Design of contracts by the Brazilian antitrust authority: the case of the cease-and-desist commitment (CCP)

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Abstract

The cease-and-desist commitment (CCP, a mechanism equivalent to a Consent Decree in the United States) is an agreement between the Administrative Counsel of Concurrence Defense (CADE) and an anticompetitive firm, aiming to cease a non concorrencial practice for a certain period of time. During this agreement, there is a withdrawal of the lawsuit. If the firm hasn't respected the CCP, fines and reputation sanctions can be applied. Considering that the CCP use is still new in Brazil as well as the literature about the theme, the objective of this paper is to analyze the Conditions for a firm to sign the CCP, in a game with incomplete information. The results have indicated that: the firms should follow the CCP if the loss of reputation and fines are big enough, and smaller the infraction profits against the normal profits; the antitrust authority should offer the CCP when the benefits of this proposal are bigger than the losses of the firm; the antitrust authority should offer the CCP when there is a belief that the firm is low cost type.

Key words: Asymmetric information; antitrust regulation; contract design

JEL: L51, C72

1. Introduction

A fundamental result of the Non-cooperative Game Theory is that a decrease of a player's expected payoff in certain contingencies can increase his payoff of equilibrium when it induces the others players to change their behavior. In the case of inter firms' relationships this result would be reached by the inclusion of a punishment system to the players that cheat anticompetitive agreements.

On the other hand, in the case of antitrust analysis, this would be the same as to say that the law capable of deterring an illegal action is the one which turns this same action expensive to the infractor (Posner, 2001). To do that, it is necessary to apply a punishment

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system that involves monetary and/or social sanctions[3], making the agents' payoffs bigger if they have acted according with the principal interests. By contrast,

> If the penalty for an antitrust violation falls short of the cost of the violation to society, the potential violator, in deciding whether to commit a violation, will reckon the cost to him (the punishment cost, since he presumably cares nothing about the consequences of his conduct for the society at large) at a figure lower than the social cost. The consequence will be an excessive amount of unlawful activity (…) (Posner, 2001, p. 267)

But the antitrust legislation has taken a different path since it has incorporated softer sanctions, in terms of fines or lawsuit withdrawal. In Brazil, this is the case of the insertion of the Leniency Program and the Cease and Desist Commitment (CCP, equivalent to a Consent Decree in the United States) mechanisms, respectively[4].

The CCP was introduced in Brazilian legislation in 1994. It is defined as an agreement between the Administrative Counsel of Concurrence Defense (CADE) and a potential anticompetitive firm, aiming to cease the investigated practice in a certain period of time. During this agreement, there is a withdrawal of the lawsuit that can be permanent if CADE concludes that the firm has behaved as a competing player. But if the firm hasn't respected the CCP, daily fines and reputation sanctions can be applied. Besides that, when the agent compromises himself to cease the anticompetitive practice, it isn't necessary to confess or recognize the illegality of the conduct (Brasil, 1994).

The CCP application is still incipient in Brazil as well as the existence of correlated studies. A case that can be mentioned is associated with the orange processing industry, in which was approved a ceasing commitment between the firms and CADE in 1995. Moreover, the firms were prohibited to make reunions to discuss prices, to jointly fix prices and the standard contract of negotiations was extinguished (Marino, 2001). But this case was originally opened under cartel allegations, that isn't permitted by the current legislation

[3] An example of social sanction would be all the ways to impose reputation loss and to include others psychological suppositions related to sanctions as guilt, shame and humiliation in the definition of the rational choice of human behavior (Posner and Rasmusen, 1999).

[4] The Leniency Programs isn't the scope of this article but a literature about it has increased. See, for example, Motta and Polo (2003); Spagnolo (2000); Spagnolo and Buccirossi (2000); Spratling (1998).

anymore. In 2000 the Brazilian antitrust legislation was revised and since then the CCP doesn't apply to the typical conducts imputed to cartel agreement (Brasil, 1994 and 2000).

As a new instrument, the CCP is involved in a controversial debate about its nature and functionality. Following the antitrust legislation, "the CCP is an institution of law and economics originated from (…) the acceptance of the economic-political nature of the concurrence law (…) that emphasizes the preventive function of the State immediately aiming at adapting the economic agents behavior to the competitive standards indicated by the [Brazilian] Federal Constitution" (Franceschini, 1998, p. 258).

Then, two comments can be made about this definition (one related to the preventive feature of the CCP and other associated with its ability to satisfy the behavior to the competitive standards, respectively): a) if the mechanism is defined as cease-and-desist commitment it means that the unlawful action has already occurred and that prevention function doesn't precise the task of the authorities in this case; b) if the probability to condemn an innocent is high the firm can accept the CCP although this acceptance doesn't mean that the activities of prevention, detection and competition incentives have been successful. And, if the punishment costs were lower than the infraction benefits, also in this case the increment of the agreements level isn't necessarily an indication that the antitrust objectives were reached.

Another aspect to point out is related with an argument regularly accepted to defend the use of the CCP by CADE: to guarantee and restore the markets competition optimizing time and reducing the financial costs with judicial legal proceedings[5]. This is not necessarily the only relevant reason to the CCP implementation since its establishment can occur when it is too hard to prove illegal action. Because of that, the CCP can be seen by the agents as a serious limitation in the effectiveness of the antitrust intervention.

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[5] Malard (1998, p. 261).

