



# Cartel Screens in the Digital Era

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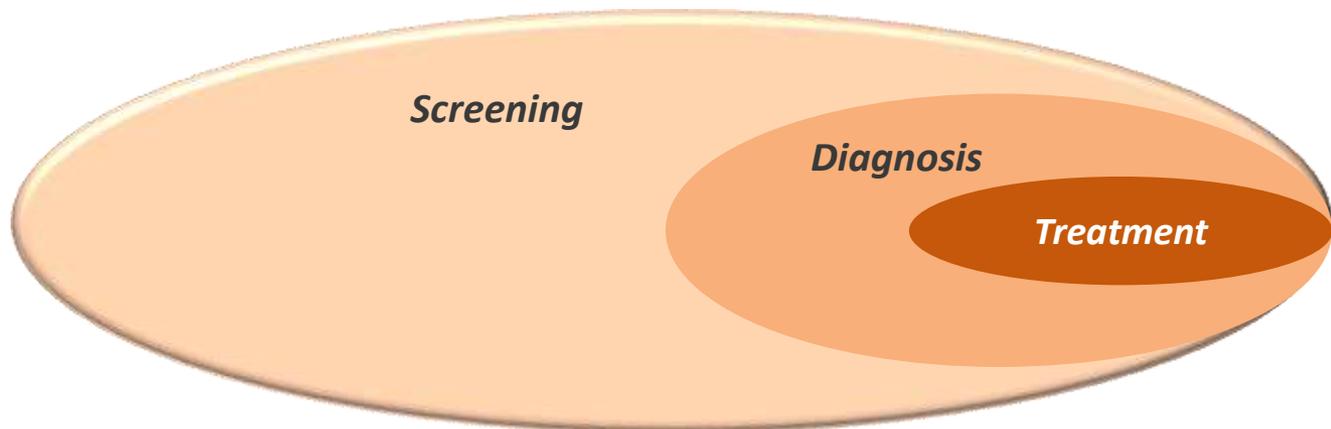
# Agenda

1. Screen tests in general
2. Screens for collusion
3. Structural screens
4. Behavioural screens
5. International experience



# What is a screening test?

- A **screening test** is a preventive measure to detect a problem or condition at an early stage, with the purpose of treating it effectively.
- For instance, in health screening tests are used by doctors to detect diseases:
  - The **screening test** is firstly applied to patients without symptoms.
  - If positive, it is followed by a **diagnostic test** to confirm the suspected disease.





# What constitutes a good screen?

- Widely applicable
- Low marginal cost
- Safe / not invasive
- ***High accuracy***

	Null hypothesis is true	Null hypothesis is false
Accept null hypothesis	Correct decision	<b>Type II Error (false negative)</b>
Reject null hypothesis	<b>Type I Error (false positive)</b>	Correct decision

**Trade-off** between Type I and Type II Errors

⇒ Screening tests should minimise **false negatives**, while **false positives** are more acceptable.



## What are screening tests used for?

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- Apart from different applications in natural sciences (e.g. medicine), screening tests can also be a useful tool to detect illegal activities:

*Credit card fraud*

*Illicit drug use*

*Tax evasion*

*Insider dealing*

*Terrorism*

***Detect cartels***



*Though not traditionally used to detect cartels, screening tests started attracting the interest of competition authorities in recent years.*



# Screens for collusion

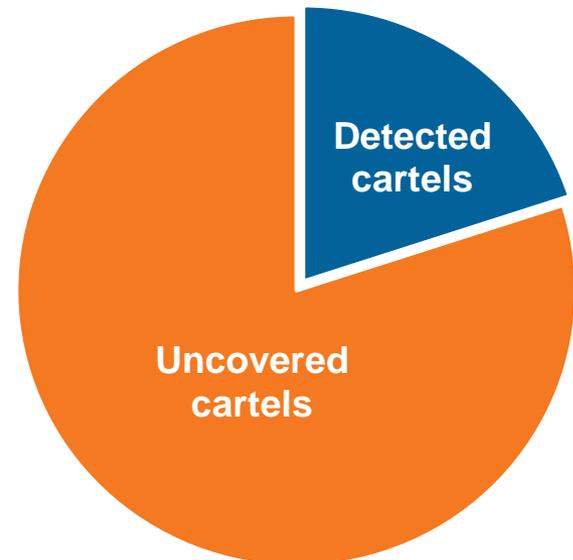


# What are the advantages of using cartel screens?

- Cartel screenings may substantially **increase the rate of detected cartels**.
  - Screenings can provide economic evidence to justify cartel investigations.
  - As proactive detection methods, screenings complement reactive methods such as leniency programs.

