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THE IMPACT OF ANTITRUST FINES ON FIRM VALUATION IN SOUTH AFRICA: THE CASE OF PIONEER FOODS, TIGER BRANDS AND SASOL CHEMICAL INDUSTRIES

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Abstract

For competition authorities to achieve deterrence based on administrative penalties there is need to create a credible threat of administrative fines that sufficiently balance the expected benefits and costs of engaging in antitrust violations. The implications for deterrence extend beyond the companies engaged in a particular contravention to potential offenders of competition laws. It is therefore imperative that fines be set at levels that not only matter to current offenders, but extend to deterring potential offenders. In this paper we use event study techniques to assess whether antitrust fines have any impact on the value of the company involved in the contravention and if so to estimate extent of that impact on the firm's stock market value. In this case we take the example of Pioneer Foods, Tiger Brands and Sasol Chemical Industries all of which are listed on the Johannesburg Stock Exchange (JSE) in South Africa. We then use the individual results and attempt to draw general conclusions which are limited to the three firms considered. The results of the empirical analysis may potentially provide the Commission with useful insights as to the impact and effectiveness of the deterrence effect of fines levied on firms found to be in contravention of the Competition Act.

JEL classification: G14; L40

1. Introduction

Event studies provide an avenue by which competition authorities can assess the extent to which penalties are of a magnitude that accords with the principle of deterrence. Competition authorities can assist in achieving better competitive outcomes for consumers by pursuing and enforcing policies that deter companies from behaving in anti-competitive conduct. The OECD (2009) states that there are 4 key principles to a successful competition law enforcement policy, that is,

(i) The ability to deter future engagement in anti-competitive conduct;
(ii) The ability to eliminate any financial gain or benefit from non-compliance;
(iii) Proportionality of enforcement to the nature of the offence and the harm caused; and
(iv) Responsiveness and appropriateness of the penalty for a particular offender and the type of prohibition.

One of the instruments, at the South African Competition Commission's disposal that can be used for this purpose is antitrust penalties which are provided for under *s. 59* of the South African Competition Act. This section allows the Competition Tribunal to impose administrative penalties on firms that:

(i) Engage in prohibited practices under s. 4(1)(b); s. 5(2); s. 8(a); s. 8(b); and/or s. 8(d);
(ii) Repeat contravene the Act in terms of s. 4(1)(a); s. 5(1); s. 8(c); and/or s. 9(1);[1]
(iii) Fail to comply or contravene an interim or final order of the Tribunal or the Competition Appeal Court (CAC); and
(iv) Fail to notify a merger and/or implement a merger against the Commission or the Tribunal's order; implement a merger in a manner contrary to conditions of the Commission or the Tribunal; and implement a merger without approval of the Commission or the Tribunal.

For competition authorities (South Africa included) to achieve deterrence based on administrative penalties, there is a need to create a credible threat of administrative fines that sufficiently balance the expected benefits and costs of engaging in antitrust violations [Wils (2006)]. The rationale behind this view is that when companies decide to engage in anti-competitive conduct, they do a cost-benefit analysis which weighs the associated risks (the costs) of engaging in such conduct against the higher profits (the benefits) derived from operating in less competitive markets.

This view is supported by Motta (2007), who argues that deterrence is likely to be achieved if a company perceives the expected gain from engaging in cartel conduct to be lower than the probability of the cartel being uncovered and successfully prosecuted, multiplied by the fine that would be imposed on it for participating in cartel conduct. According to Motta (2007) competition authorities can achieve deterrence by:

(i) Establishing antitrust authorities that can effectively operate against cartels in a way that sufficiently increases the probability of uncovering cartels; and
(ii) Introducing fines which are large enough to discourage potential cartel members from engaging in cartel conduct.

[1] In terms of *s. 59(1)(b)*, the Tribunal may impose an administrative penalty *"for a prohibited practice in terms of….., if the conduct is substantially a repeat by the same firm of conduct previously found by the Competition Tribunal to be a prohibited practice."*

Motta (2007) further states that the probability of uncovering and successfully prosecuting cartels can be increased by a combination of leniency programmes and settlements or other measures that reduce the period between the inception of an investigation and the formal decision. The second instrument relates to the level at which fines are set. Although there is no consensus regarding the appropriate levels at which fines should be set, fines can only achieve deterrence when they are set at levels large enough to significantly matter to the offenders. Moreover, the implications for deterrence extend beyond the companies currently engaged in a particular contravention to potential offenders of competition laws. It is therefore imperative that fines be set at levels that not only matter to current offenders, but extend to potential offenders.

It is only when antitrust fines matter that companies can take the management of antitrust risks[2] as a key competence in their business activities. This is particularly important given that some of the companies found in contravention of South African competition laws may also be found to be in contravention of competition laws through their subsidiaries or activities in other markets. For instance, Tiger Brands which was a member of the bread cartel and fined (a then record) R98.8m for price fixing and market allocation (in 2007), also had its subsidiary, Adcock Ingram, fined R54m in 2008/09 for its role in a collusive tendering scheme.[3]

Similarly, Pioneer, through its bread making subsidiary, Sasko, was found to have been part of the bread cartel and fined R195m in February 2010. The same company also settled a host of other antitrust cases with the Commission in a landmark antitrust settlement seen to date in South Africa (amounting to approx. R960m). Sasol, which was fined R250m in 2009/10 for its cartel activities, also entered into a settlement agreement with the Commission involving the divestiture of its ammonium nitrate producing plant (the Omnia and Profert complaints)[4]. This leaves one wondering whether or not antitrust fines and sanctions actually matter for companies engaging in anti-competitive conduct, and if they do, to what extent.

In this paper we outline the event study techniques and methodology to be used in estimating the impact of antitrust fines on firms' stock market value in South Africa. Event study analysis attempts to measure the effects of economic events on the value of firms by examining stock market data. For this analysis to work, it is important that share prices reflect the underlying economic values of assets, such that changes in equity values will properly capture expected changes in the economic profitability of the firm. A fundamental condition for any event study is the presence of at least one listed financial instrument that tracks the value of the firm under examination. A further condition is for a suitably deep market for the instrument in question. If the instrument is seldom traded its posted price may not reflect changes in value on a sufficiently timely basis for our purposes. In the present case, the methodology attempts to assess the extent to which events, such as the imposition of a fine, affect the value of a company as reflected by its stock price.

Section 2 provides a brief discussion of the vast amount of literature relating to the use of event study methodologies with particular focus on their application in competition law and economics. Section 3 then provides a brief discussion of the event study methodology and

[2] In this case antitrust risk refers to the risk of being found in contravention of competition laws and successfully prosecuted leading to antitrust sanctions being imposed against the company involved.
[3] See *"Ten years of enforcement by the South African competition authorities: Unleashing Rivalry, 1999 – 2009,"* Competition Commission South Africa and Competition Tribunal South Africa, 2009, p.42.
[4] Following an appeal by Omnia, the Competition Appeal Court ("the CAC") made a ruling against the Competition Tribunal's decision based on procedural issues, but there is no denial of the existence of a cartel.

the data used in this paper before proceeding to discuss the results of the study in section 4. We conclude in section 5 of the paper.

2. A brief review of the application of event studies in competition law investigations

Event studies are amongst the most popular research methodologies in business and finance. Modern day event studies have their foundations in the work of Ball and Brown (1968) and Fama, Fisher, Jensen and Roll, FFJR, (1969). Event studies are used to measure the economic effects of events, such as imposition of fines and regulatory changes etc., on the value of companies as reflected by their stock prices. This is based on the assumption that stock prices reflect the underlying economic values of assets such that changes in equity values will capture expected changes in the company's economic profitability.

There is a vast amount of literature on event studies and this paper will not attempt to rehash that literature. Instead, the paper will focus on the application of event study methodology in antitrust research. There are different types of event studies, among them, (1) market efficiency studies as in FFJR which sought to assess how quickly and correctly the market reacts to a particular type of new information; (2) information usefulness studies as in Ball and Brown (1968) which sought to assess the degree to which company returns react to the release of particular information. Cross, Davidson and Thornton (1988) also use information usefulness event studies to assess the effect of director and officer lawsuits on company values.

