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The wrong side of the tracks – what are the empirical differences between collusion, parallelism and competition?

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Abstract: The South African competition authorities have taken an increasingly active role in the prosecution of cartel conduct (explicit collusion), and regularly examine potential coordinated effects (tacit collusion) in merger investigations. The Commission may also gain powers to investigate conscious parallelism (tacit collusion) under the complex monopoly provisions of the proposed Competition Amendment Bill.

In this paper, I review empirical methods that try to distinguish between competition and various types of collusion. First, I consider filtering techniques used to look for conditions necessary for collusion, and market outcomes consistent with collusion. I find analogies between these preliminary screening exercises and some approaches to coordinated effects under merger control. Second, I describe some of the more detailed investigations that have been undertaken to try and make more robust inferences concerning types of collusion, tailored to the specific circumstances of individual markets. I find further analogies between these in-depth investigations and some of the more sophisticated approaches under merger control. Third, I consider contact between competitors, and outline tests that might be used to infer contact.

I draw on the academic literature and studies of known cartels, and summarise the status of currently applicable tests, suggesting likely areas for further development. I also highlight some of the challenges in the use of these empirical methods, and discuss potential alternative interpretations. Finally, I conclude on the role of empirical tests within the totality of evidence in behavioural investigations.

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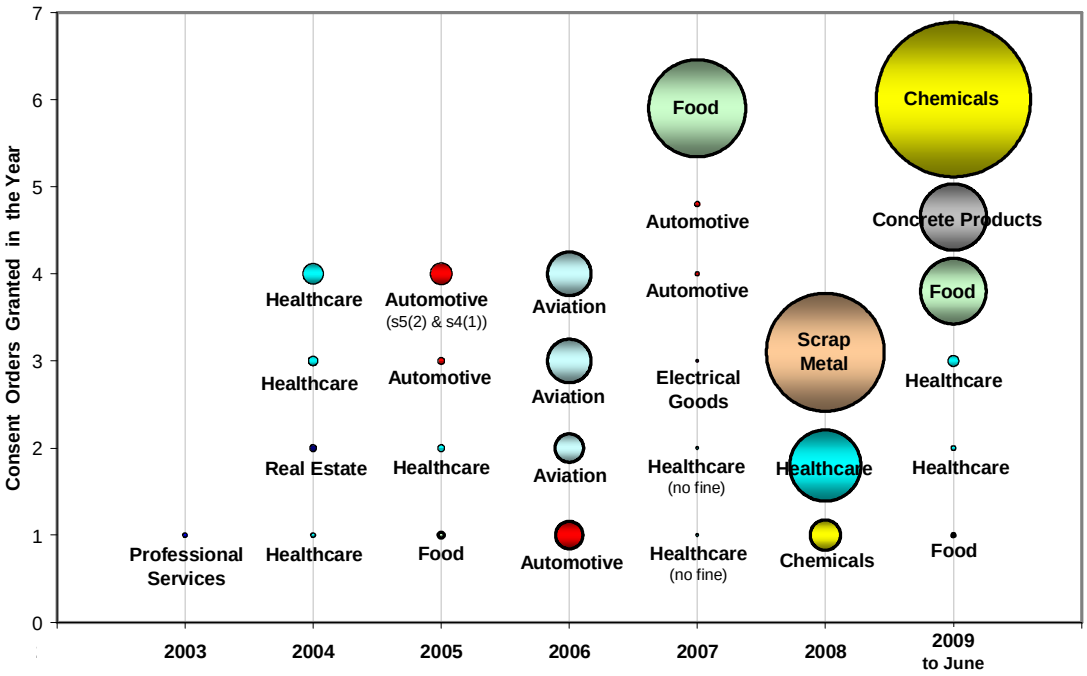
[1] NERA Economic Consulting. This paper was written with the intention of stimulating debate and discussion on the use of empirical methods to detect and distinguish competition and different types of collusion. As such, it does not represent advice or methodological recommendations and contains unsettled opinions and proposals in order to achieve its objective within the constraints of a written paper. This paper may not reflect the views or opinions of NERA Economic Consulting. I would like to thank colleagues and Dr. Rob Smith for helpful comments and suggestions, and staff at the NAMC, STATSSA, SANRAL, the Department of Public Works (Pretoria and Cape Town) and AC Nielsen for helpful discussions.

1. Introduction

The South African competition authorities have dramatically sharpened their focus on cartel enforcement in recent years, as shown in Figure 1.

Figure 1 – Section 4 Consent Orders (2003 – June 2009)



Source: Competition Commission, Competition Tribunal.
Note: Bubble sizes represent administrative fines (R0 – R251m).

However, all of these cases settled with the Commission, providing limited guidance on illegal forms of collusion. In light of the increasing appetite for investigating such situations, I draw on other potential sources, each of which offers a partial perspective on some aspects of collusive behaviour. I present a critical review of some of the empirical tests that have been used to distinguish between competition and various forms of collusion, which in turn have been driven by economic research on the theoretical ingredients and likely outcomes of collusion. I discuss detailed studies and cross sectional reviews of actual cartels, and I review coordinated effects analyses in merger control, which not only provide numerous published decisions, but also show a trend towards a more coherent and quantitative approach.

1.1. Terminology and Framework

Economists refer to "collusion" generally, encompassing a range of behaviours and outcomes, including entirely tacit collusion unsupported by any direct or indirect contact, as well as explicit collusion.[2]

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[2] As such, I use the term "collusion" more widely here than has sometimes been understood by the courts. See for example the ECJ in C-49/92P *European Commission v Anic Partecipazioni SpA* [1999] ECR I-4125, at paragraph 108: "*The list in Article [81(1)] of the Treaty is intended to apply to all collusion between undertakings, whatever form it takes... The only essential thing is the distinction between independent conduct, which is allowed, and collusion, which is not, regardless of any distinction between types of collusion*."

The economic difference between collusion and competition is that under collusion, while firms collectively increase profits, each firm still has unexploited individual opportunities to make higher profits in the short term, whereas competitive firms are assumed to take advantage of all of these individual short term opportunities. Collusive firms are able to achieve a collectively better outcome through the credible threat of mutual punishment, in the event of deviation.

The economic literature focuses on the individual incentive compatibility constraint: in order for collusion to be sustainable, each colluding firm's short term gains from cheating must be more than offset by the losses from future punishment, appropriately discounted.[3]

Multiple collusive equilibria may be feasible in a given market, ranging from close to the competitive outcome up to the monopoly outcome. The severity of sustainable collusion involves a trade-off between the increasing profits of approaching the monopoly outcome, weighed up against increasing costs such as potential antitrust penalties following detection, and the difficulty of achieving these collusive outcomes.

The economic difference between collusive situations with and without contact is primarily in the information available to competitors. Without contact, this information is limited to public observations of competitors' characteristics and historical actions. The choice between collusion with or without contact involves a trade-off between differences in the benefits and costs applicable under the two regimes.

For the purposes of this paper, I will consider that forms of collusion caught by Section 4 of the Act (which I call "explicit collusion") involve some form of contact or communication.[4] Such an investigation of explicit collusion is retrospective.

By contrast, entirely "tacit collusion" without any contact has not historically been pursued retrospectively, although it has been the target of prospective coordinated effects assessments under merger control.[5]

Under the complex monopoly provisions of the Competition Amendment Bill, the Competition Commission would have powers to investigate "tacit collusion" retrospectively as *conscious parallelism*, *cooperative* or *coordinated* behaviour without discussion or agreement.[6]

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[3] For further background on the economics of collusion see Tirole (1988).

