Do investigated companies manipulate profitability data?

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Abstract

In this paper we consider whether companies manipulate their profitability data in response to regulatory investigations. In particular, we investigate whether companies' reported profitability during an investigation of "abuse of a monopoly position" tends to be lower than pre-investigation profitability. First, in a theoretical model, we show that in equilibrium companies manipulate profitability data once an investigation starts. We then test this proposition on evidence from UK competition cases and find that there are significant differences in reported profitability during an investigation when compared to pre-investigation profit levels.

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1. Introduction

In almost all jurisdictions there are competition law provisions of some form prohibiting the abuse of a monopoly (or dominant) position. The basic approach typically has three steps. First, a market is defined. Second, it is determined whether the company is dominant on that market. Finally, if the company is dominant, then evidence is gathered and assessed to decide whether the company abused a monopoly position or not. The final stage requires the collection and interpretation of relevant evidence, e.g., profitability, market shares, behaviour, contracts, etc. There is a clear incentive structure implicit in this process. Once a company knows that it is being investigated it has an incentive to try to change its behaviour and even manipulate what evidence there is to put the company in a better light and reduce the chances of being found guilty. Unless the investigation process is without error, the incentive will exist for "innocent" and "guilty" companies. Of course, the investigating body will recognise the incentive effects and may choose to treat evidence of actions after the company knows it is being investigated differently from evidence of actions before the investigation is announced. This paper outlines a simple theoretical model of this effect and, with a data set of specific competition cases from the UK, uses evidence of predicted "guilt" and other data to test whether companies appear to engage in this behaviour. We find evidence that companies respond to investigation in this way. Therefore, the paper contributes to the debate of whether and how competition regulation affects behaviour of companies that are subject to this regulation.

A problem with addressing case evidence is that it is hard to allocate information to pre- and during-investigation, particularly in a form that can be compared over time to see if there is a break in behaviour. In this paper we focus on profitability and consider if there is a difference in reported profitability during-investigation compared to pre-investigation. Compared to most other evidence, profitability has several advantages. It is quantifiable and is measured successively for discrete periods (hence a time path can be followed with pre- and during-investigation periods relatively well). Furthermore, profitability is generally thought to be a measure that has scope for manipulation especially where there is some scope to change it during a "short" period. The paper uses a data set of all the companies investigated by the UK Competition Commission (CC) for suspected abuse of monopoly power from 1970 till 2003.[1] This data set is probably the only data set able to conduct an investigation of

[1] Formally the organisation was referred to as the Monopolies and Mergers Commission (MMC) throughout almost all this period but for simplicity, throughout the paper, the terminology Competition

this type for several reasons. First, the UK is almost the only jurisdiction to collect and publish sufficient profitability data on a regular basis. This is recognised in Office of Fair Trading Publications: "The UK seems to be one of the few jurisdictions where the usefulness of profitability assessment has been explicitly recognized, and where it is regularly applied in investigations".[2] Second, the legal process was virtually identical throughout the period we consider, allowing for some degree of legal consistency. Third, during this period the test was whether the monopoly action under investigation operated against the public interest (i.e., adverse finding, which can loosely be thought of as guilty), which gives an ambiguous outcome, making it easier to predict the probability of guilt from pre-investigation evidence. Finally, after each case the CC must produce a detailed summary of the case and the decision (amounting to several hundred pages in some cases), which provides a good summary of information (although we only use hard numerical characteristics in this investigation). The profitability figures in the report have been collected by the CC staff and provide a careful measure of profitability in the relevant market, and as such are far more reliable and informative than accounting measures.

There is some related empirical literature on the economic causes of verdicts in competition law, which we note here. The closest is Davies *et al*. (1998, 1999) who draw on UK data to investigate causes of decisions and analyse 73 cases investigated by the CC (a subset of our data) between 1973 and 1995, finding market share of the largest firm in a case to be a major factor in the outcome. Their data set of cases overlaps with the one used in the current paper but their paper is not concerned with the question of how companies respond to the incentives in a legal investigation. Lauk (2002) applies a case approach to 196 observations on both monopoly and merger cases investigated by the German Federal Cartel Office between 1985 and 2000. Finally, Neven and Röller (2000) discuss the tenets underlying a competition policy investigation, albeit as a premise to a theoretical discussion of jurisdictional conflict. None of these papers look at profitability data and so are only tangentially related to our paper. Indeed the role of profitability, particularly accounting profitability has been the centre of considerable debate in economics for many years.[3]

Commission will be referring either to the UK Competition Commission (as it is now called) or the MMC (as it was called before the 1998 Competition Act).

