

Econometric techniques and their innovative role in calculating overprice: the Car Wash case



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ABSTRACT

The study was developed with a view to testing a methodology to calculate the difference between the value charged by public bid processes in an environment with cartels and the respective value that should be charged in a competitive environment. The forms of calculation of this article encompass an econometric model estimated by the ordinary least squares method in cross-section, and a binary response model, known as propensity score matching. The sample used in the calculations contains data of 135 contracts of enterprises from Petrobras's Supply Area, of which 48 have evidence of whether or not the cartel is active. The results of the estimation of these models indicated that public bid processes won by cartelized companies showed a discount 17% inferior to that of the public bid processes won by non-cartelized companies, which is statistically significant. Such study, due to the soundness and reliability of the results obtained, showed plausibility of the use of similar techniques in the scope of the activity of the Federal Court of Accounts in the fight against corruption in bidding processes of public construction works, including in the calculation of the damages and in the call for accountability, resulting in an increase of the timeliness, continuity and effectiveness of the identification of such illegal acts in the public administration.

Keywords: Public bid process. Cartel. Econometrics. Petrobras.

1. INTRODUCTION

Cartels in public bid processes substantially harm the efforts of the states in using their resources for the development of the country, by wrongfully benefitting companies that, through an agreement among themselves, rig the competitive nature of the public bid processes. In addition to enabling anti-economic contracting by artificially raising prices – thus increasing state inefficiency -, the practice weakens the market by preventing, in the medium and long term, that companies who are apt and reliable from offering good products and services to the State. In a weaker and less innovative market, society as a whole bears both the economic cost of products that are more expensive and of products with lesser potential quality, as the cost of a more inert and worn out administration.

According to the Organization for Economic Co-operation and Development – OECD (2009, p. 2), the governmental purchases in different economic sectors, such as: health, education, infrastructure, public security, defense, etc., prove to be a key economic activity, representing, globally, around 15%, on average, of the worldwide Gross Domestic Product (GDP), reaching up to 20% in some countries.

Because of the bulky volume of resources involved, the public bid processes of public construction works are usually the target of associations among companies, major contractors operating in the infrastructure sector, to remove the competition element, and, thus,

dominate the market of major engineering works demanded by the public authorities.

However, the main difficulty in the fight against the cartels in this environment is the collection of evidence and the calculation of the damages caused by collusive practices, which has been a challenge for the control bodies. To identify this kind of agreement, among their spheres of operation and mandates, the several administrative bodies of the State resort to all the methods and tools available for the detection and punishment of the companies that make up the cartel.

From changes promoted in the legal system, the plea bargain deals and the leniency agreements began to be used as tools to obtain evidence of anticompetitive agreements. This is the case of the ongoing investigations in the Car Wash Operation, whose developments are leading to the establishment of leniency agreements by the Federal Prosecution Service (MPF), by the Administrative Council for Economic Defense (Cade) and by the former Office of the Comptroller General of the Union (CGU) with some of the companies that participate in the cartel.

In this respect, in view of these observations and acknowledging the need to enable tools so that the State may identify in a faster, more frequent and continuous manner such criminal practice, but with the use of a more "available" collection of evidences – especially for the administrative control bodies -, several studies have been developed. In the past years, the international literature has been debating about the potential role of the use of economic methods and of appropriate econometric techniques that enable both to prove the existence of cartels and to calculate the damage caused by the anti-competition practices. According to what is going to be exposed next, learning about the potential for the use of these economic tools enables us to add to the traditional tools other forms of control capable of providing more efficient responses.

Within the Federal Court of Accounts (TCU), that has constitutional jurisdiction to calculate the damages caused to the government treasury and to impose sanctions (as is the case of the declaration of lost of good standing for companies), the use of the economic methods and of the econometric techniques may represent a new paradigm of activity of the external control in cases of formation of cartels to fraud public bid processes, as well as to complement the traditional methods of the Federal Court of Accounts for quantifying overcharging.

In this respect, the Federal Court of Accounts (TCU) recently analyzed Ruling (3.089/2015 – Plenary (TC 005.081/2015-7), whose rapporteur was Minis-



ter Benjamin Zymler, regarding an econometric study based on a group of public works contracts signed by the Petrobras's Supply Division in order to calculate the damage caused to the Administration as a result of the increase in hired prices in the cartelized environment in comparison to the prices in a competitive environment. According to the Court, the results of this innovative study will be the basis for assessment of the lawfulness and legitimacy of the possible leniency agreements that may eventually be established based on Law 12.846/13 (Anticorruption Act), under the terms of IN TCU 74/2015.

