

Divide and Conquer: A Fresh Look at Media Capture

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Abstract: In this paper, we present a general model of media capture where a government attempts to buy-out media firms in order to engage in corruption with relative immunity. In particular, we relax the assumption made by Besley and Prat (2005) that each firm would individually be able to completely expose the government if it were left unpurchased. On the contrary we assume that any given firm's ability to substantiate its allegations would depend at least partly on how many other firms were also taking such a stand. Hence if more firms were to raise allegations, it would tend to enhance their credibility and thus contribute positively to a firm's payoff (the "credibility" effect). However, on the flip side, if the allegations were indeed substantiated, then the gain from the scandal would be shared among a larger group of firms, tending to reduce this payoff (the "share" effect). Accordingly, we identify two cases. In the first case, the credibility effect dominates the share effect such that the expected payoff to any firm increases as more firms raise corruption allegations. In the second case, the opposite is true. We analyse the pattern of media capture and incentive for corruption under both the cases. We find that for the second case results are similar to the findings of Besley and Prat (2005), who suggest that media capture would typically involve purchase of all firms, and that each firm would have to be at least paid a bribe equal to the highest payoff from exposure. Further as the number of firms in the media increased, the expected payoff from corruption would fall thus contributing to deterrence. For the first case, we get some new and interesting insights. Firstly, even when corruption would involve purchase of all firms, the government could reduce bribes paid by employing the "divide and conquer" strategy so that the highest bribe would be paid to only one firm and the rest would get successively lower bribes. Further, it may not always be optimal to buy all firms. There could be conditions under which corruption could be supported most profitably by buying only a subset of firms. Both these findings tend to undermine the deterrent effect of having multiple firms within the media. In fact, even more strikingly, we find that under certain conditions, the expected payoff from corruption may increase as the number of firms in the media increases. Hence under the first case, an increase in the number of firms in the media might even land up contributing to corruption rather than enhancing deterrence.

1. Introduction

The existence of an independent and vigilant media is often considered as a pre-condition for keeping governments accountable.¹ However, what is less

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¹ For a formal attempt at defining media independence see Besley and Prat (2005). On the potential role of mass media on governance, see Besley and Burgess (2001), Besley and Prat (2005), Stapenhurst (2000), Stromberg (2001), Vaidya (2005a), and Vaidya (2005b).

understood are the conditions under which we would have an independent and alert media. If the government could indeed buy the media with relative ease, then it could engage in corruption with little to fear.² Hence improving our understanding of the circumstances under which media might be captured is a crucial first step in formulating any policy initiative aimed at strengthening media independence. In this context, the existing literature (see Besley and Prat (2005)), seems to take the position that a competitive media sector comprising of multiple firms is a good deterrent to media capture. It is argued that in order to avoid exposure, the government would have to buy media firms. If any firm were left out, it would release its evidence to the public which would expose the government. Hence each firm would be in a commanding position to extract a sizable bribe. As the number of media firms increases the government would have to spend more on bribery, which would make corruption more expensive, and ultimately unprofitable.

In this paper, we present a more general and realistic model to analyse media capture than in Besley and Prat (2005) and argue that while their assertion (as summarized above) is indeed valid, it represents only a special case among the other possible ways in which media might be captured. In particular, their assertion rests on the assumption that each firm would be in a position to find a compelling piece of evidence that would leave the government exposed. In our analysis, we relax this assumption. This is because we think that in reality the evidence that the media presents need not always be totally compelling and governments often do survive media scandals unscathed.³ Hence in this paper we posit that whether media

² Such media collusion is not uncommon in countries such as Russia and Peru. For media collusion in Russia, see Albats (1999). McMillan and Zoido (2004) provide a detailed account of media capture in Peru.

³ For example allegations regarding entrenched police corruption during Joh Bjelke-Peterson's tenure as premier of Queensland in Australia, could not destabilize the government until fairly compelling evidence was broadcasted in the Australian Broadcasting Commission's program "The Moonlight

allegations would be compelling or not would itself depend on the number of firms within the media that raise allegations. If more pursue corruption allegations, they might appear more compelling to the public than if only a few did so. We call this the “credibility” effect. Such a credibility effect could exist not only because as more firms attempt to expose, more evidence might be brought to public attention, but also because corroboration from a variety of media sources might have a greater appeal to the public.

Hence in our framework as more firms raise allegations, the credibility effect tends to increase each exposing firm’s chance of winning and contribute to its payoff positively. However, on the other hand as more firms attempt to expose, it also increases the claimants of the gain from scandal (if successful) which tends to reduce each firm’s payoff. We call this the “share” effect. This allows us to identify two distinct cases. In the first case, the credibility effect dominates the share effect so that each exposing firm’s expected payoff increases as more firms within the media raise allegations, while in the other case just the opposite is true. As we will demonstrate, these two cases have considerably different implications for media capture and profitability of corruption.

In the first case, the media is more powerful collectively than individually. Such a case might arise if the evidence of corruption is dispersed widely across the media sector such that each individual firm does not have enough to make a powerful story. However, when many expose simultaneously, it might lead to preponderance of evidence against the government. Further in this case, as the government buys more and more firms, it imposes a “negative externality” on the remaining firms as their payoff from exposing corruption gets reduced. Indeed, we get some fresh insights on

State” on May 1987. The government’s ability to deflect allegations prior to this was partly due to its exceptional public relations campaign. See Tiffen (1999) for further details.

media capture from this case by applying the emerging literature on contracting with externalities.⁴ Firstly, the government need not have to pay the highest bribe to all the firms if it wishes to buy them. By practising “divide and conquer”, the government needs to pay the highest bribe to only one firm. It would pay successively lower bribes to the remaining firms. This in itself tends to encourage corruption by reducing bribe payments. Secondly, the government need not necessarily feel the need to buy all firms to engage in corruption. The government might prefer to engage in corruption by buying fewer firms, as it would reduce bribe payments, and still generate a reasonable “survival” probability by reducing the credibility of the allegations of the exposing firms. Finally, even more surprisingly, within this case, we identify conditions under which an increase in the number of firms in the media might increase the government’s expected payoff from corruption despite the fact that more firms need to be bribed.

However, in the second case, each media firm is more powerful individually. This could represent a situation where each firm possesses sizeable evidence to make its allegations persuasive and the marginal contribution to credibility from evidence released from other sources might be small as compared to the greater division of the gain as more firms join in. Further, in this case as the government buys more and more firms, it confers a “positive externality” on each of the remaining firms as its payoff from exposing corruption gets enhanced. In this case we find that “divide and conquer” strategy no longer applies and indeed to universally buy all the firms the government would have to pay the highest payoff from exposure to each firm. Similarly, as the number of firms in the media increase, the expected payoff from corruption falls thus contributing to deterrence. These results tend to corroborate the

⁴ See Segal (2003) and Genicot and Ray (2004) for more general theoretical analysis on contracting with externalities.

findings of Besley and Prat (2005). However, we consider a more general information structure (with regard to the evidence available to media firms) than the one assumed by Besley and Prat (2005). To this effect, our analysis helps clarify exactly the circumstances in which their results are applicable in a more general setting.

Our paper is organised as follows: Section 2 describes the model – the timing of game examined, the nature of payoffs and the key assumptions. Sections 3 and 4 analyse media capture under the two alternative cases, respectively. Section 5 examines the impact on media capture and corruption as the number firms in the media increase. Section 6 concludes the paper.

2. Examining media capture using a two-stage bribery game

Our analysis of media capture involves interaction between the government, and $N (\geq 2)$ symmetric firms in the media in a two-stage game.

In stage 1, the government decides whether or not to enter into a corrupt deal by choosing between CR and NCR, where CR stands for choice in favour of corruption and NCR for refraining from it. Should the government choose CR it could earn additional rents amounting to α_G over and above the payoff from NCR (normalized to unity). However, it might run the risk of facing allegations in the media. If the allegations gain momentum, government could lose everything including the rents from corruption and the normal benefits of remaining in office.

The government's move of choosing CR or NCR is privately observed by all the firms in the media.

Should the government choose CR, the game proceeds to stage 2 where the government first decides on a vector of bribes, hereafter referred to as a “bribe profile”, (b_1, b_2, \dots, b_N) that it might offer to the N firms respectively, where

$b_i \in [0, \infty)$, $i = 1, 2, \dots, N$.⁵ Following this, each firm simultaneously decides whether to accept the bribe and remain silent (A) or not accept and raise allegations (E). If all firms accept their bribes, the corruption goes undetected and the payoffs to all the parties are:

$$\text{Government: } 1 + \alpha_G - \sum_{i=1}^N b_i$$

$$\text{Firm } i: b_i \text{ for } i = 1, 2, \dots, N$$

If at least $i \geq 1$ firms choose E, a scandal emerges and the payoffs to the exposing firms and the government depends on whether the government survives the scandal. Should the media's allegations be perceived as credible then the total potential gain to the sector is $\alpha_M > 0$. This gain is shared among the number of firms that attempt an expose. Hence if i firms attempt an expose and attain credibility, each exposing firm's realized payoff would be $\frac{\alpha_M}{i}$. In this scenario, the government's

realized payoff would be $-\sum_{j=i+1}^N b_j$. Hence it would lose all the benefits from

governance as well as the bribes paid. However, should the government survive the scandal, its realized payoff would be $1 + \alpha_G - \sum_{j=i+1}^N b_j$. Which of these payoffs are

realized depends on the government's probability of surviving the scandal. This probability helps determine the expected payoffs to all the players should a scandal emerge. As stated in the introduction, the existing literature posits that this probability is zero by assuming that each media firm would have access to incontrovertible

⁵ We allow the government to potentially discriminate amongst the firms. Hence all firms need not necessarily be paid the same bribes.

evidence which if revealed to the public would implicate the government with certainty. We depart from this assumption and posit that the government would in general have a positive probability of surviving the scandal as the media's allegations may not necessarily prove to be sufficiently credible. In particular we hypothesize that such a probability would depend on the proportion of firms raising allegations in the media. We express this formally as assumptions 1 and 2 below.

