Barcelona School of Economics

Master in Competition and Market Regulation

"The Chilean Injectables Cartel: Detection of Collusion in Public Procurement"

Daniel Méndez Fernández and Noelia Saiz Contreras

Advisors: Rodrigo Carril, Elliot Motte

July 2022

ABSTRACT IN ENGLISH (100 words): This paper looks at the effectiveness of recently developed safe-tests for the detection of collusion in public procurement. We discuss the prevalence and consequences of collusion in public procurement, as well as the limitations of existing detection methods. We then inspect the new methodologies proposed by Kawai which uses backlog and incumbency status indicators to identify bid patterns that are indicative of collusion. Finally, we demonstrate the methodology's effectiveness by applying it to a Chilean cartel. Our results suggest that safe-tests like the one presented can be useful to detect collusion, making it a valuable tool for combating it.

ABSTRACT IN CATALAN/ SPANISH (100 words): Este estudio analiza la eficacia de los tests desarrollados recientemente en la literatura para la detección de colusión en la contratación pública. Discutimos la prevalencia y las consecuencias de la colusión en las licitaciones, así como las limitaciones de los métodos de detección existentes. Además, estudiamos las nuevas metodologías propuestas, que utilizan distintas medidas para identificar patrones de ofertas que son indicativos de colusión. Finalmente, demostramos la efectividad de la metodología aplicándola a un cartel chileno. Nuestros resultados sugieren que este tipo de tests pueden ser útiles para detectar la colusión, lo que los convierte en una herramienta valiosa para combatirla.

KEYWORDS IN ENGLISH (3)**:** Public procurement, Collusion,

Detection.

KEYWORDS IN CATALAN/ SPANISH (3)**:** Licitación pública,

Colusión, Detección.

Contents

List of Tables

List of Figures

1 Introduction

Public procurement is an essential activity developed by public entities. It ensures that the governments and other public authorities can deliver public services or goods. These are essential to the correct functioning of each country and may include the functioning of hospitals and schools, and the building of roads or bridges. However, it is also a very resource-intensive process, and a big amount of taxpayers' money is dedicated to this activity. For example, the European Union dedicates 16% of its total GDP to public procurement among all Member States (European Parliament, 2022). Therefore, collusion in this industry can harm governments, who must pay higher prices, and devote a higher amount of the public budget to buying public goods and services. But it also can be very harmful to consumers, who may be prevented from other public services and goods.

It is understandable that public procurement, particularly the detection of anti-competitive behaviours in this setting, has become a priority for governmental bodies worldwide. Researchers and competition authorities have tried to understand how to award public tenders in a way that collusion becomes complicated. They have also tried to understand which econometric tests can be used to detect collusion and how firms manage to beat some of these tests. In recent years, some researchers have developed econometric tests that focus on the relationship of indicators such as backlog and incumbency and their connection to collusion.

This report aims to test whether these recent tests can be applied to detect collusion. We focus on the methodology developed by Kawai et al., which uses backlog and incumbency status to build a discontinuity test (Kawai, Nakabayashi, Ortner, Chassang, 2022). We apply this methodology to public procurement data of the pharmaceutical sector in Chile from 2007 to 2021. In this sector, three firms were accused and found guilty of colluding from 1999 to 2013 in the sub-sector of injectables. We, therefore, apply the methodology to a collusive period (2007-2013) and a period where firms were supposedly behaving competitively (2014-2021) to see whether the test manages to pick up collusive behaviour from the data correctly. After checking that the test correctly detects collusion, we apply the test to the products for which the three colluders competed with each other. Because the

colluders not only competed in the injectables market, the idea is to check if they extended their collusive agreements beyond the market considered by the Competition Authority in Chile.

We found that the test manages to identify discontinuity patterns in the incumbency of winners and losers in close bids during the collusive period. Similarly, the incumbency test suggests collusion beyond the ampoule market.

This report presents some background information about the main characteristics of public procurement in Chile and a brief overview of the Injectable's Cartel in sections 1 and 2. Then a literature review is presented in section 3. Section 4 presents the empirical analysis of the data. First, we present the methodology, then a brief analysis of the data used, and lastly, the results obtained. Finally, we present our main conclusions in section 5.

