

Measuring the Economic Effects of Cartels in Developing Countries

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EXECUTIVE SUMMARY

To date, whether competition law enforcement is indeed beneficial for the economy remains a questionable topic. As implementation of the antitrust enforcement requires substantial investments, it can be questioned to which extent those expenditures are compensated in terms of prevented consumers' damages. Especially this is relevant for developing competition authorities that often experience tough budget constraints and often struggle to find the supportive evidence that could advocate their efforts -research on this question in developing economies is extremely limited and is mainly of a qualitative nature. The principal goal of the current project is to provide missing evidence, precisely, to assess the potential economic harm caused by cartels in developing countries.

For this purpose we have created a dataset that, as of today, contains information on 249 major 'hard-core' cartels prosecuted in more than 20 developing countries from 1995 to 2013. We have also developed an original and relatively simple methodology that can be employed to estimate cartel's economic harm - in terms of price overcharges and consumers' welfare losses - when sufficient data are available.

Besides providing several interesting observations over the whole sample of cartels, collected data allowed estimating the aggregated cartels' economic impact in certain countries, Brazil, Chile, Colombia, Indonesia, South Africa, Mexico, Pakistan, Peru, Russia, South Korea, Ukraine and Zambia. Obtained results confirm that cartels' impact can indeed be substantial. In terms of affected sales related to GDP taken in average for the considered period it varies among countries from 0.01% to 3.74% while its maximal value reaches up to 6.38% for South Africa in 2002. In terms of cartels' excess revenues, the actual harm is also significant, with maximal rates reaching almost 1% of GDP for South Korea in 2004 and South Africa in 2002. Our analysis also shows that, on average, a cartel decreases the production level by about 15% on the concerned market. If a cartelized industry makes a significant contribution to the national economy, then collusive practices harm consumers not only in terms of inflationary effects, but also because they limit consumption. Furthermore, as we estimate the deterrence rate, i.e., the annual probability of uncovering a cartel, to be around 24%, we suggest that the actual damage is at least 4 times bigger.¹

Competition authorities in developing countries could benefit from the results of the research in several ways. Firstly, current research brings more comprehensive data on price overcharges. Significant aggregated cartels' excess revenues related to the GDP provide an opportunity for the competition authority of a certain country to advocate the enforcement of the competition law. The methodology that we propose may be of a practical interest for competition authorities especially in developing countries as it uses a very limited set of input data. Second, the efficiency of the penalty rule can be then assessed by comparing the imposed fines with cartels' excess revenues. Actual excess revenue/penalty rates could be compared against relevant benchmarks that define optimal penalty policy, both theoretical and empirical (i.e., existing best practices). The last, but not the least, the created cartels database may be seen as a reference list that contains industries potentially vulnerable to collusive behaviour. Evidence from other countries can (and should) be employed by the competition authorities in local investigations. Cartel members often enter into collusive agreements in multiple, often neighboring, economies. This may encourage involved countries to create a platform that would allow sharing and maintaining the common cartel database.

¹ A deterrence rate of 24% implies that 76% of cartels remain unknown for competition authorities.

ACTIVITIES UNDERTAKEN

To date we have created a dataset containing information on 249 major 'hard-core' cartels that were prosecuted in more than 20 developing countries from 1995 to 2013. In Appendix I, we provide a reduced version of the database that contains the list of countries, corresponding cartel cases, their duration and estimated price overcharge rates, including, when available, their minimal and maximal bounds.

We restrict our attention to the chosen period because, many of developing countries have established their competition authorities just recently, if at all; hence no or very poor data could be collected for earlier years. Nevertheless, we find it sufficiently long to obtain quite representative sample of cartels.

The initial list of 38 countries chosen to participate in the research was created considering the active state of competition authorities and sufficiency of the experience they possess. (see Appendix II.) For this reason many of the low-income countries were not included in consideration. However, even when competition authority or competition law is in place, sufficient data were not often available. This is often due to either simple absence of records, lack of the personnel or willingness to cooperate, or due to confidentiality issues. Thus, to date, certain countries are completely excluded from consideration, namely, Benin, Belarus, Burkina Faso, Cameroon, Costa Rica, Fiji, Gabon, China, Jamaica, Mali, Moldova, Morocco, Namibia, Senegal, Suriname, Thailand, Tunisia, Uzbekistan, and Venezuela. These and those developing countries that are not included in the initial list could still profit of the current research results to advocate the introduction of the competition law or its enforcement.

For every defined 'hard core' cartel, we collected quite substantial descriptive data, including relevant market(s), number of colluding firms, cartel duration, cartel's sales, applied penalties and estimated economic harm. Given that losses in output or welfare are almost never estimated, we focus only on price overcharges as a measure of cartel's economic damage. When a cartel operated on several relevant markets, if available data allows doing so, we consider those episodes separately. When no exact date or month but only year of cartel's creation or breakdown is known, we assume that cartel's duration comprises all the months from January to December. Cartel's sales are calculated as sales of all colluding firms during cartelization period on the relevant market only. Data on penalties include all applied fines (both for companies and executives) and finalized settlements. All the monetary data collected, such as sales or penalties, are in either nominal USD or nominal local currency, depending on the country. When relevant, cartel's sales were converted by using exchange rates corresponding to the period of cartel's existence, while for penalties, we used exchange rate that corresponds to the period of cartel's discovery. To supplement the analysis with estimation of efficiency of the competition policy enforcement, we also looked for budgets of competition authorities.

The data were obtained from numerous sources such as competition authorities' websites, companies' annual reports, reports of international organizations such as OECD, UNCTAD, etc. Significant piece of information came from existing database on international cartels.² However, our sample would not be so rich without cooperation with local competition authorities. For this purpose, competition authorities in chosen countries were

² Private International Cartels spreadsheet by John M. Connor, Purdue University, Indiana, USA (March 2009).

asked to fill out a special questionnaire.³ (See Appendix III.). In addition to the mentioned above target data this questionnaire includes request for some additional information, which is necessary to implement our original methodology that is aimed to assess price overcharges if no estimates are yet available. (See Appendix IV for details on the methodology.) The minimal data that is necessary to perform estimations of the price overcharges are quite limited and include prices, market shares and sales of colluding companies at least for one period of cartel existence. All the other cartel-specific information requested in the questionnaire is not mandatory to implement the methodology, but helps to properly calibrate market parameters and, eventually, improve estimation results. In practice, competition authorities in developing countries often do not possess even these minimal data, because to condemn a cartel they mostly rely on the evidence on coordination activities (such as phone calls, meetings etc.) rather than the economic one (such as parallel pricing or constant market shares, etc.).