Thus, the purpose of this article is to present the main aspects of cartels in public bid processes, their damages and the economic methods, as well as the econometric techniques to detect and quantify the damages. Based on this, the results of the study analyzed by the Court will be offered as an example of the potential for the use of these economic tools to exercise external control, in such way as to both subsidize the activity of the other control bodies and provide the State with faster and more effective mechanisms to require accountability for such damages.

2. CARTELS IN PUBLIC BID PROCESSES

The concept of cartel does not face major controversy in the specialized literature.

Gico Jr. (2006, p. 169) defines cartels as associations between companies of the same category to ob-

tain common advantages arising from the suppression of free competition, while keeping internal autonomy. For Santacruz (2003, p. 415), cartel is an agreement among companies with the purpose of raising the prices for the buyer, by reducing competition, approaching the market outcome in terms of profitability, something that would be achieved in a situation of monopoly.

The cartels formed by economic agents may take different forms, such as: price fixing; quota fixing; zonal cartelss; service quality level fixing; public bid rigging, etc. However, the OECD (2003, p. 65) highlights the most common modalities of agreements: (i) among sellers: price fixing cartels; market allocation; output restriction; and public bid rigging; (ii) among buyers: price fixing cartels; allocation; and public bid rigging.

Taking into account the large sums of resources involved, the public bid procedures are frequently the target of cartelization. Just as in the cartels that are formed in the private sector, the main purpose of agreements among economic agents that explore public contracts is also to eliminate or reduce competition to increase the respective profit margins.

Coelho and Silva (2013, p. 201-202) state that cartels in public bids have a peculiarity in relation to the other types of illegal agreements. Unlike the traditional cartel (private sector), in which all the participants are allowed to immediately receive some benefit from the illegal agreement, the cartel operating in public bids allows only one economic agent to win the bid or lot.

The cartel in public bid processes may be operationalized in different ways, depending on the characteristics of the market in question as well as of other factual conditions. According to the Economic Law Secretariat – SDE/MJ (2008, p. 9-10), the international experience shows that the companies that participate in cartels in public bids use the following strategies: fictitious or cover bidding; bid suppression; bid rotation; market allocation or market division; and subcontracting.

Another common feature of the cartels that operate in the public sector is the corruption of employees in order to facilitate, for instance, the privileging of a given company or business group in the public bid processes. In these cases, the agreements among the cartel members may be enabled, for instance, by directing of the public call using restrictive clauses. Depending upon the degree of commitment of the internal agents of the contracting body/entity, other criminal tricks may also be observed, such as the manipulation of cost estimations; biased pre-qualification and selection of candidates; restricted or late publicization of the public

bid processes; in addition to the stipulation of bidding and contracting procedures not typical of republican standards. International literature mentions the strong connection between the cartels operating in public bids and the corruption of public agents, in the most diverse organizational levels.

In addition to the several forms through which the economic agents operationalize their agreements, the OECD (2009, p. 4-5) stresses that the cartel in public bid processes depends upon certain structural conditions of the affected market, such as: small number of companies; reduced or null level of newcomers in the market; market conditions (demand and supply); the activity of class associations and employer's associations; recurrent bids / frequent bidding processes; identical or simple products or services; reduced or null level of alternatives and reduced or null level of technological innovation.

3. DAMAGES CAUSED BY CARTELS

The existence of anti-competitive conducts, such as the formation of cartels, leads to situations of high prices and profits, compromising competition and society in general. According to Hovenkamp (2011, p. 3), the main effects arising from these anti-competitive practices are the following: (a) overcharge, and (b) dead weight. These two effects are responsible for the reduction of society's well-being in a cartelized market in comparison with the level of well-being in a situation of competition. That is why such effects are considered by the economic literature as social costs.



Overcharge is understood as the difference between the value charged for a given product in an environment with cartel and the value that should be charged if that product were sold in a competitive environment. In this situation, by purchasing a given product at a price higher than the price in a competitive market, as a result of the defrauding of the competitive nature of the process, the consumer suffers a damage to his/her assets.

