. It is assumed to be identically and independently distributed across consumers and products.

Consumer i chooses product j if it maximizes her expected utility, such that $U_{ij} > U_{ij'} \forall j' \neq j$. According to Berry (1994), demand for product j can, therefore, be represented by the following equation:

$$\ln(s_j(p)) = 1\mathrm{n}(s_0(p)) + \delta_j - \alpha p_j \tag{3.1}$$

where s_j is a market share of the firm j, s_0 is the share of the outside option, and $p = (p_1, p_2, \ldots, p_J)$ is the price vector.

Or, eventually, by

$$s_j(p) = \frac{\exp(\delta_j - \alpha p_j)}{1 + \sum_{i=1}^{J} \exp(\delta_i - \alpha p_i)}, \ \forall j = \overline{1, J} \tag{3.2}$$

where the utility of the outside option is normalized to zero $\left(U_{i0} = 0, \forall i = \overline{1, N}\right)$.

Note that, since the size of the market is fixed to N, market shares can be easily interpreted in terms of sold quantities and vice versa.

In such a framework, the profit of each firm j is defined by the function $\pi_j(p) = (p_j - c_j)^* s_j(p)^* N$, where c_j are marginal costs that are assumed to be constant.

Further, we employ several hypotheses that help to simplify the model and recover unknown demand and supply functions' parameters. We first presume that cartel participants act in perfect collusion, choosing prices that maximize the joint profit of the cartel. Second, we assume that cartel members agree to fix their gross margins to a certain value that is constant for all firms, such that $(p_j - c_j) = const, \forall j = \overline{1, J}$. Under these assumptions, from the cartel's joint profit maximization problem, it is easy to obtain the following equilibrium condition for the cartelized market:

$$(p_j - c_j) = \frac{1}{\alpha s_0}, \forall j = \overline{1, J}. \tag{3.3}$$

The system of equations that includes (3.1) and (3.3), therefore, fully describes the cartelized market equilibrium $(p_j^{cartel}, s_j^{cartel}), \forall j = \overline{1, J}$. Cartel prices are those observed on the market during the period of cartelization. However, market shares that are employed in the model (denoted further as s_j^{cartel}) are not the same as those observed from the

market data (denoted as $\bar{s}_j^{cartel}$). The latter stand for the market shares within the cartel, while the former take into account the presence of the outside option, such that

$$\bar{s}_j^{cartel} = \frac{s_j^{cartel}}{(1-s_0)} \text{ and } \sum_{j=1}^{J} \bar{s}_j^{cartel} = 1. \tag{3.4}$$

To be able to solve the system of equations composed of (3.1) and (3.3), and by doing so recover unknown parameters, we set two of them exogenously.[7] First, we fix the average cartel margin $AM \equiv \sum_{j=1}^{J} \bar{s}_j^{cartel} \frac{(p_j^{cartel} - c_j)}{p_j^{cartel}}$. Note, that this is equivalent to fixing the level of gross individual cartel margins $(p_j^{cartel} - c_j), \forall j = \overline{1,J}$.[8] The second input that we set exogenously is the market share of the "outside option," denoted as s_0.

Cartel members' gross margins could be extracted from the companies' annual reports, even if often only approximately (due to complexities associated with calculation of marginal costs). Estimation of the market share of the outside option appears more problematic. There is no standard procedure to define the potential market size, and methodologies might differ significantly depending on the product and the market considered. However, independently of the methodology that is chosen, the sum of all market shares, including the one of the outside option, must be always equal to one, that is, $\sum_{j=1}^{J} s_j^{cartel} + s_0 = 1$.

Having set exogenously average cartel margin and the share of the outside option, we first recover parameter α from equation (3.3):

$$\alpha = \frac{1}{s_0(p_j^{cartel} - c_j)} = \frac{\sum_{j=1}^{J} \frac{\bar{s}_j^{cartel}}{p_j^{cartel}}}{AM \times s_0}. \tag{3.5}$$

By substituting all known and calculated variables in equation (3.1), one is able to calculate the parameters of differentiation δ_j.

In the list of inputs set exogenously one can choose to replace the cartel's margin or the share of the outside option with marginal costs if they are known. In this case equation (3.5) will remain valid, and further steps of the methodology will not be affected.

While choosing values of exogenous parameters, one needs to make sure that obtained values of marginal costs and parameter of sensitivity to the price (α) are non-negative.[9] There are no sign restrictions to the values of δ_j.

At this point, from demand equations (3.1) or (3.2), one is able to calculate the set of own- and cross-price elasticities (respectively):

$$\varepsilon_{jj} = -\alpha p_j^{cartel}(1 - s_j^{cartel}), \forall j = \overline{1,J} \tag{3.6}$$

$$\varepsilon_{ji} = \alpha s_i^{cartel} p_i^{cartel}, \forall j, i = \overline{1,J}, i \neq j. \tag{3.7}$$

Obtained estimates for demand price elasticities can be compared against the existing ones from the other sources. This may be seen as an additional cross-validation for the values of exogenous parameters and may result in corresponding corrections.

At the end of the calibration procedure, all missing demand and supply parameters (α, δ_j and $c_j, \forall j = \overline{1,J}$) are recovered. They are assumed to remain the same whether the market is cartelized or not. In what follows we explain in more detail the second step of our methodology—simulation of the counterfactual (competitive) state of the market.

In the absence of collusion, each firm would independently set a price to maximize its profits, taking into account its own marginal costs and expected pricing strategy of competitors. A standard solution for each firm's profit maximization problem would be:

$$p_j - c_j = \frac{1}{\alpha(1 - s_j)}, \forall j = \overline{1,J}. \tag{3.8}$$

Note, that demand equation (3.2) remains valid.

As a solution of the system of equations that describes the competitive market—that is, equations (3.8) and (3.2)—we obtain counterfactual (competitive) prices $p_j^c, j = \overline{1,J}$ and corresponding market shares $s_j^c, j = \overline{1,J}$. By comparing the cartel's prices with competitive prices, we can calculate price overcharge for every cartel member as well as the cartel's average price overcharge:

$$\Delta P\% = \sum_{j=1}^{J} \bar{s}_j^{cartel} \frac{(p_j^{cartel} - p_j^c)}{p_j^{cartel}} \times 100. \tag{3.9}$$

The formula in equation (3.9) gives a price overcharge estimate in percentage, but it can easily be transformed into excessive profits expressed in money terms by multiplying firm-specific price overcharges on the corresponding cartel member's revenues.