Beyond signalizing a possible difficulty of the antitrust authority to prove the illegal action, the CCP can be seen as an ex-ante incentive to infract: while the illegal action isn't proved the infractor is benefited from the fine release under the CCP (an effect contrary to the desirable) as showed by Mattos (1996).

Nevertheless, the original model defined by Mattos was based in a game with symmetric information. Then in our paper we introduce incomplete information between the players with the objective of considering sanctions Conditioned to the firm type (low or high costs). This modification in the original game is relevant because it is important to try to capture the effectiveness of the CCP (since different firms have to be punished in a different magnitude). In order to adequate the game to the sequential decisions we also substituted the payoffs to fit in this dynamic version.

Given all these considerations, the objectives of this paper are: to verify the Conditions under which the firms have incentives to accomplish the CCP and the correspondent's fine limits; to define the Conditions under which the antitrust authority (CADE) should apply the CCP.

This paper is organized as follows: in the next section the game is presented; in the section 3 are the equilibrium Conditions to the CCP accomplishment; and in the last section are the final considerations.

2. The antitrust regulation game with the CCP mechanism

In the antitrust regulation game with the CCP, consider the following suppositions: there are two players, CADE and a firm. The nature plays first choosing a type t_i of firm between the possible types (high or low cost), given respectively by $T = \{t_A, t_B\}$, $i = A, B$, according with a probability distribution $p(t_i) = \{ p(t_A), p(t_B) \} = \{\mu , 1\text{-}\mu\}$, with $p(t_i) > 0$ to all $p(t_A) + p(t_B) = 1$. By its turn, the firm decides between infringing or not the antirust law looking at the payoffs composed by gains with the infraction (extraordinary profits); normal profits; infraction costs in financial terms; and loss of reputation costs.

The strategic role of CADE is to decide between proposing the CCP, applying the punishment directly or close the case after the movement of the firm. The fine values are previous and exogenally determined and are divided between F and F' (being F' the additional fine applied when the CCP isn't respected); and the social sanction r (where r' is the reputation lost resulting from the CADE lawsuit, with $r' < r$). When the CADE punishes without proposing the agreement (direct punishment) its task is to collect anticompetitive proofs.

Suppose first that the CADE payoffs are strictly decreasing under anticompetitive actions between the firms in the economy. Assuming that there is a cost of imposition of the antitrust law, when the firm commits with CADE and accomplishes the agreement, the antitrust authority (CADE) has a benefit H. As an anticompetitive action implies a welfare loss and a waste of resources to apply the law, CADE will monitor the market to maximize the social earnings following the antitrust legislation.

The dynamic payoff of firm i infract the law (I) is given by the next discounted present value (VPD):

$$VPD_i^I = \delta\pi_i^M + \delta^2\pi_i^M + \delta^3\pi_i^M + \ldots = \pi_i^M \sum_{t=1}^{\infty} \delta^t = \frac{\delta}{1-\delta}\pi_i^M \qquad (2.1)$$

where π_i^M is the payoff when the firm infracts the law with extraordinary profits[6] and $\sum_{t=1}^{\infty}\delta^t$ is equal to $\delta/(1-\delta)$, being $\delta \in [0,1]$ the discount factor.

On the other hand, the payoff to obey the law (NI) is given by VPD of the normal profit,

[6] For example, it can be the case of exclusivity agreements, entry deterrence or any others infractions that can be contemplated by the CCP.

$$VPD_i^{NI} = \delta\pi_i^N + \delta^2\pi_i^N + \delta^3\pi_i^N + ... = \frac{\delta}{1-\delta}\pi_i^N \tag{2.2}$$

where π_i^N is the payoff when the firm doesn't infract the law and has normal profits.

We can then define the payoff to the infractor firm in t = 1, that is directly punished (*PD*) in t = 2, without the CCP,

$$VPD_i^{PD/I} = \left[\delta\pi_i^M + \delta^2\left(\pi_i^N - F - r\right) + \frac{\delta^3}{1-\delta}\pi_i^N\right] \tag{2.3}$$

Here there is a supposition that once punished the firm will never infracts the law anymore. But if the firm isn't an infractor and was directly punished, its payoff is given by:

$$VPD_i^{PD/NI} = \left[\delta\pi_i^N + \delta^2\left(\pi_i^N - F - r\right) + \frac{\delta^3}{1-\delta}\pi_i^N\right] \tag{2.4}$$

If the CCP was established and the infractor firm or not infractor firm accomplished the CCP (*C*), the respective payoffs become

$$VPD_i^{CCP/I;C} = \left[\delta\pi_i^M + \delta^2\left(\pi_i^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_i^N\right] \tag{2.5}$$

$$VPD_i^{CCP/NI;C} = \left[\delta\pi_i^N + \delta^2\left(\pi_i^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_i^N\right] \tag{2.6}$$

But if the firm (infractor or not) didn't accomplish the CCP (*NC*), the respective payoffs are:

$$VPD_i^{CCP/I;NC} = \left[\delta\pi_i^M + \delta^2\left(\pi_i^M - F - F' - r\right) + \frac{\delta^3}{1-\delta}\pi_i^N\right] \tag{2.7}$$

$$VPD_i^{CCP/NI;NC} = \left[\delta\pi_i^N + \delta^2\left(\pi_i^N - F - F' - r\right) + \frac{\delta^3}{1-\delta}\pi_i^N\right] \tag{2.8}$$

