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HARM AND OVERCHARGE IN THE SOUTH AFRICAN PRECAST CONCRETE PRODUCTS CARTEL

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Abstract

The harmful effects of cartels depend on a number of features including the size of the over-charge and the durability of the cartel. This paper examines the effect of a very long-running cartel in a market with low barriers to entry and unstable demand, the South African precast concrete products cartel. We describe how the cartel's arrangements overcame these dual challenges and examine mark-ups against alternative measures of the competitive counterfactual. This includes a discussion of the use of punishment mechanisms, the implications of vertical integration, how the cartelists adapted to entrants, and the effect of information exchange on firms apparently not part of the explicit cartel. These considerations also have implications for the transition after the end of the explicit cartel arrangements and the extent to which coordinated outcomes may persist. There are particular implications in South Africa where the Competition Appeal Court has held that the penalty calculation should take account of the cartel mark-up.

JEL classification: L40, L41

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1. Introduction

Towards the end of 2007 the South African Competition Commission uncovered a cartel in precast concrete products, focused on pipes and culverts, which had operated for some 30 years. Apart from the duration of the cartel it was also significant as it came to light through a leniency application from Rocla, a subsidiary of one of the biggest construction companies in the country, Murray & Roberts. It heralded a major focus on construction by the Competition Commission, which uncovered numerous cartels in construction products, as well as bid-rigging for contracts.

The cartel is interesting in terms of how it operated effectively for so long, in markets with seemingly low entry barriers. It is also revealing in terms of the adjustment following the end of the explicit cartel arrangements, the role of entrants in undermining the status quo, and the importance of ancillary arrangements such as information exchange in the speed and extent of adjustment.

The case is also a useful study of the magnitude of mark-ups in a developing country such as South Africa, where there are important debates underway about the size of penalties. The Competition Appeal Court (CAC), in its first ruling on cartel penalties, sharply reduced the penalties (by around a half and two thirds) that the Competition Tribunal had imposed on the two remaining cartel members that had not settled with the Competition Commission. The CAC did so largely on the grounds that quantitative evidence should be provided on the extent of extra profits earned and the higher prices charged under the cartel, evidence which had not been led in this case.

We analyse the adjustment following the ending of the explicit cartel arrangements, assess indicators of the size of the cartel overcharges, and highlight problems with the approach suggested by the CAC.

Background on the cartel

Around 1973, Rocla embarked on a strategy to cartelise the precast concrete products market in South Africa. The core agreement with competitors was that within three defined areas of the greatest demand, namely around Johannesburg, Cape Town and Durban, the competitors fixed market shares and prices, and the other firms agreed not to compete with Rocla for business in the rest of the country.² Hitting the agreed market shares involved allocating the available work among the cartel members on a contract by contract basis through bid-rigging.

Documents titled 'Modus Operandi' set out how this worked in each region in South Africa, along with the agreed market shares of each firm. The firm designated the "banker" would compile a comprehensive list of all contracts available and the firms would agree on the "allocatee" for each. The pricing of each firm was agreed in the form of the range of discounts that would be offered from the list prices to ensure that the designated firm would be sure to win the contract. Neither the price lists nor the discounts were identical across firms to give the impression of competition. A monthly summary of volumes delivered by each firm was kept to ensure that participants did not exceed allocated tonnages. To conceal the identity of the firms, they were denoted in the documents and data spreadsheets only by a number. In addition, all documents were meant to be destroyed, although some copies were obtained by the Commission.

The arrangements illustrate the importance of monitoring to maintaining cartel agreements, especially in a market with fluctuating demand and many different buyers. In this cartel, regular meetings were held. For example, in Gauteng these meetings were held at different

² For further details see: Consent Order (24/CR/Feb09)
<http://www.comptrib.co.za/comptrib/comptribdocs/1023/24CRFeb09.pdf>

venues on the second Tuesday of each month after formal industry meetings of the Concrete Manufacturers Association of South Africa (CMA). The venues changed periodically to avoid detection.

The main threat that the larger cartel members used for keeping the smaller players in line was to institute a price war in a given region, as happened in one region, KwaZulu-Natal (KZN), around 2000-2001. Interestingly, this was apparently because a smaller firm thought the cartel arrangements would cease with the new Competition Act (which came into force from September 1999) and started selling beyond the allocated volumes and outside the designated geographical area. It was soon disabused of this notion.

2. Economics of cartels

We briefly examine economic literature on factors that facilitate cartel stability and the literature on cartel overcharge.

2.1 Stability of cartels

Firms enter into collusive agreements in order to maximise their joint profits. The most immediate problem facing a cartel is coordinating on a jointly profitable equilibrium outcome. Cartel members need to agree on an output allocation and/or price fixing strategy that maximises their joint profits. Failure to reach such an agreement may result in bargaining problems (disagreement about the rent distribution). Bargaining problems may also arise during the operation of the cartel and may result in renegotiation of the cartel agreement.

Two further problems that face a cartel are opportunistic behaviour and entry into the cartelised market by non-members. Opportunistic behaviour arises when an individual cartel member has an incentive to deviate from the agreement to capture higher individual profits at the expense of lower joint profits. Such behaviour has been found to account to between one third and one half of cartel breakdowns (Eckbo, 1976, and Griffin, 1989, as cited in Levenstein and Suslow, 2006: 75-76). In their review of nineteen case studies Levenstein and Suslow (2006) find entry and bargaining problems to be the most frequent causes of cartel failure. They argue that bargaining problems decline overtime as the cartel develops. They further argue that the likelihood of entry increases overtime as outsiders have more opportunity to respond to high cartel prices.

Opportunistic behaviour creates a need for an effective mechanism to monitor the adherence of cartel members to the agreement. The cartel also needs to design an effective mechanism to punish members who are found to have deviated from the cartel agreement. Cartels that survive are found to exist in industries whose exogenous features make collusion easier. Such industries are characterised by: high entry barriers, high market concentration, homogeneity of product, inelastic demand, small size of buyers, frequent transactions, short information lags, stable demand, cost symmetry and multimarket contact.

Cartels have employed various strategies to overcome problems of opportunistic behaviour and entry, particularly in economic environments where some of the facilitating factors are found to be weak. Cartel members can use collective predation (colloquially known as a price war) to fight cheating and new entry (Morton, 1997). The threat of a price war itself, if credible, may be self-fulfilling. Closely related to collective predation is the creation of excess capacity as an entry deterrent mechanism and to ensure punishment threats are more credible (Kreps and Scheinkman, 1983).

In the case of the lysine cartel the new entrant became a member of the cartel (Connor, 1997). In other cases cartels used vertical exclusion to prevent entry by non-members as well as cheating by members (Levenstein and Suslow, 2006). Some cartels resort to some

sort of compensation mechanism instead of costly price wars. For example, the graphite electrode cartel had set up a system whereby if it was established that a member had cheated, they would be forced to give up volume elsewhere (Levenstein and Suslow, 2004).

Successful cartels do not only rely on ex-post punishment. They also invest in monitoring mechanisms such as industry trade associations. Industry associations usually engage in the collection and dissemination of information, which may be used to facilitate collusion. This deters cheating and allows cartels to avoid costly price wars. Between a quarter and a half of the cartels in US cross-section studies report the involvement of trade associations in cartel organisation (Levenstein and Suslow, 2006).

2.2 Cartel overcharge

Cartel overcharge is the difference between the price charged and revenue earned during the conspiracy period and what would have been charged in the same period in the absence of the unlawful conduct. The calculation of overcharge requires as inputs the prices actually paid during the conspiracy, the price that would have been paid in the absence of the illegal conspiracy (counterfactual price) and the volumes sold. This does not take into account the effect of the higher sales that would have been sold if prices had been at the lower, competitive, levels (the deadweight loss triangle). The price paid by buyers and the volume of output are observable. However, the counterfactual price is not observed but needs to be estimated.

A complicating factor in the computation of the counterfactual price is the persistence of prices after the uncovering of a cartel. There is a transition period, after the uncovering of a cartel, in which prices continue to follow the cartel period price trend. The lysine cartel was uncovered in June 1995, however lysine prices rose briefly in late 1995 and continued for five months in 1996 (Connor, 1997). In a study of the vitamins cartel it was found that for vitamin products with two conspirators prices in the post-plea period continued as if the explicit conspiracy never stopped, while products with three or four conspirators returned to pre-conspiracy pricing quicker (Kovacic et al., 2007).

One of the factors that may explain the occurrence of the transition period is residual collusion. Accordingly firms may no longer be meeting formally to discuss price fixing and output allocation strategies, but they may have developed shared understanding regarding each other's businesses in ways that facilitate tacit collusion. Information sharing arrangements that continue after the uncovering of a cartel may also explain the persistence of collusive outcomes. Information sharing arrangements are often facilitated by a joint sales agency or an industry association. If damage calculations are linked to the level of overcharge, then cartel members may have a further incentive to keep post-cartel prices high during litigation (Harrington, 2004).