Our database makes a substantial contribution in summarizing and, most importantly, enriching the existing knowledge of estimated economic harm (in terms of price overcharge) caused by cartels. It comprises not only international cartels (as, for instance in Suslow et al. (2003) and Connor (2011 a and b), but also local cartels, i.e. formed by domestic firms only.

Collected data were sufficient to perform a quantitative assessment of aggregated economic effects of cartels in certain developing countries, namely Brazil, Chile, Colombia, Indonesia, South Africa, Mexico, Pakistan, Peru, Russia, South Korea, Ukraine and Zambia. In addition, we made an attempt to estimate the efficiency of the competition policy enforcement by performing a sort of cost-benefit analysis for the antitrust authorities in those countries. We discuss some interesting observations over the collected sample of cartels and results of the estimations of the aggregate economic harm in the 'Research Findings' section. Other activities related to the manipulations with collected data are listed in the "Methodology" section of current Report.

Even though our database is extensive and we have managed to obtain quite sound results, still we have to acknowledge that the list of prosecuted 'hard – core' cartels for every country is not complete, nor were all the required data obtained for each of the cases. Out of 249 defined cases only 83 have data on price overcharges, 175 on applied penalties and 114 on cartel's sales. Due to insufficient data, to date it was possible to apply proposed methodology only in few (11) cases.

³ We acknowledge a significant contribution of competition authorities from Brazil, Colombia, Peru, Ukraine, Mexico, Russia, South Korea, Chile, Egypt, Indonesia, Zambia, Pakistan and Mauritius.

METHODOLOGY

Our research comprises five consecutive phases that employ various methodological tools.

***First phase** consists in collecting data on main ‘hard core’ cartels detected in developing countries. The database that we have created makes a substantial contribution in summarizing and, most importantly, enriching the existing knowledge of estimated economic harm (in terms of price overcharge) caused by cartels. It comprises not only international cartels as, for instance in Suslow et al. (2003) and Connor (2011 a and b), but also local cartels, i.e., formed by domestic firms only. For every defined ‘hard core’ cartel we collected quite substantial descriptive data, including relevant market(s), number of colluding firms, cartel duration, cartel’s sales, applied penalties and estimated economic harm. For more details concerning the data collection process see section ‘Activities Undertaken’ of the current Report.*

*On the **second phase** we aimed at estimating the missing price overcharges where collected data allowed doing so. We have employed our original methodology that was developed for this purpose. For a detailed description of the methodology, please, consult Appendix IV. Estimation results are presented in Table 1 in the ‘Research Findings’ section of the current Report.*

*On the **third phase** we looked at the descriptive statistics of the collected sample of cartels and some relative indicators that allowed comparing with results from the other studies, including those performed for cartels in developed countries. Overall, descriptive statistics of collected data do not bring any strong evidence to the widespread idea that developing countries are exposed to anticompetitive harm to the higher extent than the developed ones. However, we do show that the anticompetitive impact in terms of price overcharges is at least similar, which calls for adequate measures. We believe that stronger results are achieved by looking at the aggregate measures of cartelization harm.*

*On the **fourth phase** we focus on several aggregate indicators. To estimate the cartels’ impact on the national level, as in Suslow, Levenshtein and Oswald (2003) we find it appropriate to consider aggregated cartels’ affected sales and, more innovatively, aggregated cartels’ excess revenues, both related to GDP. We supplement the discussion with a simplified cost-benefit-like analysis of the antitrust enforcement by relating aggregated cartels’ excess revenues to the budget of the corresponding competition authority.*

*Our estimates reflect the very minimal bound for the economic harm caused by collusive behaviour because data on detected cartels is very limited, but mostly because some of them remain uncovered. To assess how far (or how close) our aggregated estimates are from the reality, we found it important to estimate the deterrence rate, i.e., the annual probability of a cartel to be discovered. On the **fifth phase** we have adopted the methodology proposed in Combe et al (2008) to estimate the maximal bound of the annual deterrence rate. To our knowledge this is the first attempt to do so on a sample of cartels detected in developing countries.*

RESEARCH FINDINGS

Overall, there is a number of quite interesting observations that could be made over the collected sample. **First**, median number of colluding firms and median cartel's duration in months are equal to 5 and 27 correspondingly.⁴ Analogous calculations for developed economies (Connor, 2011 b) indicate similar results for the number of cartel participants and, more interestingly, higher level of median cartel duration - around 50 months in the North America and 70 in the E.U. These results may seem to be in conflict with the popular opinion that, in developing countries, collusion is sustainable for longer periods because of strong market imperfections. However, some supporting intuition that explains shorter cartel duration can be gained from theoretical discussions illustrating that on unstable but growing markets deviation from cartel agreement can indeed be very attractive.⁵ **Second**, we observe that, for developing countries, the median price overcharge rate of 20% is similar to the one experienced by developed countries, precisely, 20% for the EU and 19% for the U.S..⁶ Some missing data in the sample price overcharges were recovered by implementing our methodology. (See Table 1.) Obtained median price overcharge rate of 20.11% is of the same range as the rest of the sample. We, however, acknowledge that estimated maximal and minimal bounds can differ significantly. A competition authority that wants to implement the proposed methodology would certainly obtain a greater precision provided it uses the best information on the input parameters.