In particular, let π_i^N ($0 < \pi_i^N < 1$) denote the probability of government surviving a scandal in an N-firm media sector when $i \geq 1$ firms raise allegations. We assume the following regarding π_i^N .

Assumption 1: For a given N, π_i^N decreases as i increases so that

$$1 > \pi_1^N > \pi_2^N > \pi_3^N > \dots > \pi_N^N .^6$$

This assumption implies that the government's probability of surviving a scandal diminishes as increasing number of firms within the sector raise allegations of corruption. In other words, corruption allegations gain credibility as more firms in the media support them. As discussed in the introduction, this assumption can be rationalised in the following manner. Firstly, when more firms raise allegations, one can expect greater evidence being uncovered creating more pressure on the government.⁷ One could also expect that when more firms raise the same allegations,

⁶ The existing literature, (in particular Besley and Prat (2005)) only looks at the limiting case where $\pi_1^N = \pi_2^N = \dots = \pi_N^N = 0$.

⁷ In Vaidya (2005b), these probabilities are endogenous and depend on the efforts firms put in relative to the government towards scandal management. In that framework, when both firms investigate, increased competition spurs them to collectively produce greater effort towards producing evidence and hence leads to a greater probability of exposure as opposed to only one firm investigating. Further, such probabilities are also sensitive to the rents from corruption and media's potential prize from exposure. Unfortunately, this framework is not easily adaptable to the question being examined and hence these probabilities are assumed exogenous for analytical ease.

they gain greater coverage and credibility in the public's mind than when only one firm does so. A straightforward outcome of assumption 1 is:

$$1 - \pi_1^N < 1 - \pi_2^N < 1 - \pi_3^N < \dots < 1 - \pi_N^N$$

Hence the collective probability of media emerging victorious is highest when all N firms raise allegations. It keeps decreasing as the number of firms raising allegations diminishes.

Assumption 2: For a given $i < N$, π_i^N increases as N increases

As with assumption 1, assumption 2 also appeals to the enhanced credibility effect when a substantial segment of the media raises or echoes corruption allegations. Hence if one firm in a two-firm media sector raises corruption allegations, its likely to have a higher probability of success than if one firm in a three or a four firm media sector attempts to do so. In a two firm media sector, a single firm would control a large segment of readership, and would naturally have greater credibility as it would be one among the two main news sources. In a three or a four or an even larger media sector, each firm's audience and individual credibility would tend to be smaller.⁸ This property is useful in examining the implications for media capture as the number of firms in the media sector increases.

Obviously as stated earlier, π_i^N plays a crucial role in determining the expected payoffs to the government and the media firms including those who accept bribes and those who do not. They are presented in Table 1 which shows the expected payoffs to media firms and the government for a successively increasing number of firms deciding not to accept a bribe and raise allegations.

[Insert Table 1]

⁸ The paper implicitly assumes that media firms are identical and have an equal share of the news market. Hence it ignores asymmetries within the media sector for simplicity.

While the expected payoffs to the government in table 1 are straightforward to follow, given our discussion of π_i^N , a media firm's payoff from choosing E needs some further explanation. As per the table, when i firms ($N \geq i > 1$) pursue corruption allegations, then each exposing firm would earn $(1 - \pi_i^N) \frac{1}{i} \alpha_M$, as seen in row 5, column 3, in table 1.

Hence, as i increases it unleashes two forces with opposing impact on any given firm's expected payoff from E. Due to assumption 1, $1 - \pi_i^N$ (the probability of attaining credibility) goes up, which tends to enhance the payoff. This is the "credibility" effect as discussed in the introduction. However, the prize from exposing corruption has to be shared among greater number of firms which tends to reduce the expected payoff via $\frac{\alpha_M}{i}$. This is the "share" effect. If the credibility effect dominates, then as i increases the expected payoff to a firm from exposure increases. We refer to this as case 1. However if the share effect dominates, then the opposite is true. We refer to this as case 2. These cases are expressed more formally below.

Case 1 – Negative externality:

$$(1 - \pi_N^N) \frac{1}{N} \alpha_M > (1 - \pi_{N-1}^N) \frac{1}{N-1} \alpha_M > \dots > (1 - \pi_2^N) \frac{1}{2} \alpha_M > (1 - \pi_1^N) \alpha_M$$

Notice that for this case, the highest expected payoff to any exposing firm is when all firms choose E simultaneously. This case is referred to as one involving negative externalities because should the government buy a subset of firms, it effectively imposes a negative externality on the remaining firms by reducing the expected payoff to each of them from E and hence the minimum bribes necessary to purchase their silence. Section 3 examines the implications of case 1 for media capture and corruption as outlined in the introduction in detail.

Case 2 – Positive externality:

$$(1 - \pi_N^N) \frac{1}{N} \alpha_M < (1 - \pi_{N-1}^N) \frac{1}{N-1} \alpha_M < \dots < (1 - \pi_2^N) \frac{1}{2} \alpha_M < (1 - \pi_1^N) \alpha_M$$

In this case, the payoff from E is highest when only one firm pursues allegations. As more firms join in, the expected payoff to any firm from E falls. In contrast to case 1, this case is referred to as one involving positive externalities because should the government buy a subset of firms, that would effectively confer a positive externality on the remaining firms and raise their expected payoff from E. Section 4 examines its implications for media capture and corruption in detail.⁹

Before concluding the section, we provide examples of the types of probability functions π_i^N , $i \leq N$, which might generate cases 1 and 2. This also helps us explore the potential determinants of π_i^N , $i \leq N$.

In particular, consider the following three alternative probability functions:

$$\pi_i^N = \theta + \frac{N-i}{N}(1-\theta), i \leq N \quad (1)$$

$$\pi_i^N = \theta + \sqrt{\frac{N-i}{N}}(1-\theta), i \leq N \quad (2)$$

$$\pi_i^N = \theta + \left(\frac{N-i}{N}\right)^2 (1-\theta), i \leq N \quad (3)$$

Notice that in each of the above functions, $\pi_N^N = \theta$ ($0 < \theta < 1$). Hence θ can be understood as the government's innate reputation or base credibility with the public.¹⁰ Secondly, when $i = 0$, $\pi_i^N = 1$. Hence if no firms raise allegations,

⁹ Formally, Besley and Prat's (2005) analysis on media capture can be interpreted as a specific example of case 2 where $\pi_1^N = \pi_2^N = \dots = \pi_N^N = 0$.

¹⁰ Notice that if θ is closer to 1, then it would represent a scenario where the government enjoys a high degree of credibility with the public relative to the media even when all N firms raise allegations. Exactly the opposite holds when θ is close to 0.

government is assured of survival. Thirdly, as i increases, π_i^N falls towards θ . As more firms attempt to expose corruption, the government's probability of survival diminishes, and approaches its base value.

A quick computation of the first partials of the three probability functions with respect to i and N reveal that they satisfy Assumptions 1 and 2. The difference between them lies in their sensitivity to the proportion of firms that do not raise allegations as measured by $\frac{N-i}{N}$. Since by definition, $0 \leq \frac{N-i}{N} \leq 1$, it follows that:

i. For $0 < i < N$, $\left(\frac{N-i}{N}\right)^2 < \frac{N-i}{N} < \sqrt{\frac{N-i}{N}}$. Hence, for $N > 0$ and

$$0 < i < N, (2) > (1) > (3).$$

- ii. As $\frac{N-i}{N}$ diminishes, π_i^N decreases at a constant rate when (1) holds, at an increasing rate when (2) holds, and at a decreasing rate when (3) holds.

These properties imply that given N and i , the government has a higher probability for survival when (2) holds as compared to either (3) or (1). Further, this probability as per (2) diminishes rapidly as more firms decide to expose corruption. Hence when (2) holds, media firms individually seem to be weak and they gain credibility quickly as more firms attempt to expose. Hence it would be intuitive to expect that for equation (2) credibility effect would tend to dominate the share effect and indeed as illustrated by tables 2 and 3, equation (2) generates case 1. Analogously, equation (3) generates case 2. Equation (1) represents a neutral case where neither positive nor negative externalities are prevalent.

[Insert Tables 2 and 3]

We will refer to these specific probability functions when necessary as we analyse the game of media capture in the presence of negative and positive externality respectively, in the sections 3 and 4. We will make extensive use of them in section 5 where we explore the implications for corruption as the number of firms in the media increase under cases 1 and 2.