According to empirical research by Connor (2005, p. 2), the cartels generate, on average, a 25% overcharge, when compared to the price in a competitive market, whereas the OECD estimates between 10% and 20% (2002). A study by Oxera, commissioned by the European Commission, entitled Quantifying antitrust damages (2009, p. 88-90), concluded that 70% of the cartels examined resulted in an additional price ranging from 10% to 40%, with the average being around 20%.

Another important effect of the anti-competitive practices is called by the economic doctrine 'dead weight', which represents the damages caused not only to the consumers, but also to society, because of the inefficiencies attested by the bad allocation of resources. These inefficiencies may be represented, for instance, by the damages to the innovation and to the improvement of the quality of the products in the market. This results in the loss of well-being for the consumer and in the loss of competitiveness of the economy as a whole.

To illustrate overcharge and dead weight, we present next a graph that shows the losses arising from

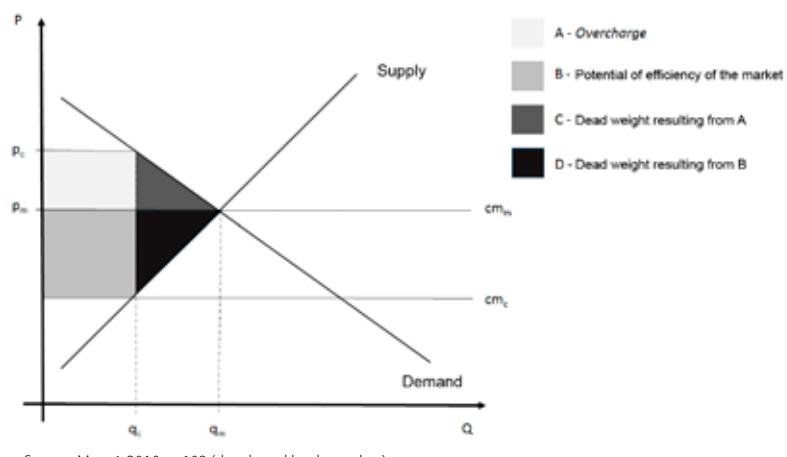
the practice of collusion, in which one may identify the areas corresponding to each of the situations described previously.

Area "A" corresponds to the damages arising from overcharge; area "B" refers to the potential of efficiency of the market, as a whole; and areas "C" and "D" correspond to the general loss of the market. We can observe that the cartel's actions bring a general loss to the market, identified by the social damage and that appears in the graph above as areas "C" and "D". The damages arising from "A" and "B" are individual while those arising from "C" and "D" are collective and diffuse. Therefore, the power of the cartelized market causes the reduction of the economic well-being.

In the cartels in public bids, Braga (2015, p. 115) comments that the agreement among competitors who aim to compromise competitiveness is to extract the highest possible income from the Public Administration without the interference of the competition, distributing to society the loss of well-being arising from the cartel. In fact, the companies that participate in the collusion wrongfully benefit by obtaining additional profits resulting from the absence of effective competition in the public bid processes and charging prices above the ordinary market value.

As a result, the social damages arising from the cartels in public bid processes are bigger than the damages of classic cartels (private sector), because the consumer directly damaged is the Public Administration itself. However, indirectly society as a whole bears the damage, which is much more costly. In addition, the damages caused generate concern not only because of the resul-

Graph 1:
The cartel and its effects



Source: Maggi, 2010, p. 103 (developed by the author)

ting overcharge, but also because of reduced efficiency of public spending, affecting directly the well-being of society and the governmental efforts in the pursuit of country's development.

4. DETECTION OF CARTELS AND QUANTIFICATION OF DAMAGES

The issue of the sufficiency of evidence collected by the competent authorities to prove the existence of a cartel constitutes a key element. In the absence of material evidence of collusion (such as minutes of meetings, testimony of people involved or signed documents), the detection of cartels may be based on indirect evidence; that is, on the set of evidences. In this respect, Santacruz (2003, p. 426-429) states that in the absence of direct evidence the economic theory may show that the actions taken are irrational from an economic perspective.

4.1 METHODS FOR THE DETECTION OF CARTELS

According to the International Competition Network (2010, p. 6-7), in general, the cartel detection methods may be divided into reactive and proactive. The former rely on some external event, such as a denunciation or a leniency agreement; the latter are methods that do not depend upon an external event and are employed by the authorities dedicated to fight anti-competitive practices, with the use of economic analyses, analysis of previous cartel cases, among others.