[4] The prohibition in the Act makes reference to a horizontal *agreement*, *concerted practice* or *decision* (by an association of firms), where concerted practices are defined as being "*achieved through direct or indirect contact*" (Competition Act, Chapter 2, Section 4, Restrictive Horizontal Practices Prohibited, and Chapter 1, Section 1, Definitions and interpretation, 1(1)(iv))

[5] Factors to be assessed in a merger investigation include "*the probability that the firms in the market after the merger will behave competitively or co-operatively*" (Competition Act, Chapter 3, Section 12A, (2)). See, for example, the Competition Tribunal's decision in Mondi/Kohler, *"[Coordination between Mondi and Sappi] need not be explicit. It may be tacit, driven by the respective interests of the members of the paper products duopoly which point them in the direction of cooperation"* (para 30), and *"it is an alignment that does not require explicit coordination"* (para 75).

Some merger guidelines also refer to explicit collusion under coordinated effects. See for example the UK OFT Substantive Assessment Guidance for Mergers (2003), para 3.8, or the joint OFT and CC Merger Assessment Guidelines, Consultation Document (2009), para 4.116.

[6] Competition Amendment Bill (B31D – 2008), Chapter 2A, Complex Monopoly Conduct, Section 10A (2), *"For the purposes of subsection (1)(b) 'conscious parallel conduct' occurs when two or more firms in a concentrated market, being aware of each other's action, conduct their business affairs in a cooperative manner without discussion or agreement."*

1.2. Outline

In the following sections, I discuss some of the empirical economic tests that have been used to try to distinguish between competition and various sorts of collusion.

First, I look at screening tests, used in the prioritisation of individual markets or sectors for more detailed scrutiny. I draw an analogy between these methods and some of the approaches that have historically been applied to coordinated effects analyses in merger control.

Second, I describe some of the more detailed assessments that might be applied to markets which have been prioritised for further investigation. I draw parallels with the more sophisticated analyses of competition and coordination that have been undertaken in merger inquiries in recent years.

Finally, I deal with what is arguably the distinguishing feature of cartels - contact, or communication. This is probably the area in which formal economic theory has the least to say, although I describe some empirical tests which may assist, alongside other sources of evidence, in inferring contact or communication.

Other papers provide detailed discussions of several of these elements. In particular, I adopt a similar approach to screening tests as Harrington (2008), and the interested reader is also referred to Porter (2005), Whinston (2004), and Levenstein and Suslow (2006), and their references, which deal with individual points in much greater detail. My contribution is to present a selection of these tests within a South African context, to focus on their practical applicability, and to discuss the relationship of these tests with analyses from other areas of competition policy, such as merger control, where there exists a richer body of jurisprudence.

2. Screening

In this section, I outline some of the screening techniques that have been used to determine industries or sectors where collusion might be more likely. At best these tests prioritise markets for further investigation, and cannot be used as “evidence” that collusion has taken place, much less so, evidence that a cartel (explicit collusion) is in operation.

These tests say little as to whether any collusion is explicit collusion or tacit collusion, which I return to in Section 4.

Many of the methods discussed in this section defy simple categorisation, and consider a combination of factors. However, in order to demonstrate some of the underlying principles, I attempt to distinguish between tests that focus largely on the market conditions that might facilitate collusion, and tests that look for outcomes consistent with a theory of collusion. I then draw some parallels between these screening tests and coordinated effects analysis in merger control.

2.1. Screening for Conditions Conducive to Collusion

Industries or sectors might be singled out for further investigation on the basis of indicators such as concentration levels, entry and exit rates; product homogeneity and rates of innovation; and demand and output stability.[7]

The Nederlandse Mededingingsautoriteit (NMa) pro-actively filters through information on a large number of different sectors, searching for those that warrant closer examination (Buijs, 2008). The NMa screen uses concentration, import penetration, market stability, and measures of profitability and international price comparisons (the last two factors perhaps focus more on outcomes of, rather than conditions for, collusion). In a paper prepared for the UK Office of Fair Trading (OFT), Grout and Sonderegger (2005) consider additional indicators such as symmetry between firms, frequency of orders, opportunities for multi-market contact, and cost volatility.

Candidate indicators are assembled across a number of industries and then correlated, either with the predictions of economic theory, or historically identified cartel cases, complaints or exemption applications.[8] These methods have achieved a significant, but modest degree of success in identifying sectors in which actual cartel activity has been found. The NMa applies two filters, and the combination predicted 20-24 per cent of sectors with a high risk of collusion, based on exemption requests filed over the period 1998-2004. The indicators used by Grout and Sonderegger explain 14-24 per cent of the variability in the allocation of cartels between industries.

A further paper by NERA (2004) also looks at structural "top-down" indicators, but only attempts to screen for "*problem markets*" that are not working well for consumers, for a range of potential reasons, not just collusion. Given the modest success of detecting actual cartel activity using top-down methods, perhaps this is a more realistic aim.

Studies of actual cartels provide mixed support for these top-down indicators (see Levenstein and Suslow, 2006). There appears to be little evidence that cartels only form when industry concentration is high or products are homogenous, although demand stability does seem important for actual cartel success. A further difficulty in using top-down screens is the weighting and coherent consideration of multiple factors.[9]

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[7] These tests might also be considered "structural" (Harrington, 2008), or "top-down" (Grout and Sonderegger, 2005; NERA, 2004). Although these factors are presented as "conditions" that might make collusion more likely or more severe, there may well be some endogeneity, in that several of these factors, such as transparency, concentration, entry and exit, symmetry, rates of innovation, and output stability could also be considered as "outcomes", affected by collusion.

[8] Difficulties may arise in using prosecuted cartels as an independent variable, as these include only a subset of all cartel activity, i.e. those cartels that have been caught. Historical prosecution may have only focussed on limited aspects of collusion, such as price and quantity fixing, and may not pick up collusion in other non-price dimensions, such as advertising, innovation, investment, or entry. Some studies use a richer set of actual cartels, including legal cartels in countries without antitrust sanctions (at the time of the cartel), and "legal" export cartels (although see the Ansac case 49/CR/Apr00). See Levenstein and Suslow (2006) for a review of these studies.

[9] Related debates concern the ability to predict economic performance at a firm level, based on industry concentration data (in the South African context, see Du Plessis and Gilbert, 2008).

In South Africa there are arguably additional considerations in the prioritisation of industries or sectors. The specific constraints on the resources and powers of the investigating authorities combine with unique historical, demographic, political and economic pressures.

Consent orders have been granted in markets with a variety of different characteristics (see Figure 1). Although recent cases are more concentrated within the priority sectors (see below) and involve homogenous products such as bread, milk and fertilizers, earlier cases span markets as diverse as automobile dealerships and private healthcare. While recent detection may have been encouraged by leniency applications, many cases have been initiated by complaints.

The Competition Commission has used three criteria to prioritise sectors. In addition to the likelihood of substantial competition concerns (based on information from complaints and merger notifications) the Commission has considered the impact on poor consumers, and the importance for accelerated and shared growth. These criteria led to the identification of four priority sectors (Roberts, 2008):

- Food and agro-processing,
- Infrastructure and construction,
- Banking, and
- Intermediate industrial products.

These top-down approaches for prioritising industries and sectors will not be discussed in further detail in this paper. Rather I proceed to look at screening methods focussing on outcomes.

2.2. Screening for Outcomes Consistent with Collusion

A second class of screening methods consider actual outcomes, although their aim is still the prioritisation of firms or markets for further investigation.

A key feature of these tests is some form of comparison. While it might be tempting to attack a summary outcomes feature, such as “high” prices, or perhaps more accurately “high” margins, screening tests typically require some comparison, either between firms, or across time, geographies or product varieties.