If the case was closed (*FC*), having the firm infracted or not, the respective payoffs become

$$VPD_i^{FC/I} = \left[\frac{\delta}{1-\delta}\pi_i^M\right] \qquad (2.9)$$

$$VPD_i^{FC/NI} = \left[\frac{\delta}{1-\delta}\pi_i^N\right] \qquad (2.10)$$

Now we will explain the CADE payoffs. First, considering the case that the firm really infracted the legislation, earning extraordinary profits which means loss for CADE. It makes clear the first term of the payoffs when the CCP is applied or the firm is directly punished. The second terms of the (2.11) and (2.12) equations are the earnings to accomplish the CCP and have punishment without the CCP, respectively,

$$VPD_{CADE}^{CCP/I;C} = \left[-\delta\left(\pi_i^M - \pi_i^N\right) + \delta^2\left(r' + H\right)\right] \qquad (2.11)$$

$$VPD_{CADE}^{PD/I} = \left[-\delta\left(\pi_i^M - \pi_i^N\right) + \delta^2\left(F + r\right)\right] \qquad (2.12)$$

If the CCP is applied and the firm doesn't accomplish it ((2.13) equation), CADE will possible lose the equivalent of the two periods extraordinary earnings excess under the normal profit should apply the additional fine *F'* (correspondent to the one time more of infraction).

$$VPD_{CADE}^{CCP/I;NC} = \left[-\delta\left(\pi_i^M - \pi_i^N\right) - \delta^2\left(\pi_i^M - \pi_i^N\right) + \delta^2\left(F + F' + r\right)\right] \qquad (2.13)$$

If CADE closes the case, having the firm infracted or not, the loss will be equivalent to the volume of the extraordinary profits excess above the normal profits, or

$$VPD_{CADE}^{FC/I} = \left[-\frac{\delta}{1-\delta}\left(\pi_i^M - \pi_i^N\right)\right] \qquad (2.14)$$

If a firm hadn't infracted the law the CADE payoffs will include the social loss *w* with injustice (when the firm accepted the CCP with or without the accomplishment of the agreement and when CADE punishes directly). Then,

$$VPD_{CADE}^{CCP/NI;NC} = \left[\delta^2\left(F + F' - w\right)\right] \quad (2.15)$$

$$VPD_{CADE}^{CCP/NI;C} = \left[-\delta^2 w\right] \quad (2.16)$$

$$VPD_{CADE}^{PD/NI} = \left[\delta^2\left(F - w\right)\right] \quad (2.17)$$

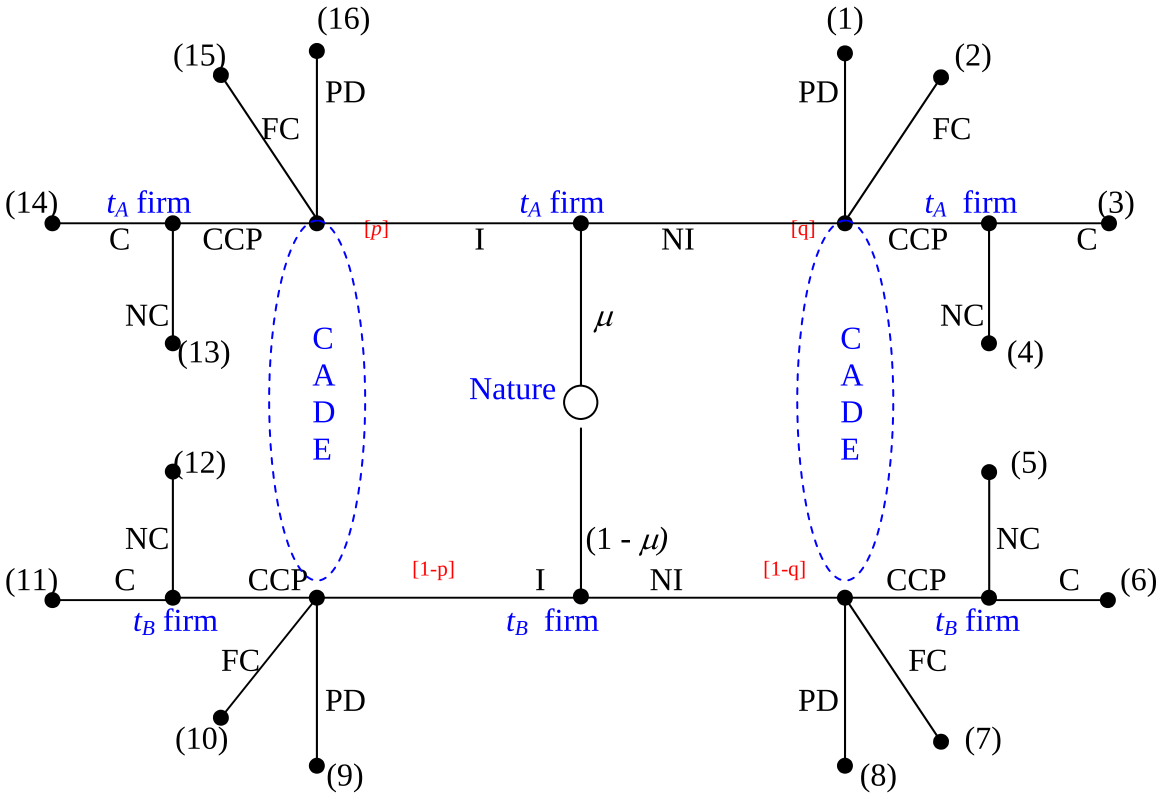
$$VPD_{CADE}^{FC/NI} = 0 \quad (2.18)$$

As mentioned before, after defining the players and their payoffs the possible actions of Nature are to choose between two types of firms. The firm observes its type and then chooses a message m_j from $M = \{m_1, m_2\} = \{I, NI\}$. The CADE can observe m_j (but never t_i) and then choose an action a_K from $A = \{a_1, a_2, a_3\} = \{CCP, PD, FC\}$. The payoffs from Figure 1 are on Table 1. The solution concept is Perfect Bayesian Equilibrium.