In applying information usefulness studies, one accepts the hypothesis that stock markets are efficient and that stock prices reflect all publicly available information relevant to the company's prospects. Consequently, the effect of an event is reflected almost immediately in the company's stock price making it easier to link the event in question to the fortunes of the company. A number of antitrust studies have used event study methodology, largely following Ball and Brown's (1968) information usefulness/content type of study. These have largely involved mergers with some application in enforcement cases.

Event studies conducted for mergers have been mixed. Some studies have found that indications that mergers were anti-competitive and could be prohibited have had a negative impact on the share price, especially for the target company [Wier (1983), Franks and Harris (1993), Duso et al (2003) and Oxera (2006)]. However, in their UK study, Arnold and Parker (2007) do not find evidence in support of this conclusion.

Diebold et al (2006) studied a sample of about 50 mergers and acquisitions involving Australian companies from 1996-2003, examining the impact on share prices of the announcement of these mergers both on the firms involved and on rival firms. In addition, for those mergers that were challenged by the Australian antitrust authorities, they consider the impact of the announcement of such a challenge. Their results suggest significant target company abnormal returns to announcements of Australian mergers and limited impact of ACCC involvement. The investors' reactions to domestic mergers were consistent with the findings of previous studies that examine merger samples in other jurisdictions as well as those that would be expected for a younger enforcement environment. While no impacts on target firm investors were found, the actions, or expected actions, of the ACCC seemed to have some impact on acquiring firms' investors' responses to domestic mergers, as the study found significantly lower abnormal returns to acquirers in mergers that were eventually challenged by the ACCC. They found some evidence indicating that cross-border impacts on share-price returns appear to be less favourable than domestic mergers. Furthermore, there was little evidence that the ACCC has much influence on investors' reactions to these mergers.

Using event study methodology to analyse the impact of antitrust investigations on company share prices, Motta and Langus (2007) found that market values of companies negatively react to dawn raids, infringement decisions and court judgements upholding the EC's decision, respectively.[5] Interestingly, the study revealed that the substantial drop in the share prices does not necessarily emanate from the fine itself but rather from the announcement of investigations and judgements, thereby suggesting that the market expects the company's profits to drop after discontinuing with the infringement. This offers indirect evidence that antitrust action against cartels should decrease prices. Dawn raids were found to lead to a 2% decline in shareholder value while a negative decision by the EC resulted in a 3.3% decrease in shareholder value.

In a similar study for the US companies facing price fixing charges, Bosch and Eckard (1991) found that the companies sampled lost a cumulative 1.08% of their share value in the days immediately after the announcement of the negative finding. In this analysis, Bosch and Eckard (1991) estimate that fines and damages account for only 13% of the total loss of stock market value resulting from the negative finding. A company may suffer a loss in value greater than what the fine would entail because following the finding the company may be required to adhere to remedies which lower its profits further than just the reduction in profitability arising from ceasing anti-competitive conduct. Langus and Motta (2007) state that lower value can also be a result of:

> *"(i) legal and consulting costs for antitrust purposes, (ii) a firm giving up profitable projects either because management is distracted by the antitrust investigations and/or because, in the case of large fines, the firm will have lower retained earnings and cash: in imperfect financial markets, lower assets will limit the firm's ability to obtain credit, (iii) the firm may be hurt by the negative publicity following an antitrust investigation."*[6]

In Australia, Feinberg and Round (2005) found little evidence of share price response to price-fixing investigations. This was largely due to the fact that investigations usually involve a small part of a company's operations and antitrust penalties have tended to be relatively small. However, some weak support was found for a greater response by investors when penalties were expected to be more significant. On the other hand, mergers clearly represent a much more significant event and as such a clearer share-price response both to the announcement of mergers and related antitrust challenges is discerned.

Lübbers (2009) investigates the effect of one of the presumably most powerful cartels ever, the Rhenish-Westphalian Coal Syndicate, on the profitability of its members. This was a coal cartel that operated in Imperial Germany in the late 19th and early 20th century. The study assessed the reaction of the member's stock prices to the foundation of the cartel and two major revisions of its original contract. The results suggest that the investigated cartel had no significant effect on the profitability of its members. However, there was some evidence that the cartel was able to stabilize coal prices and powerful enough to ensure that on average, prices were set high enough to avert negative repercussions on company performance. This could possibly explain the findings that the cartel had no effect on the profitability of members.

Beverley (2007) found that Yell's (the owner of Yellow Pages in the UK) shares suffered a cumulative abnormal return loss of 15.8% around the date of reference to the UK Competition Commission. She also found that the market took 2 days to fully absorb the impact of the reference. Most notably, Beverly (2007) found that the market did not react to

[5] Motta and Langus found that dawn raids had a strong statistically significant effect on a company's stock price.
[6] See p. 2.

the announcement that the OFT had launched a market study indicating that the market did not predict a bad outcome at that stage.

It is interesting to note that the study conducted by Feinberg and Round (2005) on Australian antitrust investigations found little evidence of significant share price response to the penalties imposed on companies involved in price-fixing investigations. Comparing this to the similar studies conducted by Langus and Motta (2007) and Beverley (2007) which found significant effects on antitrust penalties levied on companies by the EC and UK authorities respectively, it seems likely that this difference in results may reflect the relatively low penalties imposed in Australia. Our paper may shed more light on the South African position as the levels of fines have increased and become more innovative as the authorities gained more prominence over the last decade. Recent debate has centred on whether the South African fines have been too high or too low in relation to the deterrence goal.[7]

3. Data and event study methodology

3.1. Data

This paper will consider the effect of fines imposed by South African competition authorities on the stock prices of three companies that were listed on the Johannesburg Stock Exchange (JSE) at the time of the sanction. In order to analyse this effect event study methodology will be used (see section 3.2). All publicly available information relevant to the various Commission investigations will be used. In particular, the data that will be used in this study will come from various sources, including JSE share prices over time; press statements from the Commission, press statements and SENS announcements by the firms in question,[8] and decisions and consent orders by the Competition Tribunal.

Our study is limited to companies that are both listed on the JSE and that have either been found in contravention of the Act (or entered into a settlement agreement with the Commission) for which they have had to pay a fine (either monetary or divestiture if assets as a remedy). In South Africa, there are not many listed companies that have been found guilty of contravening the Act and as such there are only a limited number of companies that we can focus our analysis on. In addition, we have focused our analysis on companies that have been involved in cartel conduct and abuse of dominance contraventions in multiple cases. The specific events that we have focused on are those where the fines or the settlements mark a divergence from the traditional approach by the Commission either in terms of the amount of the fine or the structure of the fine or settlement.

For instance, the Tiger Brands fine in 2007 was a then record R98.8m fine in South African antitrust penalties. This was superseded by the Sasol Nitro fine which amounted to R250m (although this fine involved a settlement of multiple complaints). In 2008, Sasol was also fined R3.7b by the EC for its role in a wax cartel. Sasol also entered into a settlement agreement with the Commission in which it divested some of its assets. During the first quarter of 2010, the Tribunal fined Pioneer Foods R195 for its role in the same bread cartel that involved Tiger Brands. This followed Pioneer's decision to go for litigation as opposed to settling with the Commission, as did Tiger Brands in 2007.

[7] See paper presented at the Fourth Annual Competition Law and Economics Conference on 2 September 2010 [Are antitrust fines excessive to the detriment of the companies concerned and consumers in general? (Gilbert Muzata and Kholiswa Mnisi)]

[8] SENS is a news service where share news (including cautionary statements, settlements and fines) are announced to investors by companies.

For its troubles, Pioneer was fined the maximum allowable percentage under the Act, 10% of its bread turnover.[9] This compares much unfavourably to the 5.7% of bread turnover fine that Tiger Brands' paid as part of its settlement with the Commission back in 2007. In addition to this fine, Pioneer also settled with the Commission on various other complaints against it in November 2010.[10] This settlement was a landmark settlement as it went beyond a mere penalty and included price adjustments for the benefit of consumers and other elements which are expected to change the competitive structure of some the markets in which Pioneer operates.

Given the nature of the antitrust sanctions and the elements involved in those sanctions, we have elected to assess whether or not these sanctions had any significant impact on the values of the respective companies' stock prices.