A distinction could be made between screening for possible regime shifts between competitive behaviour (or punishment episodes) and collusive behaviour, and screening to identify potential cases of ongoing collusion. While several of these tests could be applied to both approaches, I summarise some observations on testing for regime shifts at the end of the section.

An ideal screen would be universally applicable, with modest data requirements. None of these screens fits that description - applicability is limited to markets where the factual matrix approximates the necessary assumptions of the test, and there typically remain a variety of potential explanations for an observed outcome. I raise a number of these alternative explanations here, although others would no doubt arise in the context of specific industries.

Practitioners are typically constrained by the type and amount of data available. In the following sections, I progress from tests using the most readily available information to more demanding situations.

2.2.1. Prices

Prices are typically the most readily available data, and several sources now exist within South Africa, at a firm level,[10] or alternatively aggregated data, which can be analysed through a comparison across geographic areas, over time, or across related product varieties.

Average price levels. A summary statistic that prices are high, while intuitive, is insufficient for indicating that collusion is likely. While comparisons of average price levels, for example between two geographic areas, or price increases over time, might arouse more justified suspicions, these comparisons beg the further investigation of additional potential explanatory factors, discussed below.

Average price changes over time. Abrupt changes in average prices may reflect punishment episodes within a collusion setting, or regime shifts between competitive and collusive behaviour. However, there may also be a variety of alternative explanations. Tests that consider additional explanatory variables, such as cost and/or demand, may provide better indications. These are discussed further below.

Price variance. More generally, price variance over time may be lower under collusion than under competition.[11] Abrantes-Metz et al (2006) refer to theoretical support, and explain the intuition that in posted-price settings,[12] colluding firms could respond more slowly to changes such as costs, and in auction settings, complementary bidding by losing members of a bidding ring could reduce the variance of submitted bids.[13] The authors provide some empirical support for this pattern in an actual cartel case, and while studies of other cartels are often consistent with this finding, they are not universally so. A price variance test is intended to contrast the controlled compromise of collusion, against vigorous, volatile competition – however, unstable collusive situations, characterised by frequent price wars, could also give the appearance of high variance.

Comparison of prices between firms. In posted-price settings, similar or even identical prices amongst competitors could be consistent with either collusion or competition, for example through common costs.

In auction settings, identical prices might raise some suspicion, especially where there is additional information of heterogeneity between bidders (e.g. costs) or across objects being auctioned, although theoretical and empirical studies provide some mixed results. Funderburk (1974) describes which used identical bidding by suspected collusive firms in procurement auctions for asphalt contracts (where the

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[10] See for example the rural food price surveys undertaken by the NAMC, StatsSA, independent websites such as http://www.cheaperdiesel.co.za, publicly available information on tenders and bidding for government contracts such as those administered by SANRAL, and Nielsen research.

[11] In addition to variance, other moments or descriptions of the distribution of prices may be analysed. Connor (2005) also discusses measures such as skewness, in that cheating from a collusive price may result in negatively skewed price dispersions, compared with competitive outcomes, and kurtosis.

[12] Throughout this paper, I refer to "posted-price" settings as those in which sellers post a price for their goods, in contrast to "auction" settings, in which a bidding process is used to determine the ultimate price paid, based on the responses of a number of potential bidders.

[13] Abrantes-Metz et al (2006) refer to theoretical support from Athey Bagwell and Sanchirico (2004), Harrington and Chen (2006), and LaCasse (1995), and empirical evidence in Bolotova, Connor and Miller (2008), Genesove and Mullin (2001), Feinstein et al. (1985) and Lee (1990).

customer paid for delivery) as a sort of allocation methodology. In relation to prosecuted cartels, Comanor and Schankerman (1976) show that bid rotation is more common with fewer members, but identical bids may be preferred as the number of cartelists grows.

Comparison of prices between firms over time. The consideration of parallel behaviour may, at times, have been too readily transformed into a search for parallel pricing.[14] Despite the intuitive appeal of price correlations, many markets show such correlation, with competitive explanations.

In auction settings, while some theoretical models predict closer correlation under collusion, there are plausible collusive strategies under which correlated bids might not be observed (such as bid rotation, with phantom bids by losing cartelists).

What is even less clear is the prediction of collusive price correlation in posted-price settings. Buccirossi (2006) considers a simple theoretical, two-firm, differentiated products model, and demonstrates that price correlation might be higher under competition (with cost shocks), higher under collusion (with demand shocks), or ambiguous (with combinations of cost and demand shocks).[15] Given this result, and the level of debate over price parallelism, this indicator alone seems a poor marker for collusion.

2.2.2. Volume (shares)

Concentration. Concentration could be considered both as a condition affecting collusion and a market outcome that may have come about through collusive exclusionary behaviour. A finding of high concentration is not sufficient, on its own, to indicate the likelihood of collusion.

Variation in volumes of each firm over time. Allocating customers or market segments is a simple collusive mechanism that results in more stable shares. This has some theoretical support as firms weigh up the higher profits of more efficient collusive schemes against the costs of designing and enforcing such schemes. However, similar patterns of behaviour could also arise under competition, through specialisation or differences in costs, location or product differentiation. Buccirossi (2006) shows that individualised cost or demand shocks result in greater market share stability under perfect competition than under perfect collusion.

Bid rotation schemes are also relatively simple, and might result in a firm's share being negatively correlated over time (also see Athey and Bagwell 2001). This pattern could also arise in a competitive setting where firms operate close to a capacity constraint or, more generally, face decreasing returns to scale (Zona, 1986) - winning one tender would make winning again in the near future less likely. Increasing costs of consecutive losses (e.g. likelihood of bankruptcy) may also make losing firms bid more aggressively.

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[14] See the discussion of parallel conduct, and parallel pricing with "plus factors" in connection with the US Supreme Court and lower courts, in Angumuthoo (2008).

[15] Note that Buccirossi abstracts from the degree or severity of collusion, assuming that collusion equates to the monopoly outcome (instantaneous joint profit maximisation by the two competitors), and competition equates to instantaneous individual profit maximisation.

2.2.3. Prices and costs

Accurate, disaggregated cost information is typically harder to find than prices or volumes, although the main cost drivers for some products (e.g. foods, basic manufactures) are commodities, whose prices are well documented.[16] Costs help in examining some of the more obvious potential explanations for unusual pricing patterns.

Level of margins. A simple finding that margins are "high" is insufficient to indicate the likelihood of collusion. Apart from the difficulty of defining margins relevant to a particular strategic time frame, detailed studies have uncovered markets where product differentiation, and not collusion, explains high margins. Studies of actual cartels include industries frustrated by low margins (see Asch and Seneca, 1975). Hicks' (1935) notion that "*the best of all monopoly profits is a quiet life*" might additionally be applied to collusion, and "Crisis cartels"[17] provide further examples of collusion in low margin environments.

Changes in prices and costs. By contrast, a change in the relationship between prices and costs (over time or between firms) might indicate a regime change between competition and collusion. Periods of low margins may even prompt explicit collusion (where tacit collusion has been ineffective).

The simplicity of coordinating on a single price, or on similar price increases may imply that prices are less responsive to costs under collusion. Theoretical papers provide support for the intuition that it may be too difficult or expensive to reveal colluding firms' true costs (Athey, Bagwell and Sanchirico, 2004), or that colluding firms fear that full pass-through of cost shocks could be (mis)interpreted by customers as suspicious behaviour (Harrington and Chen, 2006). However, in some industries, competitive prices may be determined by marginal competitors, and might not strongly correlate with other competitors' costs.