*Academic studies estimate that cartel detection rates are below 20%*

Ormosi (2013)





# What are the advantages of using cartel screens?

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- Economic evidence obtained from screening methods can also **facilitate the prosecution process**:
  - In some jurisdictions, economic evidence can be combined with “plus factors” to establish an anti-competitive agreement.
  - Economic data may also be used to estimate cartel overcharges and determine fines.
- Apart from antitrust enforcement, screening methods can **help improving regulatory design** in:
  - Regulations of natural oligopolies.
  - Public procurement processes.



## What are the limitations of cartel screens?

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- When properly implemented, cartel screenings can **consume substantial resources** from authorities:
  - Cartel screens may require costly investments in IT equipment, acquisition of data, and the employment of staff with expertise in programming and computer sciences.
  - The use of cartel screens may deviate an amount of scarce resources from traditional investigation techniques.
- The evidence collected through screening methods is **insufficient to establish an infringement**:
  - Even a very good screening method has a high rate of false positives, requiring thus further investigation.
  - Cartel screening outcomes may be complex and hard to understand by judges.



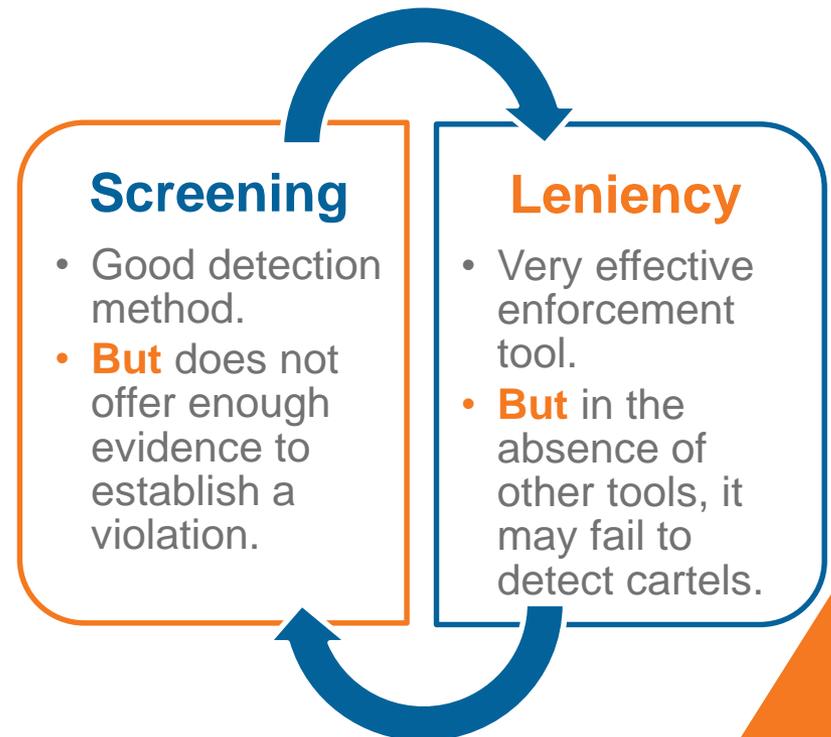
# How can cartel screens be effectively implemented?

