Measuring the Effectiveness of Anti-Cartel Interventions: A Conceptual Framework

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Our Contribution

• Provide a conceptual framework which captures the effects that various dimensions of Competition Authority (CA) enforcement actions against cartels have on:
  – Disrupting cartel activity in those industries where cartels form - *Direct Effect*
  – Deterring cartels from forming in certain industries - *Indirect Deterrence Effect*
  – Price set by cartels that do form - *Indirect Price Effect*

• Show how to measure both
  – *Absolute Welfare Effect*: benefit from all interventions by CA
  – *Marginal Welfare Effects*: additional benefit from small increase in each of the various dimensions of intervention

• Show how to decompose the *Total Effect* of each of these measures into 3 components: *Direct Effect + 2 Indirect Effects*

• Calibrate model and provide illustrative calculations

• IN THIS TALK SOLELY ON *Absolute Effects*
Key Insights

• Strong Complementarities at work:
  – between different intervention activities
  – between *Direct* and *Indirect Deterrence* Effects
• When penalties are based on revenue the *Indirect Price Effect* CAN be negative:
  – *Absolute Indirect Price Effect* is negative (resp. positive) if and only if *Marginal Indirect Price Effect* is negative (resp. positive)
• The direct effect that CAs measure – which we call *Observable Direct Effect* – may mis-measure (sometimes significantly) the true *Direct Effect*
• The *Total Effect* of CA interventions can be very substantial relative to the direct effect that they measure
Related Literature: Harrington

  – Examined separately a number of facets of cartel behaviour - e.g. pricing and deterrence - and specific policies – e.g. leniency programmes
  – Used models of birth and death of cartels to examine what we can infer from rate of cartel detection and age of detected cartels about undetected cartels and effects of policies
• But doesn’t provide such a general welfare framework that integrates *Direct* and two *Indirect Effects* and can apply to range of policy interventions.
Related Literature: Davies & Ormosi

- Similar objectives (general framework integrating direct and indirect effects, applicable to wide range of interventions)
- Very different approach
  - Start with harm detected by CA
  - Given fraction of cartels deterred and fraction of undeterred cartels detected work back to infer potential harm and various measures of effectiveness of CA – e.g. fraction of potential harm removed; ratio of total harm removed to detected harm
  - Assuming distribution of these parameters use Monte Carlo methods generate a distribution of measures of CA effectiveness
- NO model of cartel behaviour so:
  - no Indirect price effects;
  - No Marginal effects
Related Literature: Us

• Katsoulacos, Motchenkova, Ulph; *IJIO* (2015)
  – show that penalties based on cartel overcharge welfare dominate penalties based on profits which welfare dominate penalties based on revenue
    • Penalties based on revenue induce cartel prices above monopoly price

• Assume that, following detection and prosecution by CA, cartel continues in existence
  – Not crucial for above conclusions

• Extend the model to allow for actions that disrupt cartel activities
The Framework: Starting Point

- THREE intervention parameters:
  - $\beta$, $0 \leq \beta < 1$: probability of detection and prosecution in any period
  - $\gamma$, $0 \leq \gamma \leq 1$: probability that, in period after prosecution, industry will be competitive;
  - $\chi$, $0 \leq \chi < 1$: probability that if industry is competitive at start of period it is competitive at start of next period.

- Note: because of these disruptive activities of CA, industries in which cartels occur will oscillate between periods of cartelisation and periods of competition

- Fourth enforcement parameter:
  - $\rho$: penalty rate

- Define $\tau = \beta \rho$ as toughness of penalty regime
Implications of Disruptive CA Activities

• Model birth and death of cartels facing a disruptive CA.

\[ V^{\text{CART}} = \sigma V^0 \]

Expected cartel profits if cartels live for ever

\[ \sigma = \frac{1}{1 + \frac{\beta \gamma \delta}{1 - \delta \chi}}, \quad 0 < \sigma \leq 1 \]

Fraction of the profits that a cartel would have made if it lived forever, that it actually makes because of disruptive activities of CA

\[ \delta < 1 \] is the discount rate
Further Implications

• If there were no CA – i.e. if $\beta = 0$ - or if CA interventions did not stop cartel activity (at least temporarily) – i.e. if $\gamma = 0$ – then $\sigma = 1$

• If $\sigma < 1$ then $\sigma$ is a strictly decreasing function of all 3 intervention parameters

• Strong Complementarity: The more you undertake two of the intervention activities the greater is the percentage reduction in $\sigma$ brought about by increasing the third.
Cartel behaviour: pricing

- Competitive price is \( c = MC \)
- Cartel Price: \( p^C(\tau) = \max_{p \geq c} V^{\text{CART}} \)
- Key Result: \( p^C(\tau) \) is an increasing (resp. decreasing) function of \( \tau \) as \( p^C(\tau) \) is above (resp. below) monopoly price \( p^M = p^C(0) \).
- Note: cartel price unaffected by intervention parameters \( \gamma \) and \( \chi \)
Cartel Behaviour: Stability/Deterrence