Table 1: Estimations of price overcharges and output losses

Industry/country	Period of existence	Min $\Delta p\%$	Max $\Delta p\%$	Min $\Delta p\%$ ⁷	Max $\Delta p\%$
Civil airlines (Brazil)	Jan'99-Mar'03	3.20%	33.90%	10.00%	24.2%
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'1999	5.49%	37.84%	10.99%	27.81%
Steel (Brazil)	1994-Dec'99	13.55%	40.13%	5.00%	29.22%
Medical gases (Chile)	2001-2004	38.01%	66.42%	2.00%	14.93%
Cement (Egypt)	Jan'03-Dec'06	28.20%	39.3%	5.00%	10.00%
Median for the category		5.15%	35.87%	7.50%	23.68%
Median		20.11%		14.93%	

Third, our results confirm that cartels' impact in developing economies can indeed be substantial. To demonstrate this, we have aggregated case-specific anticompetitive harm estimates and extrapolated them onto the macro-economic level in order to obtain aggregate measure of the cartels' impact in developing economies. Precisely, we consider aggregated cartels' affected sales and aggregated cartel's excess revenues in relation to GDP of the relevant country. We also performed a simplified cost-benefit-like analysis of the

⁴ Median values are more convenient to consider because sample contains a few outliers with number of cartel participants more than 200 and duration of more than 150 months which makes mean values uninformative.

⁵ For a discussion on the factors facilitation collusion see, for instance, chapter 4 in Motta (2004).

⁶ Data on the E.U. and the U.S. is obtained from Connor (2011b).

⁷ Minimal estimated output losses are often rounded. This is a result of some specificities of the methodology employed, particularly because some parameters need to be set exogenously. (See Appendix IV for details.)

antitrust enforcement by relating aggregated cartel's excess revenues to the budget of the corresponding competition authority. (See results in Table 2.)

Table 2: Aggregated indicators

Country	Aggregated excess revenues / GDP, %		Affected sales/ GDP, %		Aggregated excess revenues / Budget	
	Average	Max (year)	Average	Max (year)	Average	Max (year)
Brazil (1995-2005)	0.21%	0.43% (1999)	0.89%	1.86% (1999)	308	1232 (1998)
Chile (2001-2009)	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 (2000-2009)	0.04%	0.09% (2006)	0.50%	1.14% (2006)	29	58 (2004)
Mexico (2002-2011)	0.01%	0.02% (2011)	0.05%	0.11% (2011)	7	19 (2011)
Pakistan (2003-2011)	0.22%	0.56% (2009)	1.08%	2.59% (2009)	245	518 (2008)
Peru (1995-2009)	0.002%	0.007%(2002)	0.01%	0.023% (2002)	6.44	25 (2004)
Russia (2005-2013)	0.05%	0.12% (2012)	0.24%	0.67% (2012)	0.58	1.45 (2008)
South Africa (2000-2009)	0.49%	0.81% (2002)	3.74%	6.38% (2002)	124	214 (2005)
South Korea (1998-2006)	0.53%	0.77% (2004)	3.00%	4.38% (2004)	144	214 (2004)
Ukraine (2003-2012)	0.03%	0.03% (2011)	0.15%	0.16% (2011)	0.84	0.88 (2011)
Zambia (2007-2012)	0.07%	0.09% (2007)	0.18%	0.24% (2007)	11	27 (2007)
Average	0.14%		0.9%		76	

In terms of affected sales related to GDP, the impact varies among countries from 0.01% to 3.74% on average for the considered periods, while its maximal value reaches up to 6.38% for South Africa in 2002. Remarkably, calculations for Zambia are based on only one cartel for which data are available (market of fertilizers, 2007-2012), but even taking this into consideration the impact is not negligible (0.24% in terms of affected sales related to GDP). Actual harm in terms of aggregated cartels' excess profits is also significant, with maximal rates reaching almost 1% in terms of GDP for South Korea in 2004 and South Africa in 2002.

The cost-benefit analysis performed for selected competition authorities demonstrates that potential benefits of having an antitrust division (or alternative costs of not having it) measured as aggregated cartel excess profits exceed the competition authorities' budgets on average 76 times and can reach up to 1232 times (see the last two columns in Table 5).⁸

⁸ Here we assume that when cartel breaks down then firms come back to their competitive equilibrium strategies. As a consequence of this, firms are supposed to low down prices to a pre-cartel level. Evidence on post-cartel behavior collected by Connor (2010a) and Sproul (1993) indicates that this assumption might not be always valid. Given that for our sample very limited price data were available even for the period of cartel existence, and no data at all are available for post-cartel periods, we should admit that this is almost impossible to test whether the assumption in question holds for our sample of cartels.

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. Firstly, a low level of the ratio in question can result from a high efficiency of the competition authority if the latter focuses rather on cartel deterrence (education through mass media or higher penalties, etc.) than cartel detection. Low number of detections or lower excess profits can simply reflect the fact that there exist fewer cartels or that they are weaker. Second reason is that competition authorities can 'free ride' on the experience of the other ones. By 'free riding' we mean a situation when a cartel case already went through an examination in one of the competition authorities, and the others use this fact to trigger its own investigation or even use the already extracted evidence. Therefore a competition authority can win the case without investing too much. As the collected sample demonstrates, 'free riding' can indeed take in 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. Although, 'free riding' can potentially be considered as a sort of efficiency as it is a way of 'economizing' the resources.

Here we assume that a cartel would exist for at least as long as it already did before being discovered. Data on budgets that we have collected comprise expenses for all activities of the competition enforcement unit, including merger investigations that are traditionally highly demanding in terms of resources. Therefore, the cartel-specific rates can turn out significantly higher.

Finally, our estimates can be considered as a very minimal bound for the economic harm caused by collusive behaviour because of multiple reasons. First of all, the collected data on detected cartels remain very limited. Even though some competition authorities agreed to cooperate, we 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 cases. Out of 249 defined cases only 83 have data on price overcharges, 175 on applied penalties and 114 on cartel's sales. As Table 4 above illustrates, many of recorded cases were excluded from calculations of the aggregate effects because of missing data. On top of this there is another reason, that may in fact be a principal one - some of the existing cartels remain uncovered. To assess how far (or how close) we are from understanding the real scale of the damage, we estimate the deterrence rate, i.e., 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.