The chosen demand function allows calculating also the consumers' welfare in terms of consumers' surplus (see Anderson, de Palma, and Thisse [1992]):

$$CS = \frac{1}{\alpha} \ln\left(1 + \sum_{j=1}^{J} \exp(\delta_j - \alpha p_j)\right). \tag{3.10}$$

Consumers' welfare losses due to price overcharge could, therefore, be calculated as the following:

$$Welfare\ losses(\%) = \frac{\left(\ln\left(1+\sum_{j=1}^{J}\exp\left(\delta_j-\alpha p_j^{c}\right)\right)-\ln\left(1+\sum_{j=1}^{J}\exp\left(\delta_j-\alpha p_j^{cartel}\right)\right)\right)}{\ln\left(1+\sum_{j=1}^{J}\exp\left(\delta_j-\alpha p_j^{c}\right)\right)}\cdot 100\,. \tag{3.11}$$

An obvious advantage of our methodology is that it requires very limited data: it can be employed with only information on prices and market shares of colluding companies observed at least for one point in time during the cartel's existence. On the other hand, the methodology is based on a relatively simple economic model and uses a few assumptions that result in certain limitations. We discuss them below.

First, the demand function is based on a simple logit model, which is quite flexible but has a specific property of Independence of Irrelevant Alternatives. In a nutshell, this property transforms in a particular consumer behavior: motivated by a price increase, consumers would switch to the product with the maximum market share, but not the one with the closest quality characteristics. Indeed, it may not be a true behavioral pattern in reality.

On top of this, calibrated demand and supply parameters can be very sensitive to the level of inputs that are set exogenously. Considering reasonable ranges for these inputs rather than exact values will help in assessing the robustness of obtained calibration outcomes. Additional market expertise, when available, could also help to narrow down the range of calibrated market parameters and, eventually, obtain more precise estimations of price overcharges and consumers' welfare losses.

3.3.2 Application of the Methodology on Selected Cartel Cases

It is unfortunate to acknowledge that competition authorities in developing countries often do not possess even the minimum economic data required to employ the methodology. Or, even if they do, it is often considered confidential. For this reason, it was possible to perform estimations using our methodology only in 11 cartel cases. Results are provided in table 3.3. Annex 3C illustrates the application of the proposed methodology on the price-fixing cartel between civil airlines in Brazil.

The obtained average and median price overcharge rate of 24.02 percent and 18.60 percent, respectively, are of the same magnitude as for the rest of the sample (23.1 percent and 20.0 percent, respectively; see table 3.1). We acknowledge, however, that the difference between the estimated maximum and minimum bounds of price

TABLE 3.3 Estimates of Price Overcharges and Output Losses Obtained with the Use of the Developed Methodology

		Price overcharges		Output losses	
Industry (country)	**Period of existence**	**Minimum Δp (%)**	**Maximum Δp (%)**	**Minimum Δq (%)**	**Maximum Δq (%)**
Civil airlines (Brazil)	Jan'99–Mar'03	3.20	33.90	10.00	24.20
Crushed rock (Brazil)	Dec'99–Jun'03	3.40	11.25	15.69	25.80
Security guard services (Brazil)	1990–2003	4.80	27.84	14.93	23.15
Industrial gas (Brazil)	1998–Mar'04	4.12	29.96	5.00	22.77
Steel bars (Brazil)	1998–Nov'99	5.49	37.84	10.99	27.81
Steel (Brazil)	1994–Dec'99	13.55	40.13	5.00	29.22
Medical gases (Chile)	2001–04	37.50	49.40	2.00	14.93
Petroleum products (Chile)	Feb'01–Sep'02	4.57	9.90	10.43	23.35
Construction materials (Chile)	Oct 20, '06	47.78	83.48	7.24	22.95
Petroleum products II (Chile)	Mar'08–Dec'08	1.78	11.13	9.63	18.99
Cement (Egypt, Arab Rep.)	Jan'03–Dec'06	28.20	39.30	5.00	10.00
Average for the category		**14.04**	**34.01**	**8.68**	**21.94**
Average		**24.02**		**15.41**	
Median		**18.60**		**16.90**	

Note: Price overcharges are measured with respect to the cartelized price, while losses in output are measured with respect to the counterfactual (competitive) state. Minimum and maximum estimated output losses can appear rounded. This is a result of employing rounded values for exogenous inputs.

overcharges and output losses is often large. A competition authority that wants to implement the proposed methodology would certainly obtain greater precision provided it uses the best information on the input parameters.

Analysis of aggregated cartels' impact in the next section includes these additional estimations.

3.4 Aggregated Cartels' Effects

As we illustrated in the previous section, the descriptive statistics of the collected data demonstrate that the anticompetitive impact in terms of price overcharges is at least similar to that in developed countries, which calls for adequate antitrust measures. Young competition authorities, which often lack resources to efficiently fight against collusive practices, are having difficulty in lobbying for a greater budget and, therefore, are constantly looking for strong and motivating evidence of the benefits that their existence brings. We believe that this evidence could be provided by looking at the aggregate measures of cartelization harm that we provide in this section. The approach that we use consists in summing up the obtained cartel case-specific impact estimates in money terms and assessing their significance on the macro-economic level.

Specifically, in our analysis we focus on three aggregate indicators. First, inspired by Levenstein, Suslow, and Oswald (2003), we find it appropriate to consider aggregated sales that were affected by collusive behavior, that is, total revenues received by cartel members. More innovatively, we also assess the direct aggregate cartel damage to consumers in terms of excess profits. Both measures are summed up for all cartels in each particular country and related to the respective GDP. We supplement the discussion with a sort of "cost-benefit" analysis of the antitrust enforcement by relating the aggregated excess profits to the budget of the corresponding competition authority ("CA budget").

In order to obtain more comprehensive aggregated estimates, we fill in the remaining data gaps by applying an additional treatment to the original collected data.

First, for those countries where the competition authority sets the maximum penalty as a percentage of a cartel's sales (for instance, in Brazil, the Republic of Korea, South Africa, Ukraine, and so on), we approximate the missing cartel sales as the respective penalty in money terms divided by the maximum penalty rate.[10] Note that this approach provides an estimate of the minimum value of the cartel's sales. The penalty in those cases is set based on the sales recorded in the year preceding the one in which the court decision on the case was made. Therefore, the minimum approximated cartel sales need to be further multiplied by cartel duration in years.