**1<sup>st</sup> step:** develop traditional investigation tools.

**2<sup>nd</sup> step:** design a cartel screening with good properties taking into account resource constraints.

**3<sup>rd</sup> step:** develop an automated method to systematically collect and screen data.

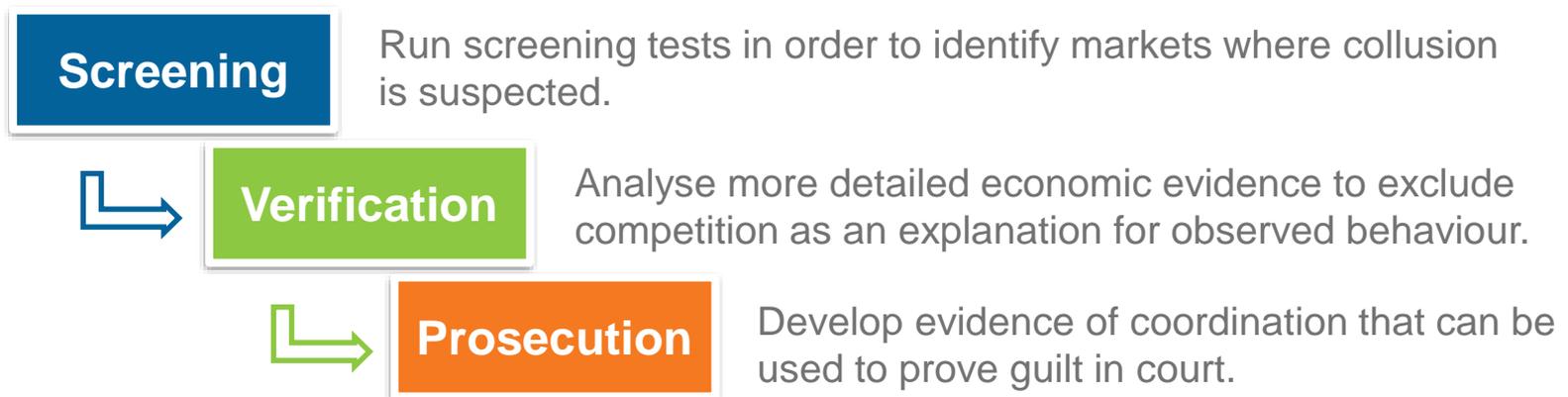
**4<sup>th</sup> step:** combine screenings with reactive methods, such as leniency programs.





# How do screening tests work?

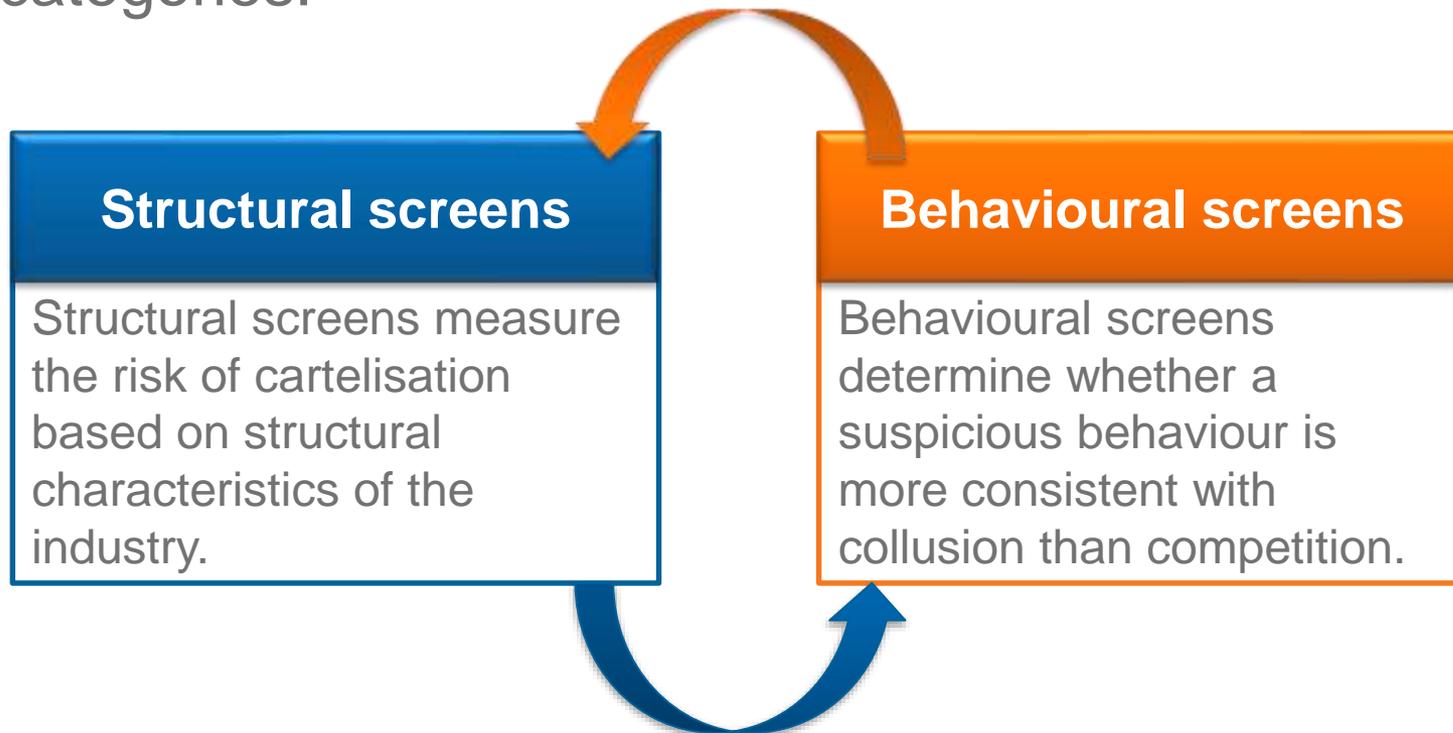
- Screening tests can detect collusion by looking at economic data that provides evidence of:
  - The conditions for firms to coordinate
  - The means by which firms coordinate
  - The end result of that coordination
- Screenings are the first stage of a multi-stage process:





## What types of cartel screens exist?

- Cartel screening tests are typically classified in two categories:



*A good screening test may have both structural and behavioural components, which can complement each other.*



# Structural screens



# Structural screens: how do they work?

- Structural screens typically regress a measure of cartel incidence against a set of **industry characteristics that facilitate collusion**:

$$Cartel_i = \beta X_i + u_i, \quad i = \text{industry}$$



## Indicator of cartel incidence:

- Number of discovered cartels
- Cartel fines
- Estimated profits of detected cartels
- ...

Structural factors	Number of firms
	Barriers to entry
	Market transparency
	Frequency of interaction
Demand-side factors	Demand growth
	Demand fluctuations
Supply-side factors	Innovation
	Cost asymmetry



## Structural screens: practical challenges

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- Structural screens are relatively **easy to implement** and in general rely on more **widely available data**.
- However, their simplicity may trade-off a **loss in accuracy**:
  - The fact that an industry has characteristics that facilitate collusion does not imply that firms will, *de facto*, collude.
  - Industry-level data typically available may be too aggregate.
  - Indicators of incidence of cartel do not account for undetected cartels.



*Should structural screens be used as a pre-screening method to prioritise industries worth of further scrutiny?*



# Behavioural screens



# Behavioural screens: how do they work?

- Behavioural screens assess whether an observed market variable is more consistent with a collusive or competitive behaviour:

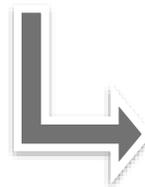
$$S_{it} = \alpha_0 + \alpha_1 \text{Cartel}_{it} + \beta X_{it} + u_{it}, \quad i = \text{firm} \quad t = \text{time}$$



**Market variable screened**



$$\text{Cartel}_{it} = \begin{cases} 1 & \text{if firm } i \text{ is involved in a cartel at time } t \\ 0 & \text{otherwise} \end{cases}$$



**Matrix of control variables**



## Behavioural screens: how do they work?

- The **expected value of the screened variable** is different under competitive and collusive behaviour:

$$E(S_{it}) = \begin{cases} \alpha_0 + \beta X_{it}, & \text{under competition} \\ \alpha_1 + \beta X_{it}, & \text{under collusion} \end{cases}$$

- Collusive behaviour may also affect **measures of dispersion** and **correlation**. For instance:

$$\text{Var}(S_{it}) = \text{Var}(u_{it}) = \begin{cases} \sigma_0, & \text{under competition} \\ \sigma_1, & \text{under collusion} \end{cases}$$



# Behavioural screens: dependent variable

- The pattern of several market variables can be affected by cartel behaviour:

	Price / bid	Quantity	Market share
<b>Measures of location</b> <ul style="list-style-type: none"><li>• Average</li><li>• Median</li></ul>	Collusive prices and “phony” bids are generally higher, while competitive prices and punishment prices are lower.	Quantities produced may be suppressed under collusion to keep prices and profits high.	-
<b>Measures of dispersion</b> <ul style="list-style-type: none"><li>• Std. Deviation</li><li>• Variance</li><li>• Coef. of Variation</li></ul>	Under collusion, prices tend to be substantially more stable and less responsive to exogenous shocks.	-	Some cartels keep market shares stable as a practical measure to distribute the gains from collusion.
<b>Measures of correlation</b> <ul style="list-style-type: none"><li>• Covariance</li><li>• Coef. of Correlation</li></ul>	Prices may be more strongly correlated under collusion.	-	Market shares might be negatively correlated when cartels allocate geographical markets or rotate bids.