To do so, we have adopted the approach proposed in Combe et al (2008). For our sample the estimated maximal annual probability of detection equals to 24%. It is significantly higher than the upper bound of the same variable estimated by Combe et al. (2008) for the E.U. cartels prosecuted from 1969 to 2007 (12.9-13.3%) that apparently witness for a more efficient antitrust enforcement in developing countries.⁹ A lower rate for the E.U. can be explained by inclusion into consideration of earlier years that are characterized with a 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 of the famous vitamins cartel, our sample includes, for instance, medical gas distribution cartels, prosecuted in Argentina, Brazil, Chile, Colombia and Mexico in late 90s-early 2000s, or cement cartels that took place over the last 30 years in South Africa, Argentina, Egypt, Korea, Mexico and other developing countries. Evidence provided by other countries may serve as a trigger for local investigations and can facilitate the cartel detection, increasing, therefore, the deterrence rate.

A maximal deterrence rate of 24% basically means that at least 3 out of 4 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.

⁹ Estimates for the E.U. are taken from Combe et al (2008) and cover cartels prosecuted from 1969 to 2007. The maximal bound for the annual deterrence rate of 13% - 17% was estimated with a similar methodology for a set of U.S. cartels. (See Bryant and Eckard, 1991.). However this result should not be compared with the one from our study as situation in the antitrust enforcement has significantly changed since the period that was considered by authors (from 1961 to 1988).

SUMMARY OF POLICY IMPLICATIONS

Competition authorities in developing countries could benefit from the results of the research in several ways.

Firstly, current research brings more comprehensive data on price overcharges. Significant country-specific aggregated cartels' excess revenues calculated on its basis and related to the GDP provide a support for the competition authority in advocating the enforcement of the competition law. Furthermore, the methodology that we propose may be of a practical interest for competition authorities especially in developing countries as it allows estimating price overcharges using a very limited set of input data. The last, but not the least, is that the created cartels database may be seen as a reference list that contains industries potentially vulnerable to collusive behaviour. Cartel members often enter into collusive agreements in multiple, often neighboring, economies. Evidence from other countries can (and should) be employed by the competition authorities in local investigations. It can serve as a trigger for local investigations and can facilitate the cartel detection, increasing, therefore, the deterrence rate. This fact calls for a deeper cooperation between competition authorities in concerned countries, implying the inter-country information exchange or even creation of a common cartels database.

As a possible extension, the efficiency of the penalty rule can be assessed by comparing the imposed fines with price overcharges. Actual excess revenue/penalty rates can be recovered from our sample for many of the involved countries. They could be then compared against relevant benchmarks that define optimal penalty policy, both theoretical and empirical, that each competition authority decides on its own.

Appendix I – Major “hard core” cartels prosecuted in selected developing countries (1995-2013)¹⁰

Argentina		Chile (cont.)	
Portland cement	1981-1999	Vehicles and spare parts	11 Aug'06 (bid rigging)
Medical gases	n/a-1997	Publishing services	Mar'08-Apr'08
Healthcare services	n/a	Pharmaceutical (distribution)	Dec'07-Apr'08
Liquid petroleum gas (S.C. Bariloche)	Jan'98-Dec'98	Public transportation	Oct'06-Nov'07
Sand (Parana city)	Jun'99-Jul'01	Radio transmission	2007
Liquid oxygen	Jan'97-Dec'01	Tourism (agent services)	2008
Cable TV (Santa Fe city)	Oct'97-Dec'01	Public transportation (maritime)	2009
Cable TV service (football transmissions)	Jan'96-Dec'98	Public transportation (bus)	Feb'07-Mar'09
Brazil		Flat Panel TV	n/a
Civil airlines	Jan'99-Mar'03	Colombia	
Retail fuel dealers (Goiania)	Apr'99-May'02	Cement	Feb'06-Jan'10
Retail fuel dealers (Florianopolis)	1999-2002	Mobile phone services	Apr'99-Aug'07
Retail fuel dealers (Belo Horizonte)	1999-2002	Green onions	Feb'07-Jan'09
Retail fuel dealers (Recife)	Apr'99-Feb'02	Pasteurized milk	Jan'97-n/a
Generic drugs	Jul'99-Oct'99	Green paddy rice	Jan'04-Nov'06
Maritime hose	Jun'99-May'07	Chocolate and cocoa products	Oct'06-Oct'09
Crushed rocks	Dec'99-Jun'03	Private security services	Feb'11-Sep'12
Security guard services	1990-2003	Services of grade systematization (Bogotá District schools)	Jun'08-Dec'09
Hermetic compressors	2001-2009	Milk processing	n/a-2008
Industrial gas	1998-Mar'04	Health services	Mar'09-Nov'11
Air cargo	Jul'03-Jul'05	Oxygen supply	May'05-Mar'11
Transportation	Oct'97-Jan'01	Road paving	Aug'10-Jan'12
Steel bars	1998-Nov'99	Sugar cane remuneration rates	Feb'10-Aug'11
Construction materials (sand)	1998-Apr'03	Cars' techno-mechanical and gas review	Mar'10-Oct'11
Steel	1994-Dec'99	Cars' techno-mechanical and gas review	Mar'10-Dec'11
Blood products	Jan'03-Dec'03	Feed ration service for prisons	May'11-Sept'12
Toy manufacturers (imports from China)	2006-2009	Cars' techno-mechanical and gas review	Apr'10-Mar'12
Chile		TV advertising market	Apr'10-Apr'11
Petroleum products	Feb'01-Sep'02	Egypt	
Medical gases (oxygen)	2001-2004	Construction (Egypt Wastewater Plant)	Jun'88-Sept'96
Medical insurance plans	2002-2004	Cement	Jan'03-Dec'06
Medical services	May'05-May'06	El Salvador	
Construction materials (asphalt)	20 Oct'06 (bid rigging)	Petroleum products	n/a-2007
Public transportation (bus)	2006	Indonesia	
Public transportation (bus)	Nov'07-May'08	Mobile phone services	Mar'03-Nov'05
Petroleum products	Mar'08-Dec'08	SMS	Jan'04-Apr'08

¹⁰ Price overcharge rates are calculated with respect to the cartelized price.