Second, when the price overcharge was unknown and it was not possible to employ the proposed methodology to estimate it, we roughly approximated the cartel's excess profits by multiplying the sample median overcharge rate and cartel sales. In case cartel sales were missing, we assumed the cartel's excess profits as equal to applied penalties. Recall that, according to table 3.1, applied penalties do not, on average, compensate for the excess profits gained by cartel members. Therefore, this approximation provides a minimum level of a cartel's excess profits. Knowing the minimum level of a cartel's excess profits allowed, in turn, recovering the missing cartel sales by applying the median price overcharge rate.

Finally, to make the nominal values such as sales, excess profits, penalties, and CA budgets comparable among different years, we apply relevant denominators to take into account money depreciation.

The above data treatment was applied for cartels in countries with relatively sufficient data—namely Brazil, Chile, Colombia, Indonesia, Korea, Mexico, Pakistan, Peru, the Russian Federation, South Africa, Ukraine, and Zambia. The selection criterion is basically the availability of quantified impacts of cartels that represent a significant part of all detected cases in the country, except for Zambia, whose only quantified cartel had a tremendous economic impact.

For the countries in table 3.4 we provide the breakdown of recorded cartel cases, indicating the number of those for which the impact was quantified. Information in

TABLE 3.4 Availability of Quantified Impacts of Detected Cartels

Country (period)	Number of cartels recorded	Number of cartels with data on sales	Number of cartels with data on overcharges	Number of "allocated" cartels
Brazil (1995–2005)	18	17 (1)	17 (3)	17
Chile (2001–09)	17	16 (6)	16 (7)	16
Colombia (1997–2012)	18	17 (17)	17 (17)	17
Indonesia (2000–09)	12	8 (0)	8 (1)	7
Korea, Rep. (1998–2006)	26	26 (0)	26 (8)	26
Mexico (2002–11)	17	17 (9)	17 (11)	17
Pakistan (2003–11)	14	14 (6)	14 (9)	14
Peru (1995–2009)	11	10 (2)	10 (2)	10
Russian Federation (2005–13)	15	11 (10)	11 (11)	11
South Africa (2000–09)	37	23 (7)	23 (18)	23
Ukraine (2003–12)	7	7 (6)	7 (7)	3
Zambia (2007–12)	7	1 (0)	1 (0)	1

Note: The numbers in parentheses refer to the number of cases for which corresponding missing inputs were approximated by means of the treatment discussed in the text. An "allocated" cartel is one for which at least beginning or breakdown year was known.

parentheses refers to the number of cases for which corresponding missing inputs were approximated by means of the treatment already discussed. We employ the term "allocated" for those cartels for which we were able to associate sales and excess profits with a certain year, that is, when at least the cartel's beginning or breakdown year was known.

For these twelve countries we calculated the three selected indicators—aggregated excess profits and affected sales, both related to GDP, as well as aggregated excess profits related to the budget of the relevant competition authority.

Looking at the year-to-year dynamics of these indicators would be misleading because both ends of each considered period have a high risk of not being representative—either because of a low activity of the competition authority in the beginning or because the end of the period is often characterized by multiple ongoing cartel investigations that do not make part of our study. For the same reason, average indicators can also be biased. Thus, we find it important also to report, on top of average values, maximum values of each indicator together with the year that it corresponds to. Table 3.5 summarizes obtained results.

The results confirm that cartels' impact in developing economies can indeed be substantial. In terms of affected sales related to GDP, it varies among countries from 0.01 to 3.74 percent on average for the considered periods, whereas its maximum value reaches up to 6.38 percent for South Africa in 2002. Remarkably, calculations for

TABLE 3.5 Estimates of Aggregated Economic Harm Caused by Cartelization

	Aggregated excess profits/GDP (%)		Affected sales/ GDP (%)		Ratio of aggregated excess profits to CA budget	
Country (period)	Average	Maximum (year)	Average	Maximum (year)	Average	Maximum (year)
Brazil (1995–2005)	0.21	0.43 (1999)	0.89	1.86 (1999)	308	1,232 (1998)
Chile (2001–09)	0.06	0.23 (2008)	0.92	2.63 (2008)	23	91 (2008)
Colombia (1997–2012)	0.001	0.002 (2011)	0.01	0.01 (2011)	7	36 (2006)
Indonesia (2000–09)	0.04	0.09 (2006)	0.50	1.14 (2006)	29	58 (2004)
Korea, Rep. (1998–2006)	0.53	0.77 (2004)	3.00	4.38 (2004)	144	214 (2004)
Mexico (2002–11)	0.01	0.02 (2011)	0.05	0.11 (2011)	7	19 (2011)
Pakistan (2003–11)	0.22	0.56 (2009)	1.08	2.59 (2009)	245	518 (2008)
Peru (1995–2009)	0.002	0.01 (2002)	0.01	0.02 (2002)	6.44	25 (2004)
Russian Federation (2005–13)	0.05	0.12 (2012)	0.24	0.67 (2012)	0.58	1.45 (2008)
South Africa (2000–09)	0.49	0.81 (2002)	3.74	6.38 (2002)	124	214 (2005)
Ukraine (2003–12)	0.03	0.03 (2011)	0.15	0.16 (2011)	0.84	0.88 (2011)
Zambia (2007–12)	0.07	0.09 (2007)	0.18	0.24 (2007)	11	27 (2007)
Average	**0.14**		**0.90**		**76**	

Note: CA = competition authority.

Zambia are based on only one cartel for which data are available (market of fertilizers, 2007–12); but, even taking this into consideration, the impact is not negligible (0.24 percent of GDP in terms of affected sales). Actual harm to consumers in terms of aggregated cartels' excess profits is also significant, with maximum rates reaching almost 1 percent in terms of GDP for Korea in 2004 and South Africa in 2002.

We also find that aggregated cartel excess profits exceed the CA budgets on average 76 times and can reach up to 1,232 times (see the last two columns in table 3.5).[11] Data on budgets that we have collected include expenses for all activities of a given competition authority, including merger investigations that are traditionally highly demanding in terms of resources. Therefore, the cartel-specific efficiency rate can turn out significantly higher.