Verifying which strategies profile are Perfect Bayesian Equilibrium in the Figure 1 game, it is initially established the condition that guarantees the fulfillment of CCP. The equilibrium path that represents this effectiveness is (*I*, CCP, *C*). For all types of firms, this condition is given by $SF > SF_{Critics} = \left(\pi_i^M - \pi_i^N\right) + \left(r' - r\right)$ (Condition (1)), with $SF = F + F'$ being the superior limit of fine[7]. The complementary Perfect Bayesian Equilibrium Conditions for the CCP being effective are summarized in Table 2 to Table 5.

[7] This and all the others conditions are proved on appendix.

Figure 1 – The CCP game*



* Payoffs of Table 1

Table 1 – Payoffs for (firm, CADE) in the CCP game

Possible actions for firm	
NI	I
(1) $\left[\delta\pi_A^N+\delta^2\left(\pi_A^N-F-r\right)+\frac{\delta^3}{1-\delta}\pi_A^N,\delta^2\left(F-w\right)\right]$	(9) $\left[\delta\pi_B^M+\delta^2\left(\pi_B^N-F-r\right)+\frac{\delta^3}{1-\delta}\pi_B^N,-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(F+r\right)\right]$
(2) $\left[\frac{\delta}{1-\delta}\pi_A^N,0\right]$	(10) $\left[\frac{\delta}{1-\delta}\pi_B^M,-\frac{\delta}{1-\delta}\left(\pi_B^M-\pi_B^N\right)\right]$
(3) $\left[\delta\pi_A^N+\delta^2\left(\pi_A^N-r'\right)+\frac{\delta^3}{1-\delta}\pi_A^N,-\delta^2 w\right]$	(11) $\left[\delta\pi_B^M+\delta^2\left(\pi_B^N-r'\right)+\frac{\delta^3}{1-\delta}\pi_B^N,-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)\right]$
(4) $\left[\delta\pi_A^N+\delta^2\left(\pi_A^N-F-F'-r\right)+\frac{\delta^3}{1-\delta}\pi_A^N,\delta^2\left(F+F'-w\right)\right]$	(12) $\left[\delta\pi_B^M+\delta^2\left(\pi_B^M-F-F'-r\right)+\frac{\delta^3}{1-\delta}\pi_B^N,-\delta\left(\pi_B^M-\pi_B^N\right)-\delta^2\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(F+F'+r\right)\right]$
(5) $\left[\delta\pi_B^N+\delta^2\left(\pi_B^N-F-F'-r\right)+\frac{\delta^3}{1-\delta}\pi_B^N,\delta^2\left(F+F'-w\right)\right]$	(13) $\left[\delta\pi_A^M+\delta^2\left(\pi_A^M-F-F'-r\right)+\frac{\delta^3}{1-\delta}\pi_A^N,-\delta\left(\pi_A^M-\pi_A^N\right)-\delta^2\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(F+F'+r\right)\right]$
(6) $\left[\delta\pi_B^N+\delta^2\left(\pi_B^N-r'\right)+\frac{\delta^3}{1-\delta}\pi_B^N,-\delta^2 w\right]$	(14) $\left[\delta\pi_A^M+\delta^2\left(\pi_A^N-r'\right)+\frac{\delta^3}{1-\delta}\pi_A^N,-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(r'+H\right)\right]$
(7) $\left[\frac{\delta}{1-\delta}\pi_B^N,0\right]$	(15) $\left[\frac{\delta}{1-\delta}\pi_A^M,-\frac{\delta}{1-\delta}\left(\pi_A^M-\pi_A^N\right)\right]$
(8) $\left[\delta\pi_B^N+\delta^2\left(\pi_B^N-F-r\right)+\frac{\delta^3}{1-\delta}\pi_B^N,\delta^2\left(F-w\right)\right]$	(16) $\left[\delta\pi_A^M+\delta^2\left(\pi_A^N-F-r\right)+\frac{\delta^3}{1-\delta}\pi_A^N,-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(F+r\right)\right]$

Source: Elaborated by the authors

Table 2 – The Perfect Bayesian equilibrium conditions: pooling in *I*

Players	Conditions
Firm	Infract and accomplishes the CCP if $\Pi_i > \delta r'$ (Condition (2)), with $\Pi_i = \left(\pi_i^M - \pi_i^N\right)$
CADE	Proposes CCP if $\begin{cases} H > H^1_{Crítico} = F + r - r' & \text{(Condition (3))} \\ H > H^2_{Crítico} = -\left[\dfrac{\mu\Pi_A}{1-\delta} + \dfrac{(1-\mu)\Pi_B}{1-\delta} + r'\right] & \text{(Condition (4))} \\ w > F & \text{(Condition (5))} \\ w > 0 & \text{(Condition (6))} \end{cases}$