2 Background

2.1 Public procurement in Chile

Public entities, like governments, need to purchase goods and services to provide an array of public services. This process is known as public procurement, and in Chile, over US$ 9 billion was spent on over 1.5 million purchases in 2021 (Directorate, 2022). Because the government spends a significant amount of taxpayers' money on this activity, they are expected to act with transparency and deliver efficient results.

In 2000, the Government of Chile established a public website, "Chile Compra", to increase transparency and decrease procurement costs. On this website, the government publishes information about past and future public purchases, including information on the goods and services purchased, the method used to carry out the purchase, the number and identity of the firms who participated in the purchase, and the final amount paid, among other data.

There are different ways in which a public purchase can be conducted, but one of the most common ways is using tenders. On tenders, the government publishes its intention to buy a particular good or service. Then, interested firms submit a

bid that represents the amount at which they would be willing to provide that good or service. Finally, the government applies particular criteria to calculate a score and decide which bid wins the tender. In the case of Chile, the criteria have been changing over the years. The current criteria applied consider many different factors about the bids of the firms. The most important ones are the evaluation of the economic offer, the evaluation of the completeness of the documents presented, and, in the case of pharmaceutical-related tenders, the evaluation of bioequivalence[1],and the evaluation of good manufacturing practices[2].These criteria amount to 95% of the score that a firm can achieve, and the highest weight is given to the economic offer, representing up to 70% of the total score (Cenabast, 2012). This ensures that the government considers efficiency when performing public purchasing. The other criteria ensure that the firm complies with a certain quality level and best practice methods.

In Chile, one single tender can include several goods and services. This mechanism allows firms to bid for just one of the products in the tender or for several products simultaneously. The government then applies the above criteria to decide which firms get each good and the final amount to be paid.

One of the biggest concerns in competition policy nowadays is collusion in public tenders, normally referred to as bid-rigging. Chile has been working to ensure that collusion is deterred in this industry and detected as fast as possible. To do so, they started elaborating a set of materials to help public entities understand the incentives of firms to collude in public tenders, and improve the criteria and process of the tenders to reduce those incentives.

2.2 The chilean injectable cartel

On January 27th, 2020, the Supreme Court of Chile confirmed the sentence emitted by the National Tribunal of Competition in 2018, on which three local pharmaceutical laboratories; Biosano, Fresenius Kabi, and Sanderson (a Fresenius Kabi's

[1]Bioequivalence refers to the biological equivalence of two preparations of one drug. In this case, the assessment checks if the drug offered by the firm is bioequivalent to the one demanded by the government.

[2]Referred to as GMP certificate, that confirms the firm is following the guidelines required to commercialize certain products like beverages, cosmetics or pharmaceutical products.

subsidiary), were found guilty of engaging in an agreement of collusive bid rotation on the generic injectables market, also known as ampoules (Sentencia Corte Suprema 278-19 - Laboratorios, [2020]). The tribunal determined that the companies had engaged in anticompetitive behaviour from 1999 until the first semester of 2013.

During the period that the agreement was in place, executives of the companies held meetings in which they exchanged internal documents of their companies and listed the most relevant tenders available from Cenabast, the Chilean state public service in charge of the acquisitions and distribution of drugs, medical supplies and food. In these meetings, they would fill out documents agreeing on the offer that the designated winning company would present and, on some occasions, the bidding price that the losing companies would present. According to the court, the agreement covered 93 different products in over 1200 tenders. The court remarks that no substitution is possible for any of the affected products, given the detailed description of each product in the tenders. The last cartel meeting occurred in February 2013, and in April of the same year, the official investigation that ultimately led to the companies' conviction was launched.

Even though the court only analysed 1200 tenders, the accused firms competed in more tenders for those 93 drugs during the cartel period. The court decided to only include in the decision the ones for which recorded evidence was found. Particularly, these bids had a higher average winning bid. Nonetheless, we performed the analysis including all the bids for those 93 drugs in which at least one colluder participated.

3 Literature review

Public procurement tenders are designed to ensure efficiency so that the seller offering the most competitive bid is the winner. The main problem is that public procurement is characterized by features that may facilitate collusion. For example, governments normally publish all the bids from winners and losers in a search for transparency. If companies are involved in a cartel, they can check whether any

firm deviates and must be punished much more easily, making it easier to sustain collusion (Porter & Zona, 1992).