Indonesia (cont.)		South Korea (cont.)	
School books	Jan'99- Dec'00	Elevators and escalators	Apr'96-Apr'06
Cement	n/a-Dec'09	Toilet roll manufacturing	Mar'97-Jan'98
Airlines	Jan'06-Dec'09	Coffee	Jul'97-Jan'98
Pharmaceuticals	n/a	Kenya	
Poultry (day old chicken)	Jan'00-Dec'00	Coffee producers	n/a
Sea cargo (Jakarta-Pontianak)	Jun'02-Oct'03	Fertilizers I	n/a-2003
Sea cargo (Surabaya-Makassar)	Jan'03-Sep'03	Beer (production)	n/a-2004
Public transportation (city bus)	Sep'01-Oct'03	Soft drinks	n/a-2004
Salt Trade (North Sumatra)	Jan'05-Dec'05	Transportation	n/a
Sea Cargo (Sorong Seaport)	Mar'00-Nov'08	Mechanical engineers services	n/a
Kazakhstan		Insurance (transportation sector)	n/a-2002
Petroleum products (brokers)	2002-2005	Petroleum (retail)	n/a-2004
South Korea		Fertilizers II	n/a-2011
Batteries manufacturing (auto)	Jun'03-Sep'04	Tea growers	n/a-2004
Beer	Feb'98-May'99	Sugar	n/a-2004
Cement	Jan'02-Mar'03	Port Customs Department auctions	n/a
Construction machinery (excavators)	May'01-Nov'04	Malawi	
Forklifts manufacturing	Dec'99-Nov'04	Cotton farmers	n/a
Petroleum products (military, wholesale)	1998-2000	Tea growers	n/a
Telecom services (local, land line)	Jun'03-May'05	Tobacco growers	n/a
Telecom services (long-distance, land line)	Jun'03-May'05	Bakeries	n/a
Telecom services (international, landline)	Jun'03-May'05	Beer	n/a
Broadband Internet service	Jun'03-May'05	Petroleum sector	n/a
Detergent manufacturing	1998-2006	Mauritius	
Telecommunications (mobile services) I	Jun'04-May'06	Travel agency	2010
Telecommunications (mobile services) II	Jan'00-Jul'06	Mexico	
Gasoline and diesel (refining)	Apr'04-Jun'04	Gas (liquid propane)	Jan'96-Feb'96
Industrial motors	1998-2006	Chemicals (film development)	Jan'98-Dec'00
Polyethylene (low density)	Apr'94-Apr'05	Poultry	Mar'10-Mar'10
Polypropylene (high density polyethylene)	Apr'94-Apr'05	Boiled corn and corn tortillas	Mar'11-Jul'12
Movie tickets	Mar'07-Jul'07	Corn mass and tortillas	May'10-Aug'12
Trunked radio system devices	Dec'03-Feb'06	Transportation (touristic sector)	Jul'09-Mar'12
Petrochemicals	Sep'00-Jun'05	Anesthesiology (services)	May'03-May'09
Copy paper imports	Jan'01-Feb'04	Auto transportation (cargo) I	Jan'10-Sep'11
Soft drink bottling	Feb'08-Feb'09	Maritime public transportation	Jun'08-Jun'12
Gas (LPG)	Jan'03-Dec'09	Auto transportation (cargo) II	Sept'08-Jun'10

Mexico (cont.)		Russia (cont.)	
Healthcare (medical drugs)	2003-2005	Laptop computer operating systems	n/a
Consulting services (real estate)	Jul'03-Apr'09	Fuel (petroleum, Krasnodarki krai)	Jan'05-Jul'05
Restricted TV signal	Oct'02-Dec'08	Fuel (petroleum, Rostov-on-Don)	n/a-2005
Food vouchers	Aug'05-Sept'05	Airlines (flights between Nizhnevartovsk and Moscow)	n/a-Dec'05
Consulting services (real estate) II	May'03-Jul'09	Railway transportation (Kemerovo)	Oct'11-Dec'12
Railway transportation (cargo)	Nov'05-Jun'09	Soda cartel	2005-2012
Cable and cable products	Feb'06-Mar'07	Polyvinylchloride cartel	2005-2009
Pakistan		Pharmaceutical cartel	2008-2009
Bank interest rates	Nov'07-Apr'08	Fish cartel (Norway)	Aug'11-Dec'12
Cement	Mar'08-Aug'09	Pollock cartel	Apr'06-Dec'12
Gas (LPG)	n/a-2009	Fish cartel (Vietnam)	Jun'08-Sept'13
Jute mills	2003-Jan'11	Salt cartel	May'10-May'13
High and low tension pre-stressed concrete poles	Aug'09-May'11	Sausage cartel	Jun'09-Dec'09
Poultry and egg industry	2007-Aug'10	Military uniform supply	2010-Jun'12
Newspapers	Apr'08-Apr'09	South Africa	
Vessels handling(ships)	2001-Mar'11	Fertilizers (phosphoric acid)	Jan'03-Dec'07
Port construction	May'09-Jul'10	Airlines (fuel surcharge)	May'04-Mar'05
Ghee and cooking oil	Dec'08-Jun'11	Airlines (So. Africa-Frankfurt routes)	Jan'99-Dec'02
Accounting services	Apr'07-Jan'13	Milk (farm and retail)	n/a-Jul'06
LDI operators	Sep'11-Apr'13	Bread and flour	1994-2007
GCC approved medical centers	Jan'11-Jun'12	Pharmaceuticals (wholesale distribution)	1998-2007
Banking services (1-Link Guarantee Ltd)	Sep'11-Jun'12	Tire manufacturing	1998-2007
Peru		Metal (scrap)	Jan'98-Jul'07
Urban public transportation 1	Aug'08-Oct'08	Steel (flat)	1999-Jun'08
Urban public transportation 2	Aug'08-Oct'08	Cement I	1996-2009
Public notaries	n/a	Plastic pipes	1998-2009
Dock work	Sep'08-May'09	Concrete, precast pipes, culverts, manholes, & sleepers	1973-2007
Insurance 1	Dec'01-Apr'02	Fishing	n/a-2009
Insurance 2	Oct'00-Jan'03	Cement II	Jan'04-Jun'09
Poultry	May'95-Jul'96	Construction	n/a-2009
Wheat flour	Mar'95-Jul'95	Steel distribution	n/a-2008
Heaters/boilers etc. manufacturing	Oct'95-Mar'96	Steel (re-bars, rods & sections)	n/a-2008
Oxygen distribution (healthcare)	Jan'99-Jun'04	Steel (wire, wire products)	2001-2008
Freight transport	Nov'04-May'09	Crushed rock	n/a-2008
Russia		Bricks	n/a-2008
Fuel (gasoline and jet)	Apr'08-Jul'08	Steel (tinplate)	Apr'09-Oct'09