3.2. Event study methodology and estimation procedure

As noted in section 2 above, the central concept applied in event studies is that markets are efficient such that the share price reflects the value to investors of all relevant publicly available information about the company's fundamentals. This entails that any relevant news relating to the company is immediately reflected in its share price.[11] If share prices reflect the underlying economic values of assets, changes in equity values will properly capture expected changes in the economic profitability of the firm.

In this paper, we analyse the impact of antitrust fines on the stock prices of three companies listed on the JSE. The event date is the date on which a fine was imposed on the company found to have infringed antitrust laws by way of either settlement with the Commission or consent order or imposition of a fine by the Tribunal. This date is identified as the day on which either the Commission released a press statement or the stock exchange disclosure by the company in question (or any other date on which the first bits of information about the sanction filters to the most information-savvy investors) or the Competition Tribunal's decision was released. Table 1 below shows the companies that will be analysed and the relevant events and event dates of interest:

Table 1: Company-specific events and event dates

Firm	Event	Event Date
Pioneer Foods	Bread cartel fine	03/02/2010
	Settlement	02/11/2010
Tiger Brands	Bread cartel fine	12/11/2007
Sasol Chemical Industries	EU wax cartel fine	01/10/2008
	Sasol Nitro fine	06/05/2009
	Sasol divestiture	05/07/2010

Source: CC press releases, company SENS announcements, and Tribunal decisions

In order to assess the variations in stock returns that arises as a result of changes in a particular fundamental we use the market model to calculate the counterfactual return, that is, the return that would have been realised had the company not been fined in this case.

[9] It is important to note that although Pioneer was fined the maximum allowable percentage (10%), this was not calculated on its total group turnover but only on its bread division's turnover. This means that although the maximum allowable percentage was imposed, it resulted in a much lower fine than the potential maximum penalty.

[10] The Pioneer settlement related to various other food products such as poultry products, eggs, wheat and maize milling etc

[11] Event studies attempt to estimate the value of a change of a particular fundamental.

The assumption here, as in other event studies, is that asset returns are jointly multivariate normal and independently and identically distributed through time.[12] The market model is potentially superior to the mean-return model as it removes the portion of the return that is related to movement in the market,[13] and as such the variance of any abnormal returns detected should be reduced. The market model is specified as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

Where:

R_{it} and R_{mt} are the period-t returns on security i and on the market portfolio (represented by the JSE all-share index in this paper) respectively;
α_i is the intercept;
β_i is the OLS regression coefficient between security i and the market portfolio; and
ε_{it} is an error term with mean of zero and variance = $\sigma^2_{\varepsilon i}$

We compute the returns for the security of interest as:[14]

$$R_{it} = ln\ (P_{it}) - ln\ (P_{it-1}) \quad (2)$$

Where:

R_{it} is the return on the stock i at time t;
P_{it} is the price of stock i on the trading day t and
P_{it-1} is the price of stock i on the previous trading day t-1

The same formula is used to calculate the return on the market (R_{mt}). Using the market model we estimate the values of α_i and β_i based on returns for the estimation period trading days' returns. Different studies use different estimation periods. Campbell et al. (1997) suggest an estimation window of 120 days prior to the event, while other studies have used 200 days or 1 calendar year. We avoid an overlap between the estimation period trading days and the event window trading days so that the event itself does not influence the parameters of the market model. We also exclude non-trading days such as public holidays to avoid distorting the parameters as well as the results of the analysis. We use an estimation period of 120 trading days excluding holidays and other non-trading days and after correcting for the return calculation and avoiding an overlap with the event window days, we have a total of 118 trading days in the estimation period (T_0 - T_1).

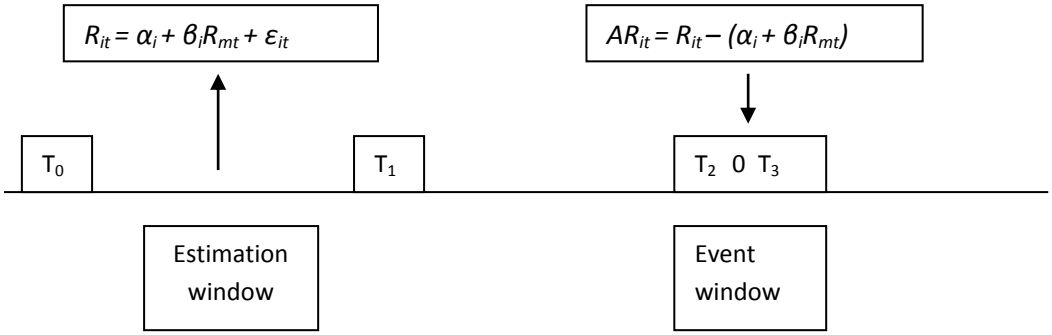
The parameters, α_i *and* β_i, are then used to calculate the counterfactual returns for the event window period. The selection of the event window can have profound effects on the results of the study. It is common practice to use an event window of a few days; encompassing the event day itself as well as the following day, and the day before. This is because in practice the market may acquire information prior to the event; speculate on the contents of an announcement before it is made; or take time to assimilate information and react to it. There is no sound empirical reason for choosing a particular time period around an event so the choice of the event window is somewhat arbitrary. However, the use of an event window wider than a few days increases the risk of confounding events contaminating the results.

In this study, we use an event window of 20 days prior to the event and 20 days after the event and 41 days including the event day (T_2 to T_3).[15] In the case of South Africa, most of

[12] Our inference is based on this assumption.
[13] Newspaper reports usually report cents per share falls and rises, and sometimes percentages, but rarely attempt to isolate the effect of the particular event being reported from general market movements.
[14] See also Langus and Motta (2007).
[15] Although we take 20 days after the event as the event window, we also consider the results taking 10 days after the event and even a shorter time period.

the fines have been imposed following settlement negotiations some of which take time as parties bargain with authorities.[16] So it is possible that some information savvy investors will 'catch wind' of the possibility of an antitrust fine being imposed on the firm before the event date itself.[17] It is also possible that the market may take time to fully reflect the new information, particularly the extent of the new information as some settlement agreements are revised within days of the original announcement (e.g., the Pioneer settlement). Figure 1 below illustrates our approach (discussed in the preceding paragraphs).

Figure 1: Approach to event study methodology



We then calculate excess returns (abnormal returns) returns for each security for each event as the difference between the counterfactual return and the return observed during the event window. This abnormal return is given as:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad (3)$$

To draw inferences from the abnormal returns, we test the null hypothesis that abnormal returns are equal to zero.[18] This test can is carried out for the individual securities as well as for the aggregate abnormal returns. In carrying out the test for the individual securities, we calculate the cumulative abnormal return (CAR) for the event window as:

$$CAR_i = \sum_{i=1}^{t} AR_{it} \quad (4)$$

The CAR is then used to calculate the t-statistic as:

$$t = CAR_i / \sigma_i \quad (5)$$

Where:

σ_i is the standard error of the abnormal returns during the estimation period.[19]

We also aggregate the abnormal returns across securities and events and average them across the number of securities and events to obtain the average abnormal returns (AAR) (a simple average of the individual abnormal returns). These are then accumulated over the event window days as:

$$CAAR_i = \sum_{i=1}^{t} AAR_{it} \quad (6)$$

[16] Discussions often centre on the conduct (some settlements involve multiple conduct cases e.g., Sasol and Pioneer), the appropriateness and level of the penalty to be paid as well as remedies.
[17] Some of the settlement negotiations go on for more than a month e.g., the Sasol settlement, and Pioneer settlements.
[18] See Campbell et al. (1997).
[19] See Cowan, A. R., and Sergeant, A. M. A. (1996).

We then also test the CAAR for significance using the t-statistic to enable general conclusions to be drawn. The test statistic is given by:

$$t = CAAR_i / \sigma \quad (7)$$

Here the standard deviation is calculated as an average of the sum of individual securities assuming that there are no co-variances between the stocks. Co-variances are avoided by ensuring that there are no overlaps between the event windows of different securities. The variance is given by:

$$\sigma^2 = 1/n^2(\sum_{i=1}^{n} \sigma_i^2) \quad (8)$$

4. Results

This section discusses the results from the study mindful of the possible limitations that may exist (e.g., cross-sectional correlation, how to deal with market expectations both pre- and post-event) and possible solutions to these challenges.