Therefore, it is important to ensure that bid-rigging and collusion do not affect these processes and find mechanisms to quickly detect collusion in public procurement. Porter and Zona developed several econometric tests to find patterns inconsistent with competitive behaviour in 1992. They tested their methods with data on auction bids for state highway construction on Long Island. Even though their method successfully detected collusion, they noted that collusive firms could easily manipulate their tests to avoid being caught (Porter & Zona, 1992). However, they also noted that, even if econometric tests were not as good as wiretap evidence or disclosure by a cartel member, they are essential to fight collusion in public procurement. Finding ways to detect collusion without relying on material evidence is essential because, even though it is hard for firms to eliminate all traces of information exchanges, it is also hard for the authorities to find it.

Porter and Zona also analyzed the difference in conduct between colluding and non-colluding firms. They applied their econometric test to Ohio's public school milk market to detect collusion patterns. They characterized the normal conduct of non-colluding firms as a control group by estimating the probability of a firm participating in a tender using Probit models and the normal mark-ups controlling for firm effects, cost variables and district-specific characteristics. With this, they compared the behaviour to the one exhibited by firms that were defendants in a collusion case to try and identify systematic deviations from the competitive conduct. They found significant deviations from the defendants compared to the control group's behaviour regarding the number of bids placed and prices offered (Porter & Zona, 1999).

Since Porter and Zona, many others have developed different tests that may help detect collusion. Recently, Kawai, together with Chassang, Nakabayashi and Ortner, has developed methodologies in different papers that can be used to detect collusion in different settings. (Kawai, Chassang & Nakabayashi, 2021), (Kawai and Nakabayashi, 2021), (Kawai, Nakabayashi & Ortner, 2021). These tests are being referred to as safe-tests. The main idea behind this methodology is that the test will

be passed with a probability one by the non-cartel members, but cartel members will fail the test. This type of test addresses one of the main concerns that arise when using econometric tools to detect collusion: the possibility of misspecifying some of the conducts or parameters and obtaining evidence of non-cartel members being collusive.

4 Empirical study

4.1 Methodology

The methodology applied in this work will be based on the one developed by Kawai et al. (2021). This methodology establishes a closer link between backlog and incumbency with collusive behaviours. It is common to point towards backlog and incumbency as indicators of bid rotation schemes since the allocation is done taking into account past wins. However, it has been proven that these allocation patterns can be justified by cost asymmetries and do not necessarily show anticompetitive practices. Kawai et al. show that the link between these variables can be attributed to collusion under the assumptions of a regression discontinuity design (Kawai et. al).

To assess if the ampoules cartel in Chile could have been detected by finding evidence of collusive bid rotation, we will look into the winners' backlog and incumbency status and apply the RD design. We will focus on the tenders that included one of the 93 affected drugs.

Two indicators are included in the analysis. On the one hand, we have backlog, which refers to the total monetary value of tenders that a firm has won recently. If bid rotation is present, it would imply that firms with low levels of backlog, i.e., firms that have not won many tenders recently, would have a higher probability of winning a tender than those with higher backlogs. There are competitive reasons for which this might be true, such as ones related to the firms' capacity constraints or costs increasing with backlog.

To deal with this, Kawai et al. (2021) propose looking at close bids, i.e., those

on which the losing bids lose to the lowest by a close margin. On these close bids, the winner should be determined as-if-random, which permits us to control for these costs or capacity reasons. If there is evidence that the winner is consistently the firm with the lowest backlog in these bids, then we could consider this as evidence of the existence of bid rotation. On the contrary, if close winners and close losers are statistically similar, then we can not reject that the outcome of this market is competitive.

Similarly, a bid rotation scheme could be agreed upon concerning the cartel members' incumbency status, meaning that if a firm has won a tender before, it will consistently win the following bids for the same product. If we analyze a sample of only very close bids, the winner should be as-if-random.

To test this idea and define more formally what we intuitively just laid out, we are, as in Kawai et al. (2021), defining this difference between close winners and close losers with a β as shown bellow:

$$\beta = lim_{\epsilon \to 0^+} \mathbf{E}[x_{i,t} | \Delta_{i,t} = \epsilon] - lim_{\epsilon \to 0^-} \mathbf{E}[x_{i,t} | \Delta_{i,t} = \epsilon]$$

Here, we also denote $\Delta_{i,t} \equiv b_{i,t} - \wedge \mathbf{b}_{-i,t}$ as the difference between the bid of firm i $b_{i,t}$ and the most competitive bid among the rest of the participant bidders $\mathbf{b}_{-i,t}$. $\Delta_{i,t} > 0$ implies that the firm lost the tender because the firm's bid is greater than the most competitive alternative. Similarly, $\Delta_{i,t} < 0$ implies that the firm i won the tender. $x_{i,t}$ is a measure of firm's i incumbency or backlog.