In practice, the competent authorities may use reactive and proactive methods in a complementary manner to increase the opportunities for cartel detection. For instance, the investigation about collusive behavior may be conducted by obtaining information from leniency or the denunciation programs together with the use of economic methods.

Thus, in view of the seriousness of the conduct and of the difficulty of detection, in the past years several studies have been dedicated to the research of different economic methods for cartel detection. In the international literature, Vasconcelos e Vasconcelos (2010, p. 3-4) highlight the contributions of Harrington (2005 and 2008) to the understanding of how to detect cartels based on the behavioral focus of the collusive companies from the analysis of economic data.

In fact, the economic analysis of the existence of a cartel, carried out by analyzing the behavior of the companies and evolution of prices, may be used both to serve as indirect evidence of the existence of a cartel



as to calculate the damage caused by the cartel. This is done, by comparing the cartelized market in a period in which its operation was competitive or to another similar market, not cartelized, used as reference, as we will see next.

4.2 METHODS FOR THE QUANTIFICATION OF DAMAGES

Quantifying the damage caused by the activity of a cartel is a complex task. However, according to Connor (2005, p. 28), since 1970, the rigour and the accuracy in estimating the damages arising from cartels have advanced considerably, boosted by the evolution of the oligopoly theory, the availability of detailed data, statistical methods and econometric models.

The main American and European methods in the literature consist in estimating the price that would have been charged in the scenario of absence of cartel, the so-called counterfactual or but-for-price scenario. These are the so-called comparative methods that seek to determine an appropriate reference scenario and estimate the price that would likely be charged for the product if the infringement had not occurred.

Connor (2005, p. 27-28) and Hovenkamp (2011, p. 6) state that the most common methods of quantification of damages acknowledged by the literature and by the American courts seek to compare the cartelized market to the same market in another moment in time

or, alternatively, to other markets (of products or geographical) considered comparable and competitive. Such methods that are most used to quantify the damages caused by cartels are the following:

- a. Before and after method: consists in comparing the prices charged in the cartelized market in different moments: the period prior or after (or both) the cartel. The overcharge shall be the difference between the prices observed in the period affected by the cartel and the prices in the periods in which the cartel was not active. In this method, the premise is that other characteristics of the market that are not associated to cartelization remained constant throughout time.
- b. Yardstick Method (comparison of markets): consists in comparing the prices of the cartelized market to the prices charged in a similar market (of product or geographical). The measured overcharge shall be the difference between the price charged in the cartelized market and the price that prevails in the similar market. This method is especially useful in situations in which the cartel establishes itself in a given geographical region, given that markets of the same product from other regions may be used as similar markets.

The European Commission's Practical Guide (2013, p. 19-26) presents the methods that are most often used by the parties and by the courts to estimate the counterfactual scenario, that is, the price that would have been charged in the absence of the competition infringement. Thus, it is possible to compare the price charged during the infringement to the price in a scenario without infringement. The most commonly used methods are those described in letters a) and b), not only in an isolated manner, but also in combination.

According to Korenblit (2012, p. 6), the American courts have widely accepted the use of regression analysis for the comparative methods. When conducted correctly, this analysis is considered a reliable means to prove the anti-trust damages for producing robust estimations. Harkrider and Rubinfeld (2005, p. 2-4) also state that the econometric evidence, together with other elements of evidence, have been used to determine the existence of damages and the quantification of anti-trust damages, among other anti-trust cases.

4.3 ECONOMETRIC TECHNIQUES

The application of comparative methods is perfected by the use of complex techniques, by means of econometric models that use regression analysis to combine economic theory with the statistical or quantitative methods to identify and measure the economic relationships among variables (for instance: price, sales volume, market quotas, profit margins). The use of econometric techniques may result in robust and accurate estimations.

All comparative methods are, in principle, susceptible to application through econometric techniques based on regression analysis, provided there are sufficient data available for this purpose. Regression analysis, because it is a statistical technique, enables us to examine the relationships among the economic variables and to determine to what extent a given variable of interest is influenced by other variables.