Recalling Buccirossi's (2006) result that prices are more correlated under competition with firm-specific cost shocks, one might additionally use information on the incidence of cost shocks in an investigation, although it would be important to account for contemporaneous demand shocks.

2.2.4. Prices and demand shocks

Information on demand shocks may be less common than prices, volumes and costs, although qualitative information may exist on the timing and incidence of significant shocks.[18] Theoretical and empirical papers have contrasted the responses of competitive and collusive firms when faced with different kinds of changes to demand.

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[16] In South Africa, some examples are the South African Grain Information Service ("SAGIS"), and the South African Futures Exchange ("SAFEX").

[17] See for example the Korean government's consideration of exceptions of certain cartels to assist economic recovery (Harris, Wang and Watanabe, 2009); European Commission case IV/31.553 (Welded steel mesh, OJ 1989 L 260, p. 1); CFI decisions T-217/03 and T-245/03, further reducing fines imposed by the European Commission in relation to the "Mad Cow Disease" crisis cartel.

[18] South African examples might include trade industry newsletters, particularly for shocks that are customer specific, perhaps related to a discrete event in a downstream market.

Collusive prices may fall during **unexpected, but observed** positive demand shocks (Rotemberg and Saloner, 1986), as this is when gains from cheating are highest. There is some empirical support for actual cartels weakening during boom periods (see Webb, 1982).

Under **anticipated fluctuations** in demand (such as seasonality), collusive prices may lead demand (i.e. peak while demand is still increasing, and recover while demand is still falling), adjusting to reflect changes in the costs of future punishment (Haltiwanger and Harrington, 1991). Borenstein and Shepard (1996) find some evidence of this pattern of pricing in retail gasoline markets in the US. Dick (1996) finds some support that "legal" export cartels were more likely to break down during anticipated downturns.

Collusive prices may fall following **unexpected, but unobserved** negative demand shocks (Green and Porter, 1984), as collusive firms confuse demand shocks with cheating, and resort to punishment to retain credibility.

While demand related tests may distinguish competitive and collusive behaviour in specific situations, two points should be noted. First, it may be difficult to accurately identify demand patterns, controlling for coincident changes, such as costs. Second, each of these patterns implies some cost to the colluding firms from not achieving perfect joint profit maximisation.[19] These costs might be lower under explicit rather than tacit collusion, and so these pricing patterns might be more muted or unobserved for more successful cartels.

2.2.5. Regime shifts

Many of the comparisons above could be re-cast as tests for regime shifts over time between competition and collusion. A structural break in prices, while controlling for cost and demand changes, could identify the initiation or resumption of collusion.

While a structural break is intuitively easy to visualise, real world situations may involve uncertain or gradual transitions, possibly due to poor communication, a lack of trust, or a fear of discovery. Collusion might (initially) only reach a relatively modest increment to long run competitive prices.[20]

Information on the timing of changes in the market can also help to distinguish the reactions of competitive and collusive firms.

The formation of a **trade association** or change in **market regulation** may change the incentives for coordination. Albæk, Møllgaard, and Overgaard (1997) describe the Danish Competition Council's decision to gather and regularly publish firm-specific transaction prices for two grades of ready-mix concrete in three regions of Denmark. Prices for types of concrete and regions covered by published transaction prices rose 15-20%, whereas those where transaction prices were not published rose 1-2%.[21]

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[19] In these cases the cost to the cartel is either in adjusting the collusive price so as to satisfy the incentive compatibility constraint (rebalancing profits from cheating against discounted costs of future punishment), or engaging in actual punishment to retain credibility.

[20] Looking ahead to the discussion of contact in Section 4, some of the differences in structural breaks might also help to distinguish between tacit and explicit collusion.

[21] As a brief aside, and to anticipate the discussion in Section 4, in this case the authors appear to have had tacit collusion and not explicit collusion, in mind.

Structural changes in the market, such as mergers, entry and exit might also provide opportunities to study responses in firm behaviour, as these changes might impact competitive and collusive outcomes differently. While there is evidence of entry related to the breakdown of collusion, entry may also affect competitive outcomes, and the two effects would need to be distinguished.

A collusive scheme might start to change its behaviour at the beginning of an **investigation** (Abrantes-Metz, Froeb, Geweke and Taylor, 2006), or an investigation into a related industry (Block, Nold and Sidak, 1981).

2.3. Lessons from Merger Control

There is an analogy between these "screening" exercises, and some of the approaches that have been applied to coordinated effects analysis in merger investigations. The early experience of the South African authorities focussed heavily on merger control,[22] and there are a significant number of published decisions both in South Africa and other jurisdictions, that deal with coordinated effects analysis.

Tests for collusion could consider either a regime shift or ongoing collusion. Similarly, coordinated effects analysis could consider either that a merger allows a regime shift to collusion, or that a merger makes existing collusion more certain, stable, or severe.[23] An investigation for a merger-specific regime shift might focus on conditions conducive to collusion, which might be augmented by the merger. An investigation into whether a merger might strengthen existing coordination could focus on outcomes already consistent with collusion (and show some merger-specific, incremental harm).

Historical assessments of coordinated effects have often considered individual factors which might make coordination more likely. Common criticisms are that these indicators have been considered subjectively, individually, or outside the framework of a coherent theory of harm, in a "check-list" approach.[24]

An early source that has been mined for these factors is Stigler's seminal article (1964), even if his motivation was to underline the difficulties firms face in reaching agreement. Judge Richard Posner provides a further discussion of conditions facilitating collusion in subsequent decisions and articles.[25] A familiar list of factors is included in the US Horizontal Merger Guidelines (1997), including concentration, transparency, product, seller and buyer characteristics, industry practices and previous instances of explicit collusion. Recent US cases have, however, required progress beyond these checklist factors to make explicit the mechanism of collusion in the post-merger environment.[26]

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[22] Note that this is contrary to the recommendation of some international institutions, to focus initially on cartel enforcement. See Lewis (2009) and Pate (2004). However, some studies of the introduction of more active cartel prohibitions without sufficient merger control provisions have shown a backlash of consolidation, which has arguably longer term effects on consumer welfare – see Lamoreaux (1985) in relation to the US experience, and Symeonidis (2002) in relation to the UK experience.

[23] See *Main Street 333 (Pty) Ltd / Kumba Resources Limited*, Case 13LMFeb06, at para 37, available at http://www.comptrib.co.za/comptrib/comptribdocs/225/13LMFeb06.pdf.

[24] See, for example, Scheffman and Coleman (2003).

[25] See Posner (1976).

[26] See Panel Discussion (2004), and Scheffman and Coleman (2003)

Several South African merger decisions refer to check-list factors, characteristics which may be conducive to collusion, without explicit reference to a coherent mechanism of collusion. However, in several of these cases additional references to pre-existing collusion likely gave the Tribunal some comfort in its conclusions.

In 2002, the Competition Tribunal prohibited the proposed vertical merger between Mondi and Kohler.[27] In relation to coordinated effects, the Tribunal refers to Stigler's "*groundbreaking work*", to "*identify those features of markets and products that lent themselves to collusion or cartelization".*[28]

The Tribunal also noted "*prima facie evidence that coordination is already the order of the day*" and reasoned that the merger may enhance existing transparency.[29] In rebutting the subsequent appeal, the Competition Appeal Court referred to structural features of the market, and emphasized two of the "*Airtours"* conditions (transparency and stability to outsiders).[30]

In *Afrox/Rico*,[31] the Tribunal concluded that the merger increased the likelihood of tacit collusion due to, *inter alia*, the limited number of players, the homogenous nature of the products (refrigerant gases), and increased post-merger symmetry in market shares and costs. Some customers had alleged pre-existing price collusion, and the Tribunal ultimately approved the merger subject to the divestiture of Rico's gas business.