[2] Office of Fair Trading, Assessing Profitability in Competition Policy Analysis (July 2003).

[3] See Fisher and McGowan (1983) and the ensuing literature. Grout and Zalewska (2007) includes a summary of the issues.

The structure of the paper is as follows. Section 2 provides a semi-formal model of the process we consider. Here the government agency, usually the competition authority, is aware that a company is able to adjust profitability data during the investigation period and the government agency adjusts its interpretation of this evidence, compared to pre-investigation profitability data, accordingly. The company knows that the government assumes that the company will reduce profitability during investigation and so has to reduce reported profitability to prevent the government agency concluding that profits are increasing (potentially indicating that the company is more likely to be taking advantage of a monopoly position). The model has an equilibrium where the extent that the government agency predicts that the company will try to manipulate profit is exactly equal to the level of "manipulation". So the whole process is self-defeating in one sense but is the natural outcome of the investigative process. The actual profit in any period depends on a stochastic process so observed outcomes are random but a conclusion of the model is that, other things equal, the expected pre-investigation profit will be greater than the expected value of reported profit during the investigation period. Section 3 of the paper outlines the data we use to test this prediction. Section 4 provides the empirical results. We assume that profit in any year depends on the profit of the previous year and various other factors. We then ask if the profit level is also sensitive as to whether the reported measure comes from within the investigation period or is pre-investigation. We show that the during-investigation dummy is negative and significant. Section 5 discusses these results.

2. Theoretical model

In this section we provide a semi-formal discussion of a model. The model has two periods, period 0 and period 1. At the start of period 1 the company is unexpectedly investigated for potential abuse of a monopoly position. During the investigation the government agency collects data on profitability and other relevant information about the case. We denote the latter by *Z*. The company cannot influence *Z* or profit reported in period 0. However, the company is able to implement some unobservable effort which is costly but reduces the observed profit in period 1 by an amount *e*. There is an underlying level of profitability for the company, π^*, and the probability that the government agency will find the company guilty depends on the government agency's estimate of the underlying level of profitability and *Z*. A lower estimate of π^* reduces the probability of being found guilty. Let *p* denote the probability of the company being found guilty.

The cost to the company of implementing effort to reduce reported profit by *e* is *c*(*e*). This is a differentiable increasing convex function of *e* with derivative of zero at *e* = 0. Furthermore, we make the realistic assumption that there is a limit as to how far the company can manipulate the profit. Specifically, there is a bound $\bar{e}$ on *e* such that the cost of effort approaches infinity as *e* approaches $\bar{e}$ from below. Let the reported profit in period 1 be denoted by π_1, and the level of profit if there is no manipulation be denoted by π_{1n}. Hence the reported period 1 profit is equal to:

$$\pi_1 = \pi_{1n} - e .$$

We assume that profit generated by the company in period 0 is a random variable normally distributed with mean π^*, and variance σ^2. Therefore, the pre-investigation profit, π_0, can be expressed as:

$$\pi_0 = \pi^* + \varepsilon , \tag{1}$$

where π^* is the "true" underlying profit level and ε is a normally distributed random variable, i.e., $\varepsilon \sim N(0, \sigma^2)$.[4] If there is no manipulation of the profit, i.e., *e* = 0, then we assume that profit in period 1 depends on the 'true' underlying profit and the level of profit that is 'drawn' in period zero. Specifically, we assume:

$$\pi_{1n} = \alpha\pi^* + (1-\alpha)\pi_0 + \varepsilon , \tag{2}$$

where the parameter $\alpha \in [0, 1]$.

Assume that the company has to choose *e* at the start of period 1, i.e., before the company knows the exact value of π_{1n}. That is, when the choice of *e* is made the company knows that π_{1n} will be determined by Eq. (2) but does not know the "draw" from the distribution. The government agency knows that a company will manipulate the profit in period 1, but does not know by how much. The government agency holds a belief of how much effort the company makes to reduce its reported profit in period

[4] Here we are analysing the position of a single firm under investigation. If we imagine that the firm is picked for investigation from a potential pool of firms then this relationship between pre-investigation profit and underlying profit implicitly assumes that there is no sample selection such that firms that have an abnormally high pre-investigation profit are more likely to be chosen. This is a reasonably good assumption in practice since an abuse generally only involves a small part of a company's activities and the profitability of this part of the company only becomes known upon detailed investigation.