Empirical estimates indicate that cartel overcharges vary depending on duration, legal environment, organisational characteristics of cartels and, to a lesser extent, method of overcharge calculation (Connor and Bolotova, 2005). Studies have generally found cartel mark-ups or overcharges are of the order of around 15% to 25% of the cartel price. Posner (2001) reviewed overcharges for 12 cases and found a median overcharge of 28% of the cartel price. OECD (2002) surveyed cartel cases of its members and found a median overcharge of 13-16%. Werden (2003) reviews 13 studies and arrives at a median of 15% of the cartel price. Connor and Lande (2008) from a data set of 200 studies of cartels found a median overcharge of 20%. In the United States Concrete Pipes cartel, the complainants (State Highway Department and certain municipalities of New Mexico) estimated a cartel overcharge of 15.5% - 20% (Finkelstein and Levenbach, 1983).

3. Anatomy of a cartel: the nature of the concrete pipes cartel and the changes that were brought about by its uncovering

After a brief history of the concrete products cartel we discuss the structure of the concrete products market during the cartel period for each product and region, and compare this to changes since the cartel was uncovered.

3.1 History of the cartel and its modus operandi

The uncovering of the cartel came about as a result of a leniency application in December 2007 by Rocla regarding its involvement in the cartel.³ In its application Rocla informed the Commission that it together with nine other firms had engaged in anticompetitive conduct involving price fixing (including credit terms and level of discounts), market allocation and collusive tendering in the market for precast concrete pipes, culverts and manholes at both regional and national level.

At the national level, the cartel began around 1973 with Rocla and Infraset as founding members. Over time, the cartel included more members and regional cartels were established in Gauteng, KwaZulu-Natal (KZN) and Western Cape provinces of South Africa. The other eight firms were: Southern Pipeline Contractors (SPC), Concrete Units, Gralio, Cobro, Cape Concrete, Conrite Walls, Craig Concrete Products and D&D.

Firms were allocated market shares in each of the three provinces and were allowed to supply within a 150km radius of Johannesburg (in Gauteng province), and in defined areas around Durban (in KZN province) and Cape Town (in the Western Cape province). Only Rocla was to supply outside these areas, across the remainder of South Africa. Members were required to declare their volumes and deliveries in order to monitor their adherence to agreed allocations and market shares. In at least one instance, external auditors were used to verify the information that a firm had submitted on its sales volumes. Firms who took more work than they were allocated in one period had to compensate by being allocated less work in the next meeting.

Subsequent to Rocla's leniency application, all firms except Gralio admitted to their contravention of the Competition Act (Act) by taking part in the cartel.⁴ Of those admitting, all but SPC and Conrite Walls settled with the Commission. As a result the Competition Tribunal imposed fines on SPC and Conrite Walls, who then appealed the size of the fines. The Competition Appeal Court (CAC) ruled in favour of SPC and Conrite Walls and imposed lesser fines.⁵

3.2 Cartel products

Pre-cast concrete products are used in various areas of building and construction including road and earthworks, pipeline and transmission networks and many other civil engineering works. The range of precast concrete products is wide and includes the following: pipes, culverts, manholes, kerbs, channels & drains, railway sleepers, poles, toilets, bus shelters and palisade fencing.

Initially, the cartel covered pipes and culverts. It was later extended to manholes, although in manholes the cartel does not appear to have operated as effectively. Most firms were capable of supplying all of the products, subject to the necessary acquisition of moulds and related equipment, unless precluded from doing so by the cartel agreement. Indications suggest that the cartel could also have involved other products, albeit not to the same extent, and the market for the other products was relatively small.

³ This followed Rocla's marker a short while before.

⁴ The case against Gralio was dismissed by the Tribunal. See Case no. 23/CR/Feb09.

⁵ See case no. 105/CAC/Dec 10 and 106/CAC/Dec10.

Pipes are used for storm-water drainage, sewers and other construction related works. Culverts are conduits used to convey water from one area to another, usually from one side of the road to the other. Manholes are working chambers installed at intervals along a pipeline to provide access to the pipeline for inspection and maintenance.

Within each product category, firms offer their products according to intended use, reflected mainly by product strength and size. For example, pipes and culverts are offered in different diameters, ranging between 300mm–3600mm and load classifications of 25D, 50D, 75D and 100D.⁶ A pre-cast concrete product of a given size and diameter is homogeneous across different manufacturers. The main inputs in the making of pre-cast concrete products are: reinforcing steel, aggregates (sand and stone), cement and labour. Costs of these inputs are similar across manufacturers.

3.3 Market structure during the cartel

In this section we discuss the market structure of the concrete products industry during the cartel period and how the cartel arrangements were implemented in each region and for each product.

Gauteng

In Gauteng it was agreed that only Rocla, Infraset, SPC, Concrete Units and Craig Concrete would be active within a 150km radius around Johannesburg. Rocla and Infraset supplied all cartelised products, Concrete Units would supply pipes and culverts, while SPC and Craig Concrete would supply pipes only (Table 1). Cartel participants agreed on a price list according to pipe type, specifications and size. A member of the cartel (known as the “banker”) was appointed to compile these price lists and then supply other members with a revised list.⁷

Table 1: Agreed cartel market shares for Gauteng

	Pipes	Manholes	Culverts
Late 1994 to 31 March 2001			
Rocla	30%	43%	50%
Infraset	40%	57%	50%
SPC	12.5%	0%	0%
Craig Concrete	17.5%	0%	0%
1 April 2001 to 30 September 2001			
Rocla	27%	43%	33.3%
Infraset	36%	57%	33.3%
SPC	12%	0%	0%
Craig Concrete	15%	0%	0%
Concrete Units	10%	0%	33.3%
1 October 2001 to 2007			
Rocla	27%	43%	33.3%
Infraset	36%	57%	33.3%
SPC	27%	0%	0%
Concrete Units	10%	0%	33.3%

Source: Cartel investigation documents and witness statements

⁶ This refers to the ability of the concrete product to constantly withstand up to a given load at a time.

⁷ Mr Stephan Riot, MD of Southern Pipeline Contractors compiled the list for Gauteng

From 1994 to 2007 market shares in concrete pipes changed twice, while those of culverts changed once. The main change in allocated market shares resulted from Concrete Units joining the cartel around April 2001 after it began to supply culverts and large diameter pipes in Gauteng in the late 1990s. The other change occurred in September 2001, when SPC acquired the pipes business of Craig Concrete, and acquired its market share.

For the production and supply of manholes in Gauteng, it was agreed that only Rocla and Infraset would participate in this market. The distribution of work was such that whoever supplied pipes for a particular contract would also supply manholes.

Western Cape

Rocla, Infraset and Cape Concrete initially divided the Western Cape market (Table 2). Concrete Units then joined the cartel arrangement around 2001 under which it agreed to stop manufacturing pipes in exchange for a large share of the culverts business. To facilitate this, it was agreed that Cape Concrete would give up its 33.3% culverts allocation.

Table 2: Agreed cartel market shares in Western Cape

	Pipes	Manholes	Culverts
1988 to 1990			
Rocla	38.5%	-	33.3%
Infraset	38.5%	-	33.3%
Cape Concrete	23%	-	33.3%
1990 to 2001			
Rocla	46%	-	33.3%
Infraset	31%	-	33.3%
Cape Concrete	23%	-	33.3%
From 2001 to 2007			
Rocla	46%	-	30%
Infraset	31%	-	30%
Cape Concrete	23%	-	0%
Concrete Units	0%	-	40%

Source: Cartel investigation documents and witness statements.

Note: we do not have information regarding the manholes market shares in the Western Cape, and it is unclear whether this was part of the cartel arrangements, although the fact that Concrete Units did not supply manholes at all under the cartel, and that they were also present in the Western Cape implies that the manholes arrangement also extended to the Western Cape. They began supplying manholes after the cartel ended.

KwaZulu-Natal

In KZN allocated firms were confined to a mapped area around Durban. Rocla was allocated the area outside these boundaries. The cartel members agreed that only Rocla would be active in culverts (Table 3). In the manholes market it was initially agreed that Cobro, Conrite Walls and D&D would participate. However, in 2006 the cartel members agreed that Conrite Walls should exit the manhole market, in return for monthly payments of R30000 and R10000 from Cobro and D&D respectively. D&D was subsequently acquired by Rocla in 2005. The exit of Conrite Walls resulted in the change in the manholes market shares in 2006, as reflected in Table 3.