South Africa (cont.)		Turkey (cont.)	
Steel (mining roof bolts)	2002-2009	Accumulators	n/a
Flour milling	2009-Mar' 10	Ukraine	
Bitumen	2000-2009	Acquisition of raw timber auctions (furniture)	2011
Poultry	2005-2009	Sale of poultry meat	n/a
Polypropylene plastic	1994-2009	Sale of sugar	n/a
Sugar	2000-n/a	Sale of alcohol	n/a
Taxi	n/a	Sale of buckwheat	n/a
Auto dealers	2005-n/a	Individual insurance markets	2003
Healthcare fees	2002-2007	Market of services on sale of arrested property state	2004
Pharmaceuticals	n/a-2002	Zambia	
Motor vehicle manufacturers/importers	n/a-2006	Pipes, culverts, manholes and pre-stressed concrete sleepers.	n/a
Freight forwarding	n/a-2007	Oil marketing	2001-2002
Energy/switchgear	n/a-2008	Fertilizer	2007-2013
Fertilizer (nitrogen)	2004-2006	Grain procurement and marketing (maize-meal)	Mar'04-Jun'04
Steel (reinforcing mesh)	2001-2008	Public transport	n/a
Soda ashes (imports)	1999-2008	Poultry	1998-1999
Tanzania		Panel Beating Services	Sep'11-Dec'11
Beer	n/a	Zimbabwe	
Pipes, culverts, manholes and pre-stressed concrete sleepers	n/a-2009	Bakeries	n/a
Petroleum sector	n/a-2000		
Turkey			
Daily newspapers	n/a		
Traffic lights	n/a		
Public transportation (buses)	n/a		
Poultry	n/a		
Bakeries	n/a		
Beer	n/a		
Soft drink	n/a		
Maritime transport service	n/a-2004		
Mechanical engineers	n/a		
Insurance	n/a-2003		
Telecommunications	n/a-2002		
Architects' and Engineers' services	n/a-2002		
Yeast	n/a		
Cement	n/a		
Cement (Aegean region)	2002-2004		

Appendix II- Initial list of countries

<i>Argentina</i>	<i>Mexico</i>
<i>Belarus</i>	<i>Moldova</i>
<i>Benin</i>	<i>Morocco</i>
<i>Brazil</i>	<i>Namibia</i>
<i>Burkina Faso</i>	<i>Pakistan</i>
<i>Cameroon</i>	<i>Peru</i>
<i>Chile</i>	<i>Russia</i>
<i>China</i>	<i>Senegal</i>
<i>Colombia</i>	<i>South Africa</i>
<i>Costa Rica</i>	<i>Suriname</i>
<i>Egypt</i>	<i>Tanzania</i>
<i>El Salvador</i>	<i>Thailand</i>
<i>Fiji</i>	<i>Tunisia</i>
<i>Gabon</i>	<i>Turkey</i>
<i>Indonesia</i>	<i>Ukraine</i>
<i>Jamaica</i>	<i>Uzbekistan</i>
<i>Kazakhstan</i>	<i>Venezuela</i>
<i>Malawi</i>	<i>Zambia</i>
<i>Mali</i>	<i>Zimbabwe</i>

Appendix III - Questionnaire

FIRST PART. General questions

- 1) Annual budget of the Competition policy unit during the period 1995-2013¹¹ (in local currency);

SECOND PART. Identification of cartels.

- 2) Please, provide a list of major "hard core" cartels for the period 1995-2013;
- 3) 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 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) If at hand at Competition Authority, please, provide 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;

¹¹ Time period is subject to change depending on the date when Competition Authority started to be functioning.

Appendix IV- Estimation of cartel's economic harm: methodology

Here we present in more details the original methodology that aims at estimating the price overcharge as a measure of an economic harm caused by a 'hard-core' cartel that we employ in our research. As 'by-products' it also allows estimating losses in the output and in the consumers' welfare. It is based on a simple and intuitive model and requires a few assumptions to be made. The limitations of the methodology are discussed at the end of the Appendix.

General approach is the following. Based on the collected cartel data we first perform calibration of the parameters of the cartelized market. If cartel operates on several markets calibration should be performed in each of them separately (if collected data allows doing so). Having estimated parameters at hands, we then proceed with the simulation of the hypothetical (counterfactual) competitive market conditions, i.e. absent cartelization. Finally, by comparing cartelized and counterfactual (competitive) states, we calculate the price overcharges and losses in the output and the consumers' welfare.

To perform calibration of the market parameters, we consider a model, which describes the equilibrium outcomes on the differentiated product market, where firms compete in prices (differentiating product characteristics are assumed to be fixed). Precisely, we consider the "supply-and-demand" framework on the oligopoly market with differentiated products, developing mainly on the technique offered by Berry (1994). Demand and supply are modeled separately in order to recover equilibrium outcomes.

Market demand is derived from a general class of discrete choice models of consumer behavior. LOGIT model that we have chosen to employ is simple and good enough to obtain the desirable structure of demand and, most importantly, it allows explicit calculation of consumers' surplus in money terms.

There are N potential consumers on the market, considering to buy one unit of product from one of J firms (which form a cartel) or otherwise choose the outside option, noted as "0". Outside option may represent a substitute offered by other firms (not participating in the cartel) on the market as well as consumer's decision not to buy at all.

The utility of consumer i buying product j is defined as $U_{ij} = \delta_j - \alpha p_j + v_{ij}$ where α reflects sensitivity to price, common for all products and consumers, $\delta_j, j = \overline{1, J}$ parameters of differentiation, specific to each product, p_j is the price of product j and v_{ij} is consumer i 's utility specific to product j that is assumed to be identically and independently distributed across consumers and choices. Each consumer i chooses product j that maximizes her expected utility, so that $U_{ij} > U_{ij'} \forall j' \neq j$. According to Berry (1994), demand associated with alternative j is described by the equation

$$\ln(s_j) - \ln(s_0) = \delta_j - \alpha p_j \quad (1)$$

or, eventually, by

$$s_j = \frac{\exp(\delta_j - \alpha p_j)}{1 + \sum_{i=1}^J \exp(\delta_i - \alpha p_i)}, \quad \forall j = \overline{1, J} \quad (2)$$

where s_j is a market share of the firm j and s_0 is the share of the outside option. Note, that since the size of the market is fixed to N (number of consumers), then market shares can be easily interpreted in terms of sold quantities and vice versa.