We start off by presenting the results for the individual securities and/or events included in the sample before moving on to present the results for the cross-sample analysis. Table 2 shows the abnormal returns for each security/event and across securities over the event window period.

Table 2: Summary of AR by security and/or event and across all securities/events

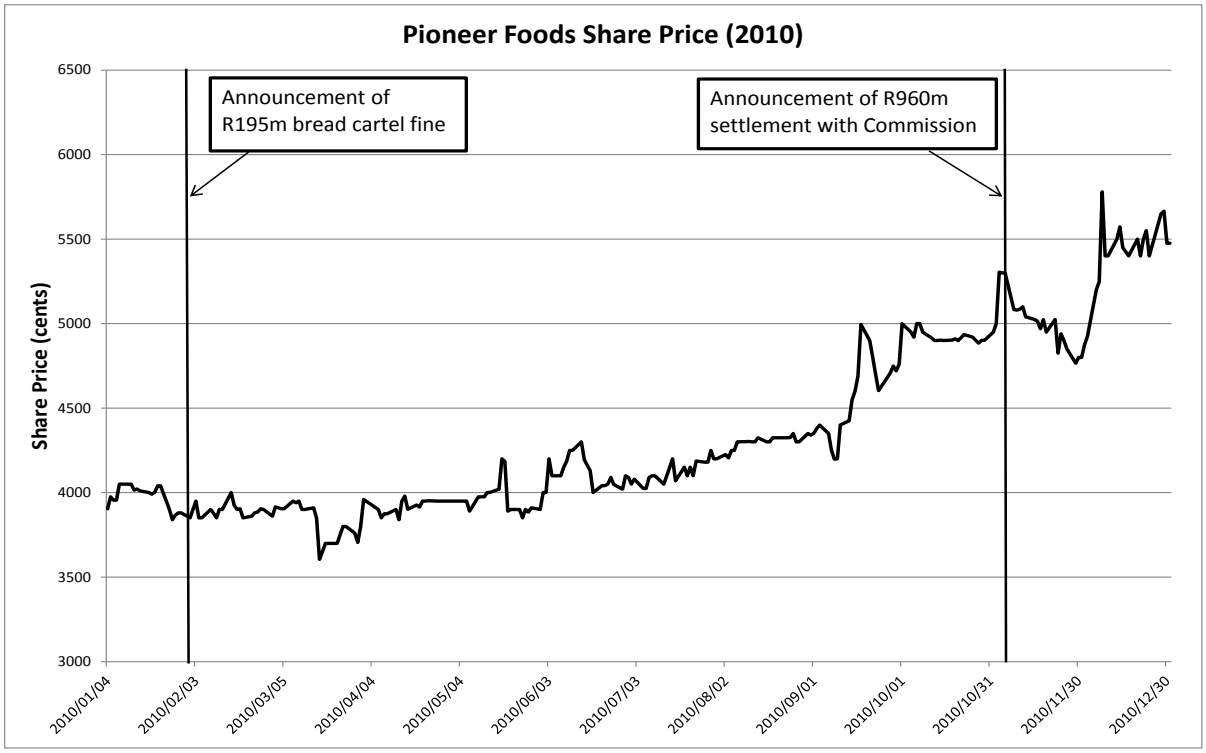
Event time	AR Pioneer bread	AR Pioneer settlement	AR Tiger Brands	AR Sasol EU fine	AR Sasol Nitro	AR Sasol Divestiture	AAR Overall
-20	-0.00740	-0.01085	0.01225	-0.00414	-0.02776	-0.00713	-0.00750
-19	-0.00194	0.01283	0.01454	-0.03730	-0.00068	0.00122	-0.00189
-18	0.02091	-0.00028	0.00544	0.01425	-0.01124	0.00356	0.00544
-17	-0.00235	-0.01330	0.00223	0.01119	-0.00986	0.00131	-0.00180
-16	-0.00130	-0.01010	0.00305	-0.02424	-0.01470	-0.00493	-0.00870
-15	-0.01083	-0.00539	0.01017	-0.04495	0.01301	-0.00314	-0.00685
-14	-0.00084	-0.00683	-0.01293	0.01478	0.00087	0.02115	0.00270
-13	-0.00425	-0.00145	-0.00670	0.00257	-0.04248	0.00003	-0.00871
-12	-0.00510	-0.00061	0.00393	-0.01882	-0.00103	0.00555	-0.00268
-11	-0.00459	-0.00270	0.01774	-0.00798	0.02068	-0.01311	0.00167
-10	0.00141	0.00133	-0.01230	-0.01971	0.00729	0.02749	0.00092
-9	0.00852	-0.00482	0.00502	-0.00755	0.01032	-0.01456	-0.00051
-8	-0.00087	-0.00247	-0.00282	0.00692	0.02182	-0.00016	0.00374
-7	-0.03744	0.00518	0.01398	-0.00523	-0.00140	-0.01026	-0.00586
-6	-0.01635	-0.00648	0.01599	0.03733	-0.02486	0.00606	0.00195
-5	0.00418	-0.00462	0.00026	-0.00715	-0.02573	0.00278	-0.00505
-4	0.00152	-0.00353	0.01178	0.04132	0.02956	0.00774	0.01473
-3	-0.00176	-0.00102	-0.01947	0.03733	-0.04257	-0.00402	-0.00525
-2	-0.00931	-0.00440	-0.02147	-0.01441	0.00642	-0.00221	-0.00757
-1	0.00981	0.00593	-0.02058	-0.00034	-0.02128	0.00939	-0.00285
0	0.01028	0.00831	-0.00785	-0.03064	0.01221	0.00313	-0.00076
1	-0.02593	0.05519	0.00987	-0.01977	0.02215	0.00175	0.00721
2	-0.00024	-0.00781	0.01105	-0.02672	0.03177	-0.01516	-0.00119
3	0.00975	-0.00323	-0.00588	-0.02063	0.01959	0.00061	0.00004
4	-0.00904	-0.04319	0.01056	-0.04788	0.00105	-0.00238	-0.01515
5	-0.00907	-0.00517	0.00956	-0.02500	0.00218	-0.00173	-0.00487

Event time	AR Pioneer bread	AR Pioneer settlement	AR Tiger Brands	AR Sasol EU fine	AR Sasol Nitro	AR Sasol Divestiture	AAR Overall
6	0.01107	0.00032	0.00023	0.00124	-0.03562	0.00315	-0.00327
7	-0.00211	0.00053	0.00886	-0.02630	0.01038	0.01233	0.00062
8	0.02187	-0.01509	0.02178	0.00301	0.00571	-0.00160	0.00594
9	-0.02176	-0.00615	-0.01790	0.07385	-0.01347	-0.02236	-0.00130
10	-0.00926	-0.00029	-0.00969	-0.03000	-0.01567	0.00785	-0.00951
11	-0.00110	-0.01033	-0.00981	-0.03223	0.00522	0.00070	-0.00792
12	-0.01568	0.00664	-0.00146	0.06738	0.00713	0.01166	0.01261
13	-0.00016	-0.01521	0.00042	0.04189	-0.04027	0.00391	-0.00157
14	0.00372	0.01298	0.00639	-0.05025	-0.01500	-0.00751	-0.00828
15	-0.00047	-0.03780	-0.00808	-0.00225	0.00444	0.00678	-0.00623
16	0.00362	0.01946	-0.00869	0.06586	-0.00482	0.00184	0.01288
17	-0.00350	-0.01191	0.01176	-0.04128	0.01811	-0.01699	-0.00730
18	-0.01321	-0.01117	0.00014	-0.02879	-0.02797	0.01379	-0.01120
19	0.01126	-0.01525	-0.01435	-0.00535	-0.02282	-0.01041	-0.00949
20	-0.00456	0.00967	-0.01150	0.00824	0.03038	0.01316	0.00757

4.1. Pioneer Foods

Figure 2 below provides a graphical presentation of the share price movements of Pioneer Foods following the announcement of the Tribunal's R195m fine in February 2010 for its involvement in the bread cartel as well as the landmark settlement between the Commission and Pioneer in November of the same year:

Figure 2: Pioneer Foods Share Price (January to December 2010)



Pioneer (for both the bread cartel fine and the settlement), had positive abnormal returns on the day of the event. However, in the next few days Pioneer's stock price reacts negatively to the news. For instance, following the bread cartel fine, Pioneer's share lost about 2.6%

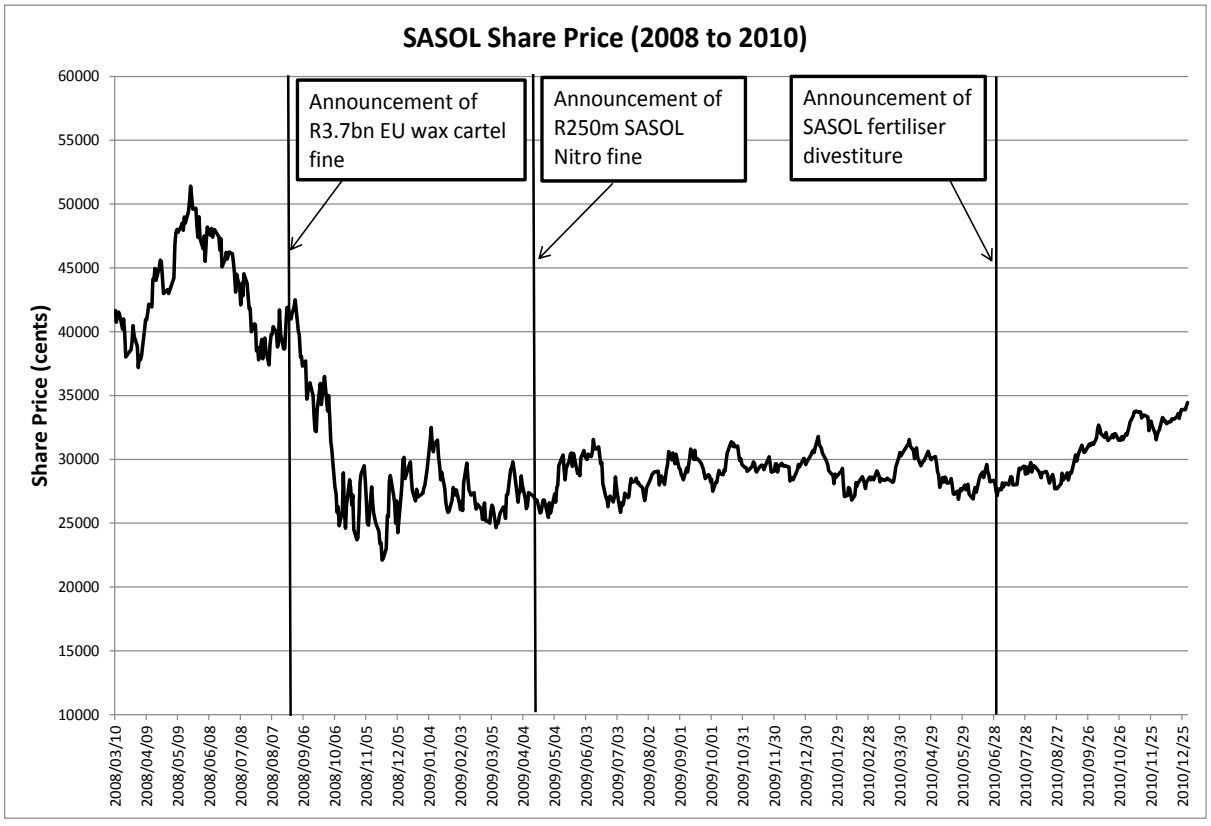
the following day. This can be expected as the Tribunal decision would have come out during the day and the market may not have had enough time to absorb the effects of the penalty news. Cumulatively, Pioneer's stock price had lost about 4.8% by event date, 8.2% by the 5th and 10th days after the fine and about 10.2% by the 20th day after the fine (see table 3 in appendix).[20] The cumulative losses are highly statistically significant at the level of 1% (see also table 3) and indicate a quick response to unexpected news (Langus and Motta, 2007 and Brooks et al., 2003).

Similarly, for the settlement, Pioneer's share price reacted days after the initial announcement as details of the agreement became much clearer to the public. Four days after the event, Pioneer's stock price lost about 4.3% (losses of 0.7% and 0.3% respectively on the 2nd and 3rd days after the event). Again cumulative losses are statistically significant at the level of 1% on the event day, 10th and 20th days after the event.

4.2. Sasol

Figure 3 below shows the share price movement of Sasol over time in order to provide a graphical illustration of the company's reaction to three separate instances of fines or other antitrust penalties imposed on it by the competition authorities in the EU and South Africa.

Figure 3: SASOL Share Price (March 2008 to December 2010)



Firstly, we considered the impact of the EC fine on Sasol's share price listed on South Africa's main stock exchange, the JSE. In 2008, Sasol was fined an equivalent of R3.7bn for the role of its German subsidiary in a wax cartel. We have elected to observe the response of Sasol's share price to the EC fine compared to the reaction of the same share to the

[20] The cumulative figure includes losses that the share experienced prior to the event date itself, but in the event window.

South African antitrust fines.[21] We note that the Sasol share lost approx. 3.1% on the day the EC fine was announced. This was followed by 5 days of consecutive losses (lost 4.8% on the 4th day after the announcement and 2.5% on the 5th day). Cumulatively, Sasol's share had lost 5.7% by the event day in response to the EC fine. The cumulative losses are statistically significantly at the level of 1%. By the 5th day after the announcement, Sasol's local share price had lost a cumulative 19.7% which is statistically significant at the level of 1%.

On the other hand, the response to Sasol's R250m settlement resulted in a share price decrease of 2.1% the day before the event and a positive abnormal return of 1.2% on the event day. However, Sasol's share price experienced losses in the days running up to the announcement (2.5% six days before the announcement; 4.3% three days before the announcement; 2.1% a day before the announcement). Given the significant share price losses in the days leading up to the public announcement of Sasol's settlement in this matter as is clear from our above analysis, it implies that other factors such as potential insider trading should perhaps be considered or investigated by the relevant authorities with regards to this matter.

In our analysis we also considered the Sasol fertiliser divestiture settlement reached with the Commission in July 2010.[22] We note that the Sasol divestiture agreement is not a financial penalty in the true sense of the word if it is assumed that Sasol would receive market prices for the entities divested in this settlement. However, we have included this event in our analysis as it has a potential financial effect on the company to the extent that it impedes their ability to earn supra-competitive returns in the future, given the commitments in the settlement agreement on Sasol pricing.[23]

The announcement of this divestiture resulted in losses of 1.5% two days after the event. On the event day, Sasol's share price experienced a positive abnormal return of 0.3%. By event date, Sasol's share price had 'shed' approx. 10% of its value as a result of the R250m fine. This is contrary to a positive cumulative abnormal return of approx. 3% in response to the divestiture settlement. These cumulative abnormal returns are significant at the level of 1% level. The divestiture settlement marked a final 'piece' in Sasol's settlements for various cases with the Commission. Most interestingly to note is that Sasol's share price lost more value in response to the EC fine than it lost in response to the settlements in South Africa (on event day as well as cumulatively over the entire event window). This is in line with what we expect given the differences in the magnitude of the fines (R3.7bn compared to R250m).