Table 3: Agreed cartel market shares in KwaZulu-Natal

	Pipes	Manholes	Culverts
2002/2003 to 2005			
Rocla	60%	0%	100%
Infrasat	21%	0%	0%
Cobro	19%	65%	0%
Conrite Walls	0%	15%	0%
D&D	0%	20%	0%
From 2006 to 2007			
Rocla	56%	0%	100%
Infrasat	20%	0%	0%
Cobro	18%	75%	0%
D&D	6%	25%	0%
Conrite Walls	0%	0%	0%

Source: Cartel investigation documents and witness statements

In 1999 Cobro defied the cartel agreement by supplying pipes in Johannesburg to a construction company known as WK Construction. This led to a price war in the pipes market in KZN from late 1999. The price war lasted until 2002, at which point Cobro rejoined the cartel.⁸

3.4 Entry and market structure post cartel

We consider developments after the end of the cartel arrangements in terms of the former cartelists beginning to make products they had agreed not to make and supplying outside the specified regions, and entry by firms that had not been part of the cartel. The extent of entry post cartel by new firms raises the question as to how the cartel had deterred entry in a market that is relatively contestable.

3.4.1 Entry by former cartelists into other products and regions

There have been extensive moves by former cartel members into products and geographic areas they had previously not supplied (Table 4). Under the cartel both SPC (in Gauteng) and Cobro (in KZN) agreed not to make culverts. Similarly, Concrete Units agreed not to supply pipes in the Western Cape. Information collated on recent developments indicates that Cobro began supplying culverts in 2010 and SPC entered this market in 2011 (Table 4). In fact, SPC now supplies all products that were covered by the cartel (although it had argued in the Tribunal and CAC that it did not make culverts during the cartel due to high costs in setting up production, and that transport costs were prohibitive when supplying outside the 150km radius).

Furthermore, there is evidence of similar changes in supply by geographic area. Cobro is now selling far outside the area to which it was restricted and is delivering in the northern part of Eastern Cape, to a distance of about 250-300km from its factory in KZN. During the cartel, it was agreed that Concrete Units would only be active in Gauteng and Western Cape. They now supply Limpopo, Mpumalanga and Free State on a regular basis and now also supply pipes even in the Western Cape⁹. Conrite Walls also confirmed that they have

⁸ See witness statement by Mr Browne of Cobro dated 3rd of September 2008.

⁹ Concrete Units response letter to the Commission's information request.

set up a new plant in the Eastern Cape in 2009 to supply precast concrete fencing and toilets.¹⁰

Table 4: Coverage of cartel members in pipes, culverts, manholes, pre and post cartel

Name	Products during cartel	Products after cartel	Area during cartel	Area after cartel
Rocla	All	All	National	
Infrasaset	All	All	GP, WC & KZN	
Concrete Units	Pipes & culverts	Pipes & culverts	GP & WC	GP, WC, LP, MP & FS
SPC	Pipes	All	GP	
Cape Concrete	Pipes & culverts	All	WC	
Conrite Walls	Manholes	None	KZN	KZN & EC
Cobro	Pipes & manholes	Pipes, manholes & culverts	KZN	KZN & EC

Notes: D&D and Craig Concrete were acquired by Rocla and SPC respectively. Conrite Walls exited the manholes market in 2005; it currently supplies precast concrete fencing and toilets. We do not have information regarding Gralio's supply of cartelised products after the cartel.

3.4.2 New entry by firms not part of the cartel

During the cartel period there was hardly any entry and the little entry that occurred appears to have been restricted to certain products and areas. For example, in 2004 Marx entered the market and produced only pipes in Gauteng province (Table 5). The next firm to enter, Nutec, also only entered in Gauteng, producing pipes and manholes.

Entry became more frequent at the same time as the cartel was ending in 2007. It was also at the time that demand spiked. And, in the post cartel period entry became more widespread in terms of both product and area. Five other firms, Lamprechts, Wearne, Bhubezi, 360 Precast and Ubuntu entered various products and geographic markets.

Table 5: Entry of non-cartel members, by product and region

Year	Pipes	Culverts	Manholes
2004	Marx(GP)	no entry	no entry
2005	no entry	no entry	no entry
2006	Nutec (GP)	no entry	Nutec (GP)
2007	Marx (Eastern Cape), Vula (GP)	no entry	Lamprechts (FS)
2008	Wearne (LM), 360 Precast (FS), Bhubezi (MP)	Wearne (LM), Marx (GP)	Lamprechts (North West)
2009	Marx (Eastern Cape)	Ubuntu (GP)	no entry

Source: Rocla

Overall this evidence suggests that the cartel was successful in discouraging new entry into the cartelised products. As we suggest below, vertical integration of the two major cartelists, Rocla and Infrasaset, may have played a part in this.

Industry participants have confirmed that there are only two sizable firms that were not implicated in the cartel arrangement but have been in the precast concrete products market

¹⁰ Conrite Walls response letter to the Commission's information request.

for many years. These are Vula Concrete and Salberg Concrete.¹¹ It appears that during the cartel these firms restricted themselves to certain sub-categories of products and did not destabilise the market. Interviews with customers indicate that the firms appear to have operated as 'fringe' firms. For example, Salberg restricted itself to narrow diameter pipes.

Salberg has been in the precast concrete products market since 1972. It supplies manholes, pipes and some associated concrete products. Its geographic coverage is mainly Gauteng, Free State, Mpumalanga, Limpopo and Northern Cape. Many of these regions are more than 150km from Salberg's factory in Irene (in Gauteng). This evidence supports the finding that the 150km radius was just an artificial barrier imposed by the cartel on its members and not an economic constraint to supplying products to regions that are more than a 150km radius from a company's factory. Vula was established in 1997, it initially supplied precast concrete toilets, it then expanded into manholes and storm-water pipes in 2004. Vula indicated that it supplies its products to a distance of 300-500km from its Benoni and Donkerhoek factories.

4. Pricing and Cartel Overcharge

We examine evidence from price data in two regions, Gauteng and KwaZulu-Natal (KZN). The data was obtained from three companies, two of which were implicated the cartel and the other one was not implicated, but was a fringe firm.

We derive simple estimates of cartel overcharges, in terms of price mark-ups over imputed competitive prices, for pipes in KZN and Gauteng by estimating counter-factual prices in different ways.

In KZN we use prices for kerbs as a cast concrete product not covered by the cartel, and compare it to the price series for pipes. We use both the period after the cartel and the period during the price war to assess the competitive price for pipes.

In Gauteng we use channels & drains data from a fringe firm as a set of comparator products. We examine the relationship with the pipes prices during the cartel and after it ended.

The use of comparator products allows an examination of price trends for non-cartelised products that have similar costs and demand shocks as the cartelised products.

In calculating the over-charge we consider the collusive period, the transition period immediately after the ending of the formal cartel but before effective competition takes place, and the competitive period, when effective competitive rivalry is disciplining prices. We use different durations of the transition period to examine the effect on the over-charge estimates. By computing the difference between pipes and the comparator product in the competitive period, we can then compute the counter-factual for pipes by projecting the different backwards, adjusting for inflation using the producer price index (PPI) for all building and construction.

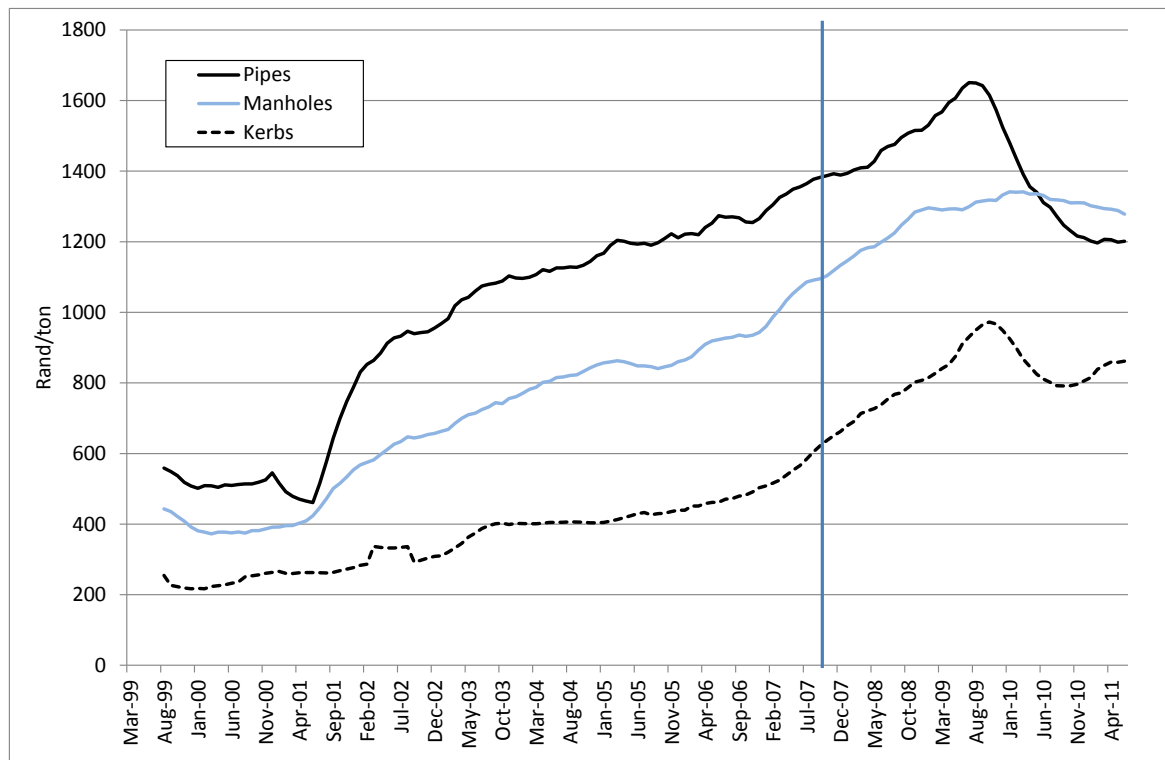
¹¹ There are other firms that have been in the precast concrete products market which we do not mention in this paper. These firms are microbusiness players who occupy a very small share of the market with a much narrow regional presence.