• Model the dynamics of cartel behaviour if there were any defection.
• Impose the cartel stability condition – it must be at least as profitable for firms to stay in the cartel as to defect.
• From this we get a variable $\Delta > 0$ that measures the *intrinsic difficulty* of holding a cartel together.
• $\Delta$ depends on various industry parameters – e.g. number of firms – but NOT on CA intervention parameters.
Deterrence

• Stable cartels exist for all $\Delta \leq \bar{\Delta}$ where:

$$\bar{\Delta} = \sigma \Delta^0(\tau)$$

Critical value of $\Delta$ if cartels live for ever
Decreasing function of toughness, $\tau$

• If there were no CA $\beta = 0$ then $\sigma = 1$, $\Delta^0 = 1 \Rightarrow \bar{\Delta} = 1$

• If CA is active: $\beta \gamma > 0$ then $\sigma < 1$, $\Delta^0 < 1 \Rightarrow \bar{\Delta} < 1$

• So $\bar{\Delta}$ is fraction of industries in which stable cartels would have existed had there been no CA in which they continue to existence in presence of active CA.

• Note strong complementarity with Direct Effect
Welfare/Consumer Surplus

• Harm = Extent to which consumer surplus below that under competition

• For an industry in which cartels exist: i.e. $\Delta \leq \bar{\Delta}$

\[
H = \sigma \left[ CS(c) - CS\left( p^c \right) \right]
\]

• Average harm across all industries in which cartels would have existed if there were no CA

\[
\bar{H} = \sigma \bar{\Delta} \left[ CS(c) - CS\left( p^c \right) \right]
\]

• Potential Harm – harm that would have existed had there been no CA is

\[
\bar{H} = \left[ CS(c) - CS\left( p^M \right) \right]
\]
Absolute Effect of CA

• So having a CA in place has a *Total Effect (TE)*:

\[
TE = \bar{H} - \bar{H} = \\
\{(1-\sigma)\bar{\Delta}[CS(c) - CS(p^C)]\} + \quad \text{Direct Effect (DE)} \\
\{(1-\bar{\Delta})[CS(c) - CS(p^C)]\} + \quad \text{Indirect Deterrence Effect (IDE)} \\
\{CS(p^C) - CS(p^M)\} \quad \text{Indirect Price Effect (IPE)}
\]

Note: If \( p^C > p^M \) then *IPE* is negative
Observable Direct Effect

- **Direct Effect (DE)** depends on $\sigma$ — very hard for CAs to measure
- What they can/do measure is number of cartels they shut down multiplied by resulting gain in surplus.
- So **Observable Direct Effect (ODE)** is

$$ODE = \beta \gamma \bar{\Lambda} \left[ CS(c) - CS\left(p^C\right) \right]$$

- The ratio of “true” **DE** to **ODE** is

$$\frac{DE}{ODE} = \frac{(1 - \sigma)}{\beta \gamma} = \sigma \cdot \frac{\delta}{1 - \delta \chi}$$
Two Measures

• One measure of performance is how much of the Potential Harm a CA removes: \( \frac{TE}{H} \)

• But CAs also interested in: by how much can they scale up their measured Direct Effect – i.e. their \( ODE \) – to get measure of the Total impact of their activity:

\[
\frac{TE}{ODE} = \frac{DE}{ODE} \left(1 + R_{IDE} + R_{IPE}\right)
\]

Ratios of Indirect Effects to Direct Effect
Calibration

- Assume penalties based on Revenue, and both probability of detection and penalty rate independent of cartel price.
- Assume penalty rate 10% i.e. \( \rho = 0.1 \)
- Discount Factor: \( \delta = 0.9 \)
- Normalise competitive price/marginal costs: \( c = 1 \)
- Demand Function: \( Q(p) = 1 + \varepsilon - p \)
- Inverse price elasticity: \( \varepsilon = 0.6, 0.8, 1.0 \)
- Probability of
  - detection: \( \beta = 0.1, 0.2, 0.3 \)
  - CA closes cartels down: \( \gamma = 1.0, 0.8 \)
  - CA maintaining competition: \( \chi = 0.1, 0.5, 0.9 \)
Table 1: $\frac{TE}{H}$

<table>
<thead>
<tr>
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<th>$\gamma$</th>
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### Table 2a: TE/ODE

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Table 2b: $RIDE = \frac{IDE}{DE}$

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<th>0.9</th>
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<td>$\chi$</td>
<td>$\gamma$</td>
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<tr>
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Table 2c: $RIPE = IPE/DE$
Table 2d: *DE/ODE*

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<th>γ</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
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<td>0.2</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
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<td>0.856</td>
<td>0.800</td>
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Conclusions

• Two key conclusions emerging from this framework are:
  – It is important to distinguish carefully between different dimensions of CA interventions
  – One of the research challenges is to better articulate, understand and measure these