The specialized literature (Oxera, 2009, p. 51; Connor, 2005, p. 29) describes the quantification of damages based on regression analysis with the use of a dummy variable. This technique consists in using data related to the period (or market) affected by the cartel to estimate the regression. The cartel's effect (γ_i) shall be taken into account in the regression equation through this dummy variable (D_i):

$$P_i = \alpha_i + \sum_{k=1}^N \beta_{ik} \cdot X_k + \gamma_i \cdot D_i + e_i$$

Regression analysis seeks to identify the statistical relationship among the other variables. The parameters that are estimated in the model are an intercept (α); the relationship among the characteristics of the companies in the market (X_k) and the price (β); the relationship between the dummy variable (D_i) and the parameter γ_i , which is the effect of the cartel; and the variable e_i is a random element that affects the price of the company i . The variable D_i assumes value equal to 1 for the company that belongs to the market in which there is the practice of cartel and value equal to 0 if the company belongs to the comparison market.

With the estimated model, it is possible to calculate the overcharge attributed to the cartel by means of the parameter γ_i , which is the main interest in this regression, as it represents the average variation of prices effectively established by the cartel. Thus, the overcharge would be the difference between the estimated price



without a cartel and the price effectively established by the cartel, in a context in which one is working with a database about which one knows which are the observations attributed to the cartel and which are not. This occurs whether in time-based comparison, in different markets (geographic or of products), in data from legal procedures or even in data from rewarded collaborations (plea bargain deals).

Therefore, in the case of damages suffered by cartels, the econometric techniques enable to assess whether – and to what extent – other observable factors other than the infringement contributed to the difference between the value of the variable of interest (for example: price) observed in the market affected by the infringement and the value observed in a comparative market or during a period of comparison, in a no-infringement scenario. Thus, the overcharge shall be the difference between the observed price and the price that would prevail according to the econometric estimations conducted.

4.4 LEVEL OF ACCURACY OF THE ECONOMETRIC METHODS AND TECHNIQUES

The quantification of the damages in cases of cartels is subject to limitations regarding the level of certainty and accuracy because of its own nature. According to the European Commission's Practical Gui-

de (2009, p.12) it is not possible to determine exactly how a market would have evolved in the absence of infringement, because the prices, the volumes of sales and the profit margins depend upon a series of factors and of complex interactions between market operators which are often not easy to estimate.

As a result, it is not possible to determine a single and real amount of the damages suffered because of the cartel. It is only possible to make estimations based on approximations. In this respect, Korenblit (2012, p. 7-8) highlights that the American Supreme Court has already decided that approximations are not sufficient to show the extension of the antitrust damages based on a just and reasonable inference, even though the outcome is only approximated, because the infringer is not entitled to complain if the damages are not accurately measured.

5. THE PETROBRAS CASE – ECONOMETRICS

In this topic, we present the strategy defined to estimate the damages suffered by Petrobras's Supply Area due to cartel activity, uncovered within the "Car Wash Operation". To do that, we considered the discounts offered in the Cost Estimates of the state-run company. In this context, two scenarios stand out: one in which cartel activity was successful and the other without the victory or without the participation

of the cartel. The difference between the discounts in these two scenarios made it possible to estimate the damage of the crime at the moment of the public bid process. This assessment is called counterfactual analysis, and proved extremely useful in view of the progression of the Car Wash Operation as commented in the Introduction.

With this purpose, initially it must be said that the studies were based on information from 135 contracts of the refining area (Petrobras's Supply Area) after requesting data related to the construction works that took place between 1997 and 2015 with values higher than \$100 million BRL. From these data, several variables were defined, such as, for instance: number of companies invited to the public bid process, type of construction work, contract value, percentage of companies invited that were part of the cartel, among others.

In addition to these variables, a dummy qualitative variable was also used to indicate the successful activity of the cartel. This variable was built individually for each of the 135 contracts in line with a plethora of evidence and/or signs arising from documents shared within the Car Wash Operation. This dummy variable, of qualitative nature, aimed at outlining the "counterfactual" scenario described by the international technical literature. When the dummy variable assumes value 1, it indicates that the cartel

won the public bid process; in the opposite case, the value is zero.