4.1 Pricing in KZN

We examine pricing data obtained from one cartelist in the KZN province, identified as Cartelist1.¹² Cartelist1 data for the main cartelised product (pipes) is consistent with the price war in 2000-2001, with a steep increase in prices under the cartel from mid-2001 (Figure 1). Prices of pipes, manholes and kerbs all continued to increase throughout the decade until July 2009, about 18 months after the uncovering of the cartel.

Pipes prices declined by a much larger 37% between their peak in July 2009 and June 2011, than the 12% decline in kerbs prices from their peak in September 2009 to June 2011. The larger decline in pipes prices (which were the main subject of the cartel) compared to kerbs (which were not cartelised) suggest that the price pressure on pipes was mainly due to the breaking of the cartel and not to factors such as declining construction activity which would also have affected kerbs.

Figure 1: Cartelist1's prices for pipes, manholes and kerbs (3-month moving average)



Notes: Vertical line indicates ending of explicit cartel. Prices do not include transport cost.

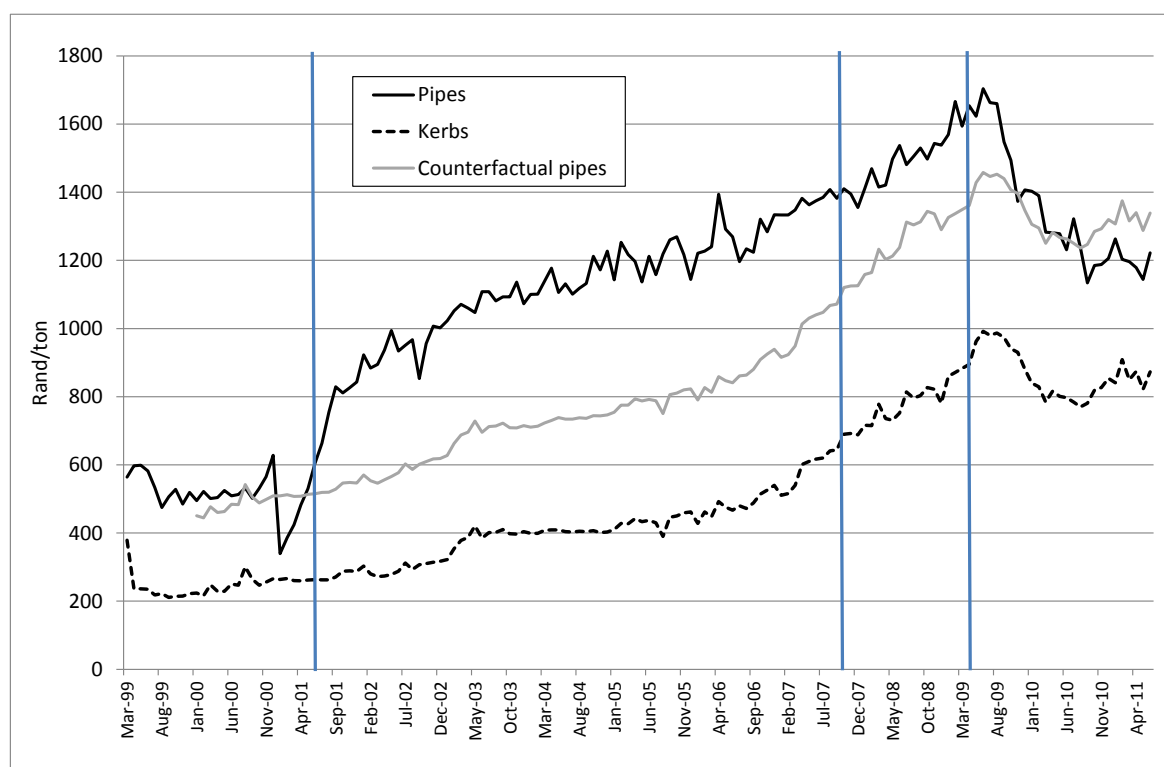
This is consistent with submissions from one of the cartelists in which they explain that price pressures in recent years have come from increased supply competition than from a lack of demand. The increased supply resulted from manufacturers bringing in products from other regions of the country into KZN. One of the cartel members also submitted that the margins they had been making over recent years were sustainable, implying that they were lower than the margins they made during the conspiracy. The relative stability of manhole prices is interesting and appears to indicate that the cartel was relatively ineffective when compared to pipes.

¹² Data was obtained for another cartelist in the same region but only for a shorter period and for a narrower product range (pipes). The pipes price over the shorter period tracked the price of Cartelist1.

Cartel overcharge in KZN

When we consider the difference between pipes and kerb prices, it appears that competitive prices were only established from mid-2009, some 18 months after the end of the cartel. We thus define May 2009-June 2011 as the competitive period for the purpose of estimating cartel overcharge (Figure 2). After correcting for inflation we find that pipes prices in this period are a similar margin above the kerbs prices as in the period leading up to the price war. We thus define the period Mid 2001 – December 2007 as the collusive period and January 2008 – April 2009 as the adjustment period. We can construct a counter-factual pipes price based on the kerbs price and the difference with the pipes price under competitive conditions.

Figure 2: Cartelist 1's prices for pipes, kerbs and counterfactual for pipes



Note: Prices do not include transport cost.

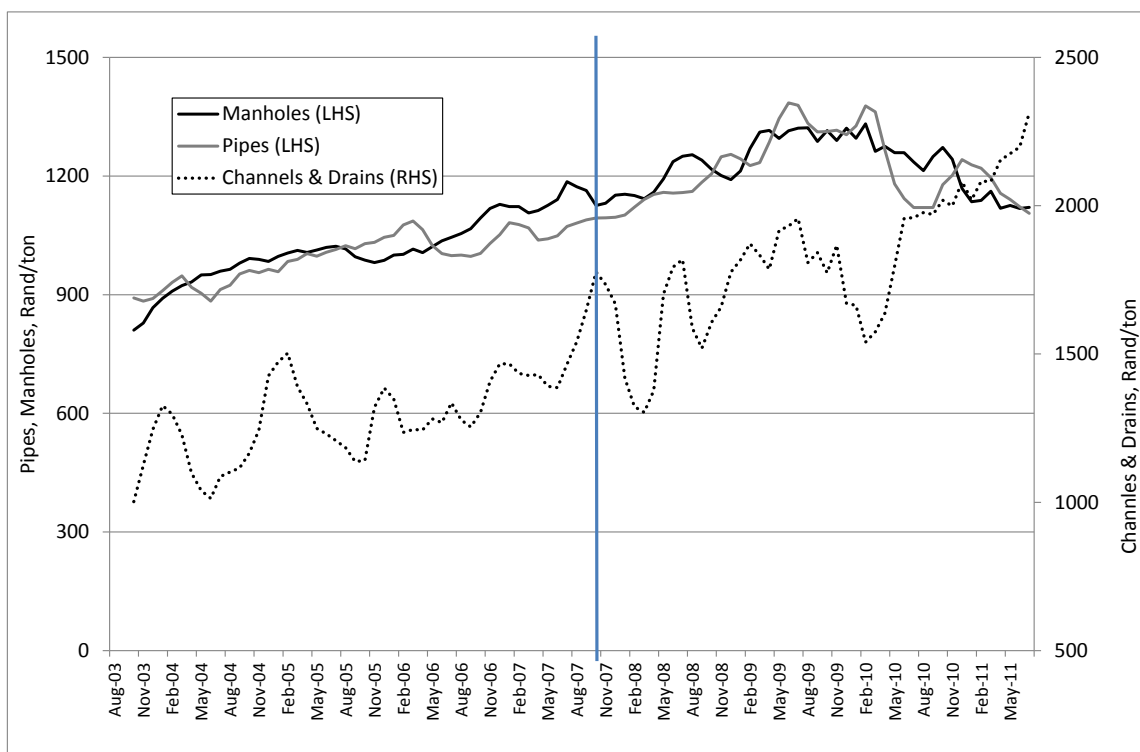
The resulting overcharge based on the cartel pipes price over the counterfactual price in the cartel period, is 57%. If we shorten the adjustment period to one year (January to December 2008) and define the competitive period from January 2009 we get a cartel overcharge of 51%.