1. This belief is denoted by $\hat{e}$. Given $\hat{e}$ the company will choose a level of manipulation, e^*, i.e., e^* is a function of $\hat{e}$. We define an equilibrium $(\hat{e}_E, e_E^*)$ as a fixed point ($e^* = \hat{e}$) of this function, i.e., if the government agency believes that the effort level is $\hat{e}_E$ and the company knows this belief then the company will indeed choose effort equal to $\hat{e}_E$.

We assume that the behavioural function for the government agency that determines the probability of the company to be found guilty, *p*, is of the form

$$p = f\left(\hat{\pi}^*, Z\right), \tag{3}$$

where Z denotes all other relevant observable characteristics of the case and $\hat{\pi}^*$ denotes the government agency's estimate of π^*. To ensure the second order conditions are satisfied the partial function of f with respect to $\hat{\pi}^*$ is assumed to be an unbounded convex function.

Given that the government agency's belief of how much the company manipulates its profit in period 1 is $\hat{e}$ then, if the reported profit in period 1 is π_1, the government agency's belief of the non-manipulated profit in period 1 is $\pi_1 + \hat{e}$. Given this belief Eq. (2) provides a period 1 estimate of π^*, i.e.,

$$\frac{\pi_1 - (1-\alpha)\pi_0 + \hat{e}}{\alpha} - \frac{\varepsilon}{\alpha}.$$

This is also a period 0 estimate of π^* (from Eq. (1)), i.e., it is equal to $\pi_0 - \varepsilon$.
Therefore, using Bayes' theorem, we have:

$$\hat{\pi}^* = \gamma\pi_0 + (1-\gamma)\frac{\pi_1 - (1-\alpha)\pi_0 + \hat{e}}{\alpha}, \tag{4}$$

where $\gamma = 1/(1+\alpha^2)$. Note, that γ depends only on α because of the simple process that determines π_0 and π_{1n}. The government agency always puts more weight on the pre-investigation period profit level.

On the assumption that the company is profit maximising, the company will seek to minimise the sum of the expected cost of being found guilty, i.e., the expected value

of the fine, *pF*, plus the cost of manipulation, *c*(*e*). More precisely, for given π_{1n}, the company wants to solve:

$$\min_e \left(pF + c(e) \right),$$

or, using Eqs. (3) and (4):

$$\min_e \left(f\left(\gamma\pi_0 + (1-\gamma)\frac{\pi_1 - (1-\alpha)\pi_0 + \hat{e}}{\alpha}, Z \right) F + c(e) \right). \tag{5}$$

Therefore, for given π_{1n} the minimisation problem becomes:

$$\min_e \left(f\left(\gamma\pi_0 + (1-\gamma)\frac{\pi_{1n} - e - (1-\alpha)\pi_0 + \hat{e}}{\alpha}, Z \right) F + c(e) \right),$$

However, the company does not know π_{1n} at the time of determination of *e*. Therefore, the minimisation problem is:

$$\min_e E\left(f\left(\gamma\pi_0 + (1-\gamma)\frac{\pi_{1n} - e - (1-\alpha)\pi_0 + \hat{e}}{\alpha}, Z \right) F + c(e) \right). \tag{6}$$

Let e^* be the argmin of Eq. (6). $e^*(\hat{e})$ is a non-decreasing function. Fig. 1 shows the function for given parameters values and given realisation of π_0. Note that e^* is always strictly less than $\bar{e}$. So e^* is less than $\hat{e}$ at $\hat{e} = \bar{e}$. Furthermore, because the derivative of *c*(*e*) is zero at *e* = 0, e^* will be greater than 0 at $\hat{e}$=0. Continuity implies that there must be at least one fixed point. Hence we have equilibrium. In equilibrium:

$$e_E^* = \hat{e}_E > 0.$$

That is, the government agency believes that the company manipulates profit by an amount $\hat{e}_E > 0$, the company knows that this is what the government agency believes and it exactly chooses $e_E^* = \hat{e}_E > 0$, i.e., exactly fulfils the government agency's expectations.

It follows that in equilibrium:

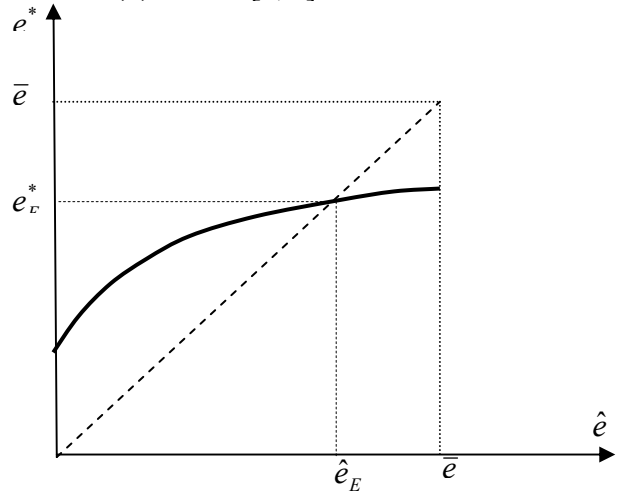
$$E(\pi_0) = \pi^*,$$

and

$$E(\pi_1) = \alpha\pi^* + (1-\alpha)E(\pi)_0 - e^* = \pi^* - e^*.$$

Hence, $E(\pi_0) > E(\pi_1)$.