These results can be considered as lower-bound estimates for the economic harm caused by collusive infringements in developing countries. This is so for multiple reasons. First of all, not all of the detected cartels were taken into account. Even though some competition authorities agreed to cooperate, the authors have to acknowledge that the list of prosecuted hard-core cartels for every country is still not complete, nor were all the required data obtained for each of the recorded cases. Out of 249 defined cases, only 83 have data on price overcharges and 114 on cartels' sales. As table 3.4 illustrated, many recorded cases were excluded from calculations of the aggregate

effects because of missing data. Second—and, perhaps, most important—some of the existing cartels remained uncovered. To assess how far (or how close) we are from understanding the real scale of the damage caused by cartelization, in the next section we estimate the maximum bound for the deterrence rate, that is, the annual probability of a cartel to be detected. To our knowledge this is the first attempt to do so on a sample of cartels detected in developing countries.

3.5 Estimation of the Deterrence Rate

To estimate the deterrence rate, we have adopted the approach proposed in Combe, Monnier, and Legal (2008). We did not modify their methodology; therefore, only a brief description of the main idea and results of its application on our database will be provided. In a nutshell, the authors consider a Markovian process with two elements that are related to the cartel's birth and death, the latter being associated with the cartel's detection. Cartels' interarrival time and duration between their birth and detection are both random variables distributed exponentially and independently across cartels.[12] The model allows estimating the instantaneous probability of cartel detection through the maximum likelihood estimation method. Because the sample naturally contains only cartels that were detected, the estimated probability is conditional on the cartel eventually being detected. This value, therefore, represents the maximum bound of the global instantaneous probability of cartel detection (the sought-for deterrence rate).

In our sample, the maximum annual probability of cartel detection is estimated at 24 percent. It is significantly higher than the upper bound of the same probability estimated by Combe, Monnier, and Legal (2008) for the EU cartels prosecuted from 1969 to 2007 (12.9–13.3 percent).[13] A lower deterrence rate for the EU can be explained by inclusion into consideration of earlier years characterized by weaker antitrust enforcement. An additional explanation can be also offered. When cartel members are international corporations, they often enter collusive agreements in several, often neighboring, developing countries. Apart from the famous vitamins cartel, the sample includes, for instance, medical gas distribution cartels prosecuted in Argentina, Brazil, Chile, Colombia, and Mexico in the late 1990s–early 2000s, or cement cartels that have existed over the last 30 years in Argentina, the Arab Republic of Egypt, Korea, Mexico, South Africa, and other developing countries. Evidence of cartel activities provided by competition authorities in other countries may serve as a trigger for local investigations and can facilitate cartel detection, increasing, therefore, the deterrence rate.

A maximum deterrence rate of 24 percent basically means that *at least* three out of four existing cartels remain uncovered. Therefore, we suggest that the actual economic harm caused by hard-core cartels in developing countries exceeds our estimations from the previous section at least fourfold.

3.6 Conclusions and Policy Implications

Competition policy implementation and enforcement, including cartel deterrence and detection, require substantial investments. Therefore, it is important to measure to what extent those costs are outweighed by the damages prevented to consumers. This is especially relevant for developing competition authorities, which often experience tough budget constraints.

To provide the required evidence we have collected an original dataset that contains information on 249 major hard-core cartels that were prosecuted in more than 20 developing countries from 1995 to 2013. Descriptive statistics of the collected data do not bring any strong evidence to the widespread idea that developing countries are exposed to higher cartel price overcharges than the developed ones. However, we do show that price overcharges are at least similar, which calls for adequate antitrust measures. We also show that the aggregated economic impact can be substantial. In terms of affected sales related to GDP, the maximum rate reaches up to 6.38 percent (South Africa in 2002). The actual damage in terms of cartels' excess profits is also significant, with maximum rates reaching almost 1 percent of GDP (Korea in 2004 and South Africa in 2002).

A study by Boyer and Kotchoni (2014) demonstrates, based on the sample from Connor (2010b), that data on price overcharges obtained from different methodologies, sources, and contexts are asymmetric and heterogeneous and, therefore, are subject to a significant estimation bias. Nonbiased estimates are, in fact, lower than simple medians calculated from the raw data. For example, bias correction reduces median price overcharge for the EU countries from 22.48 to 14.04 percent and from 16.67 to 13.58 percent for the United States and Canada.[14] Therefore, ideally, our own sample would require similar corrections to be made. We, nevertheless, highlight that our aggregate damage estimates correspond to their very minimum bound. This is so because of at least six reasons.

First, the present study takes into consideration only cartel cases that are already closed. It therefore does not take into account cases that were still under investigation when our study was held.

The second reason is that data on convicted cartels that are used to quantify their economic effects are very poor. This is so because, to condemn a cartel, competition authorities rely mostly on the evidence of coordination activities rather than on the economic indicators. This, coupled with confidentiality issues, resulted in elimination of multiple recorded cases from the calculation of aggregate economic harm.

Third, our study does not take into account the output effects. Collusive practices harm consumers not only in terms of inflationary effects, but also because they limit consumption. Our analysis demonstrates that, on average, a cartel decreases the

production level by about 15 percent (see table 3.3). Taking these output effects into account would provide more accuracy for the estimations.

Fourth, on top of this, our estimates do not take into account either price umbrella effects[15] among noncartel members, or possible degradation in quality as a result of reduced competition among cartel members.[16]

The fifth reason is that many of the cartelized industries produce intermediary goods, such as, for instance, cement or gas. Therefore, the consequent price overcharge may proliferate further on other economic sectors, increasing the final impact manifold. By employing the country-level input-output matrices and corresponding industry pass-through rates together with estimated cartel excess profits, one would be able to (i) assess the potential impact of those proliferations, and (ii) define a set of industries that have the highest potential for creating damages and therefore deserve special attention from the competition authority. We find this to be a very promising area for further development.

The final, but probably the most important, reason for our estimates to reflect only the minimum of damages is the hidden nature of cartels. Because we estimate the maximum annual probability of uncovering an existing cartel to be around 24 percent, we suggest that the actual economic damage resulting from collusive practices in developing countries is at least four times bigger than suggested by our estimations.

We have also demonstrated that even this minimum estimated economic harm for the majority of considered countries significantly exceeds the expenditures to maintain the functionality of the relevant antitrust body. This may be seen as sought-for evidence for the competition authorities who wish to justify the requirement for additional money to improve cartel deterrence and detection. More than that, developing competition authorities may wish to take advantage of the proposed methodology for their own cartel investigations because it will reduce the data required to estimate the economic damages. The efficiency of the penalty rule can be then assessed by comparing the imposed fines with cartels' excess profits. Actual penalty-excess profits rates could be compared against relevant benchmarks that are considered as optimal by the competition authority.