4.2 Pricing in Gauteng

We consider pricing in Gauteng from one cartel member, Cartelist2, and another firm which was not part of the formal cartel (a fringe firm) but which we understand followed the cartel's price-setting.

Pricing data for pipes, manholes and channels & drains for the fringe firm show a similar change between the cartelised products (pipes and manholes) and non-cartelised (channels & drains) as observed for KZN (Figure 3). The fringe firm's prices of pipes peak and begin to fall in June 2009, 17 months after the uncovering of the cartel. However, prices of channels & drains continue to increase throughout the post cartel period. Manufacturers indicate that the main inputs (cement, sand, stone, reinforced steel and labour) are the same for all products. Both pipes and channels & drains are generally driven by economic forces in the construction industry, as such they can be considered as having similar demand shocks. Similarity in demand and main inputs between pipes and channels & drains together with the fact that the latter was not cartelised suggest that the latter is a good comparator.

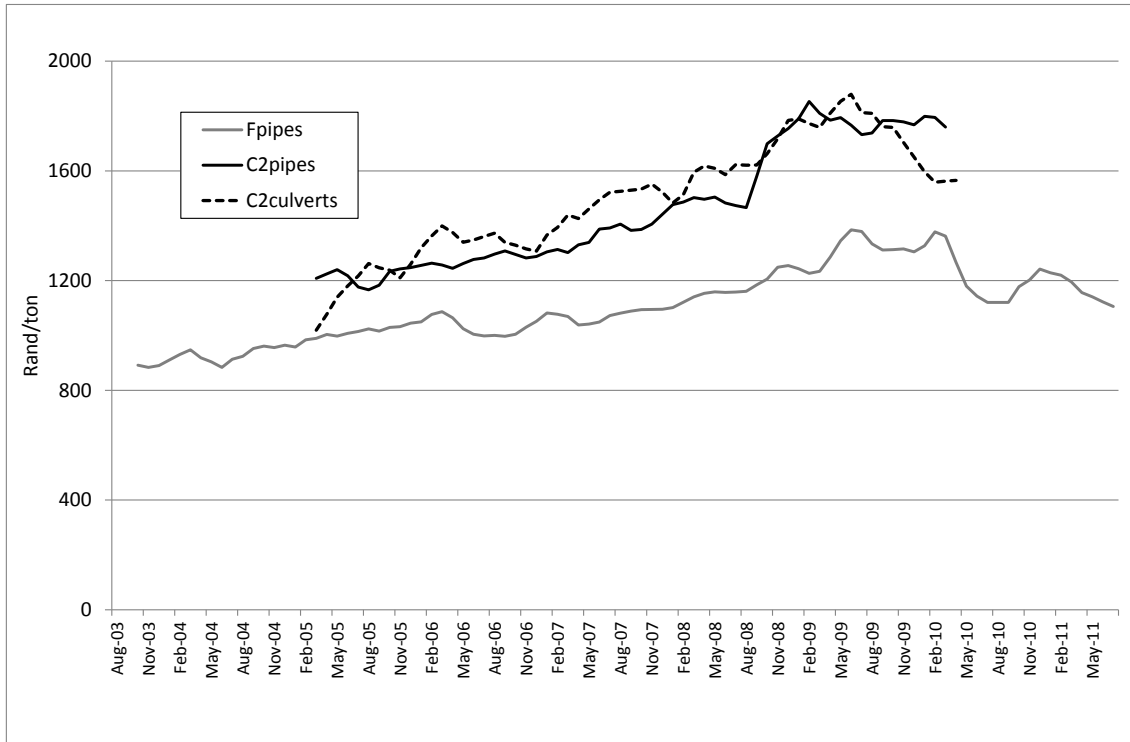
Figure 3: Fringe firm's prices for Manholes, Pipes, Channels & Drains (3-month moving average)



Note: Prices do not include transport cost.

In Figure 4 we draw a price series for pipes (from Cartelist2 and the fringe firm) together with culverts prices from Cartelist2 data. Cartelist2 products are denoted with “C2” and those of the fringe firm are denoted with an “F”. Cartelist2 and fringe firm's pipes prices have a similar general trend, although the fringe firm's prices are lower than those of Cartelist2 and seem to lag it. This appears to be because, although not formally part of the cartel, the fringe firm followed the pricing of the cartel and restricted itself to selling relatively less-expensive smaller diameter pipes. This is reflected in interviews and data from customers and the submission of the firm itself that it was relegated to tendering for smaller contracts. We note also that the adjustment of culverts prices is much steeper than that of pipes, suggesting that the cartel overcharge for culverts was higher than that of pipes.

Figure 4: Prices of Pipes and Culverts in Gauteng (3-month moving average)

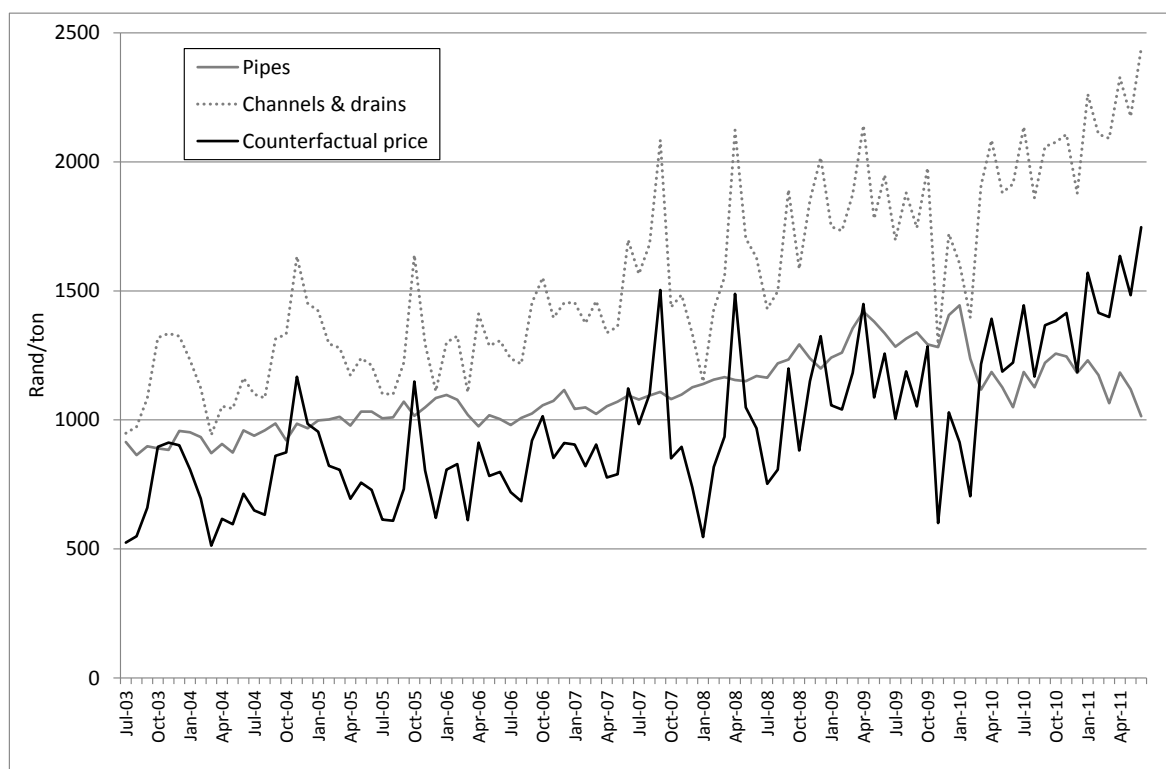


Note: Prices do not include transport cost

Cartel overcharge in Gauteng

For Gauteng we use the fringe firm’s data to assess the transition period from collusive to competitive pricing by comparing pipes prices against prices for channels & drains. We define the collusive period as July 2003 - December 2007 and the competitive period as January 2009-June 2011, which allows for a 12 month adjustment period, over 2008. The generated counterfactual price for pipes, based on the average difference between pipes and channels & drains prices in the competitive period (adjusted for inflation) is shown in Figure 5. The resulting overcharge for the fringe firm’s pipes is 28%.