In such a differentiated-products framework, profit of each firm j on the market is defined by the function $\pi_j = (p_j - c_j) * q_j = (p_j - c_j) * s_j * N$, where q_j is the quantity sold and c_j are constant marginal costs.

Further we employ several hypotheses that help to simplify the model and recover unknown market parameters, but, of course, come at their own cost. We first suggest that cartel participants act under perfect collusion, choosing prices that maximize the joint profit of the cartel. Second, we assume that forming cartel firms agree to fix margin to some value that is constant for all firms, such that $(p_j - c_j) = \text{const}, \forall j = \overline{1, J}$. Under these assumptions, it is easy to obtain from the cartel joint profit maximization problem and corresponding demand equations the following equality:

$$(p_j - c_j) = \frac{1}{\alpha s_0}, \forall j = \overline{1, J} \quad (3)$$

System of equations (2) and (3) fully describes the cartelized market equilibrium $(p_j^{\text{cartel}}, s_j^{\text{cartel}}), \forall j = \overline{1, J}$. Cartel's prices and market shares one can recover from factual market data related to the period of cartelization. Note, however, that market shares s_j^{cartel} are not the same as extracted from the market data (further denoted as $\bar{s}_j^{\text{cartel}}$), as the latter ones stand for the market shares within the cartel, while the former take into account the presence of the outside option, such that $\bar{s}_j^{\text{cartel}} = \frac{s_j^{\text{cartel}}}{(1 - s_0)}$ and $\sum_{j=1}^J \bar{s}_j^{\text{cartel}} = 1$.

To solve the system of equations (2) and (3), i.e. to recover all the unknown elements, one needs to set two of parameters exogenously. We arbitrary choose to fix the share of the outside option s_0 and average cartel margin, which is equal to $AM = \sum_{j=1}^J \bar{s}_j^{\text{cartel}} \frac{(p_j^{\text{cartel}} - c_j)}{p_j^{\text{cartel}}}$. Fixing average cartel margin is analogous fixing standard firms' margins defined above, and eventually, fixing certain level of marginal costs c_j , but we find it easier to interpret.¹²

Firms margins could be extracted from the colluding companies' annual reports, even if often only approximately. In contrast, it is much more complicated to divine the share of the outside option, which is strictly related to the total market size, N in our case. There is no standard procedure to define the market size, and methodology might differ significantly depending on the product and market considered. However, independently on the procedure chosen, the sum of all market shares, including the one of the outside option, must be always equal to one, i.e. $\sum_{j=1}^J s_j^{\text{cartel}} + s_0 = 1$.

Having set exogenously average cartel margin and share of the outside option we first recover parameter α from equation (3)

¹² Recall that margin constant for all cartel participants is the basic assumption that was used on the calibration step. Under this condition, when market shares and prices are known, it is easy to recover average cartel margin from the standard ones, and vice versa:

$$\sum_{j=1}^J \bar{s}_j^{\text{cartel}} \frac{(p_j^{\text{cartel}} - c_j)}{p_j^{\text{cartel}}} = (p_j^{\text{cartel}} - c_j) \sum_{j=1}^J \frac{\bar{s}_j^{\text{cartel}}}{p_j^{\text{cartel}}}$$

constant for all j

$$\alpha = \frac{1}{s_0(p_j - c_j)} = \frac{\sum_{j=1}^J \frac{\bar{s}_j^{cartel}}{P_j^{cartel}}}{AM * s_0} \quad (4)$$

Then, we have all required information to recover parameters of differentiation δ_j from equation (1). Again, marginal costs can be recovered from the values of margins, either average for the cartel or firm specific.

To make sure to obtain reasonable values of marginal costs while fixing values of exogenous parameters, an analyst shall perform a cross-check with the following theoretical constraint that our model implies.

Constraint 1. To obtain positive marginal costs, we need that $|\varepsilon^d| > \frac{p^{average}}{\min\{p_j^{cartel}\}}$ where $\varepsilon^d = -\alpha p^{average} s_0$ is the aggregate cartel demand elasticity

$$\text{and } p^{average} = \sum_{j=1}^J \bar{s}_j^{cartel} p_j^{cartel}.^{13}$$

At this point, in addition to the aggregate demand elasticity, one is able to calculate the set of own- and cross-price elasticities and confront them to existing estimates from other sources, if there exist any. This may serve as an additional cross-validation for the values of parameters that are chosen exogenously. Formulas for own- and cross-price demand elasticities correspondingly are presented below.

$$\varepsilon_{jj} = -\alpha p_j^{cartel} (1 - s_j^{cartel}), \quad \forall j = \overline{1, J} \quad (5)$$

$$\varepsilon_{ji} = \alpha s_i^{cartel} p_i^{cartel}, \quad \forall j, i = \overline{1, J}, i \neq j \quad (6)$$

At the end of calibration procedure sensitivity to the price α shall take positive value, while there are no sign restrictions to the values of δ_j . Constraint 1 guarantees non-negativity of marginal costs.

Once we have market parameters α, δ_j and $c_j, \forall j = \overline{1, J}$ at hands and assuming them to be fixed, we proceed by simulating the counterfactual (competitive) state of the market. In the absence of collusion among firms, equilibrium outcomes are defined within a Bertrand - Nash competition: firms compete in prices, knowing that competitors do the same: each firm takes a decision on price to maximize own profits, given the own marginal costs and prices, set by the other firms. Thus, we have a standard solution for each firm profit maximization problem:

$$p_j - c_j = \frac{1}{\alpha(1 - s_j)}, \quad \forall j = \overline{1, J} \quad (7)$$

while (2) is still valid.