3. Examining media capture in the case of negative externality

We begin the analysis of case 1 under the assumption that $N = 2$ (i.e. with only 2 firms in the media). We show subsequently that the basic nature of results would also hold for $N \geq 2$. We begin the analysis in stage 2 where following CR, the government decides on a bribe pair b_1, b_2 following which, the firms decide simultaneously whether to accept or expose. Hence the government can influence the nature of the Nash equilibrium media responses by appropriately choosing the bribe pair. Below we identify the minimum bribes the government must pay to each firm to support the different possible Nash equilibria.¹¹

[Insert Table 4]

Minimum bribes to support (A, A)¹²

A quick look at table 4 would reveal that for (A, A) to be Nash equilibrium, the following must hold:

$$b_i \geq (1 - \pi_1^2)\alpha_M, i = 1, 2$$

¹¹ Implicit in this analysis is the assumption that the government has all the bargaining power and can keep the bribes at minimum levels - the outside options for the media firms. Effectively, the media firms face “take it or leave it” offers. The obvious alternative to this would be to use the Nash bargaining solution to determine the level of bribes. However, we choose the former approach to keep the analysis simple and focus on how the government can alter the media’s outside options by structuring the bribe game suitably. If bargaining power of either firm is considered exogenous, then the main way in which the government would be able to influence the level of bribes would be by altering the outside options which may be acting as threat points as well. Hence we believe that we capture the essence of the problem while keeping the analysis simple. This approach has also been adopted by more general theoretical approaches on contracts with externalities such as Genicot and Ray (2004) and Segal (2003).

¹² Throughout the paper we shall assume that the government has access to an enforcement mechanism such that the media firms cannot accept the bribes and renege on their commitment.

Notice that $(1 - \pi_1^2)\alpha_M$ is the lowest payoff that a firm can expect in this game from exposure. Hence $b_i = (1 - \pi_1^2)\alpha_M, i = 1, 2$ would represent the cheapest “price” for buying silence. However, this might not be the only equilibrium that exists in this bribe range. (E, E) will also be Nash equilibrium as:

$$b_i = (1 - \pi_1^2)\alpha_M < (1 - \pi_2^2)\frac{\alpha_M}{2}, i = 1, 2$$

Comparing the firms’ payoffs for (A, A) and (E, E), each firm will have a higher expected payoff at (E, E).¹³ Hence if the government wanted to ensure (A, A) with certainty, it might consider paying $b_i = (1 - \pi_2^2)\frac{\alpha_M}{2} + \varepsilon, i = 1, 2$ to each firm, where $\varepsilon > 0$ and arbitrarily close to 0.

However, notice that the government can also ensure equilibrium (A, A) by adopting a strategy in which it pays a different amount of bribe to each player. In fact, it can do better and reduce its total bribe disbursements if it adopts this strategy. Suppose the government offers firm 1 a bribe $b_1 = (1 - \pi_2^2)\frac{\alpha_M}{2} + \varepsilon$, and firm 2 a bribe $b_2 = (1 - \pi_1^2)\alpha_M + \varepsilon$. In this case, A becomes a strictly dominant strategy for firm 1. The bribe offer to 1 is higher than the highest expected payoff from E. Hence firm 1 would always accept such an offer. Further, given that firm 1 would always accept, firm 2 cannot expect to earn any higher than the offered bribe should it choose E. Hence firm 2 would also choose A. Hence $b_1 = (1 - \pi_2^2)\frac{\alpha_M}{2} + \varepsilon$ and $b_2 = (1 - \pi_1^2)\alpha_M + \varepsilon$ can support (A, A) as a unique Nash equilibrium. Hence in contrast to the prediction of the existing literature, under case 1, the government need not pay the highest bribe to both the players. By paying the highest bribe to one of

¹³ Since (E, E) yields a higher payoff to each firm than (A, A) in this case, the latter equilibrium would be an outcome of co-ordination failure. If we assumed that firms could avoid this and co-ordinate on the strictly Pareto superior Nash equilibrium then these minimum bribes would not work at all. In their analysis of contracting with externalities Genicot and Ray (2004) actually assume that agents can indeed overcome co-ordination failure.

them and ensuring its acceptance, it can get the other one at a cheaper price as its outside option would be lower.¹⁴ As we show later, this result generalizes to the $N \geq 2$ case.

Minimum bribes to support (A, E) or (E, A)

In this equilibrium, the government captures exactly one firm while the other proceeds to attempt an expose. A quick look at table 4 would reveal that the minimum level of bribes that would support (A, E) would be: $b_1 = (1 - \pi_2^2) \frac{1}{2} \alpha_M + \varepsilon$ and $b_2 = 0$. Similarly, to support (E, A) the minimum level of bribes would be: $b_1 = 0$ and $b_2 = (1 - \pi_2^2) \frac{1}{2} \alpha_M + \varepsilon$.

Minimum bribes to support (E, E)

It would be obvious that $b_1 = 0$ and $b_2 = 0$ would ensure (E, E) as the unique Nash equilibrium of the above game.

It is clear from the above discussion that different levels of bribes would elicit different equilibrium responses from the media. We now examine which bribe structure and the associated media response shall be optimal for the government. In particular, we'll now demonstrate the conditions under which (A, A) or (A, E) would be optimal for the government given its choice of CR. To do this we first list the government's payoffs from different media responses using the above bribe structures as in table 5.¹⁵

[Insert Table 5]

We begin by identifying the conditions under which engaging in corruption (CR) and buying both the firms (A, A) might be optimal for the government. In stage

¹⁴ For a more general discussion of such a "divide and conquer" strategy, see Segal (2003).

¹⁵ For simplicity, the epsilon term is ignored in the table and the analysis based on it.

2, given CR, for (A, A) to be optimal, the government's payoff from (A, A) must exceed its expected payoffs from (A, E) and (E, E). Hence, as table 5 suggests, the following inequalities must hold:

$$(1 + \alpha_G) - (1 - \pi_2^2) \frac{1}{2} \alpha_M - (1 - \pi_1^2) \alpha_M \geq \pi_1^2 (1 + \alpha_G) - (1 - \pi_2^2) \frac{1}{2} \alpha_M \quad (4)$$

$$(1 + \alpha_G) - (1 - \pi_2^2) \frac{1}{2} \alpha_M - (1 - \pi_1^2) \alpha_M \geq \pi_2^2 (1 + \alpha_G) \quad (5)$$

By re-arranging terms in (4), it follows that for it to hold, the following must be true:

$$\frac{1 + \alpha_G}{\alpha_M} \geq 1 \quad (6)$$

Similarly, for (5) to hold it must be the case that:

$$\frac{1 + \alpha_G}{\alpha_M} \geq \frac{1}{(1 - \pi_2^2)} \left[(1 - \pi_2^2) \frac{1}{2} + (1 - \pi_1^2) \right] \quad (7)$$

Hence for (A, A) to be the optimal response given CR, (6) and (7) must hold simultaneously.

Further in stage 1, the government will indeed prefer to go for CR with (A, A) as the media response if along with (6) and (7) the following is also true:

$$(1 + \alpha_G) - (1 - \pi_2^2) \frac{1}{2} \alpha_M - (1 - \pi_1^2) \alpha_M \geq 1. \text{ This in turn implies,}$$

$\alpha_G \geq [(1 - \pi_2^2) \frac{1}{2} + (1 - \pi_1^2)] \alpha_M$. We summarize these conditions in the following proposition.

Proposition 1:

When $\frac{1+\alpha_G}{\alpha_M} \geq \max\left(\frac{1}{(1-\pi_2^2)}\left[(1-\pi_2^2)\frac{1}{2} + (1-\pi_1^2)\right], 1\right)$ and $\alpha_G \geq [(1-\pi_2^2)\frac{1}{2} + (1-\pi_1^2)]\alpha_M$,

the government will engage in corruption and offer bribes such that exposure is the optimal response for both media firms.

The interesting thing to note is that the government's ability to "divide and conquer" can support corruption by reducing the cost of bribing both firms. In fact, as seen in the following proposition, the divide and conquer strategy of paying different bribes in order to buy all the firms generalizes to any $N (\geq 2)$ when case 1 holds.

Proposition 2: *In the presence of negative externalities (i.e.*

$(1-\pi_N^N)\frac{1}{N} > (1-\pi_{N-1}^N)\frac{1}{N-1} > \dots > (1-\pi_3^N)\frac{1}{3} > (1-\pi_2^N)\frac{1}{2} > (1-\pi_1^N)$), *for any given*

$N (\geq 2)$ *players, the cost minimizing bribe structure that would support acceptance by each firm as a unique Nash equilibrium of the bribery game will be one in which the*

bribe received by player i is given by $b_i = (1-\pi_{N+1-i}^N)\frac{1}{N+1-i}\alpha_M + \varepsilon$, where $i =$

$1, 2, \dots, N$ *and ε is a positive number, arbitrarily close to zero.*

Proposition 2 generalizes our finding for $N = 2$ case and asserts that in contrast to the existing literature, buying all firms need not necessarily involve paying at least the highest outside option to all firms. According to the proposition player 1 receives the highest outside option, player 2 the next highest, while player N receives the lowest one. Hence our analysis suggests that under certain conditions, complete capture of all firms can be less expensive and hence corruption more viable than what is currently suggested in the existing literature.