Figure 1. Function $e^*(\hat{e})$ for $\hat{e} \in [0, \bar{e}]$.



3. Data

To address the question of whether companies under investigation of abusing market power manipulate profitability data we analyse a sub-sample of companies examined by Garside, Grout & Zalewska (2008), i.e., our sample consists of 39 cases out of 86 analysed by Garside et. al. (2008). That is we analyse all the anti-competitive investigations conducted by the CC in the period 1970-2003 for which information about return on capital employed (ROCE) has been disclosed in the final report produced by the CC.

3.1 Definition of Pre- and Within-investigation profitability

As part of its activities, the Office of Fair Trading (OFT) identifies market situations potentially harmful to competition or to the public interest. Faced with the possibility of undesirable likely economic consequences, the Director-General of OFT makes a reference to the CC, specifying which actions deserve further scrutiny.[5] The date when the reference is made marks the beginning of the CC investigation. In our

[5] "In general, the OFT considers that the likely effect of a dominant undertaking's conduct on customers and on the process of competition is more important to the determination of an abuse than the specific form of the conduct in question." OFT, December 2004, *Abuse of a dominant position – Understanding Competition Law*, OFT 402, p.18.

dataset we use the year when the investigation starts as the starting year of the within-investigation period. Obviously, if a company was subject to the OFT's referral to the CC early in the calendar year it would have more scope to undertake actions that could lower the ROCE statistics than a company that was referred to the OFT at the end of the year. Therefore, taking the year of referral as the cutting point may weaken our results, however, to free ourselves form a suspicion of data massaging we treat all companies in the same way.

The availability of the pre- and the within-investigation data varies from case to case. For majority of the companies only one within-investigation ROCE is available. For some companies, however, two and even three ROCE observations are available for the within-investigation period. Similarly, most of the companies provide no more than two or three pre-investigation ROCEs. At the other extreme, one company has 14 years of pre-investigation data. While it is tempting to use longer histories where available, adding such long runs of data puts too much weight on those few who provide more observations leading to their over-representation in the sample. Moreover, we believe that very recent pre-investigation ROCE data points are more appropriate for our analysis than distant pre-investigation observations as the OFT's practice is to act quickly to prevent abuse.

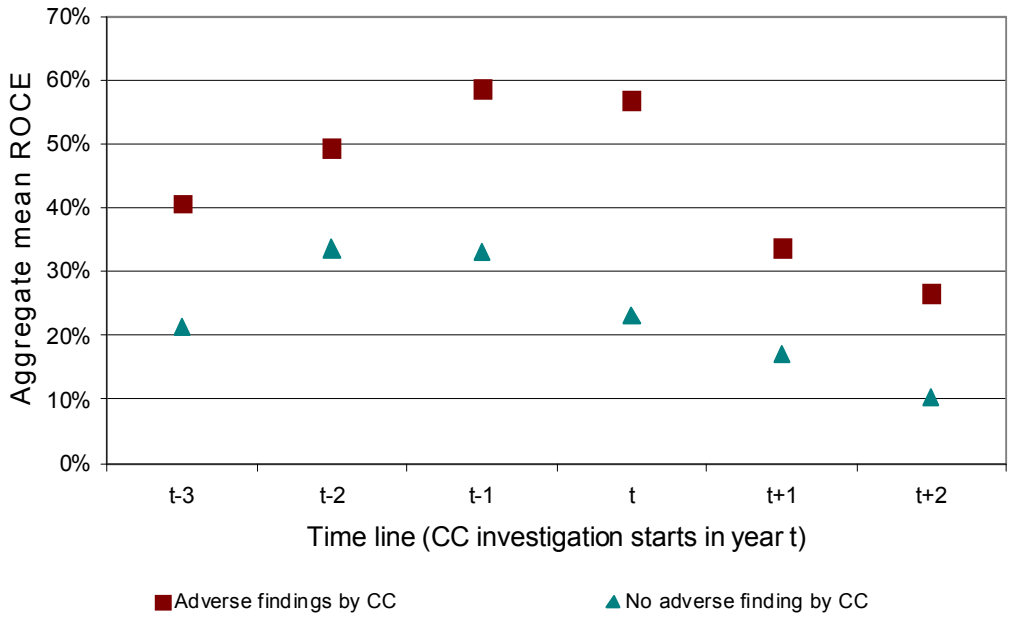
Following from this the core analysis is based on a sample that included three years of pre-investigation ROCE and three years of the within-investigation ROCE as the ceiling criteria. In other words, in the core regressions in total no more than six profit observations per company are used. To test for robustness of our findings we also use (i) seven observations per firm (i.e., 4 pre-investigation years and 3 withn-investigation years) and (ii) all the available data. As is shown in Section 4, results are not sensitive to whether the six or the seven years intervals of ROCE are used but are slightly weaker when every profitability figure is included in the regression.