After the assembly of the database, we began an analysis with the statistical software Stata, for which the Federal Court of Accounts (TCU) possesses a license, following the general guideline exposed in the equation below:

$$\text{Discount}_i = \alpha_i + \sum_{k=1}^N \beta_{ik} \cdot X_k + \gamma_i \cdot D_i + e_i$$

The parameters that are estimated in the model are an intercept (α); the relationship among the characteristics of the public bid processes (X_k) and the coefficient (β); the relationship between the dummy variable cartel (D_i) and the parameter γ_i ; and the variable e_i is a random element. The variable D_i assumes the value equal to 1 when there is a successful collusive practice and the value equal to 0 in the opposite case.

The parameter of interest to be estimated γ_i , is interpreted in the following manner. As an example, consider that this parameter was estimated as -0.2, or -20%; The interpretation is that when the binary variable assumes the value $D_i = \{1\}$, that is, when the cartel wins, the discount obtained by Petrobras in the public bid process is 20% lower than the discount obtained when $D_i = \{0\}$, without the activity of the cartel.



We adopted two approaches to analyze the existing database. First, a more restrictive approach, containing only contracts with direct evidence of successful or non-successful performance of the cartel; second, a wider approach, gathering all the contracts of the database, that is, with signs and direct evidence of the successful activity or of the defeat of the cartel. These two groups covered 48 and 135 occurrences. We opted to conduct this restrictive analysis because, in this restricted case, there was evidence of whether or not there was cartel activity. The idea was to verify if the behavior of the restricted database would occur in the wider database, in which there was no sufficient evidence for all the contracts, but only signs.

Then, regressions were estimated according to the methodology of the Ordinary Least Squares (OLS). In this stage, ten econometric models were estimated in order to identify the model that would better explain the Discount offered at the exact moment of the public bid processes: five for the restricted base and another five for the extended base. The models had different combinations of the variables contained in the database made available by Petrobras.

In the context of these studies, we necessarily verified the adjusted R² (measures the explicative power of the model), F test (evaluates the joint significance of the explicative variables) and t test (evaluates the individual significance of the explicative variables). In addition, it the fulfillment of the inherent assumptions of the Ordinary Least Square was observed, such as error normality, homoscedasticity and non-perfect correlation among the parameters. The most robust models indicated a discount 17% lower in the event of the successful activity of the cartel, both in the restricted and in the extended database.

Aiming to both corroborate and improve the results obtained with the use of OLS, a sophisticated logit model was used: propensity score matching. This latter technique aimed at mitigating possible selection bias. In other words, one wishes to compare public bids as similar as possible within the used explicative variables. Here too, we built models according to the same logic adopted for the OLS regressions that is, using the restricted and extended databases. Once again, the most robust result obtained was the 17% already mentioned, in both databases.

Taking into account the clear convergence around the 17% difference (to the detriment of Petrobras when the cartel operated and won), we set out for the monetization of the damage in the Supply Area

(for the period from 1997 to 2015 and objects above \$100 million BRL) as a result of the collusive actions committed by the operating cartel. We then reached the significant amount of \$5.7 billion BRL at historical values.

We highlight that the Federal Court of Accounts has already been investigating overcharging and responsibility for the damage caused in some contracting operations of the database studied in this article. In eight contracts established with companies that are part of the cartel, based on traditional auditing techniques, a total damage that reaches 16% of the value of the audited contracts was pointed out so far.

Although the methodology used to calculate the damage caused to Petrobras – which are the TCU methodology to calculate overpricing and the econometric analysis of this study - is completely different in both cases, we cannot forget the proximity of the percentage of damage in relation to the estimated value of the contracts. The percentage was around 16% to 17%, which strengthens the reliability of the econometric results.

Finally, the value of 17% is in total agreement with the values found in the national and international technical literature, which is around 20%, according to what is established in the references of this paper.

6. CONCLUSION

A cartel in public procurement is typified as bid rigging and is a serious and highly harmful crime to society. In addition to enabling antieconomic contracting, due to the artificial raising of prices – increasing state inefficiency -, the practice weakens the market, preventing, in the medium and long run, companies that are apt and reliable from offering good products and services to the State. In a weaker and less innovative market, society as a whole bears both the economic cost of products that are more expensive and of products with less potential quality and of a more inert and worn out administration.

It is a fact that the identification and quantification of the damage caused by cartels in public contracting operations – in view of the limitation of available elements of proof – is an old (though continuous) challenge for control bodies. As known, recent investigations uncovered a huge scheme of collusion of major contractors in the country, with anti-competitive practices identified by means of rewarded collaborations (plea bargain deals), leniency

agreements, telephone tapping and exchange of electronic messages.