The created cartels database may be seen as a reference list containing industries that are potentially vulnerable to collusive behavior. International cartel members often enter into collusive agreements in multiple, often neighboring, economies. Therefore, evidence from other countries can (and should) be employed by competition authorities in local investigations. This may encourage countries to create a worldwide platform that would allow, for instance, sharing and maintaining a common cartel database.

Annex 3A: Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013

Cartel case	Period of existence
Argentina	
Portland cement	1981–99
Medical gases	n/a–1997
Health care services	n/a
Liquid petroleum gas (S.C. Bariloche)	Jan'98–Dec'98
Sand (Paraná city)	Jun'99–Jul'01
Liquid oxygen	Jan'97–Dec'01
Cable TV (Santa Fe city)	Oct'97–Dec'01
Cable TV service (football transmissions)	Jan'96–Dec'98
Brazil	
Civil airlines	Jan'99–Mar'03
Retail fuel dealers (Goiânia)	Apr'99–May'02
Retail fuel dealers (Florianópolis)	1999–2002
Retail fuel dealers (Belo Horizonte)	1999–2002
Retail fuel dealers (Recife)	Apr'99–Feb'02
Generic drugs	Jul'99–Oct'99
Maritime hose	Jun'99–May'07
Crushed rocks	Dec'99–Jun'03
Security guard services	1990–2003
Hermetic compressors	2001–09
Industrial gas	1998–Mar'04
Air cargo	Jul'03–Jul'05
Transportation	Oct'97–Jan'01
Steel bars	1998–Nov'99
Construction materials (sand)	1998–Apr'03
Steel	1994–Dec'99
Blood products	Jan'03–Dec'03
Toy manufacturers (imports from China)	2006–09
Chile	
Petroleum products	Feb'01–Sep'02
Medical gases (oxygen)	2001–04
Medical insurance plans	2002–04
Medical services	May'05–May'06

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
Chile *(continued)*	
Construction materials (asphalt)	Oct 20, '06 (bid rigging)
Public transportation (bus)	2006; Nov'07–May'08
Petroleum products	Mar'08–Dec'08
Vehicles and spare parts	Aug 11, '06 (bid rigging)
Publishing services	Mar'08–Apr'08
Pharmaceuticals (distribution)	Dec'07–Apr'08
Public transportation	Oct'06–Nov'07
Radio transmission	2007
Tourism (agent services)	2008
Public transportation (maritime)	2009
Public transportation (bus)	Feb'07–Mar'09
Flat-panel TV	n/a
Colombia	
Cement	Feb'06–Jan'10
Mobile phone services	Apr'99–Aug'07
Green onions	Feb'07–Jan'09
Pasteurized milk	Jan'97–n/a
Green paddy rice	Jan'04–Nov'06
Chocolate and cocoa products	Oct'06–Oct'09
Private security services	Feb'11–Sep'12
Services of grade systematization (Bogotá District schools)	Jun'08–Dec'09
Milk processing	n/a–2008
Health services	Mar'09–Nov'11
Oxygen supply	May'05–Mar'11
Road paving	Aug'10–Jan'12
Sugar cane remuneration rates	Feb'10–Aug'11
Cars' techno-mechanical and gas review	Mar'10–Oct'11
Cars' techno-mechanical and gas review	Mar'10–Dec'11
Feed ration service for prisons	May'11–Sep'12
Cars' techno-mechanical and gas review	Apr'10–Mar'12
TV advertising market	Apr'10–Apr'11
Egypt, Arab Rep.	
Construction (Egypt Wastewater Plant)	Jun'88–Sep'96
Cement	Jan'03–Dec'06

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
El Salvador	
Petroleum products	n/a–2007
Indonesia	
Mobile phone services	Mar'03–Nov'05
Short Message Service (SMS)	Jan'04–Apr'08
School books	Jan'99–Dec'00
Cement	n/a–Dec'09
Airlines	Jan'06–Dec'09
Pharmaceuticals	n/a
Poultry (day-old chickens)	Jan'00–Dec'00
Sea cargo (Jakarta-Pontianak)	Jun'02–Oct'03
Sea cargo (Surabaya-Makassar)	Jan'03–Sep'03
Public transportation (city bus)	Sep'01–Oct'03
Salt trade (North Sumatra)	Jan'05–Dec'05
Sea cargo (Sorong seaport)	Mar'00–Nov'08
Kazakhstan	
Petroleum products (brokers)	2002–05
Kenya	
Coffee producers	n/a
Fertilizers I	n/a–2003
Beer (production)	n/a–2004
Soft drinks	n/a–2004
Transportation	n/a
Mechanical engineering services	n/a
Insurance (transportation sector)	n/a–2002
Petroleum (retail)	n/a–2004
Fertilizers II	n/a–2011
Tea growers	n/a–2004
Sugar	n/a–2004
Port Customs Department auctions	n/a
Republic of Korea	
Batteries manufacturing (auto)	Jun'03–Sep'04
Beer	Feb'98–May'99
Cement	Jan'02–Mar'03
Construction machinery (excavators)	May'01–Nov'04

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
Republic of Korea *(continued)*	
Forklift manufacturing	Dec'99–Nov'04
Petroleum products (military, wholesale)	1998–2000
Telecom services (local, landline)	Jun'03–May'05
Telecom services (long-distance, landline)	Jun'03–May'05
Telecom services (international, landline)	Jun'03–May'05
Broadband Internet service	Jun'03–May'05
Detergent manufacturing	1998–2006
Telecommunications (mobile services) I	Jun'04–May'06
Telecommunications (mobile services) II	Jan'00–Jul'06
Gasoline and diesel (refining)	Apr'04–Jun'04
Industrial motors	1998–2006
Polyethylene (low density)	Apr'94–Apr'05
Polypropylene (high-density polyethylene)	Apr'94–Apr'05
Movie tickets	Mar'07–Jul'07
Trunked radio system devices	Dec'03–Feb'06
Petrochemicals	Sep'00–Jun'05
Copy paper imports	Jan'01–Feb'04
Soft drink bottling	Feb'08–Feb'09
Gas (liquefied petroleum gas)	Jan'03–Dec'09
Elevators and escalators	Apr'96–Apr'06
Toilet roll manufacturing	Mar'97–Jan'98
Coffee	Jul'97–Jan'98
Malawi	
Cotton farmers	n/a
Tea growers	n/a
Tobacco growers	n/a
Bakeries	n/a
Beer	n/a
Petroleum sector	n/a
Mauritius	
Travel agency	2010