Source: Elaborated by authors

Table 3 – The Perfect Bayesian equilibrium conditions: pooling in *NI*

Players	Conditions
Firm	Doesn't infract if $\delta r' > \Pi_i$ (Condition (7))
CADE	Closes the case if $\begin{cases} w > 0 & \text{(Condition (8))} \\ w > F & \text{(Condition (9))} \\ H > H^3_{Crítico} = F + r - r' & \text{(Condition (10))} \\ H > H^4_{Crítico} = -\left[\dfrac{\mu\Pi_A}{1-\delta} + \dfrac{(1-\mu)\Pi_B}{1-\delta} + r'\right] & \text{(Condition (11))} \end{cases}$

Source: Elaborated by authors

Table 4 – The Perfect Bayesian equilibrium conditions: separating with t_A playing *I* and t_B playing *NI*

Players	Conditions
Firm	The high cost firm infracts and the low cost firm doesn't infract if $\Pi_A > \delta r' > \Pi_B$ (Condition (12))
CADE	Proposes CCP or closes the case if $\begin{cases} H > H^5_{Critico} = -\left(\dfrac{\Pi_i}{1-\delta} + r'\right) & \text{(Condition (13))} \\ H > H^6_{Critico} = F + r + r' & \text{(Condition (14))} \\ w > 0 & \text{(Condition (15))} \\ w > F & \text{(Condition (16))} \end{cases}$

Source: Elaborated by authors

Table 5 – The Perfect Bayesian equilibrium conditions: separating with t_A playing *NI* and t_B playing *I*

Players	Conditions
Firm	The low cost firm infracts and the high cost firm doesn't infract if $\Pi_A < \delta r' < \Pi_B$ (Condition 17))
CADE	Proposes CCP or closes the case if $\begin{cases} w > F & \text{(Condition (18))} \\ w > 0 & \text{(Condition (19))} \\ H > H^7_{Crítico} = -\left(\dfrac{\Pi_i}{1-\delta} + r'\right) & \text{(Condition (20))} \\ H > H^8_{Crítico} = F + r - r' & \text{(Condition (21))} \end{cases}$

Source: Elaborated by authors

The equilibrium conditions presented at the previous tables show some interesting results. Considering first that the strategies profile is pooling in infraction (*I*,*I*; *CCP*, *FC*; *p*, *q*) (Table 2), meaning that both type of firms are infracting; and CADE has the philosophy to propose the CCP to the potential infractor firm and withdraw the case if it considers that there wasn't an infraction of the antitrust law. By the Bayes' rule, the posteriori belief of CADE about the firm being a high cost type since it doesn't infracts is $p = \mu$ (after observing the firm message, the belief of CADE doesn't change in relation to the previous belief [8]).

Analyzing the condition that determines that the firm infracts and accomplishes the CCP (Table 2), we can say that when the reputation loss with the process opened by CADE (*r*') is lower, less strict is the Condition (2) and the incentive to infract and accomplish the CCP is bigger. To guarantee that CADE proposes the CCP (as a best response) it is necessary: a) that benefits of CADE be superior to the net reputation and financial loss (Condition (3)). If these sanctions are bigger, Condition (3) is stricter and the CADE incentive to apply the CCP is lower, being better direct punishment; b) the benefit of CADE to apply CCP be bigger than the discounted expected losses with the firm infraction, including the reputation loss, *r*'. And when the probability of the firm to be low cost type increases, the Condition (4) will be less strict and the incentive to apply the CCP will be bigger; c) that the best response of CADE (out of the equilibrium path) is withdraw the case if the firm doesn't infract (Conditions (5) and (6), determining that fines are smaller than social losses with injustice).

Now, considering the strategy profile (*NI*, *NI*; *FC*, *CCP*; *p, q*), meaning that the information set of CADE is not infract on the equilibrium path (Table 3). By the Bayes' rule, the CADE belief about the firm being high costs (since it doesn't infract) is $q = \mu$ [9]. Its best response is doesn't apply the CCP. Looking at the incentives of the firm, that determine it doesn't infract and accomplishes the CCP, it is necessary that the reputation losses be

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[8] $$P(A/I) = \frac{P(A)P(I/A)}{P(A)P(I/A) + P(B)P(I/B)} = \frac{\mu.1}{\mu.1 + (1-\mu).1} = \mu$$

[9] $$P(A/NI) = \frac{P(A)P(NI/A)}{P(A)P(NI/A) + P(B)P(NI/B)} = \frac{\mu \cdot 1}{\mu \cdot 1 + (1-\mu) \cdot 1} = \mu$$

significant (bigger that the infraction benefits). And the CADE conditions that define its incentives to apply the CCP are the same as given before. Considering that empirically there is a low probability to have such a level of reputation loss, then we discard the strategy profile (*NI*, *NI*; *FC*, *CCP*; *p, q*) as an equilibrium path.

Discussing the results of the separation equilibrium, first with the high cost firm playing infract and the low cost firm playing not infract (Table 4). The strategy profile (*I*, *NI*; *CCP*, *FC; p*, *q*) is an equilibrium if the net benefit of the high cost firm is bigger than the loss of reputation (the opposite for the low cost firm). As showed before, the incentive of CADE to propose the CCP is bigger when losses of reputation are lower. By its turn, when the fine *F* and the loss of reputation *r* are bigger, lower is the incentive of CADE proposing CCP. And always there is a social loss *w* (originated of proposing CCP for a not infractor firm), bigger than the financial sanctions, the CADE should withdraw the case. At last, if the strategy profile is (*NI*, *I*; *FC*, *CCP; p*, *q*), the results are similar, with the appropriated changes for the firm type (Table 5).