As a solution of both (7) and (2) we obtain counterfactual (competitive) prices $p_j^c, j = \overline{1, J}$ and market shares $s_j^c, j = \overline{1, J}$, which would have taken place on the market absent collusion.

¹³ From equation (3) and formula of aggregate cartel demand elasticity we obtain $p_j^{cartel} - c_j = -\frac{p^{average}}{\varepsilon^d}$.

Constraint 1 is a simple consequence of rearranging the equality and posing a positive sign constraint on every ε^d .

By comparing cartel and competitive prices one is then able to calculate price overcharge for every cartel member as well as cartel's average price overcharge:

$$\Delta P\% = \sum_{j=1}^J \bar{s}_j^{cartel} \frac{(p_j^{cartel} - p_j^c)}{p_j^{cartel}} \quad (8)$$

Obtained price overcharge estimate is in percentage, but can be easily transformed into money value by multiplying on corresponding values of the cartel members' sales.

As we have already mentioned, employed demand model allows explicit calculation of the consumers' welfare (surplus) losses, both is percentage and in money terms. We make use of the formula, proposed in Anderson et al. (1992):

$$CS = \frac{1}{\alpha} \ln \left(1 + \sum_{j=1}^J \exp(\delta_j - \alpha p_j) \right) \quad (9)$$

Hence, relative consumers' losses due to market cartelization could be calculated as following:

$$\text{Welfare losses} = \frac{\left(\ln \left(1 + \exp \sum_{j=1}^J (\delta_j - \alpha p_j^c) \right) - \ln \left(1 + \sum_{j=1}^J \exp(\delta_j - \alpha p_j^{cartel}) \right) \right)}{\ln \left(1 + \exp \sum_{j=1}^J (\delta_j - \alpha p_j^c) \right)} \quad (10)$$

Described above procedure shows that just having information on prices, market shares and sales of colluding companies at least for one period of cartel existence, one is able to estimate the economic harm caused by cartelization. It is based on a very simplified model and uses a few but strong assumptions; therefore we find it important to make the following remarks.

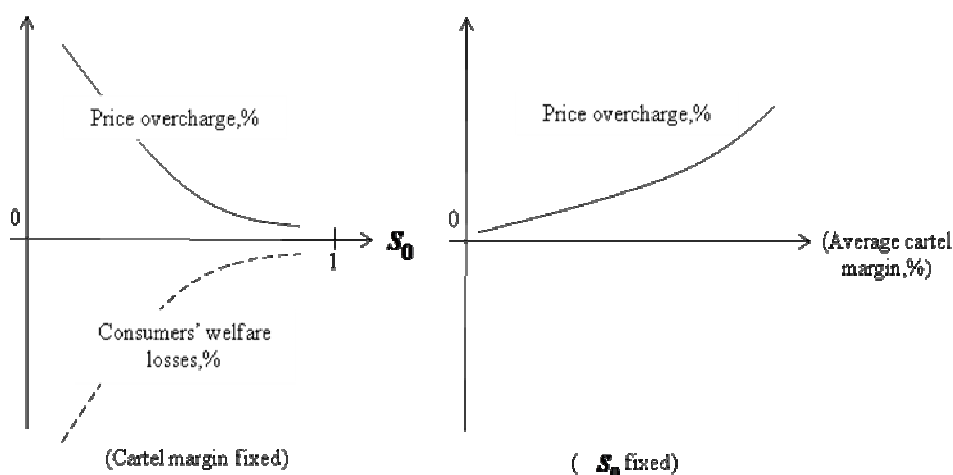
First, demand is based on the simple LOGIT model, which is quite flexible but has a specific property of Independence of Irrelevant Alternatives. In a nutshell, this model generates particular behavior, when due to a price increase of a certain product consumers switch instead to the product with maximal market share, but not the one with closest quality characteristics, which may not be a true behavioral pattern in reality.

Second, our methodology is based on assumption about the perfect collusion among cartel participants while real level of coordination among firms could be much weaker. Under these conditions, obtained estimates of price overcharge and consumers' welfare losses are the maximal ones, given fixed cartel margin and share of the outside option.

Third, when one changes assumptions about cartel margin and/or share of the outside option, then values of calibrated market parameters and, ultimately, final estimates of the interest also change. For this reason it makes sense to consider not the exact values but rather a reasonable range for each of exogenous parameters, based on the common sense and available market data.

On the Graph 1 we illustrate the reaction of the estimated price overcharge and consumers' welfare losses on the change in two exogenous parameters.

Graph1: Reaction of estimated price overcharge and consumers' welfare losses on changes in exogenous parameters' levels (illustrative)



Besides being supported by precise functional dependences, even if they often have a very complex form, the demonstrated above reactions are also quite intuitive.

When cartel margin is fixed, higher share of the outside option corresponds to a more elastic demand, which in turn limits the colluding firms' ability to increase prices, and thus losses in welfare are also limited.

Assuming the share of the outside option fixed, higher desired cartel margin naturally transforms into higher price increase. Though, no definite conclusion can be made on relative change in consumers' welfare. Increase in cartel's margin decreases calibrated values of marginal costs (because cartel prices are given), and also decreases calibrated price sensitivity α (see equation (3)). Left-hand side of equation (1) remains constant, thus, to compensate decrease in α , δ_j should decrease too. In competitive state we cannot

predict whether $(\delta_j - \alpha p_j^c)$ will increase or decrease for every product, because all three ingredients have lower values. Equation (1) indicates that if market shares in competitive state will be relatively higher with respect to the share of the outside option, then welfare level will be also higher, and vice versa. Note, that we assume the share of the outside fixed only for cartelized state, while it can naturally change when market moves towards competitive one. General conclusion would be that the more cartel poses restrictions on sales, the higher would be the relative consumers' welfare losses. At the same time, if non-cartelized market is fully covered by J firms, then relative consumer's welfare will not change no matter the change in cartel's margin.

Sensitivity of estimation results differs in each particular case, hence considering reasonable ranges for external parameters rather than exact values shall help one to assess the robustness of obtained results. Additional expertise, when available, could help to narrow down the range of calibrated values of market parameters and, eventually, obtain more precise estimations of price overcharge and consumers' welfare losses.

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