We understand the usage of backlog and incumbency to explain bid rotation can have many explanations different from non-competitive behavior, such as capacity constraints in the case of backlog, or knowledge acquired from experience, or *know-how*, for the case of incumbency. However, the usage of close bids avoids these alternatives. In Kawai et al. (2020) the formal proof provided shows that the probability that a bidder wins or loses an auction conditional on close bids approaches 50%, regardless of the bidders' characteristics.

We will then test the null hypothesis that $\beta = 0$; in the case of rejecting the null hypothesis, it would translate into the rejection of competition. In the presence of collusive bid rotation, we would expect β to be positive when x refers to backlog

and negative when x refers to incumbency.

This methodology will be applied to two groups of bids: (i) the one conformed by bids of drugs indicated by the competition authorities to have been part of the collusive agreement, and (ii) the rest of the bids on which the firms that were part of the agreement participated, but that the authority did not consider to have been collusive. The second group will include observations for other products apart from injectables. We maintain as collusive period the years between 2007 and the beginning of 2013. Moreover, we consider post cartel period all bids after 2013. Analyzing these two groups will help us check if the test correctly captures collusive behaviour and analyze if collusion was extended outside the ampoules market.

4.2 Data

The data was obtained from "Chile Compra-Datos Abierto", a website administered by the government of Chile. On that website, the government, through the Treasury Department, publishes information about public purchases. This information includes the bids presented by all participants in a tender, which allows us to study the patterns of bid rotation. According to the Supreme Court of Chile, the cartel was active from 1999 to 2013. However, only data from 2007 onwards is publicly available on the website. We, therefore, have information about tenders in the injectables market between 2007 and 2021. This implies that we have information for seven years of the collusive period and eight years of the supposedly non-collusive period.

As previously explained, Cenebast sometimes publishes tenders demanding several different injectable drugs simultaneously. Firms can present bids for each drug, and several winners are selected. We are, therefore, interested in the bid-item level, meaning we work with information about bidders competing in the same tender for the same injectable drug.

As mentioned, we work with two different datasets. On the one hand, we work with the bids presented for the 93 drugs affected by the collusion according to the Competition Authority. This includes not only the tenders for which physical proof was found but also those not included in the investigation and in which the col-

luders participated. On the other hand, we work with a dataset we denominate "Cartelized", which includes various products for which the colluders submitted bids during the cartelised periods.

	Ampoules		Cartelized	
	(1)	(2)	(3)	(4)
	Cartel	Post Cartel	Cartel	Post Cartel
Number of bidders	5.65	6.42	4.97	6.49
	(2.844544)	(5.427927)	(2.50)	(5.665097)
Winning bid	357,063.1	2,564,014	652,594	2,722,144
	(6,638,435)	(5.26e+07)	(1.30e+07)	(5.17e+07)
Second bid	883,168.5	4,159,529	1,350,168	4,359,661
	(2.32e+07)	(7.73e+07)	(2.94e+07)	(7.75e+07)
Obs.	646,594	254,519	253,217	227,080

Note: (1) The cartel period is defined based on the Authority's decision for both dataset. The collusive period includes data form 2007 to 2013, and the post cartel period includes information for after 2013. (2) The winning bid and the second bid are expressed in Chilean Pesos

Table 1: Summary statistics of the bids for the cartel and post-cartel periods.

Table 1 shows the summary statistics of the number of participants in each tender, the winning bid and the second bid for the ampoules market and the cartelized dataset for the cartel and post-cartel period. It can be seen that the number of participants was slightly lower during the cartel periods than in the competitive periods for both datasets. Also, the winning bids were significantly higher in the post-cartel period of both datasets.