## Behavioural screens: counterfactuals

- In order to establish that a behaviour is consistent with collusion, one must observe a **competitive counterfactual**:

$$S_{it} = \alpha_0 + \alpha_1 \text{Cartel}_{it} + \beta X_{it} + u_{it}$$



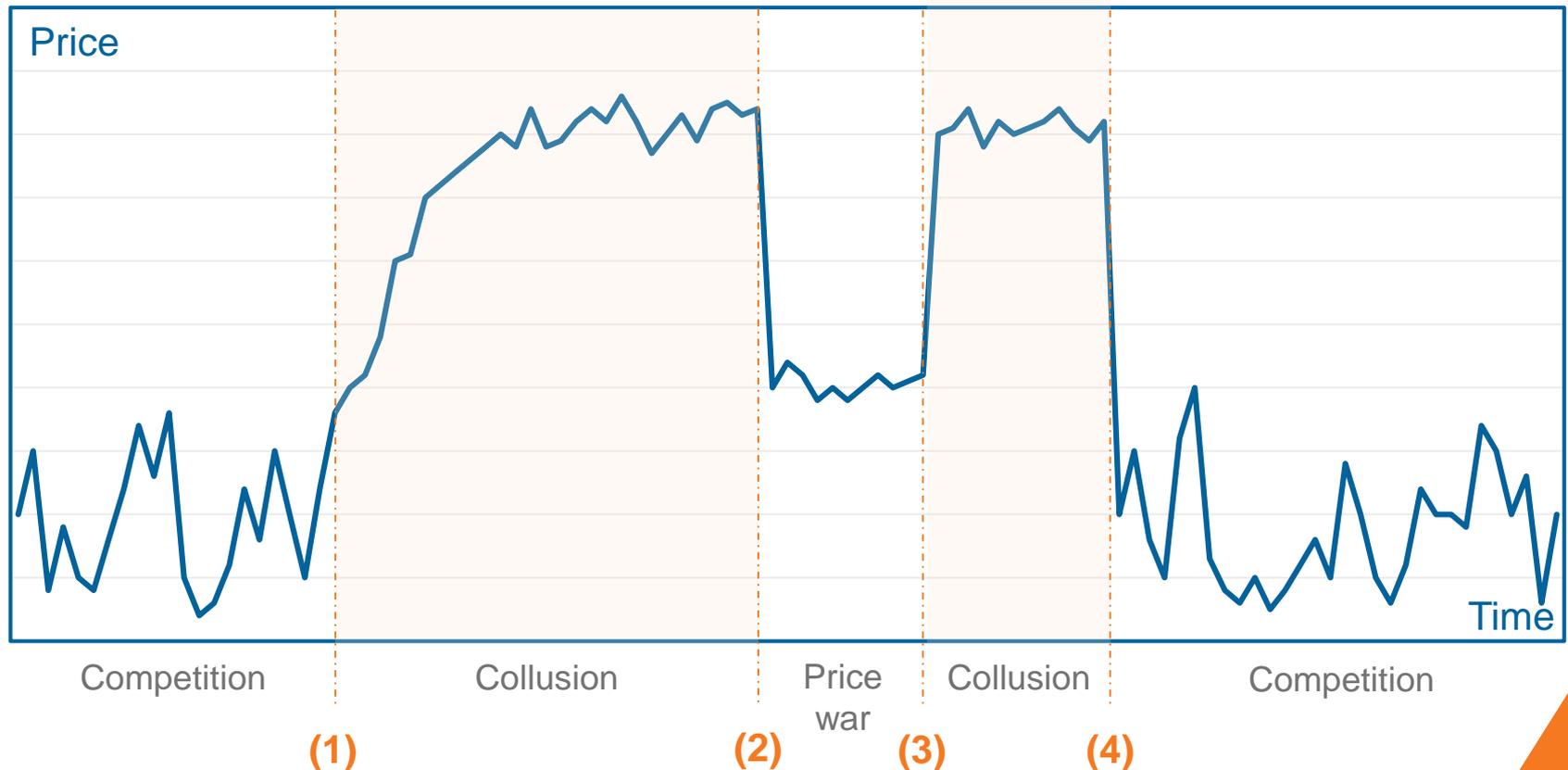
If  $\text{Cartel}_{it}$  is equal to 0 or 1 for all observations, it is not possible to identify  $\alpha_0$  and  $\alpha_1$  (or  $\sigma_0$  and  $\sigma_1$ )