The correlation between two consecutive ROCE observations in the sample based on the six-year window is over 81% (see Table 1). This is consistent with our expectations that yearly company performance figures are correlated across time. This feature of the profitability was captured in the theoretical model presented in Section 2. Note, we also use first differences as a dependent variable in the regression analysis.

To give an overview of the data and feel for the results Figure 2 presents average ROCE statistics for all the cases included in the sample for three year before the investigation starts (years denoted t-3, t-2, t-1), and three years of within-investigation

(years denoted t, t+1, t+2). A separation between companies that were found guilty (denoted by squares) and those that were not found guilty (denoted by triangles) is made. It is clear that profitability declines as investigations start. This is in contrast to the steady increase in ROCE in the pre-investigation period. Interestingly, although, cases that are not found guilty seem to be characterised by lower ROCE in the pre-investigation period, they also display a larger drop than cases that are subsequently found "guilty" during the year of referral.

Figure 2: Average ROCE statistics in a 6-year window calculated for 39 firms with the highest market share in the corresponding case with separation for innocent and guilty verdicts.



We should stress that we do not correct the ROCE statistics for differences in company risk. There are two reasons for doing so. One is that the CC do not calculate company risk measures (e.g., via the Capital Asset Pricing Model) and do not discuss them in the reports. Therefore, as legally the CC should not use evidence to come to a decision that they do not report practically, there is no reason to suppose risk adjustment (in a formal finance term) affects their decision. Second, the spread and scale of the ROCE numbers is so large that adjustment for companies' risk changes over time (using any sensible range for the equity risk premium) would have

negligible impact on the relative differences in ROCE between periods, hence, it can be ignored without any impact on the results.[6]

3.2 Probability of being found guilty

Being investigated does not necessarily mean being guilty although as Garside et al. (2008) show in more than 50% of investigations end with adverse finding. Indeed, it is shown that in 60 cases out of 85 at least one company was found guilty of at least one anti-competitive conduct, and at the firm level 270 individual filings were with adverse finding out of 431being investigated. They also show that there are several factors that can help predict whether a company will be found guilty or not. In particular, the experience of the chairman of the panel, the proportion of women sitting on the panel, the market share of the biggest investigated company and whether a company was investigated for more than one anti-competitive conduct were always highly significant across various specification models. In addition, their core model included such control variables as whether it was a repeated investigation and how many companies were investigated in a year when a particular investigation started in order to control for the atmosphere towards businesses. Using the Garside et al. (2008) regression model and their full sample of 431 companies to estimate coefficients of the model specification we calculate probability of being found guilty for the companies selected for this study.

In addition to the above specification we also employ a prediction model which excludes 'human factors', i.e., does not use the experience of the chairman and the gender ratio of the investigating panel in the equation specification that estimates the probability of being found guilty. This is done to restrict the calculations of the probability of being found guilty to the information available when a company is referred to the CC (and hence no chairman and panel is assign to the case). Unless otherwise indicated, the terminology "predicted findings" refers to the first prediction procedure based on Garside et al. (2008).

Figure 3 shows the relationship between companies profitability (horizontal axis), actual finding (1 denotes guilt and 0 denotes not guilty) and the calculated probability of being found guilty (vertical axis). The profitability per company is calculated as the

[6] Grout and Zalewska (2006) find significant beta changes due to anticipated major policy changes. However the effects on beta are less than 0.5 so it is reasonable to suppose that the changes in company betas during the years where profitability data is used are likely to be less than 0.5.

mean of ROCE for the six-year window. It is clear that our prediction of guilt is close to the CC's finding. Indeed, if we take the 50% probability as the cutting point, i.e., ask the question of how many companies that were found guilty (not found guilty) had the estimated probability of being guilty more (less) than 50%, the answer is 20 (8), that is in total in 28 cases out of 39 considered, we were close to the true outcome of the investigation.