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
Mexico	
Gas (liquid propane)	Jan'96–Feb'96
Chemicals (film development)	Jan'98–Dec'00
Poultry	Mar'10–Mar'10
Boiled corn and corn tortillas	Mar'11–Jul'12
Corn mass and tortillas	May'10–Aug'12
Transportation (touristic sector)	Jul'09–Mar'12
Anesthesiology (services)	May'03–May'09
Auto transportation (cargo) I	Jan'10–Sep'11
Maritime public transportation	Jun'08–Jun'12
Auto transportation (cargo) II	Sep'08–Jun'10
Health care (medical drugs)	2003–05
Consulting services (real estate)	Jul'03–Apr'09
Restricted TV signal	Oct'02–Dec'08
Food vouchers	Aug'05–Sep'05
Consulting services (real estate) II	May'03–Jul'09
Railway transportation (cargo)	Nov'05–Jun'09
Cable and cable products	Feb'06–Mar'07
Pakistan	
Bank interest rates	Nov'07–Apr'08
Cement	Mar'08–Aug'09
Gas (liquefied petroleum gas)	n/a–2009
Jute mills	2003–Jan'11
High- and low-tension prestressed concrete poles	Aug'09–May'11
Poultry and egg industry	2007–Aug'10
Newspapers	Apr'08–Apr'09
Vessels handling (ships)	2001–Mar'11
Port construction	May'09–Jul'10
Ghee and cooking oil	Dec'08–Jun'11
Accounting services	Apr'07–Jan'13
Long-distance and international operators	Sep'11–Apr'13
Gulf Cooperation Council–approved medical centers	Jan'11–Jun'12
Banking services (1-Link Guarantee Ltd)	Sep'11–Jun'12
Peru	
Urban public transportation I	Aug'08–Oct'08
Urban public transportation II	Aug'08–Oct'08

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
Peru *(continued)*	
Public notaries	n/a
Dock work	Sep'08–May'09
Insurance I	Dec'01–Apr'02
Insurance II	Oct'00–Jan'03
Poultry	May'95–Jul'96
Wheat flour	Mar'95–Jul'95
Heaters/boilers, etc., manufacturing	Oct'95–Mar'96
Oxygen distribution (health care)	Jan'99–Jun'04
Freight transport	Nov'04–May'09
Russian Federation	
Fuel (gasoline and jet)	Apr'08–Jul'08
Laptop computer operating systems	n/a
Fuel (petroleum, Krasnodarki Krai)	Jan'05–Jul'05
Fuel (petroleum, Rostov-on-Don)	n/a–2005
Airlines (Nizhnevartovsk-Moscow flights)	n/a–Dec'05
Railway transportation (Kemerovo)	Oct'11–Dec'12
Soda cartel	2005–12
Polyvinylchloride cartel	2005–09
Pharmaceutical cartel	2008–09
Fish cartel (Norway)	Aug'11–Dec'12
Pollock cartel	Apr'06–Dec'12
Fish cartel (Vietnam)	Jun'08–Sep'13
Salt cartel	May'10–May'13
Sausage cartel	Jun'09–Dec'09
Military uniform supply	2010–Jun'12
South Africa	
Fertilizers (phosphoric acid)	Jan'03–Dec'07
Airlines (fuel surcharge)	May'04–Mar'05
Airlines (South Africa-Frankfurt routes)	Jan'99–Dec'02
Milk (farm and retail)	n/a–Jul'06
Bread and flour	1994–2007
Pharmaceuticals (wholesale distribution)	1998–2007
Tire manufacturing	1998–2007
Metal (scrap)	Jan'98–Jul'07

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
South Africa *(continued)*	
Steel (flat)	1999–Jun'08
Cement I	1996–2009
Plastic pipes	1998–2009
Concrete, precast pipes, culverts, manholes, and sleepers	1973–2007
Fishing	n/a–2009
Cement II	Jan'04–Jun'09
Construction	n/a–2009
Steel distribution	n/a–2008
Steel (rebar, rods, and sections)	n/a–2008
Steel (wire, wire products)	2001–08
Crushed rock	n/a–2008
Bricks	n/a–2008
Steel (tinplate)	Apr'09–Oct'09
Steel (mining roof bolts)	2002–09
Flour milling	2009–Mar'10
Bitumen	2000–09
Poultry	2005–09
Polypropylene plastic	1994–2009
Sugar	2000–n/a
Taxi	n/a
Auto dealers	2005–n/a
Health care fees	2002–07
Pharmaceuticals	n/a–2002
Motor vehicle manufacturers/importers	n/a–2006
Freight forwarding	n/a–2007
Energy/switchgear	n/a–2008
Fertilizer (nitrogen)	2004–06
Steel (reinforcing mesh)	2001–08
Soda ashes (imports)	1999–2008
Tanzania	
Beer	n/a
Pipes, culverts, manholes, and prestressed concrete sleepers	n/a–2009
Petroleum sector	n/a–2000
Turkey	
Daily newspapers	n/a
Traffic lights	n/a

(Table continues on the following page.)

TABLE 3A.1 Major "Hard-Core" Cartels Prosecuted in Selected Developing Countries, 1995–2013 *(continued)*

Cartel case	Period of existence
Turkey *(continued)*	
Public transportation (buses)	n/a
Poultry	n/a
Bakeries	n/a
Beer	n/a
Soft drinks	n/a
Maritime transport service	n/a–2004
Mechanical engineers	n/a
Insurance	n/a–2003
Telecommunications	n/a–2002
Architectural and engineering services	n/a–2002
Yeast	n/a
Cement	n/a
Cement (Aegean region)	2002–04
Accumulators	n/a
Ukraine	
Acquisition of raw timber auctions (furniture)	2011
Sale of poultry meat	n/a
Sale of sugar	n/a
Sale of alcohol	n/a
Sale of buckwheat	n/a
Individual insurance markets	2003
Sales of arrested property	2004
Zambia	
Pipes, culverts, manholes, and prestressed concrete sleepers	n/a
Oil marketing	2001–02
Fertilizer	2007–13
Grain procurement and marketing (maize-meal)	Mar'04–Jun'04
Public transport	n/a
Poultry	1998–99
Panel beating services	Sep'11–Dec'11
Zimbabwe	
Bakeries	n/a

Note: n/a = not available.