Our main variables of interest are the bids presented by each firm for each tender and their backlog and incumbency status. The bids are obtained from the dataset, but the backlog and incumbency variables had to be constructed. To construct a variable for the backlog, we measured, for each tender, the amount of tenders each bidder won in the previous 90 and 180 days. We normalized by using the sum of the monetary value of those wins. Therefore the higher the backlog, the higher the monetary value of tenders the firm had won lately. We then standardized the backlog

of each firm by subtracting each firm's time-series backlog average and dividing by its standard deviation, as shown below. In this way, we avoid capturing firm size heterogeneity and only capture inter-temporal changes in the backlog.

$$x_{i,t}^{\bar{B}_k} = \frac{x_{i,t}^{B_k} - \mu_{x_i}^{B_k}}{\sigma_{x_i}^{B_k}} \tag{1}$$

where $\mu_{x_i}^{B_k}$ is the firm's backlog mean, $\sigma_{x_i}^{B_k}$ is the firm's backlog standard deviation and B signals 180 or 90 days.

Similarly, we construct a variable for incumbency. To capture incumbency, we create a dummy variable that shows whether a given firm won the previous tender or not. Under this methodology, we expect the incumbency status of close winners to be higher than those of close losers.

Table 2 shows some summary statistics about the variables of interest. The backlog appears to be higher in the post-cartel period for both datasets and both for the 90-day and the 180-day specifications. The incumbency status seems to be similar on average for the post and cartel periods. However, it is necessary to carry out formal tests to understand the implications for competition in the market period.

4.3 Results

We first implement the backlog test. We considered as close bids those bids that were at most 20% higher than the winning bid[3].To restrict our analysis to close bids, we construct our delta variable. $\Delta_{i,t}$ represents the difference between the bid of firm i $b_{i,t}$ and the most competitive bid among the rest of the participant bidders. After finding this $\Delta_{i,t}$, we divide it by the total winning bid, which helps us achieve a standardized measure of the variable.

Once we have restricted to close bids, we first conduct the test for the ampoules market and the backlog variable. The main idea is to see whether the test can correctly identify the patterns of collusion in the collusive period based on the trends of backlogs for close winners and losers. Formally, the idea is to test if $\beta = 0$ where

[3]This limit is taken from the methodology applied by Kawai et al. (2021).

	Ampoules		Cartelized	
	(1)	(2)	(3)	(4)
	Cartel	Post Cartel	Cartel	Post Cartel
Raw 90-day Backlog (million CLP)	87.947 (254.063)	232.810 (651.507)	132.966 (348.303)	255.318 (666.114)
Raw 180-day Backlog (million CLP)	157.525 (402.475)	418.424 (1021.356)	240.514 (565.01)	464.711 (1069.424)
Incumbency (by product)	0.227 (0.414)	0.284 (0.451)	0.286 (0.452)	0.263 (0.440)
Obs.	8,644	3,407	3,734	2,948

Note: (1) The cartel period is defined based on the Authority's decision for both dataset. The collusive period includes data form 2007 to 2013, and the post cartel period includes information for after 2013. (2) The winning bid and the second bid are expressed in Chilean Pesos

Table 2: Summary statistics of the backlog and incumbency variables.

$\beta = lim_{\epsilon \to 0^+} \mathbf{E}[x_{i,t} | \Delta_{i,t} = \epsilon] - lim_{\epsilon \to 0^-} \mathbf{E}[x_{i,t} | \Delta_{i,t} = \epsilon]$. To apply this test, we use the methodology developed by Cattaneo (2014). We find the polynomial that best fits the trends of backlogs for winners and losers and then find whether the differences between them at the point where $\Delta_{i,t} = 0$ is statistically significant from 0, i.e., $\beta = 0$.

Figure 1 shows the 90-day-backlog for close winners and losers for the ampoules market. There are no significant breaks in the data, meaning that the backlog of winners and losers appears to be similar in close bids. We check by testing the null hypothesis that $H_0 : \beta = 0$. Table 3 shows the result of the test. It can be seen that we fail to reject the null hypothesis for both the cartel period and the post-cartel period. This implies that the test fails to capture the collusive activity during the cartel period. If it had captured it, we would expect to find a higher backlog for losers than winners. The same results are obtained for the 180-day backlog[4].

One potential explanation for the test failing to capture competitive behaviour is that the firms performed the bid rotation in bids that closed the same day. Because the backlog variable is constructed to approximate the value of past wins, if firms

[4]The results for the test can be found in Appendix A.