4. Final considerations

One of the most important tasks of the antitrust authorities is to implement mechanisms capable to restrain the law violation by the agents, which implies to make the illegal actions unprofitable to the firms. In this case a key problem emerges that is to define the superior limits of the infraction cost. As a punishment level depends on how serious the illegal action was, this cost has to be calculated in a way to create an equal or similar cost in comparison to the social cost produced by the illegal action.

In the case under analysis the social costs were defined as a function of the superiors limits that the anticompetitive actions can reach. However, if it isn’t possible to observe the types of the firms, there is an informational problem in the antitrust regulation. The informational problem inherent to the antitrust regulation goes beyond the discussion of the limits of the punishment system. It is related with the non annunciated reasons to implement certain softer instruments (as a difficulty to collect enough proofs to condemn the firms).

The objective of this paper was to present the regulatory efficiency of CCP when the Principal considers the firms classified by different technologies and to define the consequences of this separation on the incentives to apply more lenient antitrust rules. Since the information asymmetry causes inefficiency on the detection system of anticompetitive actions, the definition of the parameters to calculate the limits of the applicable penalties is very important. For this reason, the CCP was modeled in terms of a game between the firm and CADE, which by supposition has a philosophy to propose the CCP always when there is an infraction.

The analysis of the results of the Perfect Bayesian equilibrium existence indicated two groups of Conditions to the CCP effectiveness. Firstly, the firm should follow the CCP when: reputation loss and financial penalties with condemnation were big enough; the profits with infraction were smaller than normal profits. Secondly, the CADE should propose the CCP when the benefit to do it was bigger than the financial and reputation loses of the firm. And, when the firm infracts and the antitrust authority doesn’t observe that, the CADE should apply the CCP when the belief that the firm is low cost type was big enough.

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Appendix

1. Condition (1)

1.1. If the firm is high cost type and infracts, it accomplishes the CCP if its payoff number (14) is bigger than the payoff number (13) (Table 1) that is:

$$\delta\pi_A^M + \delta^2\left(\pi_A^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_A^N > \delta\pi_A^M + \delta^2\left(\pi_A^M - F - F' - r\right) + \frac{\delta^3}{1-\delta}\pi_A^N$$

$$\pi_A^M - \pi_A^N < F + F' + r - r' \text{ (Condition (1.1))}$$

1.2. If the firm is high cost type and doesn't infract, it accomplishes the CCP if (3) > (4) (Table 1), that is:

$$\delta\pi_A^N + \delta^2\left(\pi_A^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_A^N > \delta\pi_A^N + \delta^2\left(\pi_A^N - F - F' - r\right) + \frac{\delta^3}{1-\delta}\pi_A^N$$

$$F + F' + r - r' > 0 \text{ (Condition (1.2))}$$

1.3. If the firm is low cost type and it doesn't infract, it accomplishes the CCP if (6) > (5) (Table 1), that is:

$$\delta\pi_B^N + \delta^2\left(\pi_B^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_B^N > \delta\pi_B^N + \delta^2\left(\pi_B^N - F - F' - r\right) + \frac{\delta^3}{1-\delta}\pi_B^N$$

$$F + F' + r - r' > 0 \text{ (Condition (1.3))}$$

1.4. If the firm is low cost type and infracts, it accomplishes the CCP if (11) > (12) (Table 1), that is:

$$\delta\pi_B^M + \delta^2\left(\pi_B^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_B^N > \delta\pi_B^M + \delta^2\left(\pi_B^M - F - F' - r\right) + \frac{\delta^3}{1-\delta}\pi_B^N$$

$$\pi_B^M - \pi_B^N < F + F' + r - r' \text{ (Condition (1.4))}$$

Then

$$SF > \left(\pi_i^M - \pi_i^N\right) + \left(r' - r\right) \text{ (Condition (1))}$$

being $SF = F + F'$ and $i = A,B$, $A \neq B$.

2. Condition (2)

Since CADE proposes the CCP (if the high cost type firm infracts) and closes the case (if the firm doesn't infract), the firm infracts if (14) > (2) (Table 1), that is

$$
\begin{aligned}
&\delta\pi_A^M + \delta^2\left(\pi_A^N - r'\right) + \frac{\delta^3}{1-\delta}\pi_A^N > \frac{\delta}{1-\delta}\pi_A^N \\
&\delta(1-\delta)\pi_A^M + \delta^2(1-\delta)\left(\pi_A^N - r'\right) + \delta^3\pi_A^N > \delta\pi_A^N \\
&\delta(1-\delta)\pi_A^M + \delta^2\pi_A^N - \delta^3\pi_A^N + \delta^3\pi_A^N - \delta\pi_A^N - \delta^2(1-\delta)r' > 0 \\
&\delta(1-\delta)\pi_A^M - \delta(1-\delta)\pi_A^N - \delta^2(1-\delta)r' > 0 \\
&\left(\pi_A^M - \pi_A^N\right) > \delta r' .
\end{aligned}
$$

Mutatis mutandis, the same result is founded for the low cost firm, with the Condition of (11) > (7) (Table 1).