We will now proceed to demonstrate that under case 1, there exist conditions under which the optimal move for the government would be to engage in corruption by buying just a subset of firms instead of all firms. The possibility that corruption

might be viable with a partial capture of firms has been ignored in the existing literature due to the restrictive assumption of all firms acquiring “smoking gun” evidence. This means that information in the possession of each firm is important enough to prove the government’s corruption by itself. To demonstrate that partial media capture is possible, we return to our $N = 2$ case. We examine conditions under which the government would prefer to engage in corruption by buying only one firm.

From table 5, it is clear that if (A, E) is the response of the media preferred by the government, the following must simultaneously hold:

$$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \geq (1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M - (1 - \pi_1^2)\alpha_M \quad (8)$$

and

$$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \geq \pi_2^2(1 + \alpha_G) \quad (9)$$

For (8) to hold the following must be true:

$$\frac{1 + \alpha_G}{\alpha_M} \leq 1 \quad (10)$$

For (9) to hold the following must be true:

$$\frac{1 + \alpha_G}{\alpha_M} \geq \frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)} \quad (11)$$

Further, note that under case 1, since $(1 - \pi_1^2) < (1 - \pi_2^2)\frac{1}{2}$ it follows that

$(\pi_1^2 - \pi_2^2) > (1 - \pi_2^2)\frac{1}{2}$. Hence, $\frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)} < 1$. Thus, under case 1, conditions (10)

and (11) are always mutually consistent. Hence for $\frac{1 + \alpha_G}{\alpha_M} \in \left[\frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)}, 1 \right]$ both

(10) and (11) will be satisfied and (A, E) will be the best option for the government as compared to (A, A) or (E, E). This result is quite intuitive. If the payoff from

corruption is neither too large nor too small relative to the media's prize from exposure, it may make sense to buy just one player and keep the bribe payment smaller, albeit with a lower probability of survival rather than attempting to buy both for sure.

So far we have identified the condition under which (A, E) might be optimal for the government following CR. We will now demonstrate that it may be optimal for the government to choose CR with (A, E) as the optimal pattern of capture.

We know that CR with (A, E) will be preferred over NCR as long as:

$$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \geq 1$$

Re-arranging the terms in the above inequality yields the following:

$$\frac{(1 + \alpha_G)}{\alpha_M} \geq \frac{1}{\pi_1^2 \alpha_M} + \frac{(1 - \pi_2^2)\frac{1}{2}}{\pi_1^2} \quad (12)$$

Hence for CR to be profitable with (A, E) as the optimal response, condition (12)

should be compatible with (10) and (11), i.e. $\frac{1 + \alpha_G}{\alpha_M} \in \left[\frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)}, 1 \right]$. Firstly, note

that the R.H.S. of (12) will attain its lowest value of $\frac{(1 - \pi_2^2)\frac{1}{2}}{\pi_1^2}$ when α_M is infinitely

large. By inspection, it is clear that $\frac{(1 - \pi_2^2)\frac{1}{2}}{\pi_1^2} < \frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)}$. Hence when α_M is

infinitely large, the R.H.S. of (12) will be strictly less than values in the

interval $\left[\frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)}, 1 \right]$. However, when α_M is arbitrarily close to zero, the R.H.S

of (12) is infinitely large making it strictly outside the interval $\left[\frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)}, 1 \right]$.

Hence, since the R.H.S of (12) is continuous in α_M , it follows that

$\exists \alpha_M \left| \frac{1}{\pi_1^2 \alpha_M} + \frac{1}{2} \frac{(1-\pi_2^2)}{\pi_1^2} \in \left(\frac{1}{2} \frac{(1-\pi_2^2)}{(\pi_1^2 - \pi_2^2)}, 1 \right) \right.$ so that (12) is consistent with (10) and

(11). These conclusions lead to the following proposition:

Proposition 3: Under case 1, for $\alpha_M \in \left(\frac{2}{2\pi_1^2 + \pi_2^2 - 1}, \frac{2(\pi_1^2 - \pi_2^2)}{\pi_2^2(1 - \pi_2^2)} \right)$ and

$\alpha_G \geq \theta_1 + \theta_2 \alpha_M$ (where $\theta_1 = \frac{1-\pi_1^2}{\pi_1^2}$ and $\theta_2 = \frac{1-\pi_2^2}{2\pi_1^2}$), the government will opt for

corruption when there are two media firms, and offer bribes such that the media's optimal response is (A, E).

While we have formally demonstrated the $N = 2$ case, the possibility that corruption might be better supported by buying a subset of players instead of all of them is applicable for even higher values of N . To explore this further, we consider proposition 4, which follows directly from proposition 2.

Proposition 4: In an N media firm game, the cost minimizing bribe structure that would support acceptance by exactly $j < N$ firms under case 1

is $b_i = (1 - \pi_{N+1-i}^N) \frac{1}{N+1-i} \alpha_M + \varepsilon$, where $i = 1, 2, \dots, j$ and ε is a positive number,

arbitrarily close to zero. Further, $b_i = 0$ for $i = j+1, \dots, N$.

Consider an example where the total number of media firms is $N = 3$. Given propositions 2 and 4, we observe that for $N = 3$, the government's payoff from different collusive arrangements would be as follows:

Buying all three firms (A, A, A)

$$(1 + \alpha_G) - (1 - \pi_3^3) \frac{1}{3} \alpha_M - (1 - \pi_2^3) \frac{1}{2} \alpha_M - (1 - \pi_1^3) \alpha_M \quad (13)$$

Buying two of the three firms (A, A)

$$\pi_1^3 (1 + \alpha_G) - (1 - \pi_3^3) \frac{1}{3} \alpha_M - (1 - \pi_2^3) \frac{1}{2} \alpha_M \quad (14)$$

Buying one of the three firms (A)

$$\pi_2^3(1 + \alpha_G) - (1 - \pi_3^3)\frac{1}{3}\alpha_M \quad (15)$$

Not buying any

$$\pi_3^3(1 + \alpha_G) \quad (16)$$

Hence if purchasing a subset comprising 2 of the 3 firms is to be the optimal collusion pattern for the government following CR, then the following must hold simultaneously:

$$(14) \geq (13)$$

$$(14) \geq (15)$$

$$(14) \geq (16)$$

Also, corruption by the government with the media choosing to play (A, A, E) would be optimal, if $(14) \geq 1$ along with the above inequalities.

In fact it can be verified that all of the above inequalities would be mutually consistent for $N = 3$ when, for example, π_i^N is given by equation 2 (see table 2). In fact this function also supports the possibility that corruption might be optimally supported with the purchase of only one firm and exposure by the remaining firms. Hence the result that corruption might be sustainable by purchase of fewer firms is not limited to $N = 2$ case.

The fact that corruption could be optimally sustained by colluding with fewer firms is important as it tends to undermine at least partially, the deterrent impact of having more firms in the media. Further, as we will demonstrate in the next section, this result is more likely in case 1. This is because, in case 1, the media firms are powerful collectively rather than individually. Hence in our $N = 3$ example, leaving out one or even two firms does not substantially reduce the government's probability

of surviving a scandal. For example, in table 2, compare the entries in column 2 and 3 (which represent cases 1 and 2 respectively). The government's probability of survival is fairly high when only one or two of the three firms expose corruption in column 2 (0.834 and 0.61 respectively) when compared with corresponding entries in column 3, and it drops precipitously (to 0.1) only when all three firms expose.

This concludes our discussion of the negative externalities case for the moment. We will return to this case later in section 5 when we examine the implications for corruption, as the number firms within the media increases. In the next section, we carry out our analysis for the case of positive externalities.

4. Examining media capture in the case of positive externalities

In this case, the expected payoff from exposure to a firm falls as more and more firms attempt to do the same – i.e. the share effect dominates the credibility effect. Here, a firm gets the highest payoff from exposure when it attempts to expose alone with the expected payoffs related by the following expression:

$$(1 - \pi_N^N) \frac{1}{N} \alpha_M < (1 - \pi_{N-1}^N) \frac{1}{N-1} \alpha_M < \dots < (1 - \pi_2^N) \frac{1}{2} \alpha_M < (1 - \pi_1^N) \alpha_M .$$

In this section we examine how such a structure of payoffs affects media capture and incentives for corruption. As we shall demonstrate, the results for this case (case 2) differ considerably from those for case 1. Consider proposition 5 to begin with.

Proposition 5: *In case 2, the cost minimizing bribe structure that would ensure acceptance by all N firms as a unique Nash equilibrium would be $b_1 = b_2 = \dots = b_N = (1 - \pi_1^N) \alpha_M + \varepsilon$, where ε is a positive number, arbitrarily close to zero.*

The above proposition states that under case 2, the cost minimizing bribe structure that would secure acceptance from all N firms as a unique Nash equilibrium, involves paying every firm a bribe slightly larger than the highest expected payoff from exposure. This is in sharp contrast to case 1 (see proposition 2) where the highest outside option is paid to only one firm and all the firms get lower bribes. This is because under case 2 any one firm can earn the highest expected payoff by simply unilaterally deviating from the all acceptance equilibrium. Hence it would be simply impossible to sustain acceptance by all firms as a unique Nash equilibrium without paying each firm a bribe slightly larger than the highest expected payoff from exposure.