Annex 3B: Questionnaire Submitted to Local Competition Authorities

FIRST PART. General questions.

1. Please provide the annual budget of the competition policy enforcement unit during the period 1995–2013 (in local currency).

SECOND PART. Identification of cartels.

1. Please provide a list of major "hard-core" cartels for the period 1995–2013.
2. For each identified cartel, provide information on:
   a. Relevant market (product, geography, etc.)
   b. Names of cartel members
   c. Period of existence of the cartel (beginning/termination)
   d. Date of discovery of the cartel
   e. Date of entry of each company in the cartel coalition, if available
   f. Fines applied, if any (in local currency)
   g. Price overcharge by cartel members, if available (percentage with respect to the cartel price or money terms in local currency).

THIRD PART. Economic data on each cartel identified in the second section of the questionnaire.

1. At least for one period (month/year) of cartel existence indicate the market share/volume sold and price (in local currency) of the product/products for each colluding company.
2. If possible, give an estimation of the average margin for the cartel = (price − marginal costs)/price.
3. Please provide, when available, the estimate of the volume of the relevant market (in local currency), if not:
4. According to the good that is analyzed, please provide an estimation of the total market share of the non-cartel members on the relative market.

Annex 3C: Example of the Calibration and Estimation Procedure: Civil Airlines in Brazil

Four national airlines in Brazil, namely Varig, TAM, Transbrasil, and VASP, were convicted in collusive price-fixing behavior on the civil air transportation market between Rio de Janeiro (Santos Dumont Airport) and São Paulo (Congonhas Airport) during 1999. We do not go into detail concerning the evidence that the Brazilian competition authority employed to convict the airlines but rather will focus on the estimation of the economic harm to consumers caused by this anticompetitive practice.

Table 3C.1 provides the collected data regarding the observed one-way ticket prices charged by cartel members, as well as their observed market shares (based on number

TABLE 3C.1 Available Input Data, July 1999

Airline	Observed market share (%)	Average price of a one-way ticket (reals[a])
VARIG	46.6	129.32
TAM	41.5	124.90
Transbrasil	6.5	106.85
VASP	5.4	108.03

Source: Conselho Administrativo de Defesa Econômica (the competiton authority of Brazil).

a. Real = Brazilian national currency.

of tickets sold). These are the minimum data that are sufficient to implement our methodology and recover the price overcharges.

We recognize that it would be more correct to separate leisure and business segments of the demand, which would obviously have different sensitivities to price (parameter α); however available data did not permit us to do so. Given that the share of the business segment in the relevant market reaches up to 70 percent, we believe that recovered market parameters will correspond mostly to this demand category.

As the developed methodology implies, to perform calibration of supply and demand parameters we need to set the share of the outside option (s_o) and average cartel margin exogenously. We use additional data on the case to set the admissible ranges for these parameters.

The considered airports are the only ones situated close to the city centers of Rio de Janeiro and São Paulo, which makes them especially relevant for business passengers. In addition, there are no convenient substitutes, such as sufficiently fast trains or buses. The airlines that formed the cartel performed nearly 100 percent of the flights between the mentioned airports during the considered period. Therefore, one can assume that the share of the outside option for the business segment cannot be too big. However, the presence of the leisure segment and other airports serving the same origin and destination cities suggest that s_o cannot be too low either. We arbitrarily choose the admissible range for the share of the outside option as $s_o \in [10\%, 50\%]$.

As for the second exogenous parameter—average cartel margin—we first make use of the results in Betancor and Nombela (2001), which demonstrate that marginal costs of the U.S. and European airlines are at least equal and at most twice higher than their average costs. We assume further that Brazilian airlines' cost structure is not much different from that in Europe and the United States. Having extracted average costs from the annual reports of the colluding companies, we get 40 percent as a maximum value for the average margin (when marginal costs are equal to average costs). Given that the airlines' activities on the relevant market include also those non-cartelized, we assume that the possible margin on the cartelized market could have an upper bound above 40 percent. After a final check with sign constraints for marginal

costs and price sensitivity parameter α, we define a permitted range for the average cartel margin as [10%, 45%].

When one changes the level of external parameters, calibrated market parameters also change. Along with the minimum and maximum bounds for exogenous parameters, considering some intermediary values might be also reasonable if an analyst has an idea about their most probable values inside the chosen interval. In table 3C.2 we provide calibrated price sensitivity α depending on the average cartel margin and share of the outside option: for minimum, maximum, and some intermediary values of external parameters. These dependencies are monotonic. We also report corresponding calibrated values of $\delta_j, j = \overline{1,J}$ in table 3C.3.

We observe that calibrated parameter α and $\delta_j, j = \overline{1,J}$ decrease when the share of the outside option increases, margins being fixed. This dependence follows directly from equations (3.1) and (3.5) and can be explained as follows: lower α indicates that preferences of consumers are driven mostly by quality rather than prices. Lower δ_j, therefore, result in a higher number of consumers who preferred the outside option because its utility is normalized and remains fixed. α also decreases with higher cartel margin—when consumers are less sensitive to the price, cartel members have more incentives to charge a higher price.

For the set of calibrated market parameters, we further perform the simulation of the counterfactual (competitive) state.[17] Tables 3C.4 and 3C.5 report the average for the

TABLE 3C.2 Calibrated Price Sensitivity Parameter (α)

		Average cartel margin (%)			
		10	**20**	**35**	**45**
Share of the outside option (S_0) (%)	**10**	0.80	0.40	0.23	0.18
	20	0.40	0.20	0.11	0.09
	35	0.23	0.11	0.07	0.05
	50	0.16	0.08	0.05	0.04

Source: Authors' simulations

TABLE 3C.3 Calibrated Parameters of Differentiation (δ_j)

	Average cartel margin (%)/Share of the outside option (%)			
Airline	**10/10**	**45/10**	**10/50**	**45/50**
VARIG	105.22	24.42	20.02	3.86
TAM	101.66	23.62	19.19	3.58
Transbrasil	85.30	18.54	14.43	1.08
VASP	86.06	18.56	14.44	0.94

Source: Authors' simulations

TABLE 3C.4 Estimated Price Overcharge
Percent

		Average cartel margin (%)			
		10	20	35	45
Share of the outside option (S_0) (%)	10	7.3	14.7	26.2	33.9
	20	4.5	9.2	13.6	21.8
	35	4.8	8.7	18.2	20.8
	50	3.2	6.5	14.2	18.9

Source: Authors' simulations
Note: Price overcharge is reported for the cartel on average.