- Two possible standards of comparison:
  - Periods of collusion vs periods of competition
  - Cartel members vs non members



# 1<sup>st</sup> counterfactual: periods of collusion vs periods of competition

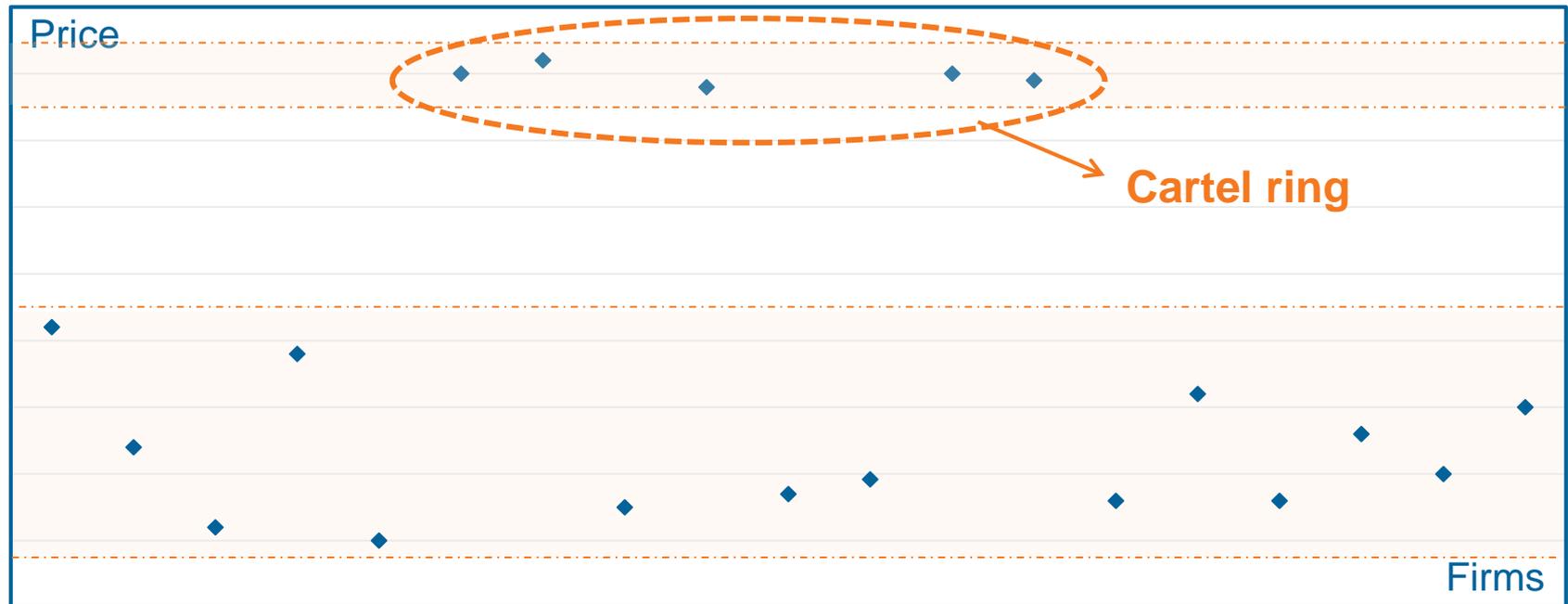
- Structural breaks in time can be identified at periods of (1) cartel formation, (2) deviation from collusion, (3) end of temporary price war and (4) cartel demise.