The search for signs of existing collusion has not been confined to allegations of contact between competitors, but has also extended to the analysis of pricing outcomes (as in *Primedia/Capricorn/Nail*, para 90). [32]

The Tribunal also refers directly to the search for a "*mechanism*" of collusion, or "*clear theory of the rationale for collusion*" in recent cases (see *Main Street 333/Kumba* para 43, and *Primedia/Capricorn/Nail*, para 78).[33]

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27 Mondi Limited and Kohler Cores and Tubes, Competition Tribunal Case No: 06/LM/Jan02, Decision of 23 May 2002, available at: http://www.comptrib.co.za/%5Ccomptrib%5Ccomptribdocs%5C222%5C06LMJAN02.pdf

28 *"Stigler's typology provides a near perfect fit for the South African pulp and paper products markets – a small number of large participants, stable and equal market shares, homogenous products, mature technologies, high entry barriers and transparency*." (para 91).

29 Para 92. Additionally *"Our concern then that this transaction provides the basis for an exchange of information that would facilitate horizontal coordination does not emanate from a clear sky."* (para 96).

30 *"the requirements as set out in the Airtours case are easily met, namely that the two parties have the ability to know how the other behaves so as to monitor common practices, sustainable tacit co-ordination and the inability of competitors (who do not effectively exist) and customers to jeopardise the results obtained from the common practice is manifestly reasonable."* (para 78)

31 African Oxygen Limited (Afrox) / Refrigeration Investment Company (Pty) Ltd (Rico), Competition Tribunal Case No: 37LMMay06, Decision of 22 November 2006, available at: http://www.comptrib.co.za/%5Ccomptrib%5Ccomptribdocs%5C691%5C37LMMay06.pdf

32 Primedia Ltd / Capricorn Capital Partners (Pty) Ltd and New Africa Investments Ltd, case 39AMMay06, (second examination) available at http://www.comptrib.co.za/comptrib/comptribdocs/825/39AMMay06.pdf.

33 *Main Street 333 (Pty) Ltd / Kumba Resources Limited*, Case 13LMFeb06, available at http://www.comptrib.co.za/comptrib/comptribdocs/225/13LMFeb06.pdf, and Primedia Ltd / Capricorn Capital Partners (Pty) Ltd and New Africa Investments Ltd, case 39AMMay06, (first examination) available at http://www.comptrib.co.za/comptrib/comptribdocs/603/39AMMay06.pdf.

The European Commission and courts provide a series of cases analysing cooperative behaviour.[34] As in the US, there has been some movement away from a check-list approach,[35] and towards a requirement to examine a mechanism for collusion. Decisions connected with the Sony/BMG joint venture illustrate this evolution.[36]

The European Commission first cleared the transaction unconditionally in 2004, despite having initially raised concerns related to collective dominance.[37]

In *Impala v Commission* (2006),[38] the appeal by a third party, the Court of First Instance (CFI) reiterated the three conditions from its judgment in *Airtours v Commission,* [39] and also listed other structural and behavioral indicia which might give rise to a finding of coordination.[40]

In *Bertelsmann and Sony v Impala* (2008),[41] the subsequent appeal by the Parties, the European Court of Justice (ECJ) was clear on the need for a coherent theory of harm, not merely a check list of factors, and raised some important points in relation to the assessment of collusion more generally:

- The ECJ referred to industry characteristics as a marker for (presumably tacit) collusion.[42]
- The ECJ highlighted the need to reach a common perception, in addition to the frequently quoted *Airtours* conditions of transparency, deterrence and stability to outsiders.[43]

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34 First under collective dominance and later "coordinated effects" under the new merger regulation (Council Regulation (EC) No 139/2004 of January 20, 2004 on the control of concentrations between undertakings).

35 In addition to the *Airtours* case, numerous papers have been (mis)interpreted as a source of check-list factors. "*The economics of tacit collusion*", presents a detailed discussion of individual points which might make collusion more likely, although the authors do discuss a prioritisation of these points, and in their final paragraph note that "*the interplay of the factors may be important*", so that "*it becomes important to undertake a joint assessment of the factors*". Ivaldi et al (2003), p 65 – 67.

36 This joint venture has now been wholly acquired by Sony Corporation. See European Commission case M5272 at http://ec.europa.eu/competition/mergers/cases/index/m105.html#m_5272

37 European Commission case M3333, available at http://ec.europa.eu/competition/mergers/cases/index/m66.html#m_3333

38 Case T-464/04 *Impala v Commission* [2006], OJ C 224 of 16.09.2006.

39 Case T-342/99 *Airtours/First Choice* [2002] ECR II-2585, para 62. Namely, conditions of transparency, a deterrent mechanism and stability to customers and competitors.

40 Case T-464/04 *Impala v Commission* [2006], OJ C 224 of 16.09.2006, para 251. "*although the three conditions defined [in Airtours], are indeed also necessary, they may, however, in the appropriate circumstances, be established indirectly on the basis of what may be a very mixed series of indicia." (para 251).* Namely a close alignment of prices, especially for differentiated products; a "high" level of prices, prices unresponsive to fall in demand, and stable market shares

41 Case C-413/06 P *Bertelsmann and Sony Corporation of America v Impala* [2008], OJ C 223 of 30.08.2008.

42 The ECJ notes that a collective dominant position (tacit collusion) will occur when firms are able to adopt a common policy, in particular because of "*correlative factors which exist between them*" (para 120), where such correlative factors would include, in particular "*a tight oligopoly within which, on a market with the appropriate characteristics, in particular in terms of market concentration, transparency and product homogeneity*" (para 121).

43 *"Such tacit coordination is more likely to emerge if competitors can easily arrive at a common perception as to how the coordination should work, and, in particular, of the parameters that lend themselves to being a focal point of the proposed coordination."* (para 123). For a South African parallel, see the Competition Tribunal in *Main Street 333/Kumba Resources* at para 39(i).

- The ECJ was clear that the mere application of a check-list is insufficient, and an overall mechanism for coordination is required.[44]
- The ECJ specifically pointed to the possibility of express collusion where tacit collusion might be less likely or more difficult.[45]

This final observation will become important in Section 4, where I start to look for distinguishing features of tacit and explicit collusion.

Several of the indicators used in assessing coordinated effects within a merger context are familiar from the previous discussion of screens for potential collusion, and the understanding and information gained in merger investigations might be used to inform subsequent screening for collusive situations.[46] There remains a legal question as to whether or not the standards of proof are different for coordinated effects analysis under merger control and collusion under horizontal practices.[47]

3. Further Examination

The patterns of market outcomes used above for screening may yet have a range of alternative explanations, including competition. In this section I describe more detailed examinations to try and distinguish between some of these potential alternative explanations. I still consider collusion generically; in section 4 I consider the role of contact in explicit collusion.

Two types of methods are reviewed, incremental to those of the previous section:
- First, further information is used to control for some potentially confounding factors.
- Second, expectations of candidate models of collusion and competition are directly compared within the context of the market, using benchmarks either from other markets or firms, or directly informed by economic theory.

As the analysis becomes more tailored to the facts of individual markets, specific examples are inevitable – the discussion below is broadly divided into posted-price settings and auction settings. The choice of method will be driven by the manner in which competition works (often inferred through a number of qualitative indicators or, occasionally, empirically tested) and the data available.