Figure 3 also shows that there is an outlier in the sample with a ROCE statistic far above the group. Further details of the data set are given in Tables 1 and 2.

Figure 3: Scatter diagram of predicted and actual findings against mean ROCE per firm in 6-year window dataset (39 firms)

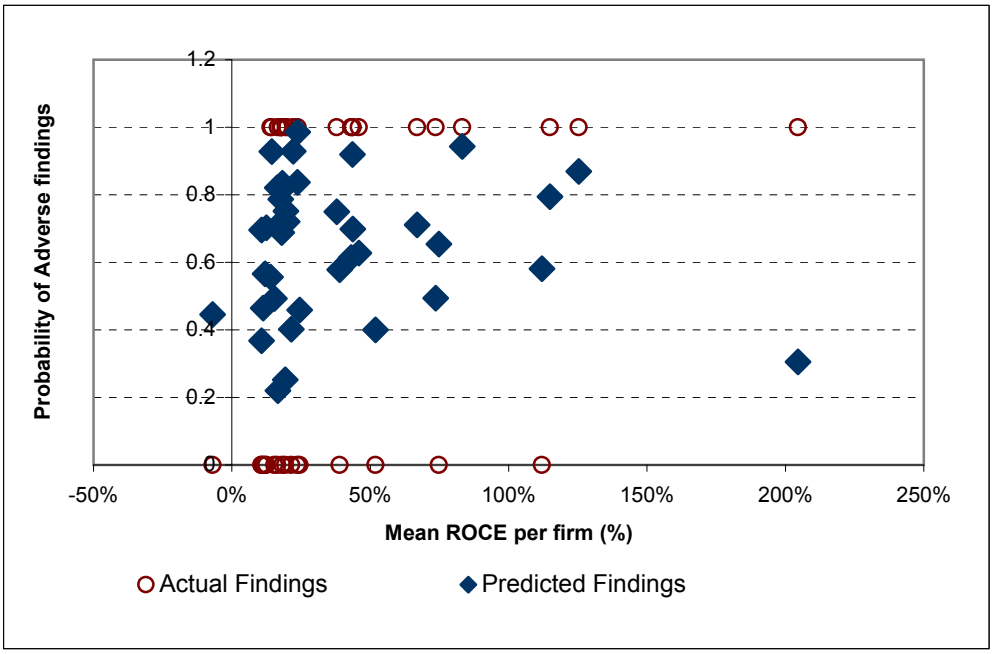


Table 1. Correlation matrix of key variables in 6-year window dataset ($N = 121$)

	ROCE	Lagged ROCE	Within-investigation	Actual adverse finding	Predicted finding
ROCE	1				
Lagged ROCE	0.815	1			
Within-investigation	-0.074	0.059	1		
Actual Adverse finding	0.262	0.253	0	1	
Predicted finding	-0.063	-0.036	0	0.378	1

Table 2. Mean and range of key variables in the 6-year window dataset (N = 121)

Variable	Mean	Range	
Difference in ROCE	2.2%	-173.6%	146.8%
ROCE	42.2%	-33.3%	315.1%
Lagged ROCE	40.0%	-75.5%	315.1%
Within-investigation	0.37	0	1
Predicted finding	0.65	0.22	0.99
Actual adverse finding	0.57	0	1

4. Regression Results

In most regressions ROCE is used as the dependent variable and regressed on one-period lagged ROCE, GDP growth (to control for a business circle), adverse finding (actual or estimated probability), the within-investigation dummy (1 if within the period of investigation and 0 otherwise) and further case characteristics. While the various cases are independent from one another, ROCE within a given case are not. If we do not take account of this correlation we under-estimate standard errors. Hence, we cluster our data by case to obtain robust standard error estimates.

4.1. Main regressions

Table 3 shows regression results that use ROCE (first six columns) and difference in ROCE (columns 7 and 8) as the dependent variable and lagged ROCE (but for the difference regressions), GDP growth (annual GDP growth at constant 2000 prices), predicted finding (as described in Section 3.2) and within-investigation dummy as the independent variables. It is clear that results do not differ whether the six-year window or the seven-year window of the ROCE data are used. The coefficient of the lagged ROCE is positive and significant at the 1% level across all model specifications. The within-investigation dummy, however, is negative indicating that when the CC's investigations start they negatively impact on current profitability. The coefficient is significant at the 5% level for the 6-year and the 7-year window, but declines to the 10% level when all available observations are used. As already discussed, the decline in the significance and the absolute size of the coefficient may result from the fact that when all available data are used a high weight is put on very

distant observations that might not have much explanatory power for the case under investigation. Therefore, in the further columns results for the six- and seven-year windows will be presented.