## 2<sup>nd</sup> counterfactual: cartel members vs non-members

- A counterfactual for collusion can be found in partial agreements, where the behaviour of the cartel ring differs from outsiders:



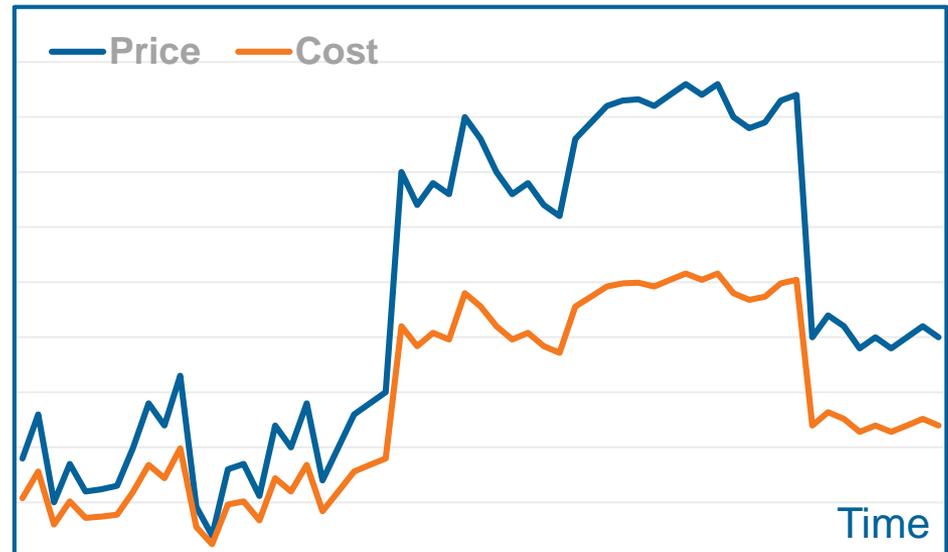
Alternatively, it is also possible to use a competitive market as counterfactual.

⇒ But greater heterogeneity requires the use of better controls.



# Behavioural screens: control variables

- Suspicious patterns in prices or other markets variables may be explained by all kind of market shocks.
- Need to control for:
  - **Supply factors**
    - Costs
  - **Demand factors**
    - Income
    - Seasonality
    - Preferences





# Behavioural screens: practical challenges

- The **collusive behaviour is not observed** ( $Cartel_{it}$  is an unobservable). Possible solutions:
  - Guess observations of collusion
  - Test outliers as candidates for collusion
  - Estimate through advanced methods (e.g. **switching regressions**)
- Most control variables rely on **data that is hard to collect**, particularly cost data. Possible solution:

## Screening

Run regressions without control variables as a screen test.



## Verification

If the screen test is positive, use control variables as part of a verification device.



## Prosecution

Open an investigation, asking the company to justify suspicious behaviour.



# International experience



## UK: CMA's screening tool

- The CMA launched in 2017 a **digital tool to fight bid-rigging**:
  - Free to download and use ⇒ no need to share data.
  - Data is organised into a folder structure that is familiar to procurers.
  - Adjustable thresholds and test weightings.

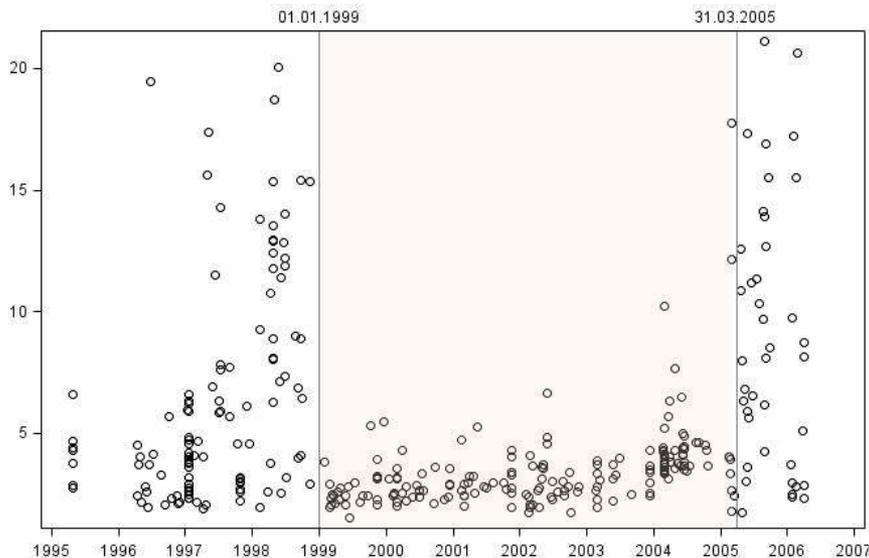
Theme	Indicators	Weight
<b>Number and pattern of bidders</b>	Low number of bidders	20
	Single bid	30
<b>Suspicious pricing patterns</b>	Winning price is outlier	20
	Similar pricing across bids	20
	Costs appear to be made up	40
<b>Low endeavour submissions</b>	Some authors in two or more bids	200
	Low endeavour losing bids	40
	Similar text in losing bids	200
<b>Combination tests</b>	Similar text & word count in losing bids	50
	Low number of bidders and made up prices	20
	Winning price is outlier and made up prices	10
	Low endeavour losing bids and made up prices	10