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[44] "*In applying those criteria, it is necessary to avoid a mechanical approach involving the separate verification of each of those criteria taken in isolation, while taking no account of the overall economic mechanism of a hypothetical tacit coordination*". (para 125)

[45] "*Unless they can form a shared tacit understanding of the terms of the coordination, competitors might resort to practices that are prohibited by Article 81 EC in order to be able to adopt a common policy on the market.*" (para 123)

[46] The South African Competition Commission already uses information in this way (see Roberts, 2008).

[47] In identifying the likelihood of collusion we actually see the market outcomes, whereas we only anticipate future merger outcomes. For purposes of quantification, collusion still involves the comparison of actual behaviour with an unseen counterfactual (an assumed competitive market), whereas merger control involves the comparison of two unseen counterfactuals.

3.1. Posted-Price Settings

3.1.1. Structural modelling – ongoing collusion

Several studies, (see Bresnahan (1987) for an early example), have tried to estimate structural models of an industry to test whether the data are better explained by a collusive or a competitive model.

Bresnahan used data on movements in the quantity and quality-adjusted prices for automobile sales in the US over the period 1954-1956, and found that a collusive model fit the data better in 1954 and 1956, whereas a competitive model (price war) fit the data better in 1955, in which automobile sales were 45% higher than in the two surrounding years.

Later applications (see Nevo, 2001, and Slade, 2004)[48] have tried to determine the relative contribution of three potential factors in explaining observed margins:

- Product differentiation
- The internalisation of inter-brand competition within the same firm
- Collusion between firms

In contrast to collusion, the first two sources would be modelled as individual short term profit maximisation (first by each brand, second by each firm which might own several brands).

A challenge for these techniques is in choosing appropriate benchmarks for competition and collusion. Between the theoretical extremes of instantaneous profit maximisation (perfect competition) and joint profit maximisation (collusion), some "competitive" firms may incur medium term avoidable costs in the course of a longer term strategy, and it may be difficult to delineate which costs are relevant to pricing decisions over different strategic time horizons. In addition, observed collusion may be less than perfect.

Furthermore, these techniques typically focus on price effects, and may miss collusion in non-price dimensions, such as raising costs or barriers to entry, which might be equally harmful.

3.1.2. Structural modelling - regime shifts

In Section 2 I noted a theoretical explanation for on-going regime shifts between collusive and punishment behaviour under uncertainty (Green and Porter, 1984).

Some studies have tried to directly model regime shifts over time in actual or suspected cartel situations, fitting competitive and collusive models to the different regimes, and looking for triggers linked with the timing of shifts in behaviour. Porter (1983) performs a structural estimation to test for on-going regime shifts in the Joint Executive Committee (JEC) railroad cartel, which coordinated the freight of grain from Chicago to the East coast of the US in the late 19th century. Porter (1985) and later Ellison (1994) try to find links between triggers (an unexpectedly high share for

[48] Nevo (2001) estimates the demand function for 25 different brands of cereal in the US, whereas Slade (2004) estimates demand functions for 63 brands of beer in the UK. Both authors find no evidence of collusion, and rather explain margins with reference to product differentiation or the suppression of inter-brand competition within multi-brand firms.

a conspirator, deviations of shares from quotas, or high aggregate demand) and reversions to price wars within the same JEC cartel.

However, reviews of actual cartels indicate that the most successful cartels appear to avoid punishments, even when they might theoretically be predicted – especially when punishment is costly to the enforcers (Levenstein and Suslow, 2006). Sophisticated tests for regime shifts might fail to identify such cartels.[49]

3.2. Auction Settings

In an auction setting comparisons can be made either between bidders to distinguish a collusive subset, or between models of collusion and competition to see which best characterises market outcomes. The appropriate modelling techniques will depend on the auction mechanism, and the nature of the object being auctioned, particularly the way in which bidders' information and characteristics affect their valuations of the object.

Auction mechanisms can broadly be divided into those with publicly stated bids (oral auctions), and those with privately submitted bids (sealed bid auctions).[50]

Information settings can largely be divided into those where bidders are each confident in their own valuation of the object, but valuations differ between bidders due to bidder heterogeneities such as costs or location (independent private values), and those where bidders would have a similar objective valuation for the object, but under uncertainty bidders' estimated valuations are different, due to the limited information available to each bidder (common values).

I describe applications within an independent private values set up, divided between oral auctions and sealed bid auctions, to provide some flavour of the variety of approaches used. For further discussion of common values settings, including the potential for the "winner's curse" to act as an obstacle to collusion, see Hendricks, Porter and Tan (2008).

Within the South African context there may be additional factors to consider in auction mechanisms, such as preference programmes (e.g. BBBEE, see an analysis of similar programmes in Krasnokutskaya and Seim, 2008). Several insights described below have applications in designing auctions to hinder collusion, as well as detecting collusion (see Hendricks and Porter, 1989).

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[49] Consider, *a fortiori*, that studies of known cartels may omit even more successful, unknown cartel activity.

[50] Two further divisions are commonly made: within open auctions between ascending bid auctions (English auctions), and descending bid auctions (Dutch auctions); and within sealed bid auctions between first price sealed bid auctions (in which the bidder with the highest bid wins and pays his own highest bid), and second price sealed bid auctions (Vickrey auctions, in which the bidder with the highest bid wins, but pays a price equal to the second highest bid). For a further description of auctions, see Klemperer (2004).

3.2.1. Sealed bids – data available on all bids

The first class of techniques tests observed outcomes against predictions of economic theory, in particular:

- whether or not collusive bids are determined in the same way as non-collusive bids; and
- whether or not there are interactions between suspected collusive firms' bids.

Bajari and Ye (2003) test for collusion in a series of procurement auctions (for highway maintenance) by examining whether a large number of potential permutations (sub-sets) of competitors satisfy two expectations of competitive firms:

- independence (if the costs of each bidder are independent, the bids submitted by each bidder should be independent (unrelated), after controlling for publicly available information about other firms, such as transport costs, available capacity, and history of success in similar tender situations); and
- exchangeability (bids should respond in a similar way to major cost drivers, such as capacity, and transport costs).

Only two permutations of competitors did not pass both tests, and the three firms included in these sub-sets had all previously been investigated for bid rigging.

Porter and Zona (1993) use procurement auction data (for highway construction projects) to examine how each firm's bids are related to expected cost drivers, such as capacity and capacity utilisation. The authors find that these relationships are significantly different for the suspected collusive sub-set of firms, and were not consistent with the predictions of a competitive model proposed by the authors.

The authors also found that, for the suspected colluding firms, the determinants of the winning bid (such as capacity utilisation) were significantly different to the determinants of the losing bids – consistent with losing members of a bidding ring submitting "phantom" bids, unrelated to cost drivers.

Porter and Zona (1999) examine procurement auctions (for the supply of milk to schools), and test for relationships between bids and expected cost drivers, in this case distance, as well as the decision to submit a bid. Both the variation of bids with expected cost drivers, and the decision to bid, differed between suspected collusive firms and a presumed competitive fringe.

The question which arises in applying these tests is whether the researcher has adequately accounted for potential alternative explanations. In testing for independence, specification is crucial (controlling for observable and common factors), and when examining relationships between prices and costs, alternative potential explanations must be considered, such as price discrimination, and cost, product, location or demand differences between subsets of firms. Despite the tempting appearance of some common principles in the presentation of the tests above, it is instructive that Hendricks and Porter (1989) conclude in a survey article that there is no general strategy for the empirical detection of collusion in auctions; rather, detailed investigations need to be tailored individually to the facts of each market.

3.2.2. Oral auction – Data on the winning bid

In oral auctions data may exist only on the winning bid and the identity of the winning bidder. Nevertheless, some tests have been developed which can make use of even this limited information in inferring collusive behaviour.