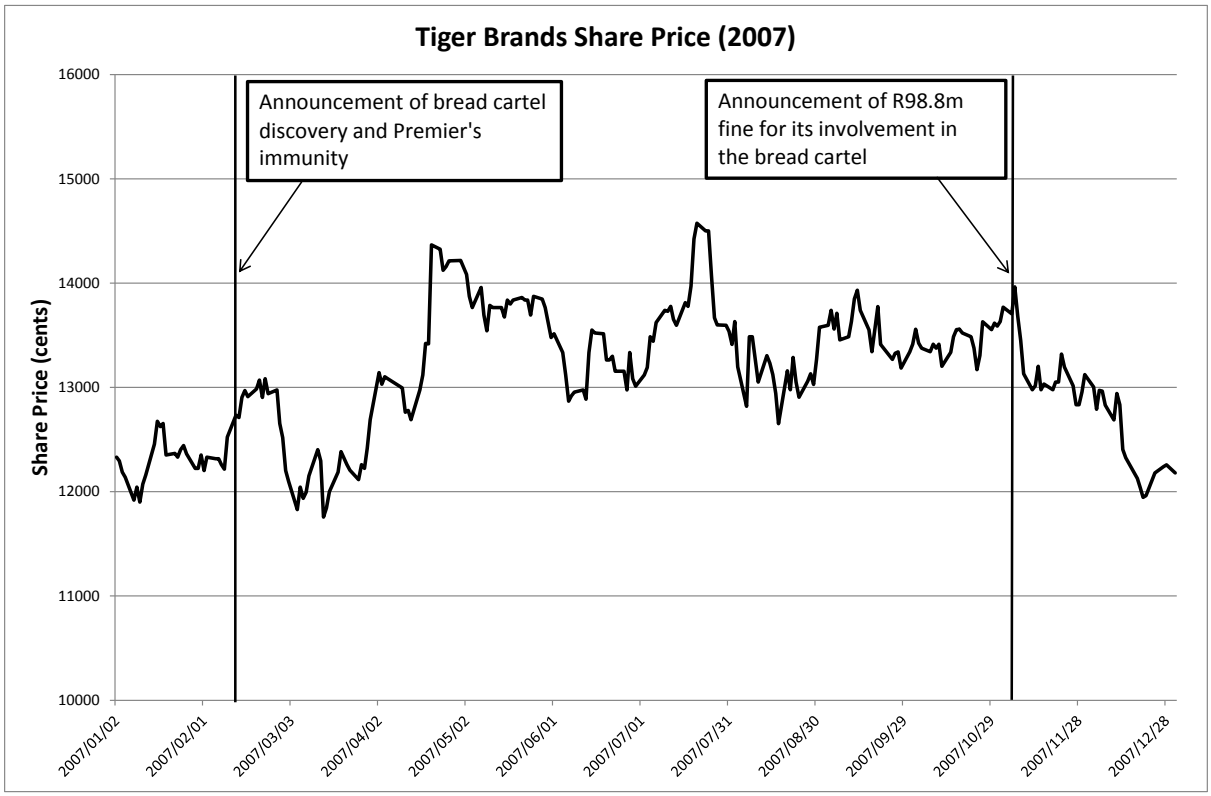
Given that the Sasol Nitro and the Sasol divestiture both relate to the various cases against Sasol, it is possible that following Sasol's agreement to pay R250m as part of the overall settlement, the market anticipated that Sasol would at least pay another fine for the remaining conduct (in this case, the fine was in the form of a divestiture). This could explain the less negative response of Sasol's share price to the divestiture announcement. In many ways, investors may have viewed the divestiture in a more positive way as reflecting an end to Sasol's antitrust problems.

[21] We note that when a company is fined following litigation it is likely to pay a higher fine than the fine is a result of settlement negotiations.
[22] The Commission reached a settlement agreement with Sasol on the 25th of June 2010 (which was publically announced on the 5th of July 2010) with regards to the finalisation of the abuse aspect of the fertiliser case in which Sasol paid a R250m fine and which is also discussed and analysed in this paper. This agreement involved the divestiture of five of Sasol's blending facilities; a commitment to sell ammonium nitrate based fertilisers on an ex-works basis; a commitment not to differentiate in its pricing of ammonium nitrate based fertilisers; and to house the ammonia plants as a separate business unit from Sasol Nitro.
[23] See footnote 21

4.3. Tiger Brands

Figure 4 below shows Tiger Brands' share price around the time of the announcement of the Commission's uncovering of a bread cartel in February 2007, as well as the subsequent fine of R98.8m that was paid by the company in November of the same year after settling with the Commission on this matter.

Figure 4: Tiger Brands Share Price (January to December 2007)



Tiger Brands' stock price appears to suffer modest losses (0.8%) in response to the bread cartel fine. However, the share price suffered consecutive losses for three days prior to the announcement (between 1.9% and 2.1%). Cumulatively, Tiger Brands' share price appears not to be negatively affected by the then record R98.8m. We look at the history of the bread cartel and its prosecution. The first public announcement was issued by the Commission during February 2007 when Premier Foods was granted immunity in return for co-operating with the Commission's investigation.

Evidently, Tiger Brands' share price experienced a significant decline around the time when Premier Foods' immunity from prosecution was announced. Similarly, the share also experienced declines around the time when the R98.8m fine was announced. It is also possible that investors anticipated that Tiger Brands would be fined following immunity that had been granted to Premier Foods for the bread cartel back in February 2007. This could explain the share value's less negative reaction to the announcement of the fine in November 2007.

4.4. Summary of results

As stated earlier, we also averaged abnormal returns across securities and/or events. The results show that on average the securities in the sample lost about 0.08% of their value on event day. The securities also experienced losses during the days prior and after the event (see table 2 above). Cumulatively, the securities lost an average of 3.5% by event date and this is significant at the level of 1% (see table 3). For the entire event window, Pioneer lost a cumulative 10.2% due to the bread cartel fine and 12.3% due to the settlement. Sasol responded to the EU wax cartel fine with a cumulative loss of 15.2% and 11.9% loss in response to the R250m (what we have termed the Sasol Nitro fine) South African fine. For the Tiger Brands bread cartel fine and the Sasol (divestiture) on the other hand, positive cumulative abnormal returns of 1.6% and 2.9% were experienced.[24]

Overall across all securities/events in the sample, the loss in value as a result of antitrust fines or sanctions is about 7.5% over the event window. Using our 41 day event window, we summarise the results of the hypothesis testing in table 4 below.

Table 4: Summary of results using the market model

Event period	Measure	Pioneer bread	Pioneer settlement	Tiger Brands	Sasol EU fine	Sasol Nitro	Sasol Divestiture	Overall
20 days after event	t statistic	-6.0078***	-7.5200***	1.2337	-7.6119***	-4.8329***	2.6549***	-10.5220***
10 days after event	t statistic	-4.8312***	-4.2869***	4.0348***	-8.7761***	-2.9799***	1.1192	-7.8737***
Event day	t statistic	-2.7956***	-2.7661***	0.9759	-2.8470***	-4.1205***	2.7107***	-4.8704***
1 day after event	t statistic	-4.3156***	0.6062	1.7616**	-3.8388***	-3.2202***	2.8691***	-3.8623***

Significant at 10%, ** significant at 5%, * significant at 1%*

Most of the reported statistics are highly significant both for individual securities/events and across securities over the event window. We have also varied the length of the event window taking the event window to run up to 10 days after the event; the event day; and a day after the event window as checks. We observe that the magnitudes of the cumulative losses are largely significant at the 1% for an event window running up to 10 days after the event (save for the Sasol divestiture which is not significant). With an event window that runs up to the event day, cumulative abnormal losses are largely significant at the level of 1% save for Tiger Brands which is positive and insignificant (Note that Sasol divestiture is positive, but significant at the level of 1%). For an event window that runs up to a day after the event, cumulative abnormal returns are negative and significant at the 1% level for Pioneer bread cartel fine, Sasol EU wax cartel fine and Sasol Nitro.[25] Overall, the cumulative abnormal returns are negative and significant at the 1% level across all event window lengths.

We also use the mean-return model to estimate the normal returns and our findings are summarised in table 5 below. The use of the mean model helps avoid problems of endogeneity which is likely to arise when the market model is employed.[26] The results show that over a 41 day event window, the cumulative abnormal losses are significant at the 1% level (for Pioneer's bread cartel fine and settlement, Sasol's EU fine) and at the 10% level for Tiger Brands' bread cartel fine. The Sasol Nitro fine is positive, but significant at the level of

[24] Possible reasons for this observation are explained in the preceding paragraphs.
[25] We note that cumulative abnormal returns are positive and significant for Tiger Brands and the Sasol divestiture (10% and 1% respectively), but insignificant for the Pioneer settlement.
[26] Endogeneity occurs when a change in one security affects the relevant stock market index. This is more likely if the security concerned is for a large firm.

5%. Overall, cumulative abnormal returns (losses) are also significant at the level of 1%.[27] Of note is the divergence between the mean-return model and the market model in terms of the Tiger Brands statistics.