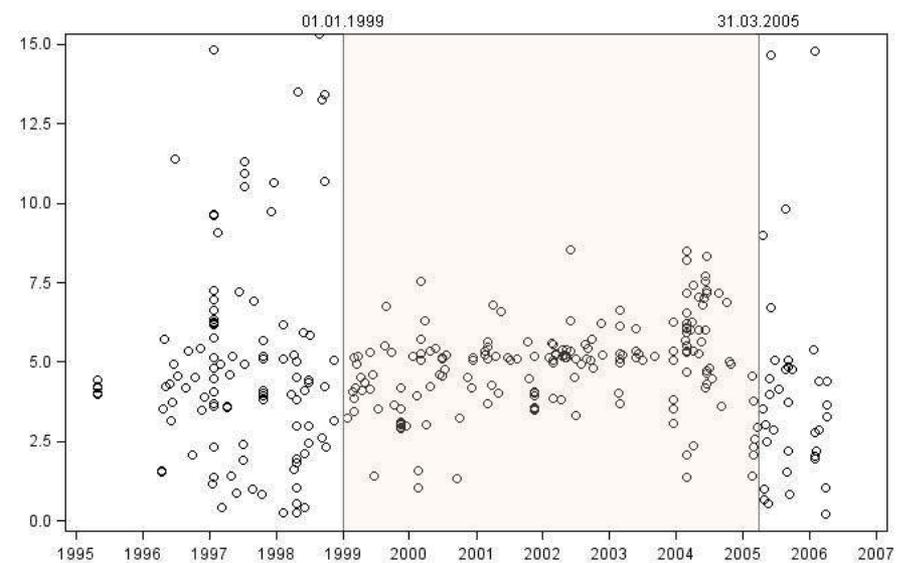
# Switzerland: COMCO's screening project

- The COMCO initiated in 2008 a **screening project to fight bid rigging**, leading to a 2013 investigation that confirmed the results of the screen.
  - Easy-to-implement method based on descriptive statistics.
  - Low data intensive, requiring only bidding data.
  - Use of different screens to capture different forms of manipulation.

## Variance screen



## Relative distance screen





# Brazil: CADE's screen interface "Cérebro"

- Since 2013 CADE has been developing a **screening tool "Cérebro" to detect bid rigging**, with the purpose of:
  1. Providing evidence for dawn raids in *ex-office* investigations.
  2. Supporting and enhancing ongoing investigations.
  3. Generally supporting of data for all units of CADE.
- Data warehouse composed by near 40 public and private databases in one searchable IT language.
- Use of data mining and statistical tests from the screenings literature to identify multiple suspicious patterns:

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Bid suppression            | <input checked="" type="checkbox"/> Stable market shares     |
| <input checked="" type="checkbox"/> Cover bidding              | <input checked="" type="checkbox"/> Pricing patterns         |
| <input checked="" type="checkbox"/> Bid rotation               | <input checked="" type="checkbox"/> Text similarities        |
| <input checked="" type="checkbox"/> Superfluous losing bidders | <input checked="" type="checkbox"/> Submitted files metadata |

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|--|--|
| <input checked="" type="checkbox"/> Superfluous losing bidders | <input checked="" type="checkbox"/> Submitted files metadata |
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# Some lessons from the interchange of international experience

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- **Simple screen methods are a good starting point for authorities** to improve detection rates.
  - As offenders learn how to outsmart screening tests, authorities can develop more sophisticated and resilient methods.
- **Public procurement is a relevant area of focus**, due to greater data availability and higher incidence of cartels.
  - As screening tests prove successful in detecting bid rigging, authorities may consider extend these methods to other markets.
- A **screening unit should include staff with expertise in IT**, in addition to competition economics.
  - In the future, screening methods could also largely benefit from the automated collection of data from price comparison websites and other sources, combined with the use of machine learning.



# Cartel Screens in the Digital Era

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*Thank you!*