I describe one situation that would allow such a test. If competitive bidders submit their valuations in an ascending oral auction,[51] the winning bid will equal the second highest valuation (the winner only has to wait until the second highest bidder drops out, and does not have to pay his full valuation). If the bidders with the highest two valuations collude, they only have to out-bid the third highest valuation.

If we could observe or estimate the full distribution of valuations, we could distinguish between competition and collusion: under competition, we would observe the winning bid as the second highest valuation; under collusion, we would observe a mixture of situations in which the winning bid was sometimes the second highest, third highest or lower ranked valuations, depending on how many bidders were colluding, and how often these collusive bidders had the highest valuations. The following two papers apply this idea.

Baldwin, Marshall and Richard (1997) test for collusion in oral ascending auctions for government sales of timber. The authors test a range of different models (also accounting for the market-specific complication of multi-unit auctions where each bidder may only want one unit) and find that a collusive model fits the data best.

Banerji and Meenakshi (2004) apply a similar technique to wheat auctions in Northern India.[52] When compared with the predictions of a competitive model, they found stronger support for a collusive model in which three large bidders colluded to rotate their purchasing behaviour, while smaller bidders behaved competitively.

While these papers represent impressive applications of economic and econometric theory, they raise important questions as to the standing of these tests as evidence of collusion.

These applications involve a “horse race” between collusive and competitive models. Although the data may be more consistent with a collusive model than with a competitive model, this is not the same as showing that collusion has occurred.

Even specifying collusive and competitive models typically involves extensive qualitative information. Necessary assumptions (e.g. the type of auction, related institutions, characteristics of the products and the bidders) must be justified, either through qualitative evidence or empirical testing. There may be shortcomings in the competitive and/or collusive models which could affect the outcome of any direct comparison between two chosen models.

Notwithstanding the criticisms above, if a sufficiently robust technique shows that a number of reasonable competitive models systematically under-perform a coherent model of collusion, this could at least prompt some difficult questions for the suspected collusive firms.

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[51] This is the standard auction setting where bidders purchase a product. In a procurement auction, where bidders submit the price at which they are willing to provide a service, the situation may be reversed, with prices descending until only one supplier is willing to provide the services.

[52] A landmark paper which opened up further possibilities in this kind of testing, is Athey and Haile (2002), who demonstrated that the key to the exercise, the distribution of valuations, can be reverse-engineered using only limited data (depending on the type of auction, and the distribution of information between bidders), and in the simplest cases can be worked out using information on only the winning bids.

3.3. Parallels with Merger Control

It may initially be difficult to imagine these more sophisticated approaches within the obvious time constraints of merger investigations. However, there are some examples that have been driven by the trend towards greater economic and econometric rigour in merger analysis.

Applications involving structural modelling (Bresnahan, 1987, Nevo, 2001, and Slade, 2004) are analogous to demand estimation techniques used to assess the closeness of competition under non-coordinated effects in merger investigations.[53] Researchers adjust the behavioural assumptions to model collusive as opposed to competitive interactions. When assessing non-coordinated effects, these models compare competition between the merging parties (and other competitors) pre-merger, with joint profit maximisation by the merging parties (with ongoing competition between the merged entity and other competitors) post-merger.

In addition to non-coordinated effects examples, the European Commission applied similar techniques to assess coordinated effects in a recent case (*ABF/GBI Business*) attempting to model demand to determine whether or not collusive behaviour existed pre-merger, and to estimate how potential payoffs from collusive behaviour might change post-merger.[54] The analysis ultimately failed due to data limitations, although it seems likely to be attempted again, given the exhortation of the ECJ, noted in Section 2, to take "*account of the overall economic mechanism of a hypothetical tacit coordination*".[55]

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[53] See for example in the US: *United States v. Interstate Bakeries Corp*. (1995), *State of New York v. Kraft General Foods* (1995), *United States v. Kimberly-Clark Corp*. (1996), *United States v. Vail Resorts, Inc* (1997), *FTC v. General Mills* (1997), *United States v. Georgia Pacific Corp*. (2000), and *United States v. Oracle Corp*. (2004).

In Europe: *Volvo/Scania* (2000), *Lagardere/Natexis/VUP* (2004), *TomTom/Tele Atlas* and *Nokia/NAVTEQ* (2008) (see Mosso et al, 2008).

[54] European Commission case M4980, available at http://ec.europa.eu/competition/mergers/cases/index/m99.html#m_4980. See also de la Mano (2008)

[55] Case C-413/06 P Bertelsmann and Sony Corporation of America v Impala [2008], OJ C 223 of 30.08.2008, para 125

4. Contact

In this section, I discuss what is arguably the feature that distinguishes cartels from other courses of parallel conduct or tacit collusion,[56] which is some form of contact or communication.[57] The prohibition in the Act refers to a horizontal *agreement*, *concerted practice* or *decision* (by an association of firms); even concerted practices are defined as being "*achieved through direct or indirect contact*".[58]

Even if the legal questions were settled, as to the precise manner and extent of contact and communication that constitutes prohibited conduct, the examination of outcomes or behaviour to infer contact is likely to be difficult. A finding of illegality might stem from an episode of contact that was only incidental to the actual outcome of (largely tacit) conduct. To the extent that economic tests are able to provide any assistance, they will be most helpful in distinguishing situations consistent with free and continuous communication, from situations consistent with very limited or no communication.

Empirical tests for actual contact have not been well developed in the academic literature, and this is probably the area where economics has the least to say. Nevertheless, it may be helpful to identify some places where economic evidence might assist. Given the early stages of development, what follows is not intended as a menu for immediate application, but rather as suggestions for further consideration and research.

Economic and particularly empirical evidence are expected to remain as only one part of the evidence relating to contact, and should be seen as a source of confirmation or support, or alternatively the source of difficult questions, rather than a stand-alone piece of incontrovertible evidence. A taped telephone conversation, incriminating email or competitor testimony could prove decisive in determining illegal contact. The following ideas merely suggest where one might look, before such decisive evidence is available.

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[56] I do not consider whether contact should result in a "*per se*" offence (see, for example, Whinston (2004), Parr (2008)) - policy makers appear to have satisfied themselves that the costs of investigating cases involving explicit price fixing on the merits are not likely outweighed by the possibility of pro-competitive benefits in a minority of cases.

[57] I do not consider the degree or types of contact that might be required (see, for example Angumuthoo, 2008), and there may remain unsettled legal questions as to whether or not the types of contact discussed here would constitute "*per se*" illegal conduct, or whether some forms of contact might be examined against potential pro-competitive benefits. The Tribunal has remarked that "*Meetings between the competing firms in the industry are frequent and issues of strategic importance appear to be discussed openly on a collegial basis. Most canners share their expectations of pricing, costs, views on innovation etc."* (para 61) and *"We would hasten to add that this is not to suggest that the canning firms are engaged in activity that is unlawful."* (para 63) Tiger Brands Ltd, Ashton Canning Company (Pty) Ltd, Newco and Langeberg Foods International, Ashton Canning Company (Pty) Ltd, Competition Tribunal, September 2005, 46LMMay05.pdf, available at http://www.comptrib.co.za/comptrib/comptribdocs/431/46LMMay05.pdf

[58] Competition Act, Chapter 2, Section 4: Restrictive Horizontal Practices Prohibited, and Competition Act, Chapter 1, Section 1: Definitions and interpretation.

