Is Media Bias Bad?

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Abstract

Contrary to the common sentiment, I argue that consumers are better off with biased media firms rather than unbiased ones. To make such an argument, I use a simple communication game between potentially biased experts (media firms) and a decision maker (news consumers). In the game, information is costly for experts to acquire, all parameters are common knowledge, and reported information is verifiable. Upon characterizing the informative equilibria, in which reports are fully revealing, I show that biased experts have a higher willingness to pay for information than unbiased ones. In addition, competition among experts further improves the welfare of the decision maker, and the size of those improvements does not depend on having asymmetrically biased experts.

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1 Introduction

A common sentiment is that society is better off with unbiased experts than biased ones. Much of the economics literature, notably starting with Crawford and Sobel (1982), conclude that the conflict of interests between experts and decision makers leads to information loss. I explore this topic of biased experts in the context of the media market with the media firms as potentially biased experts and news consumers as decision makers.

The American Society of Newspaper Editors (ASNE) has identified at least three different interpretations of bias in a public poll.

"not being open-minded and neutral about the facts" : 30%
"having an agenda, and shaping the news report to fit it" : 29%
"favoritism to a particular social or political group" : 29%

The meaning of bias in this paper encompasses the latter two interpretations. Bias is the media firm’s preference for a particular side. For example, The New York Times is accused of having a liberal bias, meaning that it has a left preference, while Fox News Channel is accused of having a conservative bias, meaning that it has a right preference. Moreover, the strength of the sided preference can vary, so that The New York Times may be more left biased than The Los Angeles Times.

In this paper, I argue that consumers are better off with a biased media firm rather than an unbiased one. Using a simple communication game between a potentially biased media firm and unbiased consumers, I explore the incentives for information acquisition in the media market. When information is costly, bias provides an additional incentive for a firm to acquire it in the first place. I also show that competition among firms improves the welfare of consumers, and those improvements do not depend on a diversity of biases. In other words, having two firms of opposite bias does not improve the welfare of consumers any more than having two firms of the same bias.

The framework of my model is best illustrated by a simple story. A mass of voters is about to vote on a policy. Of two proposed alternatives, one of them is better than the other. No one knows for sure which is better, but voters want to select the best one. Before the election, voters can read a news report about the two proposed alternatives. Meanwhile, the media firm can hire reporters to investigate the alternatives and then publish a report. The firm then generates revenue from advertisements. Additionally, the firm also cares about having the best policy in effect, but may be biased toward one of the alternatives.
Five key assumptions are made in this model.

1. *Information is costly for the expert to acquire.* A cursory observation of reality confirms such an assumption. Media firms incur costs in hiring journalists, photographers, and sending them to various parts of the world to collect information. Many previous models of media bias\(^1\) and communication games\(^2\) assume information is costless and exogenously given to the expert. An author who does endogenize costly information acquisition is Austen-Smith (1993 & 1994); however, he neither examines the consequences of bias nor of competition. Dewatripont and Tirole (1999) also have costly information, and I discuss their paper in the related literature section.

2. *People read news reports because they are informative, but reading is costly in terms of time and effort.* With numerous alternative uses for a person’s time and attention, consuming news cannot be costless. If it were costless, then people might as well consume an infinite amount of news.

3. *Reports are not priced by the firm.*\(^3\) In reality, news reported through the radio, Internet, and television are almost never priced. The revenue of most media firms is generated through advertisements, and not from directly selling its reports. Reflecting such a fact is the recent demise of *TimesSelect*, a paid subscription program of *The New York Times* online. Exceptions to the non-pricing of reports include the *Wall Street Journal* online and portions of the *Financial Times* online, but there are recent speculations about the *Wall Street Journal* removing its subscription fees upon its acquisition by News Corporation.

4. *All parameters are common knowledge.* There is no uncertainty about the firms’ bias level, the cost of information, and the effort cost of reading. Here, common knowledge is a simplifying assumption used to separate out the acquisition incentives from the effects of uncertainty.