Thus, acknowledging the need to make available to the State tools that will enable it to identify such criminal practice in a more timely, continuous and recurrent manner, but using a more "available" collection of evidence – especially for the administrative control bodies -, several studies are being developed. By collecting a robust history of contracting operations, each with its own characteristics, among competing companies, contracted prices, discounts offered, number of qualified companies, number of bids, inherent characteristics of each market, among other possibilities, statistical-mathematical methods and economic techniques have been caught up in the "sea of information" generated by years of records.

This paper, in this perspective, has examined the results achieved by means of a new approach in the quantification of the overcharge of public procurement recently analyzed by the Federal Court of Accounts (TCU), by means of Ruling 3.089/2015-Plenary. Through the study, that used methods already acclaimed in the United States and in the European Union, econometric techniques were associated with regression analyses, from fifteen years of contracting of construction works conducted by Petrobras's Supply Area. Such data, applied to information arising from ongoing legal procedures in the Car Wash Operation – or provided by Petrobras itself and by the Judiciary Power -, duly "treated" from an econometric perspective, offered a powerful tool for the identification of the "general damage" caused by the monopolistic price charged in the state-run company in this past decade.

The methodology consisted in comparing the behavior of the discount offered by the contracted companies against Petrobras's budget, in the scenarios with cartel (factual) and without the infringement (counterfactual). As the outcome of the application of the methodology, we obtained the estimation that the activity of the cartel reduces in 17%, on average, the discount offered in a competitive scenario.

The methodology is in consonance with TCU's Bylaws, Article 210, §1 item II. The article states that the calculation of the debt may occur by "*estimation, when, through reliable means, one calculates an amount that would certainly not exceed the actual value that should be paid*". Considerint this, one investigates the advantage of calculating the damages through this means, in comparison with the "traditional methods" - and

even the call for the relevant accountability. In addition to simplifying the procedural development (without some loss in technical soundness), shorter trials in addition to being consistent with the efficiency demanded from control by dealing calling for the consequences of the irregularities committed in a faster manner, provide more resources to identify cartelized practices in other sectors of the state activity.

According to a statement by Minister Benjamin Zymler, rapporteur of Ruling 3.089/2015-Plenary, this was a leading case, as it involved a procedural apparatus containing new strategies, statistically robust and of major practical relevance. It also had direct applicability in the greatest corruption scandal in the history of the country – because of the activity of a cartel in Petrobras's construction works.

The Rapporteur also highlighted that the results of this innovative study shall serve as a foundation for the evaluation of the lawfulness and legitimacy of future leniency agreements that may eventually be established based on Law 12.846/13 (Anticorruption Act), under the terms of TCU's Normative Ruling 74/2015. This Ruling establishes rules about TCU monitoring of the processes of establishment of leniency agreements within its jurisdiction.

Recently, the Attorney General of Brazil (AGU) filed two misconduct lawsuits against 15 companies suspected of involvement in the corruption scheme uncovered by the Car Wash Operation. Together, the amount charged in the lawsuits reaches \$11 billion BRL, with \$3 billion BRL corresponding to 17% of each of the relevant fraudulent contracts, based on the econometric study analyzed by TCU through the Ruling 3.089/2015-Plenary.

Therefore, we can conclude that the use of the internationally acclaimed methods and of the econometric techniques may represent a new paradigm of operation of the external control. They can be used in similar cases in which there are signs of the formation of cartel to rig public bids, as well as to quantify overcharge/overcharging, when it is not possible to compare quoted/hired prices based on parameters of prices defined in law as market references (Sinapi and Sicro, mainly).

REFERENCES

BRAGA, T. C. A. CADE, Cartéis e Licitações: um novo nicho da Política Antitruste Brasileira. Revista de Defesa da Concorrência, Brasília, DF, v. 3, n. 1, p. 108-132, 2015.

COELHO, G. F.; SILVA, R. V. M. A. Os eventos esportivos de 2014 e 2016 e o combate aos cartéis em licitações no Brasil. In: NETO, A. D.; CASTRO, R. P. A. Temas de direito econômico: A Copa do Mundo de 2014 e os Jogos Olímpicos de 2016. Curitiba: Clássica, 2013.