4.1. Potential Economic Tests

The economic difference between situations in which there has been contact, and where there has been no contact, is primarily in the information available to competitors.[59] Without contact, information flows between suspected collusive firms are limited to inferences gained from the public observation of competitors' characteristics and actions. Under contact, a much richer set of information might be exchanged, including key competitive characteristics and future intended behaviour.

§ Contact inferred from the use of private information

One might search for situations in which one firm's actions are consistent with information that should reasonably only have been privately known by its competitor(s). The important distinction is between truly private information and information that could have been gained from public observation of competitors' behaviour, even over a long period. For example, in procurement auctions settings the information private to each firm in a given tender includes whether or not the firm will bid aggressively (after controlling for observable factors, such as capacity constraints or other costs). Identical bids in the presence of differences in valuation or information might also imply contact,[60] unless these bids formed "focal points" that were reasonably achievable following a sufficiently long period of tacit observation.

§ Contact inferred from coordinated changes

Another idea would be to search for situations in which more than one firm demonstrates changes in behaviour that are sufficiently similar and correlated, without a time delay or iteration, that would be unlikely absent some degree of contact. The intention is not to capture changes which could reasonably have been anticipated, such as standard (percentage or absolute) price increases, on a given day of the week, which could have been chosen based on previous patterns of increases. Nor to pursue static price similarities, which could have been arrived at over time through an iterative method. Rather, the intention is to look for changes initiated simultaneously, indicating an unreasonably high degree of common information that would normally be private - collusive action, as distinct from intelligent reaction or anticipation.

§ Contact inferred by the complexity of a collusive strategy

In some situations a collusive strategy might be found, but it may be difficult to contemplate a purely tacit explanation, due to the complexity of the observed behaviour or outcome. Examples might include the ability to respond quickly or renegotiate a strategy under uncertainty or unexpected shocks, or even the ability to reach an initial collusive equilibrium in complex circumstances.

§ Contact inferred by the avoidance of mutually costly punishments

Successful cartels appear to avoid punishment, especially mutually costly punishment, more often than economic theory might expect. Intuitively, communication might provide firms with an enhanced ability to avoid costly episodes. If punishment does not follow an observed deviation from collusive behaviour, but collusion is regained, one might look for opportunities for the re-negotiation of an agreement, signs of side payments or self-punishments by the deviating firms.

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[59] Both in terms of potential signalling, and the pure transfer of information. Neven (2001) includes an overview of the literature discussing the value of talk.

[60] See Scherer and Ross (1990), and Mund (1960) for examples of identical bids.

I discussed, above, the role of actual punishment as a necessary response to unanticipated, unobserved demand shocks (Green and Porter, 1984). However, the JEC still engaged in price wars even under full communication (pre-Sherman Act, see Porter, 1983). Others have argued that the JEC was an inherently unstable cartel. Communication may allow more successful cartels to achieve outcomes characterised by fewer punishments in response to apparent cheating.

§ Contact inferred from the response to changes in information

Changes in publicly available forms of communication may allow us to infer the degree of contact that previously existed. One example is to revisit Albæk, Møllgaard, and Overgaard (1997), and the Danish Competition Council's decision to publish firm-specific transaction prices for concrete. The large effect on actual prices might imply that this level of transparency was not achieved before the change. Unfortunately we are still not able to exclude the possibility of a degree of communication prior to the structural break, although we can say that the previous levels of communication were insufficient to achieve the outcomes experienced following the publication of prices.[61]

4.2. Other Empirical Tests

In addition to these rather tentative proposals for economic tests, economists have investigated other data-rich phenomena to try and infer contact.

§ Market outcomes and opportunities for communication

Competitors might communicate or meet for a variety of reasons. Short of hard evidence of illegal contact (taped conversations, incriminating emails or documents) an inference might be made from the timing of communication opportunities (meetings or telephone calls) and market outcomes. Wang (2008) illustrates the close correlation between telephone calls made between 10 competing service station operators, and large price increases implemented over a 90-day period. Connor (2001) describes travel patterns of executives involved in the Lysine cartel (although these were secondary to extensive direct evidence). Evidence of a bread cartel in the Czech Republic included incriminating email messages as well as photographic evidence of cartel operators' cars parked outside the same pub, where they were meeting (OECD, 2006).

§ Correlation of private (mis)information

The US Department of Justice (2005) recommends looking for identical calculations or spelling errors in bidding submissions, as a sign of potential bid rigging - an example of competitors revealing a mutual understanding of private (mis)information.

Artificially generated bids (e.g. losing cartelists, attempting to generate an appearance of competition) may be distinguishable from objectively determined bids (driven by cost factors). There are a number of ways in which such "made-up" bids might differ statistically from objectively determined bids.[62]

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[61] Firms could have also been explicitly (albeit imperfectly) colluding prior to the publication of these firm-specific transaction price data. Firms may have been dishonest, slower or more limited in the extent of their sharing of transaction price data. Presumably, honesty would have been at least partially verifiable by watching the award of contracts, but this does not exclude the possibility of some pre-existing explicit collusion that might have been strengthened by the increased transparency.

[62] For example, Benford's Law describes how the expected distributions of naturally occurring numbers differ from random numbers.

§ Communication through the sale mechanism

Cramton and Schwartz (2000) describe US Federal Communications Commission (FCC) spectrum auctions, which adopted an open ascending bid format for many licenses simultaneously. Early auctions allowed signaling between different bidders, either by using the trailing digits of their actual monetary bids to signal the lot numbers in which a given bidder was interested, or through strategies such as aggressive bidding followed by strategic withdrawal from a lot targeted by a competitor.

4.3. Documentary Evidence

Finally, there are the documentary sources, which will no doubt remain central in assessing the degree of contact that has actually occurred. Some of the more amusing amongst these might include bidders who included notes from their pre-auction meeting in the envelope containing their sealed bid,[63] or files labelled "Cartel", found during dawn raids.

4.4. Conclusion on Contact

Economic theory currently provides little clear and universal guidance to distinguish between explicit and tacit collusion. However, there are some cases in which economic analysis or data-driven approaches may help to show the effect or importance of contact on market outcomes. Even in these cases, it is likely that economic evidence of contact will at best achieve a complementary role, alongside other types of evidence demonstrating that actual contact has taken place.

[63] Attributed to McAfee, cited in Porter (2005)

5. Conclusion

Over the period 2003-2009 there has been a significant shift in the South African competition authorities' focus towards cartels and other restrictive horizontal practices. While still awaiting the first written decision, this paper set out to initiate a discussion on what empirical methods might be used to detect and distinguish between competition and different kinds of collusion.

Screening exercises have been used to identify conditions necessary for collusion or commonly associated with collusion, although these approaches have only achieved modest success in identifying industries or sectors where collusion has occurred. Further screens have been used to search for market outcomes consistent with collusion, and have been applied to a wide variety of situations. I find analogies between these preliminary screening exercises and some approaches to coordinated effects under merger control. These techniques need to be applied carefully, mindful of the implicit assumptions and the factual matrix in the market. Finding outcomes consistent with collusion may not be sufficient evidence that collusion has occurred, and invites a further investigation of alternative potential explanations.

More detailed studies can take into account several alternative possible explanations, attempting to control for a range of potentially confounding variables, and may provide greater confidence in a conclusion of collusive behaviour. I find further analogies between these in depth investigations and some of the more sophisticated approaches applied under merger control.

The feature which distinguishes cartels from completely tacit collusion is contact, and our understanding of the empirical signs distinguishing the effects of contact on market outcomes is not yet well developed. I have proposed some areas for further investigation, as well as empirical analyses which might assist in looking for traces of contact. Nevertheless, empirical tests are likely to remain complementary to other direct evidence in this area.

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