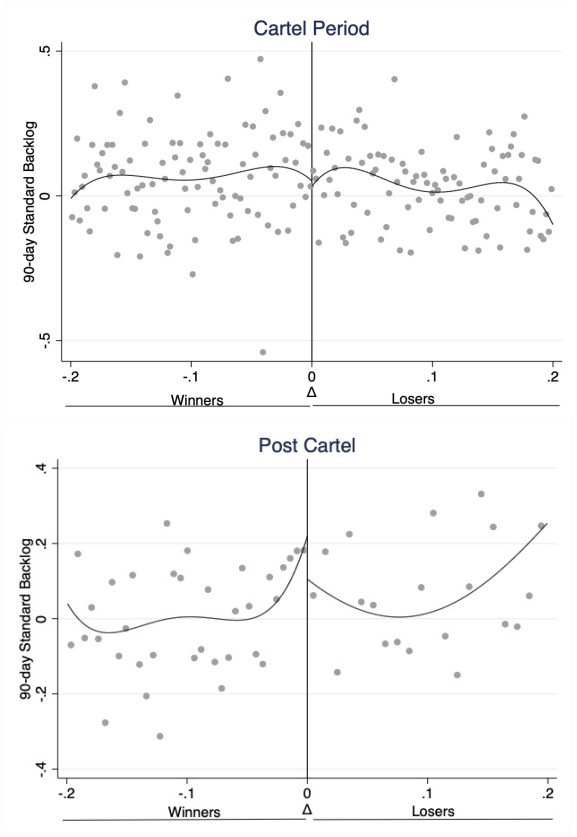

Figure 1: 90-day-Backlog for close winners and losers for the Ampoules Market

Notes: (1) The top graph represent the backlog for close winners and losers for the cartel period. The bottom graph represents the backlog for close winners and losers for the post cartel period. (2) Each point represents the average of the bids contained in equal-size bins created to group the data. (3) The lines represent the 4^{th} order polynomial that best fits the trend of each group.

	(1)	
	90-day Standard Backlog	
	Cartel	Post cartel
$\hat{\beta}$	-0.0719	-0.0131
	(0.0732)	(0.0716)
P-value	0.326	0.855
Obs.	8644	3407

Table 3: Test results for 90-day backlog differences between close winners and losers.

colluded within the same day, the backlog variable would fail to capture this effect. Therefore, we reconstruct the backlog variable to try and capture this effect. To do so, we modify the backlog so that it takes into account not only past wins but also present wins. After modifying the backlog specification, we re-run the same test but still failed to capture the collusive behaviour during the cartel period.

After failing to capture collusive behaviour using the backlog, we implemented the same analysis but using incumbency as the indicator of collusion. Incumbency can be used to organise cartels when the firms compete in heterogeneous goods. In this case, it can be plausible to think that firms may have organised the cartel by ensuring that firms always won the same drug. This would imply that winners should have a higher incumbency status than losers because firms who have previously won a specific item should be more likely to win it. We test this theory by applying the same methodology to the incumbency indicator of close winners and losers.

Figure 2 shows the graphical representation of the incumbency status for close winners and losers for the ampoules market both during the cartel and the post cartel. It can be seen that there appears to be a break in the incumbency status for the cartel period. It seems that the incumbency status of winners is slightly higher than those of losers. This is consistent with the collusion theory, and it cannot be seen in the post-cartel period. This implies that the test can differentiate between collusive and non-collusive periods. To check whether this is correct, we formally check if the null hypothesis $H_0 : \beta = 0$ is true. Table 4 shows the results of the test. It can be seen that the null hypothesis is rejected at a 5% level for the cartel period, and the coefficient is negative. This means that, as the methodology suggests, winners