The regressions shown in columns five and six check for robustness of the results by excluding the GDP growth variable, and the regression presented in column six adds a dummy for the company that had an abnormally high ROCE[7] as compared with the other rest of the sample. The results remain unaffected. The last two columns of Table 3 use the difference in ROCE as the dependent variable. Again, the coefficient of the within-investigation dummy remains negative and statistically significant at the 5% level.

Since adding an extra year does not increase the number of companies but only enlarges the number of observations per company, and since these extra observations do not bring anything new to the analysis in the follow-up analysis we use the six-year window only.

Table 3. Regression results for six-, -seven year windows and for all available ROCE observations.

Dependent Variable	ROCE						Difference in ROCE	
	Length of the window in years							
	6	7	All	6	7	6	6	7
Constant	0.185	0.182	0.137	0.206	0.209	0.129	0.119	0.125
	(0.134)	(0.122)	(0.095)	(0.152)	(0.142)	(0.102)	(0.084)	(0.088)
Lagged ROCE	0.854***	0.839***	0.837***	0.852***	0.834***	0.711***		
	(0.061)	(0.052)	(0.047)	(0.064)	(0.056)	(0.187)		
GDP growth	0.013	0.017	0.014			0.017	0.014	0.019
	(0.013)	(0.012)	(0.009)			(0.016)	(0.015)	(0.014)
Predicted finding	-0.127	-0.154	-0.103	-0.107	-0.130	0.001	-0.113	-0.165
	(0.164)	(0.154)	(0.121)	(0.149)	(0.144)	(0.141)	(0.126)	(0.132)
Within-investigation dummy	-0.140**	-0.119**	-0.101*	-0.147**	-0.127**	-0.124**	-0.150**	-0.132**
	(0.065)	(0.058)	(0.051)	(0.068)	(0.063)	(0.048)	(0.070)	(0.065)
Outlier case dummy						0.670*		
						(0.384)		
Observations	121	152	190	121	152	121	121	152
Adjusted R^2	0.69	0.71	0.71	0.69	0.70	0.72	0.09	0.09

Next, using the six-year window set-up we take into account a variety of case characteristics. First, we test whether different types of anti-monopoly conducts that are specified by the OFT at the start of the investigation in its reference to the CC affect the size and the significance of the within-investigation dummy. To test for it

[7] Bryant & May Ltd, investigation report Cm 1854, *Matches and Disposable Lighters*, published 1992.

we create a set of dummies that take value 1 when a company is investigated for a particular conduct, and zero otherwise. We also control for the number of companies in the case and market share inequality defined as the ratio of the largest market share to the combined second and third largest market shares on the reference market. Results are presented in Table 4.

As in the previously discussed regression specifications the estimated coefficients of the lagged ROCE and the within-investigation dummy are significant. They also preserve the sign and magnitude. Similarly, the regression with the first difference in ROCE as the dependent variable remains unaffected when anti-monopoly conduct dummies are added.

It is possible that there are firm specific effects that have not been explicitly modelled. The difference equations in Tables 3 and 4 would not suffer from any such problem since a firm specific effect would cancel out as a result of taking the difference in profitability as the dependent variable. Then we 'difference' the regressions, i.e., take the equation for t-1 away from the equation for t, and estimate the difference equation. All variables drop out except for the difference in lagged profitability, the difference in the within-investigation dummy and the difference in the GDP growth. The difference in the within-investigation dummy is tantamount to a "start of investigation" variable taking the value of one for the first financial year during the CC investigation and zero otherwise. We regress these on the six-year and seven-year windows. Table 5 shows the results and proves that, although taking differences reduces the number of observations that we can use and we are "pushing the data" so to speak, the within investigation dummy has the correct sign and is significant at the 10% level in the both regressions. This suggests that either there are no firm specific effects or if there are firm specific effects they are not significant for our results.