The market model shows a positive cumulative abnormal return which is not significant over the entire event window while the market model shows a negative cumulative abnormal return which is significant at the level of 10%. A divergence is also observed for the Sasol R250m fine. However, for the other events the conclusion is generally in the same direction. Overall across all securities/events, the conclusions reached are the same for both the market model and the mean-return model.

Table 5: Summary of results using the mean-return model

Event time	Measure	Pioneer bread	Pioneer settlement	Tiger Brands	Sasol EU	Sasol Nitro	Sasol Divestiture	Overall
20 days after event	t statistic	-6.3298***	-6.7009***	-1.4897*	-17.7445***	1.8692**	5.1723***	-8.5536***
10 days after event	t statistic	-5.1714***	-2.9057***	-0.0575	-17.3328***	2.1807***	0.9293	-7.5027***
Event day	t statistic	-3.1170***	-1.8962**	-0.5450	-7.5936***	0.1852	-0.3317	-4.5793***
1 day after event	t statistic	-4.7494***	1.5086*	-0.3252	-9.7766***	0.3430	0.9683	-4.5028***

Significant at 10%, ** significant at 5%, * significant at 1%*

We note that cross-sectional correlation may also introduce bias into the inferences. This is more likely when there is clustering of abnormal returns across firms and can become a serious problem (Bernard, 1987). Clustering is likely to occur when an event affecting one firm affects other firms in the same industry and sample for example in the case of a cartel. In our case this does not arise as there are no overlaps between event windows across the securities/events. Investor expectations (pre- and post-event) can also create problems. For instance, in the case of Tiger Brands where an announcement that immunity had been granted to one of the bread cartel members, Premier Foods, was made prior to the other members being sanctioned. In such a pure prisoner's dilemma situation, the optimal strategy is to also confess and if investors anticipate this to be the case, then they would expect that the company will face some sanction of some sort (either a full fine in the event of non-co-operation or a reduced fine in the event of co-operation). In such cases, it is difficult to ascertain the direction of the impact of the fine on the company's returns as investor expectations may be adjusted prior to the event itself.

5. Conclusions

Event study analysis attempts to measure the effects of economic events on the value of firms by examining stock market data. Some of the potential challenges and issues in using event study analysis are highlighted in the paper. However, despite these challenges, event studies are a useful tool for competition practitioners in impact assessment studies, as is evidenced by their use by competition authorities such as the U.K. Competition Commission.

In the present case, we used the methodology to assess the impact of antitrust fines (and other sanctions such as divestitures and settlements that go beyond just a monetary fine) on a company's stock market value. We observe that the share prices reacted negatively and in a statistically significant manner (at the level of 1%) to the news of the fines imposed by the competition authorities. However, we observe that where some events are linked to other sanctions already imposed or where there is a possibility of investor expectation that the

[27] Significance is also observed for an event window running up to 10 days after the event, event date and a day after the event. However, some of the cumulative abnormal returns (e.g., Tiger Brands) though negative are not significant.

company is likely to be fined at a future date, (e.g., Tiger Brands and the Sasol divestiture) the response to a fine is ambiguous. This may possibly be due to investor expectation adjusting prior to the event itself occurring.

We however note that, despite this possibility the share prices, to some extent, react to the fine itself with negative abnormal returns being experienced in the days around the event. We also note that the magnitude of the fine itself may possibly have an influence on the extent to which the share prices lose value. For instance the reaction of the Sasol's share to the R3.7bn EU wax cartel fine is greater than the reaction of the same share to the R250m fine. Cumulatively over the event window, Sasol's share lost 15.2% on the EU fine compared to a cumulative loss of 11.9% on the R250m SA fine.

Our findings therefore show a clear contrast between those of Tiger Brands on the one hand and Pioneer Foods and Sasol (excluding the divestiture settlement) on the other. Tiger Brands co-operated fully with the Commission's investigation into the bread cartel after its uncovering in February 2007 and its eventual settlement in November of the same year amounted to a lower penalty (in terms of the percentage of relevant turnover paid), as well as an ambiguous effect on shareholder value after the settlement announcement. In contrast to this finding, our analysis showed that in the case of Pioneer and Sasol (the EU wax cartel fine and the SA Nitro fine), there was a significant impact on shareholder value and the amount of the fine paid was also higher as a percentage of the company's relevant turnover.

Given these findings, we can identify two possible areas of further discussion and research by making preliminary conclusions on the deterrence effect of antitrust penalties in South Africa. Firstly, penalties that are paid later in the prosecution stage (i.e. imposed by the Tribunal or settlements made after a full investigation by the Commission, as is the case with Pioneer and Sasol), may need to be higher in future in order to incentivise early settlement as was the case with Tiger Brands. Secondly, more recent penalties imposed by the Tribunal (such as the Pioneer settlement in November 2010) are being increased in order to achieve deterrence, which suggests that some of the earlier penalties such as the Tiger Brands bread cartel fine in November 2007 may have been too low to achieve the desired effect, much the same as the experience in Australia.[28]

These results also indicate that following the imposition of the sanction and associated remedies, investors expect the company's fortunes (profitability) to reduce as markets become more competitive.[29] The negative reaction of share prices to antitrust penalties suggests that such sanctions ***could*** potentially deter companies (current and potential offenders) from engaging in antitrust violations.[30] Whether this negative response is sufficient or significant enough to achieve deterrence is a separate research question. We are therefore not able to provide an answer to this question at this point. We however, note that deterrence is determined by the probability that an infringement will be uncovered and successfully prosecuted multiplied by the costs that the firm incurs if the investigation went ahead. As noted in section 1, deterrence is likely to be achieved if the sanction has the ability to at least balance out the benefits received by a company from engaging in anticompetitive conduct. Our study results show that the average reduction in company value over the event window is about 7.5%. These results are more or less in line with

[28] We note that settlement is a useful tool for antitrust authorities in their quest to achieve deterrence, but the outcomes of these settlements must be sufficient enough to deter future conduct.

[29] The loss in value is a result of a composite factors e.g., the penalty itself and the implications of discontinuing the conduct on future profits etc

[30] We note that respondents spend a significant amount of time and resources trying to bargain with competition authorities on the appropriate level of the fines themselves. This is particularly applicable to the recent cases before the Commission.

results of similar studies (e.g., Langus and Motta, 2007, Bosch and Eckard, 1991, Gunthorpe, 1997, MacKinlay, 1997).

These antitrust fines also coincide with the rise to prominence of competition authorities in South Africa, particularly over the last few years of the decade gone by. The last few years have seen the levels of the fines increase as well as some innovative ways of sanctioning companies that violate competition laws. Examples include the more recent imposition of maximum allowable percentage, 10%, fines under the Competition Act (10% of relevant turnover for Pioneer[31] and 10% of all turnover for the pipes cartel), a departure from just the monetary fine to sanctions that have a structural effect on the markets (e.g., the Sasol divestiture, and Pioneer settlement).

Finally, we conclude that this analysis provides indirect evidence of the impact of antitrust enforcement on the behaviour of companies and the outcomes of related markets. However, the exact levels and forms of interventions needed to achieve deterrence are beyond the scope of this paper. This would be an interesting exercise for future research particularly for South African competition authorities who are currently seeking to establish their effectiveness.