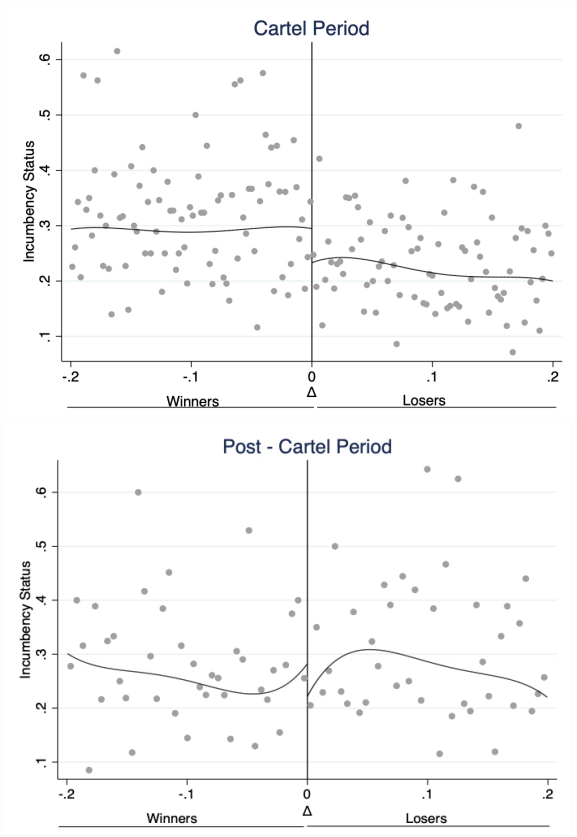

Figure 2: Incumbency status for close winners and losers for the Ampoules Market

Notes: (1) The top graph represent the incumbency status for close winners and losers for the cartel period. The bottom graph represents the incumbency status for close winners and losers for the post cartel period. (2) Each point represents the average of the bids contained in equal-size bins created to group the data. (3) The lines represent the 4^{th} order polynomial that best fits the trend of each group.

have a higher incumbency status. In the case of the post cartel, we fail to reject the null hypothesis. This implies that the test can correctly differentiate between the collusive and competitive agreements.

	Incumbency	
	(1)	(2)
	Cartel	No cartel
$\hat{\beta}$	-0.0737^{**}	0.0048
	(0.0318)	(0.0501)
P-value	0.020	0.924
Obs.	8644	3407

Table 4: Test results for incumbency differences between close winners and losers.

After checking that the test correctly functions, we decide to apply this test to another dataset. Specifically, we apply it to data on all the bids of all products in which the competitors face each other. Since the three colluders are high renowned pharmaceutical companies, they not only competed against each other in the market for ampoules, but they also competed for other products, and the theory suggests that it might have been profitable to extend the collusion agreement beyond the market for ampoules.

Figure 3 shows the graphical representation of the incumbency status for the market that contains these products. As it can be seen, we again find a break in the data for the collusive period and continuity for the post-cartel period. We check this formally by testing the null hypothesis, and we find that, indeed, we reject the null hypothesis for the cartel period and fail to reject it for the post-cartel period. This implies that the incumbency status was different for close winners and losers during the cartel period[5]. Therefore, the test suggests that the colluders extended their agreements beyond the ampoules market.

[5]Defining the cartel period as the years in which the Ampoules Cartel was operating.

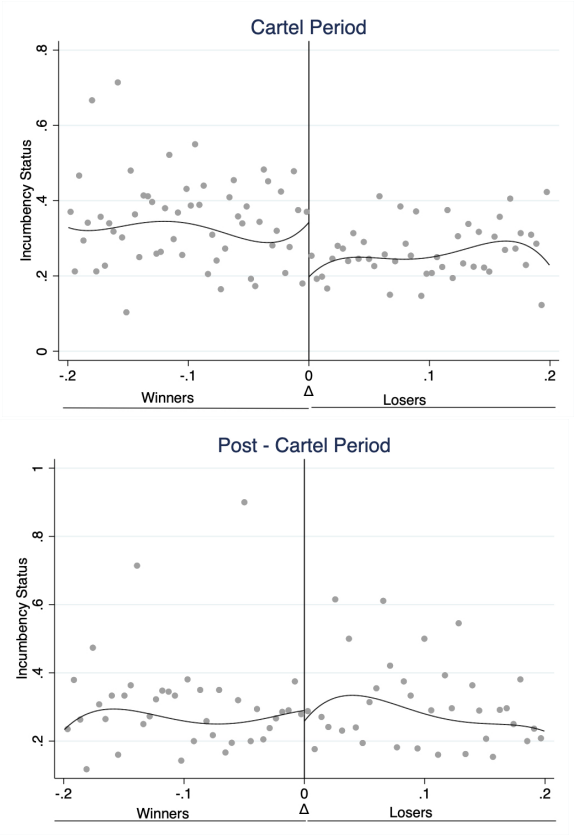

Figure 3: Incumbency status for close winners and losers for all products in which colluders met

Notes: (1) The top graph represent the incumbency status for close winners and losers for the cartel period. The bottom graph represents the incumbency status for close winners and losers for the post cartel period. (2) Each point represents the average of the bids contained in equal-size bins created to group the data. (3) The lines represent the 4^{th} order polynomial that best fits the trend of each group.