This result resembles Besley and Prat (2005) where they argue that media capture would necessarily involve paying the highest payoff from exposure to each firm. In their paper, as every firm has ‘clinching’ evidence, there is no scope for a credibility effect of the kind observed in our model. Hence our result helps clarify the circumstance under which their result would be applicable when a credibility effect does exist. In particular, their result generalizes to the case where the credibility effect is weaker than the share effect. This might arise when all firms have a reasonable endowment of evidence so that allegation by one more firm does not provide a significant marginal contribution to exposure. On the other hand, this also means that buying off one firm does not significantly damage the overall case for proving corruption either, and the value of the information in the possession of others does not decrease significantly. Hence, in order to significantly decrease the strength of the group of firms trying to expose it, the government must buy off all of them by paying them the same amount of bribe.

This situation is very different from the one seen in case 1, where the structure of the government's survival probabilities was strongly affected by the credibility effect. The environment observed in case 1 could arise when evidence is more thinly distributed across firms so that information released by one more firm contributes significantly to the overall case for proving corruption. However, the downside of this is that if one firm is bought off, the case for proving corruption is weakened considerably, so the value of the information in the possession of other firms goes down significantly. This means that the rest of the firms could be given lesser bribes and bought off.

So far, we have discussed the cost-minimising bribe structure when the government is interested in securing acceptance of all N firms as a unique Nash equilibrium under case 2. The next proposition presents the cost minimizing bribe structure when the government is interested in surely securing acceptance from a subset of firms.

Proposition 6: *In case 2, the cost minimizing bribe structure that would ensure acceptance by $j < N$ firms as a unique Nash equilibrium would be*

$$b_1 = b_2 = \dots = b_j = (1 - \pi_{N+1-j}^N) \frac{1}{N+1-j} \alpha_M + \varepsilon, \text{ where } \varepsilon \text{ is a positive number}$$

arbitrarily close to zero. Further, $b_i = 0$, for $i = j+1, \dots, N$.

The proof and the intuition behind proposition 6 are analogous to those for proposition 5. Essentially, the bribe paid to each of the j firms must at least cover the payoff from unilateral deviation from acceptance, given that $N - j$ firms would be attempting to expose the government. Further, under case 2, this also represents the highest expected payoff from exposure to each of the j firms. Hence by paying a bribe slightly larger than this value, the government can secure an acceptance from each of the j firms for sure. Again, this proposition presents a bribe structure that is markedly

different from proposition 4 (which relates to case 1) in exactly the same way as the one presented by proposition 5 differs from that of proposition 2.

We now look at the $N = 2$ case to explore the circumstances under which capturing either both the firms or only one firm might support corruption. Table 6 provides the government's expected payoff from different patterns of collusion under case 2.

[Insert Table 6]

As before we first present the conditions under which engaging in corruption by buying both the firms would be optimal for the government. Analogous to conditions (4) and (5), for (A, A) to be the optimal pattern of collusion given CR, the following must hold:

$$(1 + \alpha_G) - 2(1 - \pi_1^2)\alpha_M \geq \pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \quad (17)$$

$$(1 + \alpha_G) - 2(1 - \pi_1^2)\alpha_M \geq \pi_2^2(1 + \alpha_G) \quad (18)$$

Further for corruption to be an optimal choice, the following must also hold:

$$(1 + \alpha_G) - 2(1 - \pi_1^2)\alpha_M \geq 1 \quad (19)$$

Conditions (17) and (18) in turn imply (20) and (21) respectively:

$$\frac{1 + \alpha_G}{\alpha_M} \geq 2 - \frac{(1 - \pi_2^2)\frac{1}{2}}{(1 - \pi_1^2)} \quad (20)$$

$$\frac{1 + \alpha_G}{\alpha_M} \geq \frac{(1 - \pi_1^2)}{(1 - \pi_2^2)\frac{1}{2}} \quad (21)$$

Notice that since both (20) and (21) only stipulate lower bounds, they are quite likely to be satisfied simultaneously. In particular it is clear that for

$$\frac{1 + \alpha_G}{\alpha_M} \geq \text{Max} \left[2 - \frac{(1 - \pi_2^2)\frac{1}{2}}{(1 - \pi_1^2)}, \frac{(1 - \pi_1^2)}{(1 - \pi_2^2)\frac{1}{2}} \right] \text{ both (20) and (21) would be simultaneously}$$

satisfied so that (A, A) would be the optimal pattern of collusion following CR. From (19), it is clear that corruption would be optimal with (A, A) if

$$\frac{1 + \alpha_G}{\alpha_M} \geq \frac{1}{\alpha_M} + 2(1 - \pi_1^2) \quad (22)$$

Hence similar to proposition 1, we have the following result.

Proposition 7: *Under case 2 (i.e. $(1 - \pi_1^2) > (1 - \pi_2^2)\frac{1}{2}$), if there are two firms in the media industry, the government will engage in corruption while purchasing both the*

$$\text{firms when } (\alpha_G, \alpha_M) \left| \frac{1 + \alpha_G}{\alpha_M} \geq \text{Max} \left[2 - \frac{(1 - \pi_2^2)\frac{1}{2}}{(1 - \pi_1^2)}, \frac{(1 - \pi_1^2)}{(1 - \pi_2^2)\frac{1}{2}}, \frac{1}{\alpha_M} + 2(1 - \pi_1^2) \right].$$

Hence under case 2, while purchasing both firms is more expensive, that does not necessarily rule out corruption.

What about the possibility of corruption getting sustained by purchase of a subset of firms? As will become clear shortly, this possibility is less likely in case 2 relative to case 1. To see this, we first present the conditions under which the (A, E) along with CR might be the optimal responses.

Again, corresponding to conditions (8) and (9), we have the following:

$$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \geq (1 + \alpha_G) - 2(1 - \pi_1^2)\alpha_M \quad (23)$$

$$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \geq \pi_2^2(1 + \alpha_G) \quad (24)$$

Also, for CR to be optimal with (A, E) the following must hold as well:

$$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M \geq 1 \quad (25)$$

Conditions (23) and (24) further resolve into (26) and (27) respectively:

$$\frac{1 + \alpha_G}{\alpha_M} \leq 2 - \frac{(1 - \pi_2^2)^{\frac{1}{2}}}{(1 - \pi_1^2)} \quad (26)$$

$$\frac{1 + \alpha_G}{\alpha_M} \geq \frac{(1 - \pi_2^2)^{\frac{1}{2}}}{\pi_1^2 - \pi_2^2} \quad (27)$$

Further, for corruption to be optimal with (A, E) as the desired pattern of collusion, equations (26) through (28) need to be simultaneously satisfied. Equation (28) is seen below and obtained by re-arranging (25):

$$\frac{1 + \alpha_G}{\alpha_M} \geq \frac{1}{\pi_1^2 \alpha_M} + \frac{(1 - \pi_2^2)^{\frac{1}{2}}}{\pi_1^2} \quad (28)$$

Hence, for two media firms, the government will opt for CR and will offer bribes such that the media's underlying optimal response is (A, E) in case 2, when:

$$(\pi_1^2, \pi_2^2) \left| \frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)} < 2 - \frac{(1 - \pi_2^2)^{\frac{1}{2}}}{(1 - \pi_1^2)}, \right.$$

$$\alpha_M \left| \frac{1}{\pi_1^2 \alpha_M} + \frac{1}{2} \frac{(1 - \pi_2^2)}{\pi_1^2} \in \left(\frac{1}{2} \frac{(1 - \pi_2^2)}{(\pi_1^2 - \pi_2^2)}, 2 - \frac{(1 - \pi_2^2)^{\frac{1}{2}}}{(1 - \pi_1^2)} \right), \text{ and} \right.$$

$$\alpha_G \left| \frac{(1 + \alpha_G)}{\alpha_M} \geq \frac{1}{\pi_1^2 \alpha_M} + \frac{(1 - \pi_2^2)^{\frac{1}{2}}}{\pi_1^2}. \right.$$

However, as mentioned earlier, the conditions stipulated above are unlikely to hold. Recall that in this case $(1 - \pi_1^2) > (1 - \pi_2^2)^{\frac{1}{2}}$ by definition. Hence it follows that the R.H.S. of (26) is strictly within the interval (1, 2). Further, the R.H.S. of (27) is strictly greater than 1.¹⁶ Hence while there is scope for (26) and (27) to be

¹⁶ It can be verified that under case 2, $\pi_1^2 < \frac{1}{2} + \frac{1}{2} \pi_2^2$ so that $\pi_1^2 - \pi_2^2 < \frac{1}{2}(1 - \pi_2^2)$. Hence the R.H.S. of (27) would be strictly greater than 1.

simultaneously satisfied, it would not always be true in contrast to the simultaneous satisfaction of conditions (10) and (11) in case 1. In fact the closer is π_1^2 to π_2^2 , the greater the chance that R.H.S of (27) will be high and in conflict with (26). Under such circumstances, (E, E) will tend to dominate (A, E). Further π_1^2 is more likely to be closer to π_2^2 under case 2 as even a single firm's allegations considerably reduce the government's probability of survival and the credibility gain to the media as more firms join the chorus are relatively smaller.