[31] See footnote 8

Appendix:

Table 3: Summary of CAR and calculated t-statistics by security and/or event and across all securities/events

Event time	CAR Pioneer bread	t statistic CAR	CAR Pioneer settlement	t statistic CAR	CAR Tiger Brands	t statistic CAR	CAR Sasol EU	t statistic CAR	CAR Sasol Nitro	t statistic CAR	CAR Sasol Divestiture	t statistic CAR	CAAR Overall	t statistic CAAR
-20	-0.00740	-0.43360	-0.01085	-0.66295	0.01225	0.97537	-0.00414	-0.20755	-0.02776	-1.12795	-0.00713	-0.64729	-0.00750	-1.04922
-19	-0.00934	-0.54737	0.00198	0.12078	0.02679	2.13237	-0.04144	-2.07831	-0.02844	-1.15572	-0.00592	-0.53704	-0.00939	-1.31363
-18	0.01157	0.67821	0.00170	0.10375	0.03223	2.56518	-0.02719	-1.36353	-0.03968	-1.61255	-0.00236	-0.21406	-0.00396	-0.55307
-17	0.00922	0.54062	-0.01161	-0.70922	0.03446	2.74268	-0.01600	-0.80230	-0.04954	-2.01304	-0.00104	-0.09482	-0.00575	-0.80415
-16	0.00793	0.46456	-0.02171	-1.32630	0.03751	2.98545	-0.04023	-2.01792	-0.06424	-2.61045	-0.00598	-0.54252	-0.01445	-2.02110
-15	-0.00290	-0.17004	-0.02710	-1.65570	0.04768	3.79529	-0.08518	-4.27261	-0.05122	-2.08163	-0.00912	-0.82779	-0.02131	-2.97954
-14	-0.00374	-0.21928	-0.03392	-2.07287	0.03475	2.76628	-0.07040	-3.53114	-0.05036	-2.04645	0.01203	1.09134	-0.01861	-2.60189
-13	-0.00799	-0.46847	-0.03537	-2.16148	0.02805	2.23283	-0.06783	-3.40241	-0.09284	-3.77266	0.01205	1.09372	-0.02732	-3.82047
-12	-0.01310	-0.76770	-0.03598	-2.19850	0.03198	2.54546	-0.08665	-4.34619	-0.09386	-3.81434	0.01761	1.59738	-0.03000	-4.19508
-11	-0.01768	-1.03650	-0.03868	-2.36338	0.04972	3.95737	-0.09463	-4.74624	-0.07318	-2.97399	0.00450	0.40810	-0.02833	-3.96088
-10	-0.01627	-0.95367	-0.03735	-2.28241	0.03741	2.97812	-0.11434	-5.73505	-0.06590	-2.67783	0.03199	2.90259	-0.02741	-3.83265
-9	-0.00775	-0.45403	-0.04217	-2.57674	0.04243	3.37770	-0.12189	-6.11359	-0.05557	-2.25839	0.01743	1.58172	-0.02792	-3.90389
-8	-0.00861	-0.50476	-0.04464	-2.72758	0.03961	3.15333	-0.11497	-5.76667	-0.03375	-1.37157	0.01727	1.56733	-0.02418	-3.38120
-7	-0.04605	-2.69931	-0.03945	-2.41080	0.05360	4.26619	-0.12020	-6.02909	-0.03515	-1.42828	0.00702	0.63682	-0.03004	-4.20050
-6	-0.06239	-3.65751	-0.04593	-2.80649	0.06959	5.53917	-0.08288	-4.15695	-0.06000	-2.43836	0.01308	1.18698	-0.02809	-3.92775
-5	-0.05822	-3.41260	-0.05055	-3.08896	0.06985	5.56018	-0.09003	-4.51541	-0.08574	-3.48409	0.01586	1.43898	-0.03314	-4.63351
-4	-0.05670	-3.32377	-0.05409	-3.30488	0.08163	6.49785	-0.04871	-2.44299	-0.05617	-2.28279	0.02360	2.14130	-0.01841	-2.57376
-3	-0.05846	-3.42704	-0.05510	-3.36695	0.06216	4.94822	-0.01137	-0.57050	-0.09875	-4.01290	0.01958	1.77628	-0.02366	-3.30811
-2	-0.06778	-3.97296	-0.05950	-3.63583	0.04069	3.23899	-0.02579	-1.29333	-0.09233	-3.75213	0.01736	1.57557	-0.03122	-4.36599
-1	-0.05797	-3.39813	-0.05358	-3.27371	0.02011	1.60090	-0.02612	-1.31025	-0.11361	-4.61686	0.02675	2.42713	-0.03407	-4.76399
0	-0.04769	-2.79562	-0.04527	-2.76606	0.01226	0.97593	-0.05676	-2.84697	-0.10140	-4.12052	0.02988	2.71071	-0.03483	-4.87035
1	-0.07362	-4.31562	0.00992	0.60619	0.02213	1.76157	-0.07654	-3.83880	-0.07924	-3.22020	0.03162	2.86910	-0.02762	-3.86228
2	-0.07386	-4.32986	0.00211	0.12875	0.03318	2.64113	-0.10326	-5.17903	-0.04747	-1.92899	0.01646	1.49362	-0.02881	-4.02805
3	-0.06411	-3.75811	-0.00112	-0.06845	0.02730	2.17290	-0.12388	-6.21357	-0.02788	-1.13304	0.01707	1.54890	-0.02877	-4.02307
4	-0.07315	-4.28798	-0.04431	-2.70724	0.03785	3.01317	-0.17176	-8.61520	-0.02683	-1.09048	0.01469	1.33273	-0.04392	-6.14117
5	-0.08223	-4.81993	-0.04948	-3.02311	0.04741	3.77381	-0.19676	-9.86911	-0.02466	-1.00204	0.01295	1.17536	-0.04879	-6.82275
6	-0.07116	-4.17125	-0.04916	-3.00359	0.04764	3.79181	-0.19553	-9.80699	-0.06028	-2.44953	0.01610	1.46122	-0.05206	-7.27997

Event time	CAR Pioneer bread	t statistic CAR	CAR Pioneer settlement	t statistic CAR	CAR Tiger Brands	t statistic CAR	CAR Sasol EU	t statistic CAR	CAR Sasol Nitro	t statistic CAR	CAR Sasol Divestiture	t statistic CAR	CAAR Overall	t statistic CAAR
7	-0.07327	-4.29477	-0.04862	-2.97100	0.05650	4.49707	-0.22183	-11.12627	-0.04989	-2.02752	0.02844	2.58023	-0.05145	-7.19372
8	-0.05140	-3.01286	-0.06371	-3.89316	0.07827	6.23052	-0.21882	-10.97550	-0.04419	-1.79562	0.02684	2.43527	-0.04550	-6.36245
9	-0.07316	-4.28845	-0.06986	-4.26893	0.06037	4.80576	-0.14497	-7.27139	-0.05766	-2.34314	0.00448	0.40662	-0.04680	-6.54402
10	-0.08242	-4.83118	-0.07016	-4.28690	0.05069	4.03481	-0.17497	-8.77614	-0.07333	-2.97991	0.01233	1.11917	-0.05631	-7.87370
11	-0.08351	-4.89552	-0.08049	-4.91791	0.04088	3.25432	-0.20721	-10.39282	-0.06811	-2.76765	0.01303	1.18253	-0.06423	-8.98164
12	-0.09919	-5.81468	-0.07385	-4.51225	0.03942	3.13795	-0.13983	-7.01340	-0.06098	-2.47801	0.02470	2.24071	-0.05162	-7.21830
13	-0.09936	-5.82408	-0.08906	-5.44156	0.03984	3.17147	-0.09794	-4.91250	-0.10125	-4.11451	0.02860	2.59528	-0.05319	-7.43794
14	-0.09563	-5.60583	-0.07608	-4.64874	0.04623	3.68006	-0.14819	-7.43286	-0.11625	-4.72391	0.02109	1.91386	-0.06147	-8.59545
15	-0.09610	-5.63327	-0.11388	-6.95837	0.03815	3.03680	-0.15044	-7.54559	-0.11180	-4.54338	0.02787	2.52893	-0.06770	-9.46647
16	-0.09248	-5.42128	-0.09441	-5.76905	0.02946	2.34471	-0.08458	-4.24245	-0.11663	-4.73935	0.02971	2.69605	-0.05482	-7.66589
17	-0.09598	-5.62639	-0.10632	-6.49659	0.04121	3.28052	-0.12586	-6.31289	-0.09851	-4.00339	0.01272	1.15416	-0.06212	-8.68692
18	-0.10919	-6.40067	-0.11749	-7.17886	0.04135	3.29136	-0.15465	-7.75689	-0.12649	-5.14015	0.02651	2.40517	-0.07333	-10.25333
19	-0.09793	-5.74040	-0.13274	-8.11073	0.02700	2.14883	-0.16001	-8.02543	-0.14931	-6.06753	0.01610	1.46049	-0.08281	-11.58002
20	-0.10249	-6.00778	-0.12307	-7.52005	0.01550	1.23366	-0.15176	-7.61194	-0.11893	-4.83290	0.02926	2.65493	-0.07525	-10.52201

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