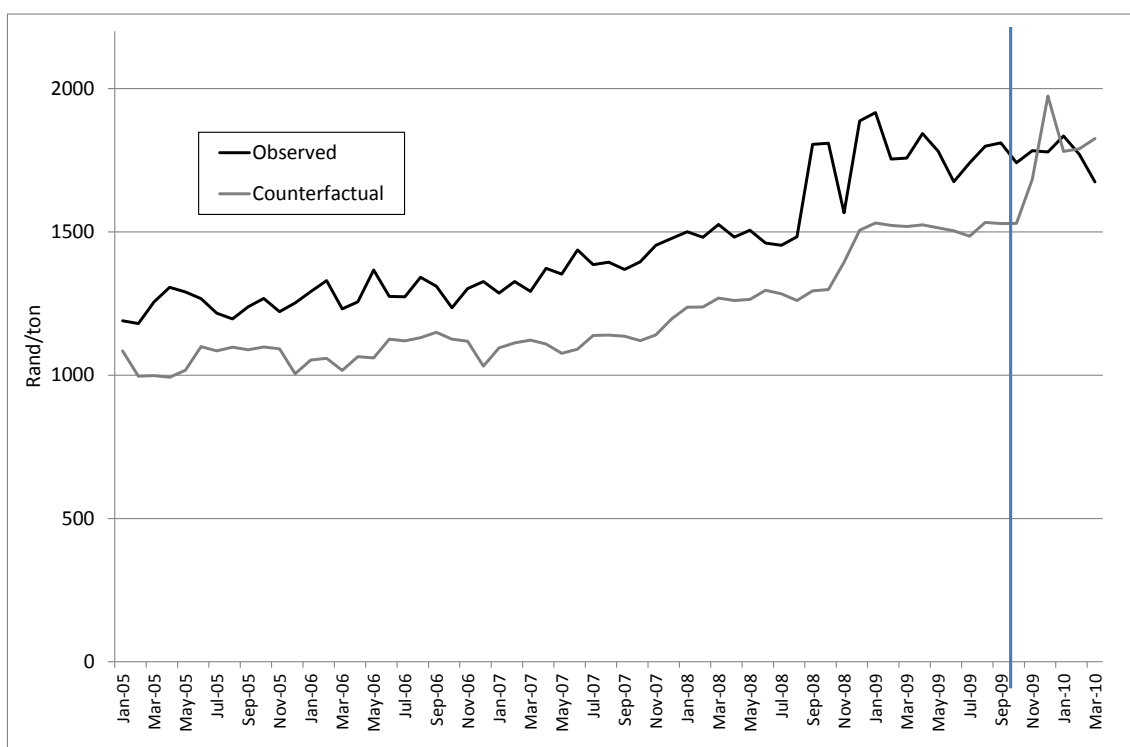
Figure 5: Fringe firm's prices for pipes, channels & drains, and counterfactual for pipes.



Source: Fringe Firm. Prices do not include transport cost.

The series for Cartellist2's pipes prices does not extend as far as the fringe firm into the post cartel time period. While it shows a flattening off (in 2009), it does not reflect the time into 2010 when prices fell. We employ an alternative way of calculating cartel overcharge based on margins over average costs to assess the extent to which the relatively stable pipes prices over 2009 reflect narrower margins consistent with more competitive rivalry post-cartel. This data does indeed reveal substantially lower margins towards the latter part of 2009, to levels not reflected at any point in the dataset before this (which extends back to 2005). We take the period from October 2009 when the margins reduced notably, until March 2010 as indicative of a competitive margin and use the average ratio of price to variable cost in this 'competitive period' of 1.975 to compute a counterfactual price over the cartel period from the variable cost data (Figure 6). The resulting cartel overcharge, as the mark-up of the observed prices during the cartel over the counterfactual prices is 16.5%.

Figure 6: Observed and Counterfactual Prices for Cartelist 2's Pipes



Notes: Prices do not include transport cost. Vertical line indicated the beginning of the competitive period.

4.3 Transition period from cartel to effective competition

In both cases the price data indicate that prices did not fall immediately after the uncovering of the cartel. There are three main reasons for the transition from collusive to more competitive outcomes.

First, the way in which pipes and culverts are priced and delivered for construction projects means that time elapses between when a contract is tendered for and when the product is delivered (and the price and revenue recorded). Customers indicate that this varies considerably, with 6 months given as a norm. Therefore, contracts which fell under the cartel at the end of 2007 would still be reflected in the price data through at least the first half of 2008, and perhaps longer. In addition, there were large projects associated with the construction activity around the 2010 soccer world cup. Most of these projects ended in 2009 but may have been priced much earlier under the cartel.

Second, given the long nature of the cartel, there may have been shared understanding amongst cartelists. In addition, the main cartelists continue to submit monthly volumes by product category to an industry body (CMA) and receive back the aggregate, meaning they can still track their market share. This information exchange together with the shared understanding could have continued to dampen competition after the ending of the formal cartel arrangements.

Third, the close knit nature of the industry suggests that entry by new firms will play a substantial role in 'shaking it up' and realising outcomes consistent with effective competitive rivalry. Even if the cartel had completely ended immediately after the Commission's intervention, it takes time for new firms to enter and compete on a reasonable scale. Furthermore, it takes time for firms that were in the cartel to make investment decisions and

expand into previously reserved products and geographic markets. For example, two cartel members that did not supply culverts during the cartel only started supplying culverts in 2011, three years after the cartel was uncovered.

All these considerations have implications for our assessment of overcharges as they suggest allowing a lag before we accept that prices are determined competitively. In turn we have used the competitive period (post cartel) to impute a competitive price during the cartel period and to determine the cartel mark-ups.

4.4 Summary

Overall the data suggest a range of 16.5%-28% cartel overcharge for Gauteng and 51%-57% for KZN. The mark-ups for KZN are extremely high when compared with the international literature on cartel mark-ups. It should be considered, however, that this is a highly inelastic product meaning a cartel has very substantial pricing power. We have employed a comparator product, along with the price war period to cross-check the KZN mark-ups. The comparator product could also have been affected by the cartel and so, in this sense at least, is conservative. While a price war may involve pricing below the competitive level, we have not used the low prices in the price war period but have rather compared the prices when Cobro exited the cartel with the counterfactuals developed based on the post cartel period and the counterfactual product.

By comparison, in Gauteng the data for the cartel firm have not extended as far into the post cartel period, and so we have drawn on data from a fringe firm – that appears to have benefitted from the cartel's umbrella but whose prices would be expected to underestimate the mark-up. Of course, the existence of fringe firms in Gauteng means the cartel may also not have been as effective.

In considering the price elasticity of demand, alternative products are relevant. At least in the case of concrete pipes (although apparently not for culverts) plastic and steel pipes were identified as potential alternatives by some producers.¹³ We do not understand these to be good alternatives in many applications, however, and it is also notable that there was also a cartel in plastic pipes, while steel was also found by the Tribunal not to be priced competitively.¹⁴

The high average cartel mark-up raises the question of durability, given the attraction of such collusive margins to entrants. We turn to this now.

5. Stability and durability of the cartel

The stability and durability of the concrete products cartel is interesting as entry barriers are relatively low and the demand for these products is very volatile. Despite these considerations, the cartel endured for some 30 years because of how it addressed them.

The risk that some cartel members can be tempted to cheat lies at the core of the stability of the cartel. It therefore necessitates that the cartel develops monitoring mechanisms to detect such cheating. One way of doing this is through the establishment of an industry association that collects and disseminates detailed information (Levenstein and Suslow, 2006). In this case, the Concrete Manufacturers Association (CMA) could play such a role, although the separate cartel meetings in fact involved the detailed recording of the volumes of each

¹³ For example, SPC made mention of this in their arguments before the Tribunal.

¹⁴ See the Competition Commission's Annual Report 2008/09. The Tribunal finding on steel pricing in Harmony-Mittal was over-turned by the CAC based on the tests employed and remitted back to the Tribunal, whereupon the complainant settled with the respondent.

contract. The CMA data appears to have been more useful to assess the impact of producers not members of the explicit cartel.

As already noted, the concrete products cartel also had a compensation mechanism that was used to re-arrange the allocated tonnages of product sold by allocating less work to those firms that over-shot their allotments and more work to those that under-shot them in the next period. This scheme worked well as it avoided the need to resort to a costly price war, although the cartel at some point did engage in such price war in KZN in 2000 which was targeted at a smaller firm that had purposely strayed outside of its allocated product and area. For cartel members, the only form of expansion that was allowed was through acquisition of existing firms.