[Insert Table 7]

As an example, let us suppose that the government's survival probabilities are given by equation (3) in case 2. Table 7 lists and compares them with those given by equation (2) under case 1 for $N = 2$. Using the probabilities under case 2 from table 7, the R.H.S. of 26 takes the value 1.33 while the R.H.S. of (27) takes the value 2 making them mutually inconsistent. Also, the lowest value of (28) is 1.38 and hence in conflict with (26). Accordingly, for $N = 2$, corruption with (A, E) would not be optimal in case 2 as stipulated by equation (3). In fact, it can be similarly verified that supporting corruption by buying a subset of firms (either 2 firms or 1 firm) is not optimal under case 2 for $N = 3$ as well, when the survival probability is given by equation (3).

Hence to sum up, under positive externalities in order to optimally sustain corruption, the government would most likely have to purchase all the firms and pay higher bribes. This suggests that the media as an institution generates greater deterrence to corruption in this case than under negative externalities. The difference in the nature of deterrence under cases 1 and 2 is further highlighted in the following section where we examine the nature of deterrence as the number of firms within the media increase.

5. Impact on corruption as the number of firms within the media increase

In this section, we use the survival probabilities as given by equations (2) and (3) which represent cases 1 and 2 respectively, to examine the impact of an increase in the number of firms within the media sector on the government's incentive to engage in corruption.

We begin with case 1. Let us examine table 8 which uses equation (2) and shows the government's survival probabilities, a representative firm's expected payoff from exposure as well as the government's expected payoff from different collusive arrangements using propositions 2 and 4 for $N = 2$ to 5. Notice that for $N = 2$, the highest payoff from corruption is when all firms are bought and it equals $0.93 < 1$ – the assured payoff from NCR. Hence corruption is not profitable. However, as N increases to 3 this payoff increases to $1.017 > 1$. Hence corruption becomes optimal when N increases from 2 to 3. There after, corruption stays as the optimal response with purchase of all firms as the optimal pattern of collusion with corruption.¹⁷ Hence contrary to the conventional wisdom, table 8 reveals that under certain circumstances, an increase in the number of firms in the media might inadvertently support corruption. In fact as per table 8, the government's expected payoff from corruption increases monotonically with respect to N . This pattern persists despite the fact that for higher N , more firms need to be bribed to support a given pattern of collusion.

Why this might be the case? Part of the reason is that the government's probability of survival (π_k^N) for any given $k \leq N$ (firms attempting to expose) goes

¹⁷ Table 9 uses alternative values for α_G and α_M and finds a similar result. Corruption becomes optimal for $N \geq 4$ with leaving out 1 firm as the optimal pattern of capture.

up as N increases.¹⁸ This tends to directly increase the government's expected payoff from CR when k firms are not captured. Further, this also means that as N increases, for any given k , an exposing firm's probability of winning and hence the expected payoff falls.¹⁹ In fact, even the highest expected payoff to a firm from exposure (and hence the highest bribe paid) falls as N increases.²⁰ This pattern also contributes to increasing the expected payoff from corruption as the bribes paid would be smaller.

It is obvious that the above described patterns would contribute to increasing the expected payoff from corruption, as N increases. However, as the examination of case 2 will reveal, the ability to "divide and conquer" (which is unique to case 1) must also be playing an important role as it helps the government to make the most out of the falling bribe levels necessary to support corruption. Accordingly, we now proceed to examine case 2.

[Insert Tables 10]

In particular, examine table 10 which uses equation (3) and shows the government's survival probabilities, a representative firm's expected payoff from exposure as well as the government's expected payoff from different collusive arrangements using propositions 5 and 6 for $N = 2$ to 5. Table 10 can be compared with table 8 as it uses exactly the same values of α_G and α_M and it reveals patterns that are considerably different from those revealed by table 8.²¹ For any given N , the government's survival probability for a given pattern of exposure is typically lower in

¹⁸ For example, compare column $N = 2$ with $N = 3$ in table 8. You should notice that comparable π_k^N values are higher for $N = 3$ than $N = 2$.

¹⁹ Notice that in table 8, where comparable, a firm's expected payoff is higher for $N = 2$ as compared to $N = 3$.

²⁰ For example, in table 8, the highest expected payoff to a firm when $N = 2$ is 0.675. This falls to 0.45 when N increases to 3. It continues to fall as N takes higher values. This is due to the fact that when all firms attempt to expose, while they collectively enjoy the same high credibility, the gain from exposure needs to be shared among larger number of firms as N increases.

²¹ Table 11 relates to table 9 in exactly analogous way.

table 10 (case 2) than in table 8 (case 1).²² Correspondingly, a representative firm's expected payoff from a given pattern of exposure and hence the bribe that might need to be paid is higher in table 10 than table 8.²³ Hence not surprisingly, for any given N, the government's expected payoff from corruption for any given pattern of collusion is much lower in table 10 than in table 8.²⁴ In fact in table 10, the government's expected payoff from corruption turns out to be negative for any pattern of collusion making it an unattractive option.

Even more importantly, in contrast to table 8, the government's expected payoff from corruption for any given pattern of collusion (i.e. for a given row) falls as N increases in table 10.²⁵ This is despite the fact that even in table 10 as with table 8, the government's survival probabilities increase and the bribes needed to be paid fall as N increases. Hence it must be the case that in table 10, as N increases, the need to buy more firms to support any given pattern of collusion more than offsets the benefits from these factors. Perhaps, this is due to the fact that bribe levels are consistently higher and "divide and conquer" is not available in case 2. In case 1, the "divide and conquer" strategy allows the government to pay the highest bribe to only one firm and the rest are paid systematically lower bribes. Hence as N increases and all bribes to be paid fall, the government can take greatest advantage of lower bribes as not only the existing firms need to be paid lower bribes, the additional firm needs

²² For example, π_3^N for N = 4 is 0.55 for table 8 and 0.156 for table 10. The only exception to this pattern is when the government does not buy any firms as in that case the survival probability is the same in both the cases with all firms in the media attempting an expose.

²³ For example, $((1 - \pi_3^N) \frac{1}{3} \alpha_M$ for N = 4 is 0.225 for table 8 while it is 0.422 for table 10.

²⁴ For example, when N = 4 and the government leaves out 3 firms, the expected payoff as per table 8 is 0.763. However, for the same option, the expected payoff as per table 10 is -0.025.

²⁵ For example, if one examines the buy all row, the payoff falls from -1.17 to -1.62 as N increases from 2 to 3. For higher values of α_G (such as 5, 10, 100 etc.) relative to α_M (=1.5), the decline in the payoff to corruption as N increases holds true for the buy all option but not necessarily for payoffs involving purchase of a subset of firms. However, in such cases, the payoff from buy-all option turns out to be the highest and hence it is the one that determines the decision to engage in corruption.

to be paid the lowest bribe. However in case 2 while the highest bribe falls as N increases, the additional firm would still have to be paid the highest bribe in the new bribe profile as all the other firms. This seems to offset the benefit from paying a lower bribe to all the existing firms and has an overall negative impact on the payoff from corruption. These findings are summarized in the proposition below.

Proposition 8: *When survival probabilities under case 1 are given by equation (2), there could be situations where an increase in the number of firms in the media can enhance the expected payoff from corruption. However, such a pattern is not observed for case 2 with survival probabilities given by equation (3).*

Hence as the above proposition suggests, in the presence of negative externalities, increasing number of firms in the media might land up encouraging corruption rather than hurting it contrary to the current thinking in the literature. However, in the presence of positive externalities, more firms in the media reduce the payoff from corruption along the lines of Besley and Prat (2005).

6. Conclusion

In this paper, we analyse a more general model of media capture that both reveals new insights and also helps place the existing literature, in particular Besley and Prat (2005), in a broader context. Our framework is more general in the sense that unlike Besley and Prat (2005), the credibility of media's allegations regarding corruption is not automatic but is rather sensitive to the number of firms raising such allegations. As more firms attempt to expose corruption, they unleash two distinct and opposite effects on any participating firm's expected payoff from such an exposure. Firstly, they enhance the credibility of the allegations being made, which has a positive effect on a participating firm's payoff (referred as the "credibility" effect). However, as more firms attempt to expose, the gain from the scandal is shared among

larger number of firms. This has a negative effect on a participating firm's payoff (referred as the "share" effect). Given this we identify two distinct cases in the paper. In case 1 (or the "negative externality" case), the credibility effect dominates the share effect so that the expected payoff to a firm increases as more firms attempt to expose. In case 2 (or the "positive externality" case), exactly the opposite is true and the expected payoff to a firm decreases as more firms attempt to expose.

Using such a framework, we re-interpret Besley and Prat (2005) as essentially an examination of a simpler version of case 2. Indeed for this case, we find that our results corroborate their findings. Hence for case 2, media capture is likely to involve all existing firms and the highest payoff from exposure would have to be paid to all firms. Further as the number of firms in the media increase, it tends to reduce the expected payoff from corruption and hence potentially contribute to deterring corruption.

However, our analysis of case 1 produces some surprising findings. Firstly, if the media capture involves purchasing all the firms, the government can reduce the bribes paid by employing the "divide and conquer" strategy. With this strategy, only one firm gets paid the highest payoff from exposure of corruption. The other firms are paid successively lower bribes. This in itself enhances the scope for corruption. Further, we also find that the government's optimal collusion pattern with the media need not necessarily involve purchase of all firms and may involve buying only a subset of firms. Finally and more surprisingly, we find that under certain conditions, an increase in the number of firms in the media might increase the payoff from corruption and encourage it rather than deterring it. As the number of firms within the media sector increase *ceteris paribus*, each individual firm and any given subset of firms control a smaller segment and hence become less powerful. As a result, the

government's survival probability from a scandal and the bribes that it has to pay fall. This pattern coupled with the government's ability to "divide and conquer" allows it exploit the fall in bribes to the fullest and enhance the payoff from corruption. This holds despite the fact that that as N increases, more firms need to be bribed.