3. Conditions (3) to (6)

3.1. CADE best responses on equilibrium path

CADE should follows its goal to propose the CCP when the firm infracts if $VPD_{CADE}^{CCP/I;C} > VPD_{CADE}^{PD/I}$, or if the respective expected payoffs of CADE (14) + (11) > (16) + (9) (Table 1), that is

$$
\begin{aligned}
&\left[-\delta\left(\pi_A^M - \pi_A^N\right) + \delta^2\left(r' + H\right)\right]\mu + \left[-\delta\left(\pi_B^M - \pi_B^N\right) + \delta^2\left(r' + H\right)\right](1-\mu) > \\
&\left[-\delta\left(\pi_A^M - \pi_A^N\right) + \delta^2\left(F + r\right)\right]\mu + \left[-\delta\left(\pi_B^M - \pi_B^N\right) + \delta^2\left(F + r\right)\right](1-\mu)
\end{aligned}
$$

$$H > F + r - r' \text{ (Condition (3))}$$

And if $VPD_{CADE}^{CCP/I;C} > VPD_{CADE}^{FC/I}$, that is equivalent to the expected payoffs (14) + (11) > (15) + (10) (Table 1), that is

$$\left[-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(r'+H\right)\right]\mu+\left[-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)\right](1-\mu)>$$
$$\left[-\frac{\delta}{1-\delta}\left(\pi_A^M-\pi_A^N\right)\right]\mu-\left[\frac{\delta}{1-\delta}\left(\pi_B^M-\pi_B^N\right)\right](1-\mu)$$

$$-\mu\delta\left(\pi_A^M-\pi_A^N\right)+\mu\frac{\delta}{1-\delta}\left(\pi_A^M-\pi_A^N\right)-\delta\left(1-\mu\right)\left(\pi_B^M-\pi_B^N\right)$$
$$+\left(1-\mu\right)\frac{\delta}{1-\delta}\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)>0$$

$$\frac{-\mu\delta+\mu\delta^2+\mu\delta}{1-\delta}\left(\pi_A^M-\pi_A^N\right)+\frac{-\delta\left(1-\mu\right)+\delta^2\left(1-\mu\right)+\delta\left(1-\mu\right)}{1-\delta}\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)>0$$

$$H>-\left[\frac{\mu\left(\pi_A^M-\pi_A^N\right)}{1-\delta}+\frac{\left(1-\mu\right)\left(\pi_B^M-\pi_B^N\right)}{1-\delta}+r'\right] \text{ (Condition (4)).}$$

3.2. CADE best responses out of the equilibrium path

CADE should follow its goal to propose FC when the firm doesn't infracts if $VPD_{CADE}^{FC/NI} > VPD_{CADE}^{PD/NI}$, or if the expected payoffs (2) + (7) > (1) + (8) (Table 1), that is

$$0>\mu\delta^2\left(F-w\right)+\left(1-\mu\right)\delta^2\left(F-w\right)$$
$$\delta^2\left(F-w\right)<0$$
$$w>F \text{ (Condition (5))}$$

And if $VPD_{CADE}^{FC/NI} > VPD_{CADE}^{CCD/NI}$, that is equivalent to the expected payoffs (2) + (7) > (3) + (6) (Table 1), that is:

$$0>\mu\delta^2\left(-w\right)+\left(1-\mu\right)\delta^2\left(-w\right)$$
$$w>0 \text{ (Condition (6))}$$

4. Condition (7)

The high cost firm doesn't deviate of the NI strategy if its payoff (2) > (14), that is:

$$\frac{\delta}{1-\delta}\pi_A^N > \delta\pi_A^M + \delta^2\left(\pi_A^N + r'\right) + \frac{\delta^3}{1-\delta}\pi_A^N$$
$$\delta r' > \pi_A^M + \delta\pi_A^N - \frac{1}{1-\delta}\pi_A^N + \frac{\delta^2}{1-\delta}\pi_A^N$$
$$\delta r' > \pi_A^M + \frac{\delta(1-\delta)\pi_A^N - \pi_A^N + \delta^2\pi_A^N}{1-\delta}$$
$$\delta r' > \pi_A^M - \pi_A^N \text{ (Condition (7))}$$

Mutatis mutandis, the same result can be reached for the low cost firm, since (7) > (11) (Table 1).

5. Conditions (8) to (11)

5.1. CADE best responses in the equilibrium path

CADE should follow the goal to propose FC when the firm doesn't infracts if $VPD_{CADE}^{FC/NI} > VPD_{CADE}^{CCP/NI}$, or if the expected payoffs of CADE (2) + (7) > (3) + (6) (Table 1) that is:

$$0 > -\delta^2 w\mu - \delta^2 w(1-\mu)$$
$$w > 0 \text{ (Condition (8))}$$

And if $VPD_{CADE}^{FC/NI} > VPD_{CADE}^{PD/NI}$ or (2) + (7) > (1) + (8) (Table 1) that is,

$$0 > \delta^2\left(F - w\right)\mu + \delta^2\left(F - w\right)(1-\mu)$$
$$w > F \text{ (Condition (9))}$$

5.2. CADE best responses out of the equilibrium path

CADE should propose FC when the firm doesn't infract if $VPD_{CADE}^{CCP/I} > VPD_{CADE}^{PD/I}$ or if the expected payoffs (14) + (11) > (16) + (9), that is

$$\left[-\delta\left(\pi_A^M - \pi_A^N\right) + \delta^2\left(r' + H\right)\right]\mu + \left[-\delta\left(\pi_B^M - \pi_B^N\right) + \delta^2\left(r' + H\right)\right](1-\mu) >$$
$$\left[-\delta\left(\pi_A^M - \pi_A^N\right) + \delta^2\left(F + r\right)\right]\mu + \left[-\delta\left(\pi_B^M - \pi_B^N\right) + \delta^2\left(F + r\right)\right](1-\mu)$$

$$\left(r'+H\right)\mu+\left(r'+H\right)\left(1-\mu\right)>\left(F+r\right)\mu+\left(F+r\right)\left(1-\mu\right)$$
$$r'+H>F+r$$
$$H>F+r-r' \text{ (Condition (10))}$$