The strategy of the cartel for dealing with entry is less clear. In one case, that of Concrete Units, an entrant was accommodated in the cartel. However, the evidence is of significant entry occurring, of new firms and of existing firms into different product and geographic markets, on the ending of the cartel, but not before. We suggest that it is important to view the concrete products cartel in the context of vertical integration and the now-evident extensive collusive arrangements in the construction sector.

With regard to vertical integration, the two main cartel firms are part of major construction conglomerate groupings. These conglomerates are integrated back into inputs such as reinforcing steel, and represented markets in the form of construction contracts into which pipes were generally sold. Recently cartels at both upstream and downstream levels have been uncovered. Upstream there were cartels in reinforcing steel and cement, downstream there were various cartels in the general construction industry.

Rocla and Infraset are subsidiaries of Murray & Roberts (M&R) and Aveng respectively. M&R and Aveng are two of the five largest construction conglomerates which account for nearly 75% of output in South Africa's construction and engineering market. M&R was involved in the upstream reinforced steel cartels through its shareholding in RSC while Aveng was involved in the reinforced steel cartel through its shareholding in Steeledale. Downstream M&R and Aveng are also major customers as the contractors for construction projects.

It is possible that entry by another construction company would have gone against well-understood arrangements in the sector as a whole, while entry by independent firms was deterred as by the vertical integration. This integration means barriers could have been raised through influencing access to input and output markets.

6. Penalties and cartel mark-ups – a critical assessment of the Competition Appeal Court's decision in Southern Pipeline Contractors

Two companies admitted their involvement in the cartel but appealed the penalties the Tribunal had imposed on them. On 29 November 2010 the Competition Tribunal imposed penalties of R16.9mn on Southern Pipeline Contractors (SPC) and R6.2mn on Conrite Walls, being 10% and 8% respectively of their turnovers in 2008. The CAC reduced the penalties to R8.7mn and R2.0mn. We focus on the decision regarding SPC.

The Competition Act sets out factors that the Competition Tribunal must consider in determining a penalty (which factors are not specific to penalties for cartels) and caps the imposition of an administrative penalty at 10% of turnover in the Republic and exports from the Republic in the preceding year (s59). The factors include: the nature, duration, gravity and extent of the conduct; loss or damage suffered; behaviour of the respondent; the market circumstances; level of profit derived; degree of co-operation; and whether the respondent has previous contraventions (s59(3)). The apparently large penalties have led both the

Competition Appeal Court and the Supreme Court of Appeal to observe that the administrative penalties bear a close resemblance to criminal penalties.¹⁵

We assess how the factors should be applied in a case such as the concrete products cartel, and what does the substantial size of possible penalties mean for the evidence necessary for the determination of penalties. In doing so, we critically reflect on the approach taken by the CAC in its decision with regard to the penalty imposed on SPC, particularly with regard to the nature of the offence and its effect that were emphasised by the CAC (para 9).

The CAC gave credibility to several of the representations of SPC. These include (para 56): that the participation of SPC in the cartel activities had been limited to Gauteng and to the specific sale of concrete pipes (and not culverts or manholes); that there was little evidence on the record to suggest significant consumer losses or the extent of the increased profit that flowed to SPC from the cartel; and, that SPC had indicated that the increase in costs for 2002 to 2007 had been higher than the increase in return (revenue) over that period. With regard to profits the CAC indicated that the increase in profit could have been determined by a ratio analysis based on figures provided in the financial statements. The CAC also found that the evidence available cannot sustain the Tribunal's conclusion that this was the most egregious kind of cartel behaviour envisaged in the Act (para 57). However, the CAC did acknowledge (para 58) that penalties should be sufficiently onerous to act as a deterrent.

To start with how we should understand the conduct and the nature of harm, it is now obvious that harm is wider than the turnover to which each participant was restricted, in order to prevent competition and sustain the prices agreed. Participants could and did supply more widely and enter other product categories after the end of the cartel, as is evident from SPC itself in recent years. This is an evolving process and not necessarily something that will become evident immediately after the ending of the explicit cartel arrangements. Indeed, if it is a factor in determining the penalty then this will have the perverse effect of continuing to dampen such competitive behaviour once a cartel is revealed and penalties are to be determined.

Arrangements on market division, including in this case the rigging of tenders, are integrally related to fixing prices. The necessity to do all three will depend on the industry in question. A cartel may be able to operate effectively by simply dividing markets by allocating one part of the country to each firm such that each is then a monopolist. There is then no need to fix prices but there is nevertheless the full extent of harm.

Taking this into account it is clear that the harm of any individual firm's participation includes what it agrees not to supply, in terms of geography and product category. In this case, agreeing to the three narrow geographic areas around Johannesburg, Durban and Cape Town bequeathed monopoly power on Rocla outside this. The fact that supplying more widely may require some costs and investment, such as in transport or in additional plant, does not diminish the effect, particularly given the long-running nature of the cartel.

There is also harm in terms of non-price factors. The agreement meant little need to compete in terms of factors such as service and delivery. The fact that the magnitude of such an effect is impossible to assess does not make it any less important to consumers.

At the level of practicality or administrability, our analysis above has highlighted that the extent of the harm will only become evident as the coordination that the cartel had engendered unwinds. First, this will likely take some time. Second, it is uneven and affected

¹⁵ Supreme Court of Appeal, *Woodlands Dairy v Competition Commission* 2010 (6) SA 108 (SCA). The decision related to what standards to hold the Commission to in exercising its powers in conducting an investigation. The CAC in its decision on SPC and Conrite Walls noted (para 9) that 'a penalty which is of a criminal nature should be proportional in severity to the degree of blameworthiness of the offending party, the nature of the offence and its effect on the South African economy in general and consumers in particular'.

by a range of factors such as demand, entry, investment decisions, and other arrangements of the firms themselves which may not be appreciated including the degree of vertical integration and on-going information exchange.

When assessing the size of the penalty, in light of the size of the apparent mark-up, the CAC decided to apply a penalty on 'affected turnover' (ultimately deciding on 20% of one year) and engaged in an exercise to determine what the affected turnover was. It failed to appreciate the difficulty in determining precisely what is the turnover affected by the cartel. In this case it would appear to be wider than the specific products identified. For example, one of the participants contacted indicated that, 'of course', the cooperation between the cartelists meant rivalry was dampened between them more broadly than the particular products set out in the formal cartel arrangements.

More importantly, perhaps, the CAC failed to understand what deterrence requires when it engaged with the size of the penalty, even assuming it was correct on the narrow definition of the turnover. A long-running cartel achieving non-trivially higher prices from its conduct would likely not be deterred by a penalty of just 20% of one year of the specific turnover affected.

Consider if the cartel manages to keep prices just 5% higher than they would have been otherwise, then in four years an amount equivalent to a 20% penalty has been reached in nominal terms, assuming a fixed turnover and none of the non-price affects we have discussed above. Moreover, during the cartel each firm is earning the higher prices today, and will only pay the penalty sometime in the future and, given the legal process, some years after the ending of the cartel. For example, if the cartel persisted for just four years and then penalties were imposed four years after the end of the cartel (as in this case for SPC given the appeal) then, if interest rates were 10%, the present value of the anticipated 20% penalty eight years hence is just 9.3% of one year of the turnover being cartelised. As revealed here, and by international studies, cartel mark-ups are likely in the range of at least 10-25%, *per year*. In considering the benefits and costs of colluding a firm must assess the likely duration of the cartel, and the likelihood of detection.

The SPC argument that returns (prices and margins) had not increased by more than costs over 2002-2007 is also irrelevant. In 2002, the cartel was already in place and, it appears, operating perfectly in Gauteng meaning prices were already being set close to the collectively profit maximising level (or the level a monopolist would choose). An increase in costs will not lead a monopolist to increase prices by the same amount, but by a smaller amount, given the impact of price increases on demand. At the very least, demand elasticity would have to be taken into account (measurements of which tend to be very uncertain) in making an assessment of how much cost pass-through there would be. In addition, a number of other factors would need to be taken into account to even engage with such a scenario, such as to control for changes in demand.

Lastly, deterrence must take into account the probability of being caught. With secret arrangements, this probability is, of course, far less than 1. The record of extensive cartel conduct in South Africa (see Makhaya et al., 2012) suggests it is very small, especially in tight knit industries such as this one. International studies of detection put it between 0.1 and 0.3, largely based on developed jurisdictions such as the USA and in Europe (Connor, 2011).