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Appendix

Proof of Proposition 2

Proposition 2: *In the presence of negative externalities (i.e. $(1 - \pi_N^N)\frac{1}{N} > (1 - \pi_{N-1}^N)\frac{1}{N-1} > \dots > (1 - \pi_3^N)\frac{1}{3} > (1 - \pi_2^N)\frac{1}{2} > (1 - \pi_1^N)$), for any given $N (\geq 2)$ players, the cost minimizing bribe structure that would support acceptance by each firm as a unique Nash equilibrium of the bribery game will be one in which the bribe received by player i is given by $b_i = (1 - \pi_{N+1-i}^N)\frac{1}{N+1-i}\alpha_M + \varepsilon$, where $i = 1, 2, \dots, N$ and ε is a positive number, arbitrarily close to zero.*

Proof:

Note that acceptance by each player (A, ..., A) would always be a Nash equilibrium as long as $b_i = (1 - \pi_1^N)\alpha_M$ for every i . However this bribe profile would not yield a unique Nash equilibrium of the bribery game under case 1. If $(1 - \pi_N^N)\frac{1}{N}\alpha_M > (1 - \pi_1^N)\alpha_M$, (E, ..., E) would also be a Nash equilibrium where each firm would earn the highest outside option. In fact for any bribe profile supporting (A, ..., A) where every $b_i < (1 - \pi_N^N)\frac{1}{N}\alpha_M$, (E, ...E) would also be a Nash equilibrium. Hence for a bribe profile to support (A, ..., A) as a unique Nash equilibrium, it must be the case that at least one firm (say firm 1) must be offered a bribe $b_1 = (1 - \pi_N^N)\frac{1}{N}\alpha_M + \varepsilon = (1 - \pi_{N+1-1}^N)\frac{1}{N+1-1}\alpha_M + \varepsilon$. When offered such a bribe, A becomes a dominant strategy for player 1, as it pays more than the highest outside option available from exposure.

Now suppose that $b_1 = (1 - \pi_N^N) \frac{1}{N} \alpha_M + \varepsilon$. If firms 2, ..., N are offered $b_i = (1 - \pi_1^N) \alpha_M$, it would support (A, ..., A) as a Nash equilibrium. However, the same bribe profile would support (A, E, ..., E) as a Nash equilibrium as well. In this equilibrium, each of the firms 2, ..., N would get the highest outside option $(1 - \pi_{N-1}^N) \frac{1}{N-1} \alpha_M > (1 - \pi_1^N) \alpha_M$. Hence as before, to get a unique (A, ..., A) equilibrium, at the very minimum, at least one of the remaining 2, ..., N firms (say firm 2) would have to be offered $b_2 = (1 - \pi_{N-1}^N) \frac{1}{N-1} \alpha_M + \varepsilon = b_2 = (1 - \pi_{N+1-2}^N) \frac{1}{N+1-2} \alpha_M + \varepsilon$. Given this bribe, acceptance becomes a dominant move for firm 2, given firm 1's dominant strategy to accept.

By the same logic, the expression $(1 - \pi_{N+1-i}^N) \frac{1}{N+1-i} \alpha_M$ captures the highest outside option available to firm i , given that $i-1$ firms would always choose A given their bribe offers. Hence, under case 1 firm i would get the highest expected payoff, if it along with the remaining $N-i$ firms were to attempt to expose the government. This expected payoff would correspond to exactly $N+1-i$ firms raising allegations. Hence by paying the i th firm $b_i = (1 - \pi_{N+1-i}^N) \frac{1}{N+1-i} \alpha_M + \varepsilon$, the government ensures that firm i would always choose A given that the previous $i-1$ players choose A. Hence it is clear that the minimum bribe structure necessary to ensure a unique (A, A, ..., A) equilibrium of the bribery game is given by $b_i = (1 - \pi_{N+1-i}^N) \frac{1}{N+1-i} \alpha_M + \varepsilon$, where $i = 1, 2, \dots, N$ and ε is a positive number, arbitrarily close to zero. \square

Proof of Proposition 4

Proposition 4: *In an N media firm game, the cost minimizing bribe structure that would support acceptance by exactly $j < N$ firms under case 1*

is $b_i = (1 - \pi_{N+1-i}^N) \frac{1}{N+1-i} \alpha_M + \varepsilon$, where $i = 1, 2, \dots, j$ and ε is a positive number,

arbitrarily close to zero. Further, $b_i = 0$, for $i = j+1, \dots, N$.

Proof: Let us suppose $j = 1$. Unless this single firm is paid at least

$b_1 = (1 - \pi_N^N) \frac{1}{N} \alpha_M + \varepsilon = (1 - \pi_{N+1-1}^N) \frac{1}{N+1-1} \alpha_M + \varepsilon$, it can get the highest payoff

from exposure $(1 - \pi_N^N) \frac{1}{N} \alpha_M$ by joining the remaining $N-1$ firms in their attempt to

expose. Hence, only b_1 can ensure that A would be a dominant strategy for firm 1.

Now suppose $j = 2$. Again the lowest cost bribe structure that would ensure acceptance by exactly 2 firms would be:

$$b_1 = (1 - \pi_N^N) \frac{1}{N} \alpha_M + \varepsilon = (1 - \pi_{N+1-1}^N) \frac{1}{N+1-1} \alpha_M + \varepsilon$$

$$b_2 = (1 - \pi_{N-1}^N) \frac{1}{N-1} \alpha_M + \varepsilon = (1 - \pi_{N+1-2}^N) \frac{1}{N+1-2} \alpha_M + \varepsilon$$

And, $b_i = 0$ for $i = 3, \dots, N$

Notice that if neither firm were offered b_1 , then exposure by all N firms would also be a Nash Equilibrium. If one of the two firms got b_1 but the other were offered less than b_2 then exposure by $N-1$ firms would also a Nash equilibrium. Hence the only way to ensure acceptance by two firms for sure is to offer them b_1 and b_2 .

By the same logic, if the government wanted to surely purchase exactly j firms ($N > j > 2$), then it must offer each of the first j firms, bribes ε larger than the first j

highest outside options, i.e. $b_i = (1 - \pi_{N+1-i}^N) \frac{1}{N+1-i} \alpha_M + \varepsilon$ where $i = 1, 2, \dots, j$

and ε is a positive number, arbitrarily close to zero. If any one of the j firms were offered a bribe lower than the above profile, then E by at least $j + 1$ firms would also be a Nash equilibrium. \square

Proof of Proposition 5

Proposition 5: *In case 2, the cost minimizing bribe structure that would ensure acceptance by all N firms as a unique Nash equilibrium would be $b_1 = b_2 = \dots = b_N = (1 - \pi_1^N)\alpha_M + \varepsilon$, where ε is a positive number, arbitrarily close to zero.*

Proof: Notice that for (A, A, \dots, A) to be a Nash equilibrium, no firm should be better off by a unilateral deviation. Hence, the bribe offered must be at least as high as the payoff to a firm from unilateral exposure i.e. $b_i \geq (1 - \pi_1^N)\alpha_M$ for $i = 1, 2, \dots, N$. However, under case 2 this is also the highest payoff from exposure a firm can expect. Hence if the government were to offer $b_i = (1 - \pi_1^N)\alpha_M + \varepsilon$ for $i = 1, 2, \dots, N$, accepting the bribe would be a dominant strategy for every firm as it would pay greater than the highest expected payoff from exposure. Hence, such a bribe would ensure that acceptance by all would be a unique Nash equilibrium of the game and a bribe lower than $(1 - \pi_1^N)\alpha_M$ would simply not support acceptance by all firms as a Nash equilibrium. \square

Tables

Table 1: Payoffs to the government and a media firm when a given number of firms raise allegations

Number of firms raising allegations	Payoff to the government from CR	Payoff to a media firm following A or E
1	$\pi_1^N (1 + \alpha_G) - \sum_{j=1}^{N-1} b_j$	A: b_j E: $(1 - \pi_1^N) \alpha_M$
2	$\pi_2^N (1 + \alpha_G) - \sum_{j=1}^{N-2} b_j$	A: b_j E: $(1 - \pi_2^N) \frac{1}{2} \alpha_M$
3	$\pi_3^N (1 + \alpha_G) - \sum_{j=1}^{N-3} b_j$	A: b_j E: $(1 - \pi_3^N) \frac{1}{3} \alpha_M$
$i (N \geq i \geq 1)$	$\pi_i^N (1 + \alpha_G) - \sum_{j=1}^{N-i} b_j$	A: b_j E: $(1 - \pi_i^N) \frac{1}{i} \alpha_M$
N	$\pi_N^N (1 + \alpha_G)$	E: $(1 - \pi_N^N) \frac{1}{N} \alpha_M$