And if $VPD_{CADE}^{CCP/I} > VPD_{CADE}^{FC/NI}$, or the equivalent expected payoffs (14) + (11) > (15) + (10) (Table 1) that is,

$$\left[-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(r'+H\right)\right]\mu+\left[-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)\right]\left(1-\mu\right)>$$
$$\left[-\frac{\delta}{1-\delta}\left(\pi_A^M-\pi_A^N\right)\right]\mu+\left[-\frac{\delta}{1-\delta}\left(\pi_B^M-\pi_B^N\right)\right]\left(1-\mu\right)$$

Likewise the Condition (4), we have

$$H>-\left[\frac{\mu\left(\pi_A^M-\pi_A^N\right)}{1-\delta}+\frac{\left(1-\mu\right)\left(\pi_B^M-\pi_B^N\right)}{1-\delta}+r'\right]$$

6. Condition (12)

If the firm is high cost type, the Condition which turns out the infract strategy (I) optimal instead of the don’t infract strategy (NI) is equivalent to (14) > (2) (Table 1). If the firm is low cost type, the Condition which optimizes the NI strategy is equivalent to (7) > (11) (Table 1). Respectively

$$\delta\pi_A^M+\delta^2\left(\pi_A^N-r'\right)+\frac{\delta^3}{1-\delta}\pi_A^N>\frac{\delta}{1-\delta}\pi_A^N$$

As in Condition (2),

$$\left(\pi_A^M-\pi_A^N\right)>\delta r'$$

e

$$\frac{\delta}{1-\delta}\pi_B^N>\delta\pi_B^M+\delta^2\left(\pi_B^N-r'\right)+\frac{\delta^3}{1-\delta}\pi_B^N$$
$$\delta r'>\left(\pi_B^M-\pi_B^N\right)$$

Then, $\Pi_A>\delta r'>\Pi_B$ (Condition (12))

7. Conditions (13) to (16)

7.1. Best responses of CADE in the equilibrium path

CADE proposes the CCP if the payoff to do it is bigger than the payoff of close the case and direct punishment, which means (14) > (15) and (14) > (16) respectively (Table 1), that is,

$$\mu p\left[-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(r'+H\right)\right]>\mu p\left[-\frac{\delta}{1-\delta}\left(\pi_A^M-\pi_A^N\right)\right]$$

$$H>-\left[\frac{\left(\pi_A^M-\pi_A^N\right)}{1-\delta}+r'\right] \text{ (Condition (13.1))}$$

and

$$\mu p\left[-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(r'+H\right)\right]>\mu p\left[-\delta\left(\pi_A^M-\pi_A^N\right)+\delta^2\left(F+r\right)\right]$$

$$H>F+r-r' \text{ (Condition (14.1))}$$

And CADE decides to close the case (if the firm doesn't infracts) always that the payoff of doing it is bigger than the payoff to propose the CCP and give direct punishment (respectively), that is (7) > (6) and (7) > (8), or

$$0\left(1-\mu\right)>-\delta^2 w\left(1-\mu\right)$$

$$w>0 \text{ (Condition (15.1))}$$

and

$$0\left(1-\mu\right)>-\delta^2\left(F-w\right)\left(1-\mu\right)$$

$$w>F \text{ (Condition (16.1))}$$

7.2. Best responses of CADE out of the equilibrium path

CADE closes the case when the high cost firm doesn't infract if (2) > (1) and (2) > (3) (Table 1), that is, respectively,

$$\mu 0>\delta^2\left(F-w\right)\mu$$

$$w>F \text{ (Condition 16.2))}$$

and

$$\mu 0>\delta^2 w\mu$$

$$w>0 \text{ (Condition (15.2))}$$

CADE proposes CCP to the low cost firm that infracts if (11) > (10) and (11) > (9) (Table 1), that is, respectively,

$$\mu\left[-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)\right]>\mu\left[-\frac{\delta}{1-\delta}\left(\pi_B^M-\pi_B^N\right)\right]$$

$$H>\frac{\pi_B^M-\pi_B^N}{1-\delta}-r' \text{ (Condition (13.2))}$$

and

$$\mu\left[-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(r'+H\right)\right]>\mu\left[-\delta\left(\pi_B^M-\pi_B^N\right)+\delta^2\left(F+r\right)\right]$$

$$H>F+r+r' \text{ (Condition (14.2))}$$

8. Condition (17)

If the firm is high cost type, the condition which makes the strategy of doesn't infracting (instead of infract) optimal is equivalent to (2) > (14) (Table 1). If the firm is low cost type, the condition which makes the strategy of doesn't infract optimal is equivalent to (11) > (7) in the same Table. Then, with the correct changes, the proof is obtained as in condition (12) so that $\delta r'>\left(\pi_A^M-\pi_A^N\right)$ and $\delta r'<\left(\pi_B^M-\pi_B^N\right)$, or $\left(\pi_A^M-\pi_A^N\right)<\delta r'<\left(\pi_B^M-\pi_B^N\right)$.

9. The proofs of conditions (18) and (19) are equivalent to the proofs of conditions (16) and (15). And the proofs of conditions (20) and (21) are equivalent to the proofs of (13) e (14), respectively.