Table 4. Evidence on case characteristics

Table 4. Regression results

Dependent Variable		ROCE				Difference in ROCE	
Constant		0.302*	0.289*	0.223	0.181	0.196*	0.187
		(0.170)	(0.161)	(0.158)	(0.128)	(0.112)	(0.112)
Lagged ROCE		0.821***	0.836***	0.844***	0.831***		
		(0.052)	(0.050)	(0.066)	(0.087)		
GDP growth		0.013	0.013	0.013	0.012	0.016	0.014
		(0.011)	(0.011)	(0.013)	(0.013)	(0.014)	(0.013)
Predicted finding		-0.029	-0.052	-0.152	-0.153	-0.030	-0.044
		(0.202)	(0.156)	(0.178)	(0.182)	(0.125)	(0.100)
Dummy	Within-investigation	-0.158**	-0.158**	-0.141**	-0.140**	-0.168**	-0.168**
		(0.070)	(0.069)	(0.065)	(0.064)	(0.078)	(0.077)
	Monopoly pricing	-0.130				-0.146	
		(0.123)				(0.093)	
	Discriminatory pricing	-0.217*				-0.182*	
		(0.110)				(0.099)	
	Collusive pricing	-0.180				-0.137	
		(0.119)				(0.103)	
	Predatory pricing	0.004				0.036	
		(0.087)				(0.074)	
	Pricing practice	-0.136	-0.111			-0.113	-0.096
		(0.093)	(0.081)			(0.076)	(0.069)
	Tie-in Sales	-0.021	0.004			0.033	0.049
		(0.113)	(0.104)			(0.106)	(0.102)
	Vertical integration	-0.124*				-0.082	
		(0.065)				(0.058)	
	Exclusive distribution	-0.167*				-0.110	
		(0.094)				(0.078)	
	Exclusive purchasing		-0.142				-0.127
			(0.100)				(0.088)
	Exclusive restraint		-0.155*				-0.095
			(0.087)				(0.072)
Number of firms investigated				-0.153			
				(0.129)			
Market share inequality					0.104		
					(0.118)		
Observations		121	121	121	121	121	121
Adjusted R^2		0.71	0.71	0.69	0.69	0.13	0.13

Table 5.

Dependent Variable	Difference in ROCE	
	6-year window	7-year window
Constant	0.054*	0.050*
	(0.030)	(0.027)
Lagged difference in profitability	0.315**	0.329**
	(0.149)	(0.137)
Difference in within-investigation dummy	-0.153*	-0.151*
	(0.090)	(0.088)
Difference in GDP growth	0.011*	0.011**
	(0.006)	(0.005)
Observations	113	129
Adjusted R^2	0.13	0.13

4.2. Different specifications of the "adverse findings" variable

As the next step of robustness check we apply a different definition of the predicted finding variable. We make use of the alternative prediction specification that excludes information about the chairman and the investigating panel, and, in addition to it, we use the actual findings (1 for found guilty and zero otherwise). Results are presented in Table 6.

The sign and magnitude of the coefficients on the predicted adverse finding variable varies from one specification to the next, and are usually insignificant or only very narrowly significant at the 10% level. Hence we also regress our model excluding any predicted or actual findings. Throughout the three specification the coefficients and significance levels of the lagged ROCE and of the within-investigation dummy remain stable.

Finally, we apply the same three specifications to the difference in ROCE as the dependent variable. As previously the coefficients estimated for the within-investigation dummy are negative and significant at the 5% level.

Table 6. Regression results for alternative specifications of the "adverse finding" variable.

Dependent Variable	ROCE			Difference in ROCE		
Constant	0.090* (0.047)	0.356** (0.171)	0.105** (0.044)	0.051 (0.040)	0.256** (0.119)	0.049 (0.032)
Lagged ROCE	0.847*** (0.048)	0.840*** (0.058)	0.857*** (0.054)			
GDP growth	0.012 (0.012)	0.018 (0.013)	0.012 (0.012)	0.013 (0.013)	0.019 (0.015)	0.013 (0.013)
Actual adverse finding	0.034 (0.045)			-0.003 (0.044)		
Adverse finding predicted without information about the chairman and panel		-0.408* (0.218)			-0.346* (0.173)	
Within-investigation dummy	-0.138** (0.065)	-0.131** (0.062)	-0.140** (0.065)	-0.150** (0.070)	-0.143** (0.068)	-0.150** (0.070)
Observations	121	121	121	121	121	121

Adjusted R^2	0.69	0.70	0.69	0.08	0.11	0.08

5. Conclusions

In this paper we consider whether companies change their behaviour and manipulate their profitability data in response to regulatory investigations. In particular, we investigate whether companies' reported profitability during an investigation of "abuse of a monopoly position" tends to be lower than pre-investigation profitability. Given that the government agency knows that the company tries to reduce reported profit and the company knows that the government agency knows that the company tries to reduce reported profit, then it is useful to model the process to show that the equilibrium will indeed involve expected falls in profitability data. We show that such an equilibrium exists. We then test this proposition on evidence from UK competition cases and find that there are significant differences in reported profitability during an investigation when compared to pre-investigation profit levels.

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