Table 2: $N = 3$; $\theta = 0.1$

π_i^N as per (1)	π_i^N as per (2)	π_i^N as per (3)
$\pi_1^3 = 0.7$	$\pi_1^3 = 0.834$	$\pi_1^3 = 0.5$
$\pi_2^3 = 0.4$	$\pi_2^3 = 0.61$	$\pi_2^3 = 0.2$
$\pi_3^3 = 0.1$	$\pi_3^3 = 0.1$	$\pi_3^3 = 0.1$
$1 - \pi_1^3 = 0.3$	$1 - \pi_1^3 = 0.16$	$1 - \pi_1^3 = 0.5$
$(1 - \pi_2^3) \frac{1}{2} = 0.3$	$(1 - \pi_2^3) \frac{1}{2} = 0.19$	$(1 - \pi_2^3) \frac{1}{2} = 0.4$
$(1 - \pi_3^3) \frac{1}{3} = 0.3$	$(1 - \pi_3^3) \frac{1}{3} = 0.3$	$(1 - \pi_3^3) \frac{1}{3} = 0.3$

Table 3: $N = 4$; $\theta = 0.1$

π_i^N as per (1)	π_i^N as per (2)	π_i^N as per (3)
$\pi_1^4 = 0.775$	$\pi_1^4 = 0.879$	$\pi_1^4 = 0.606$
$\pi_2^4 = 0.55$	$\pi_2^4 = 0.736$	$\pi_2^4 = 0.325$
$\pi_3^4 = 0.325$	$\pi_3^4 = 0.55$	$\pi_3^4 = 0.156$
$\pi_4^4 = 0.1$	$\pi_4^4 = 0.1$	$\pi_4^4 = 0.1$
$1 - \pi_1^4 = 0.225$	$1 - \pi_1^4 = 0.12$	$1 - \pi_1^4 = 0.393$
$(1 - \pi_2^4) \frac{1}{2} = 0.225$	$(1 - \pi_2^4) \frac{1}{2} = 0.132$	$(1 - \pi_2^4) \frac{1}{2} = 0.337$
$(1 - \pi_3^4) \frac{1}{3} = 0.225$	$(1 - \pi_3^4) \frac{1}{3} = 0.15$	$(1 - \pi_3^4) \frac{1}{3} = 0.281$
$(1 - \pi_4^4) \frac{1}{4} = 0.225$	$(1 - \pi_4^4) \frac{1}{4} = 0.225$	$(1 - \pi_4^4) \frac{1}{4} = 0.225$

Table 4: Media payoffs in the bribery game when $N = 2$

Firm 2			
Firm 1		A	E
	A	b_1, b_2	$b_1, (1 - \pi_1^2)\alpha_M$
	E	$(1 - \pi_1^2)\alpha_M, b_2$	$(1 - \pi_2^2)\frac{1}{2}\alpha_M, (1 - \pi_2^2)\frac{1}{2}\alpha_M$

Table 5: Government's payoff from CR from different media equilibrium responses using the necessary bribe structures in case 1

Alternative media responses	Government's payoff
(A, A)	$(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M - (1 - \pi_1^2)\alpha_M$
(A, E) or (E, A)	$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M$
(E, E)	$\pi_2^2(1 + \alpha_G)$

Table 6: Government's payoff from different collusive arrangements under case 2	
Alternative media responses	Government's payoff
(A, A)	$(1 + \alpha_G) - 2(1 - \pi_1^2)\alpha_M$
(A, E) or (E, A)	$\pi_1^2(1 + \alpha_G) - (1 - \pi_2^2)\frac{1}{2}\alpha_M$
(E, E)	$\pi_2^2(1 + \alpha_G)$

Table 7: Survival probabilities as per (2) and (3) when $N = 2$

Case 1: π_j^N as per (2), $N = 2$	Case 2: π_j^N as per (3), $N = 2$
$\pi_1^2 = 0.736$	$\pi_1^2 = 0.325$
$\pi_2^2 = 0.10$	$\pi_2^2 = 0.10$
$1 - \pi_1^2 = 0.264$	$1 - \pi_1^2 = 0.675$
$(1 - \pi_2^2)\frac{1}{2} = 0.45$	$(1 - \pi_2^2)\frac{1}{2} = 0.45$

Table 8: Number of firms in the media and payoff from corruption in case 1 with

$$\alpha_G = 1 \text{ and } \alpha_M = 1.5$$

	N = 2	N = 3	N = 4	N = 5
Government's survival probability under different patterns of capture as per (2)				
π_1^N	0.736	0.835	0.879	0.905
π_2^N	0.100	0.620	0.736	0.797
π_3^N		0.100	0.550	0.669
π_4^N			0.100	0.502
π_5^N				0.100
A media firm's payoff for a given number of firms attempting to expose				
$(1 - \pi_1^N)\alpha_M$	0.395	0.248	0.181	0.143
$(1 - \pi_2^N)\frac{1}{2}\alpha_M$	0.675	0.285	0.198	0.152
$(1 - \pi_3^N)\frac{1}{3}\alpha_M$		0.450	0.225	0.165
$(1 - \pi_4^N)\frac{1}{4}\alpha_M$			0.338	0.187
$(1 - \pi_5^N)\frac{1}{5}\alpha_M$				0.270
Government's expected payoff from CR under different collusive arrangements				
Buy all	0.930	1.017	1.059	1.083
Leave out 1	0.798	0.934	0.999	1.036
Leave out 2	0.200	0.789	0.910	0.972
Leave out 3		0.200	0.763	0.882
Leave out 4			0.200	0.735
Leave out 5				0.200

Table 9: Number of firms and corruption in case 1 with $\alpha_G = 1.88$ and $\alpha_M = 3$

	N = 2	N = 3	N = 4	N = 5
Government's survival probability under different patterns of capture as per (2)				
π_1^N	0.736	0.835	0.879	0.905
π_2^N	0.100	0.620	0.736	0.797
π_3^N		0.100	0.550	0.669
π_4^N			0.100	0.502
π_5^N				0.100
A media firm's payoff for a given number of firms attempting to expose				
$(1 - \pi_1^N)\alpha_M$	0.791	0.495	0.362	0.285
$(1 - \pi_2^N)\frac{1}{2}\alpha_M$	1.350	0.571	0.395	0.304
$(1 - \pi_3^N)\frac{1}{3}\alpha_M$		0.900	0.450	0.331
$(1 - \pi_4^N)\frac{1}{4}\alpha_M$			0.675	0.373
$(1 - \pi_5^N)\frac{1}{5}\alpha_M$				0.540
Government's expected payoff from CR under different collusive arrangements				
Buy all	0.739	0.914	0.998	1.047
Leave out 1	0.771	0.934	1.012	1.058
Leave out 2	0.288	0.884	0.996	1.052
Leave out 3		0.288	0.909	1.014
Leave out 4			0.288	0.907
Leave out 5				0.288

Table 10: Number of firms in the media and corruption in case 2 with $\alpha_G = 1$ and $\alpha_M = 1.5$

	N = 2	N = 3	N = 4	N = 5
Government's survival probability under different patterns of capture as per (2)				
π_1^N	0.325	0.500	0.606	0.676
π_2^N	0.100	0.200	0.325	0.424
π_3^N		0.100	0.156	0.244
π_4^N			0.100	0.136
π_5^N				0.100
A media firm's payoff for a given number of firms attempting to expose				
$(1 - \pi_1^N)\alpha_M$	1.013	0.750	0.591	0.486
$(1 - \pi_2^N)\frac{1}{2}\alpha_M$	0.675	0.600	0.506	0.432
$(1 - \pi_3^N)\frac{1}{3}\alpha_M$		0.450	0.422	0.378
$(1 - \pi_4^N)\frac{1}{4}\alpha_M$			0.338	0.324
$(1 - \pi_5^N)\frac{1}{5}\alpha_M$				0.270
Government's expected payoff from CR under different collusive arrangements				
Buy all	-0.025	-0.25	-0.363	-0.430
Leave out 1	-0.025	-0.2	-0.306	-0.376
Leave out 2	0.200	-0.05	-0.194	-0.286
Leave out 3		0.200	-0.025	-0.160
Leave out 4			0.200	0.002
Leave out 5				0.200

Table 11: Number of firms in the media and corruption in case 2 with $\alpha_G = 1.88$ and $\alpha_M = 3$

	N = 2	N = 3	N = 4	N = 5
Government's survival probability under different patterns of capture as per (2)				
π_1^N	0.325	0.500	0.606	0.676
π_2^N	0.100	0.200	0.325	0.424
π_3^N		0.100	0.156	0.244
π_4^N			0.100	0.136
π_5^N				0.100
A media firm's payoff for a given number of firms attempting to expose				
$(1 - \pi_1^N)\alpha_M$	2.025	1.500	1.181	0.972
$(1 - \pi_2^N)\frac{1}{2}\alpha_M$	1.350	1.200	1.013	0.864
$(1 - \pi_3^N)\frac{1}{3}\alpha_M$		0.900	0.844	0.756
$(1 - \pi_4^N)\frac{1}{4}\alpha_M$			0.675	0.648
$(1 - \pi_5^N)\frac{1}{5}\alpha_M$				0.540
Government's expected payoff from CR under different collusive arrangements				
Buy all	-1.170	-1.620	-1.845	-1.980
Leave out 1	-0.414	-0.960	-1.292	-1.509
Leave out 2	0.288	-0.324	-0.752	-1.047
Leave out 3		0.288	-0.225	-0.593
Leave out 4			0.288	-0.148
Leave out 5				0.288