TABLE 3C.5 Estimated Consumer Welfare Losses
Percent

		Average cartel margin (%)			
		10	20	35	45
Share of the outside option (S_0) (%)	10	78.6	78.6	78.6	78.6
	20	66.1	66.1	65.8	66.2
	35	50.4	48.0	52.8	49.5
	50	35.0	35.2	41.2	42.2

Source: Authors' simulations

cartel price overcharge rates (equation (3.9)), and consumers' welfare losses (equation (3.11)) estimated for a given combination of values of exogenous parameters.

Variations of the obtained estimations of price overcharges and welfare losses according to the level of external parameters are intuitive. On one hand, when the cartel margin is being fixed, a high share of the outside option informs the analyst about a high elasticity of demand. In these conditions, the ability of colluding firms to increase their prices is rather limited. Accordingly, welfare losses are also less significant. On the other hand, keeping the share of the outside option fixed, a higher desired cartel margin naturally transforms into a greater price increase when compared to a competitive state of the market. However, in this case no definite conclusion can be made concerning the relative change in consumers' welfare.[18]

We acknowledge that variations of the estimates in tables 3C.4 and 3C.5 are quite large. Price overcharge varies from 3.2 percent to 33.9 percent, while the welfare loss estimates range from 35.0 percent to 78.6 percent. A greater precision can be gained provided that more precise inputs concerning the relevant market are at hand.

Notes

1. Collusive behavior could be granted an exemption by the competition authority if it is shown to be beneficial for consumers or necessary for firms' survival in given economic conditions. This was, for instance, the case of the mixed concrete industry cartel in the Republic of Korea in 2009.

2. We have used the list of developing countries from the International Monetary Fund's *World Economic Outlook Report*, April 2010.
3. Private International Cartels database by John M. Connor, Purdue University, West Lafayette, Indiana (March 2009).
4. We wish to thank, for fruitful cooperation, competition authorities from Brazil, Chile, Colombia, Indonesia, the Republic of Korea, Mauritius, Mexico, Pakistan, Peru, the Russian Federation, South Africa, Ukraine, and Zambia, as well as UNCTAD RPP initiative coordinators.
5. Median values are more convenient to consider because the data are skewed and contain a few outliers with number of cartel participants more than 200 and duration of more than 150 months that renders mean values uninformative.
6. We understand that in some cases this can result in a slightly overestimated estimate of excess profits as output effect is not taken into account. Output effect refers to either reduction in sold quantities of the good due to the overall hike in market prices in the presence of a cartel, or deliberate limitation of quantities by cartel members in order to increase prices.
7. The system comprises 2J equations and 2J + 2 unknown parameters.
8. Recall that the margin constant for all cartel participants is one of the basic assumptions of the methodology. Keeping this in mind, when market shares and prices are known, it is easy to recover average cartel margin from the gross individual margins, and vice versa:

$$AM \equiv \sum_{j=1}^{J} \bar{s}_j^{cartel} \frac{\left(p_j^{cartel} - c_j\right)}{p_j^{cartel}} = \underbrace{\left(p_j^{cartel} - c_j\right)}_{\text{constant for all } j} \sum_{j=1}^{J} \frac{\bar{s}_j^{cartel}}{p_j^{cartel}}.$$

9. Marginal costs are calculated from margins, either average for the cartel or firm-specific ones.
10. For example, if a cartel was fined US$100 and the maximum penalty rate is 10 percent of the cartel's sales, then the minimum bound for the cartel's sales can be estimated as 100/0.1 = US$1,000. Because the percentage penalty rule is sometimes applied to a company's total sales, we have employed, where needed and where possible, a coefficient that corresponds to the share of sales on the relevant market in total company sales.
11. Note that a high level of excess cartel profits related to the competition authority budget does not necessarily witness for the efficiency of the antitrust enforcement. First, a low level of the ratio in question can result from a high efficiency of the competition authority if the latter focuses on cartel deterrence (education through mass media or higher penalties, and so on) rather than on cartel detection. A low number of detections or lower excess profits can simply reflect the fact that there exist fewer cartels or that they are weaker. Second, competition authorities can free ride on the experience of others. By "free riding" we mean a situation in which a cartel case already went through an examination in one of the competition authorities, and the others use this fact to trigger investigations of their own or even use the already collected evidence. Therefore a competition authority can win the case without investing too much. As the collected sample demonstrates, free riding can indeed take place—the same cartels are often found in a large number of (often neighboring) countries. For example, this is the case of industrial gas distribution cartels in Latin America or cement cartels in Africa. However, free riding can potentially be considered as a sort of efficiency because it is a way of optimizing available resources.
12. To see whether our data fit model assumptions of independency and exponential distribution we performed the same testing as in Bryant and Eckard (1991). Corresponding estimation results and graphs are available upon request.
13. The maximum bound for the annual deterrence rate of 13–17 percent was estimated with a similar methodology for a set of U.S. cartels (see Bryant and Eckard [1991]). However, these results should not be compared with those from our study because the situation in antitrust enforcement has significantly changed since the period that was considered by the authors (1961 to 1988).

14. Estimates from Boyer and Kotchoni (2014) were originally provided with respect to "but-for" prices; therefore, they were recalculated with respect to the cartel price to be comparable with the other estimates in this chapter.
15. Cartels can potentially cause a price umbrella effect because remaining firms could have more incentives to charge higher prices facing a price increase from cartel members.
16. Even though our model does not allow the quality characteristics to change, the degradations in quality can still appear because colluding firms may have less incentives to maintain it.
17. We solve the system of nonlinear equations implied by proposed methodology with the use of SAS (Statistical Analysis System) routines and procedures.
18. An increase in a cartel's margin decreases calibrated values of marginal costs (cartel prices are given), and also decreases calibrated price sensitivity α (see equation (3.3)). The left side of equation (3.1) remains constant; therefore, to compensate the decrease in α, δ_j should decrease, too. In a competitive state we cannot predict whether $\left(\delta_j - \alpha p_j^c\right)$ will increase or decrease for every product, because all three parameters would have lower values. Equation (3.1) indicates that if market shares in a competitive state will be relatively high compared to the share of the outside option, then the welfare level will be higher, and vice versa.

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