COMISSÃO EUROPEIA. Guia prático sobre quantificação dos danos nas ações de indenização com base nas infrações aos artigos 101 e 102 do Tratado sobre o funcionamento da União Europeia, 2013. Disponível em: <<http://bit.ly/2p3bveJ>>. Acesso em: 4 nov. 2015.

CONNOR, J. M. Price-fixing overcharges: legal and economic evidence. Research in Law and Economics, Bingley, v. 22, p. 59-153, 2005.

GICO JÚNIOR, I. T. Cartel: teoria unificada da colusão. São Paulo: Lex Editora, 2007.

HARKRIDER, J.; RUBINFELD, D. L. Econometrics: legal, practical, and technical issues. American Bar Association, Chicago, 2005. Disponível em: <<http://bit.ly/2p5dcpc>>. Acesso em: 6 nov. 2015.

HOVENKAMP, H. J. Quantification of Harm in Private Antitrust Actions in the United States. University of Iowa Legal Studies Research Paper/Elsevier, Iowa City/Amsterdam, 11 feb. 2011. Disponível em: <<http://bit.ly/2p375o8>>. Acesso em: 6 nov. 2015.

HARRINGTON JR., J. E. Detecting cartels. Johns Hopkins University, Baltimore, dec. 2005. Disponível em: <<http://whr.tn/2onc6VD>>. Acesso em: 5 nov. 2015.

INTERNATIONAL COMPETITION NETWORK. Anti-Cartel Enforcement Manual – Cartel Working Group – Subgroup 2: Enforcement Techniques, Istanbul. 2010. Disponível em <http://www.internationalcompetitionnetwork.org/uploads/library/doc628.pdf>. Acesso em 7 nov. 2015.

KORENBLIT, C. M. Quantifying Antitrust Damages Convergence of methods recognized by U. S. Courts and the European Commission. Competition Policy International Journal, Philadelphia, mar. 13 2012. Disponível em: <<http://bit.ly/2oVHjCD>>. Acesso em: 29 out. 2015.

MAGGI, B. O. O cartel e seus efeitos no âmbito da responsabilidade civil. 1985. 233 f. Dissertação (Mestrado) – Faculdade de Direito da Universidade de São Paulo, São Paulo, 2010. Disponível em: <<http://bit.ly/2otdcRz>>. Acesso em: 11 nov. 2015.

ORGANIZAÇÃO PARA COOPERAÇÃO E DESENVOLVIMENTO ECONÔMICO – OCDE. Diretrizes para combater o conluio entre concorrentes em contratações públicas. 2009. Disponível em: <<http://bit.ly/2oq1Spd>> Acesso em: 26 out. 2015.

OXERA. Quantifying antitrust damages. Towards non-binding guidance for courts. Study prepared for the European Commission. 2009. Disponível em: <<http://bit.ly/2p5jsNC>>. Acesso em 11 nov. 2015.

SANTACRUZ, Ruy. Cartel na lei antitruste: o caso da indústria brasileira de aços planos. In: MATOS, César (coord.). A revolução da antitruste no Brasil – A teoria econômica aplicada a casos concretos. São Paulo. Singular, 2003, p. 415 e p. 426-429.

SDE/MJ. Secretaria de Direito Econômico do Ministério da Justiça. Combate a cartéis em licitação: guia prático para pregoeiros e membros de comissão de licitação. Brasília. Publicação Oficial, 2008.

VASCONCELOS, S. P.; VASCONCELOS, C. R. F. Ferramentas de detecção dos acordos em preços no mercado de gasolina a varejo. Juiz de Fora, 2010. Programa de Pós-Graduação em Economia Aplicada – Faculdade de Economia da Universidade Federal de Juiz de Fora, 2010. Disponível em: <<http://bit.ly/2p8NCQ4>>. Acesso em: 9 nov. 2015.

VASCONCELOS, S. P.; VASCONCELOS, C. R. F. Ferramentas de detecção dos acordos em preços no mercado de gasolina a varejo. Juiz de Fora, 2010. Programa de Pós-Graduação em Economia Aplicada – Faculdade de Economia da Universidade Federal de Juiz de Fora, 2010. Disponível em: <<http://bit.ly/2p8NCQ4>>. Acesso em: 9 nov. 2015.