	Incumbency	
	(1)	(2)
	Cartel	No cartel
$\hat{\beta}$	-0.0910^{**}	-0.0155
	(0.0423)	(0.0570)
P-value	0.032	0.785
Obs.	3734	2948

Table 5: Test results for incumbency differences between close winners and losers for all products.

5 Conclusion

In this document, we test a novel safe-test for non-competitive behavior screening in public tenders based on incumbency status and backlog. It is tested on the generic injectable drugs market of Chile, since there was a cartel that operated for several years on it, and was subsequently discovered (with very rich data of the whole tender processes), providing a perfect opportunity to apply the test on this product market before and after the cartel was found. The results point in the direction that rather than basing themselves on backlog to incur in non-competitive behavior, the players participating in non-competitive manners based their behavior on the incumbency status for the previously mentioned market. We believe the value of the project is not only to confirm that the safe-test developed is robust enough to detect collusion in markets very different from the ones where Kawai et al. (2021) applied them, but that it can be applied for screening purposes by competition and procurement authorities with the sole requisites of having a clear idea of the product markets, and the details of each tender process part of said markets.

As with every safe-test, it is most efficient when firms are not aware of it or of how it functions, as they can come up with strategies to justify their bidding, or even modify the way on which they cooperate in order to pass them. Even then, because of how recent is the test, it can be efficiently used to screen for current and very recent data that could lead to the detection of cartels, potentially saving significant amounts of contributors' money by halting and punishing the infringement. And even if firms adapt, screens based on safe tests make cartels at least weakly worse off, and could lead them to suspicious bidding patterns that can also be detected,

as illustrated in Ortner et al. (2020).

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A Appendix

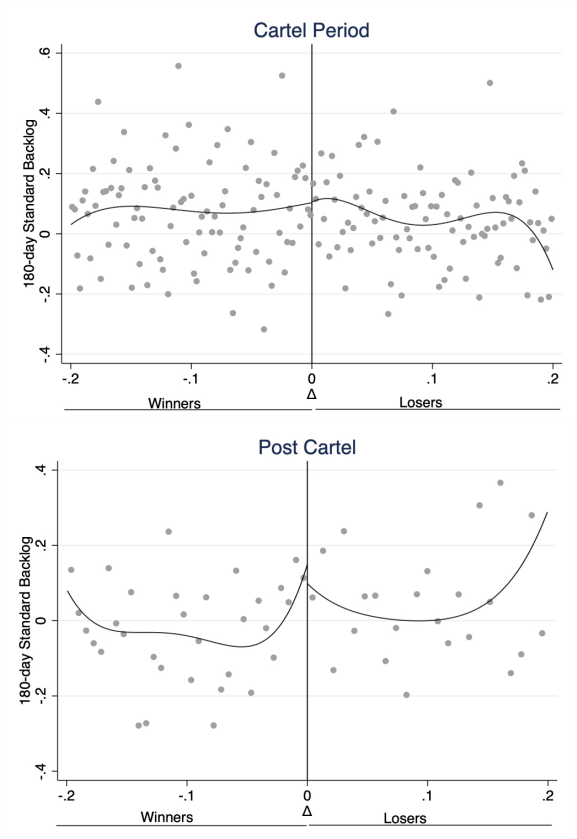

Figure 4: 180-day-Backlog for close winners and losers for the Ampoules Market

Notes: (1) The top graph represent the backlog for close winners and losers for the cartel period. The bottom graph represents the backlog for close winners and losers for the post cartel period. (2) Each point represents the average of the bids contained in equal-size bins created to group the data. (3) The lines represent the 4^{th} order polynomial that best fits the trend of each group.

	(1)	
	180-day Standard Backlog	
	Cartel	Post cartel
$\hat{\beta}$	0.01439	-0.01098
	(0.0557)	(0.0899)
P-value	0.796	0.903
Obs.	8644	3407

Table 6: Test results for 180-day backlog differences between close winners and losers.