SPC, which joined the cartel in October 1994, was originally fined R16.9mn by the Tribunal. This penalty would have not covered the last 6 years of SPC's overcharge in pipes. Based on our assessment above, this amount accounts for at most only 43% of SPC's overcharge

from 2002-2007¹⁶. And, this in purely nominal terms and takes no account of interest rates. The Tribunal's penalty was therefore far too low relative to the harm, but was bound by the cap of 10% of total turnover set in the Act. While the CAC acknowledged that after detection of a cartel the level of penalties imposed should be sufficiently onerous to act as a deterrent, in the case of the penalty imposed on SPC this does not seem to be the case.

We recognise the difficulties in estimating the mark-up and the sensitivity of the estimation to all of the considerations relevant for identifying the competitive counterfactual. Indeed, this is one of the important insights from the exercise we have attempted. Even some years after the investigation, it is difficult to pin down the mark-up. We estimate that in just the two regions of greater Durban and Gauteng the over-charge for all firms in the explicit cartel that covered these regions totalled R429mn, over the period 2002 to 2007. While this specific amount can be attacked on various grounds, the size of the penalties should be seen in light of the order of magnitude of the estimate. What we believe cannot be in dispute is that the mark-up is far from trivial and that the harm from the conduct extended beyond the higher prices attained by each of the firms on the products they sold.

All this suggests that the exercise the CAC is suggesting for the determination of cartel penalties, while attractive in the abstract, is unworkable in practice. At the very least, it would require waiting for some years after the end of a cartel before engaging in the exercise of determining penalties. However, our study does indicate that cartels are nonetheless very harmful to consumers and the economy in general, and that the effects importantly extend far beyond the specific turnover on which prices are maintained at above competitive levels. These effects include on consumers who are denied alternatives, the dampening of non-price rivalry, and the undermining of dynamism from such arrangements.

7. Conclusion

By comparing pricing during the cartel to a comparator product, kerbs, benchmarked against the price war and post cartel periods in KZN it was possible to derive a cartel mark-up estimate of 51% to 57%. Gauteng proved more difficult as it appears to have taken longer for the coordination to give way to more effective rivalry and data constraints, however, the mark-ups we estimate are still very substantial, ranging upwards of 16.5% over the competitive price.

Our analysis highlights several important features of the concrete pipes cartel which underpinned its durability and stability notwithstanding the apparently low barriers to entry and unstable demand.

First, the cartel combined market allocation arrangements with price fixing and bid-rigging. The agreements on market shares by geographic area were strictly maintained, with shares only being changed through acquisition of another cartel member, aside from one episode of renegotiation when faced with the major entrant, Concrete Units, in pipes and culverts in Gauteng, and culverts in the Western Cape. The unstable nature of demand with large and lumpy contracts was overcome by anticipating tenders and allocating them in order to meet the target market shares with well understood cover pricing principles used to hide the cartel arrangements from customers.

Second, the separation into different regions and product categories meant that if any firm aside from Rocla and Infraset cheated on arrangements the punishment could be targeted. This apparently occurred in the case of a smaller player, which was subjected to an aggressive price war in its home market (of KZN) when it attempted to enter Gauteng.

¹⁶ The figure (43%) is based on the 28% estimate of overcharge for Gauteng. This was applied to SPC's total revenue in pipes over the period 2002-2007.

Third, information exchange by product category and province meant that fringe firms not part of the explicit arrangements, but submitting data to the Concrete Manufacturers Association, could be monitored to ensure they did not compete in the cartel's product area.

Fourth, vertical integration of the major players, backwards into inputs (in the form of reinforcing steel mesh and bar) and forwards into construction firms who were in many cases responsible for the construction projects of which pipes and culverts were just one part, acted as a deterrence for potential entrants. In addition, cartels have been uncovered both upstream and downstream.

Some of these circumstances continued after the ending of the explicit cartel arrangements. The two largest producers remain vertically integrated and, after decades of collusion, have a very good understanding of each other's operations. Taken together with the lags between tenders for contracts being made and the product being delivered, this implies a lag in more competitive outcomes being observed. The information exchange through the CMA also continues, suggesting a dampening effect on competition may continue to the extent that the main producers (and cartel ringleaders) can distinguish between where lower sales are due to weaker demand and where business has been won by rivals.

Changes since the end of the cartel, in particular, the entry of firms into products and geographic areas they were not previously supplying indicates the reinforcing nature of the different arrangements and the time necessary for the transition from collusion to effective competition. There are other reasons for the persistence of coordinated outcomes after the ending of the explicit cartel, such as the lags in contracts being delivered and the effect of such a detailed understanding on firms' behaviour, especially in the presence of on-going arrangements such as information sharing.

These considerations illustrated in the concrete pipes case examined here suggest that it is very difficult, if not impossible, to make good estimates of mark-ups at the time a penalty is to be determined. The case nevertheless suggests that the cartel mark-ups are likely to be significant.

To achieve deterrence in the setting of penalties, the duration over which such supra-competitive prices are being earned must also be weighed against the delay in payment of the penalty from the cartel being ended, such as from when a CLP is filed, to the penalty being imposed. Other considerations such as the probability of being detected should also be taken into account (Motta, 2008). In this case, SPC only paid a penalty after the Competition Appeal Court ruling in August 2011, some two and a half years after the Commission referred the case in February 2009 and close to four years after the end of the cartel arrangements when Rocla filed for leniency (although SPC claims to have withdrawn of their own accord). The CAC imposed a reduced penalty equivalent to just 20% of one year of the most narrowly defined affected turnover which we find is not consistent with the principle of deterrence.

Lastly, we observe that the harm due to non-price factors from the lack of rivalry, in terms of denying buyers alternatives in terms of regions and products, as well as the harm from poorer service are more difficult to assess but nonetheless significant.

References

Connor, J.M (1997) 'The Global Lysine Price-Fixing Conspiracy of 1992-1995', *Review of Agricultural Economics*, 19(2), 412-427.

Connor, J.M. (2011) 'Cartel Detection and Duration Worldwide', *CPI Antitrust Chronicle*, September 2011 (2).

Connor, J.M. and Y. Bolotova (2006), 'A Meta-Analysis of Cartel Overcharges', *International Journal of Industrial Organization*, 24(6), 1109-1137.

Connor, J.M. and R.H. Lande (2008) 'Cartel overcharges and Optimal Cartel Fines', chapter 88, pp2203-2218 in Waller, S.W. (ed) *Issues in Competition Law and Policy*, Vol 3, ABA Section of Antitrust law.

Finkelstein, M.O. and H. Levenbach (1983), 'Regression Estimates of Damages in Price-Fixing Cases', *Law and Contemporary Problems*, 46(4), 145-150.

Harrington, J.E. (2004) 'Post-cartel pricing during litigation', *The Journal of industrial Economics*, LII (4), 521-525.

Kovacic, W., Marshall, R.C, Marx, L.M., Raiff, M.E., (2007) 'Lessons for Competition Policy from the Vitamins Cartel', in V. Ghoshal and J Stennek (eds) *The Political Economy of Antitrust*, Amsterdam: Elsevier.

Kreps, D. M. and J.A. Scheinkman (1983), 'Quantity precommitment and Bertrand competition yield Cournot outcomes', *The Bell Journal of Economics*, 14(2), 326-337.

Levenstein, M.C. and V.Y. Suslow (2004), 'Contemporary International Cartels and Developing Countries: Economic Effects and Implications for Competition Policy', *Antitrust Law Journal*, 71(3), 801-852.

Levenstein, M.C. and V.Y. Suslow (2006), 'What Determines Cartel Success', *Journal of Economic Literature*, 44(1), 43-95.

Makhaya, G, W. Mkwanzani and S. Roberts (2012) 'How should young institutions approach enforcement? Reflections on South Africa's experience', *South African Journal of International Affairs*, 19(1), 43-64.

Morton, F.S. (1996), 'Entry and Predation: British Shipping Cartels 1879-1929' National Bureau of Economic Research, Working Paper 5663.

Motta, M. (2008) 'On cartel deterrence and fines in the EU', *European Competition Law Review*, 29(4), 209-220.

OECD (2002) *Report on the Nature and Impact of Hard Core Cartels and Sanctions against Cartels under National competition Laws*, 9 April.

Office of Fair Trading (OFT) The deterrent effect of competition enforcement by the OFT *OFT 963*.

Ormosi, P. (2011) 'How big is a tip of the iceberg? A parsimonious way to estimate cartel detection rate', UEA Centre for Competition Policy Working paper 11-6.

Oxera (2009) *Quantifying antitrust damages: Towards non-binding guidance for courts*. A study prepared for the European Commission. <http://ec.europa.eu/competition/publications/>

Posner, R. A. (2001), *Antitrust Law*, 2nd edition, The University of Chicago Press.

Werden, G.J. (2003), 'The Effect of Antitrust Policy on Consumer Welfare: What Crandall and Winston Overlook', Economic Analysis Group discussion paper, January.