5. *The media firms can withhold acquired information in their reports, but cannot lie.*\(^4\)

\(^1\)Gentzkow and Shapiro (2006), Mullainathan and Shleifer (2005), Baron (2006)


\(^3\)Previous models of media bias, such as Mullainathan and Shleifer (2005) and Baron (2006), include a pricing strategy for the firm.

Firms are generally accused of creating biased by selectively omitting certain facts rather than outright fabrication, since being caught lying results in large penalties. One example is the infamous *New York Times* reporter Jayson Blair, who plagiarized and created fraudulent reports. To minimize damage to the newspaper’s credibility, not only was Jayson Blair forced to resign, but two top editors as well. In the long run, a media firm that continuously deceives the public cannot survive in the industry, for no one would waste time reading lies. Alternatively, this assumption is justified if information is verifiable. The consumer may be able to verify facts on his own or ask the firm for the source of information. It is not necessary for every news consumer to be able to verify the information, just so long as someone is able to verify the information and expose any fabrications.

The main result of this paper is striking – consumers are better off with a biased media firm than an unbiased one. Informative equilibria exist when the firm’s cost of acquiring information is sufficiently low and the consumers’ effort cost of reading is sufficiently low. Reports are fully revealing in informative equilibria and this is not inconsistent with reality, as the ASNE cites:

More than two-thirds of adults say their perception of bias in newspapers does not represent a "major obstacle" to being able to trust newspapers as a source of news - perhaps because they believe they’ve built sufficient filtering mechanisms to identify and neutralize it when they think they see it.

Moreover, as the firm’s bias level increases, its willingness to pay for information also increases. Since a biased media firm would never withhold favorable information, withheld information must be unfavorable. If a biased media firm does not acquire information, then consumers would believe the firm acquired unfavorable information and was simply not reporting it. The certainty of an unfavorable outcome by not acquiring information provides the incentive for a biased media firm to acquire it. Therefore, a more biased media firm has a higher willingness to pay for information than a less biased one.

The second result is that competition, modeled as a duopoly, improves the welfare of the consumers. Having two firms rather than one improves the welfare of the consumers because it allows for the possibility of two informative reports.

The third and final result is that having two asymmetrically biased firms does not offer any more welfare improvements in addition to what was already present with two identical
experts. In the informative equilibria, reports are fully revealing. The decision of a firm to acquire information depends on whether its competitor is acquiring information. The bias level is relevant only in determining whether or not a competitor will acquire information. Other than that purpose, a competitor’s bias level does not affect a firm’s decision to acquire information. Therefore, the welfare improvements from competition do not depend on whether the experts are identically biased or asymmetrically biased.

1.1 Related Literature

This paper contributes to the communication game literature, which includes the classic paper by Crawford and Sobel (1982). In their paper, when the preferences of the expert and decision maker are not perfectly aligned, information loss occurs due to the strategic incentives of the expert to distort her message to the decision maker. Numerous subsequent papers have explored different possible ways of attaining full information despite the conflict of interests. For instance, Milgrom and Roberts (1986) as well as Krishna and Morgan (2001) consider competition among experts. Battaglini (2002) considers bias across many dimensions. Chakraborty and Harbaugh (2007) consider transparency of the expert’s bias to the decision maker. They all share the common assumption that information is costless and the expert is exogenously informed. Indeed, given that the expert is informed, there is an incentive to distort the information. However, my paper addresses the question, will the expert acquire that information in the first place. When information is costly for the expert to acquire, the conclusions are different because the incentives of the expert have changed.

Topically, this paper also contributes to the literature on media bias. Three notable models of media bias are Gentzkow and Shapiro (2006), Mullainathan and Shleifer (2005), and Baron (2006). Because interpretations of media bias greatly differ, the models also greatly differ. Gentzkow and Shapiro (2006) do not have any biased players in their model and interpret media bias as the presence of information loss. Mullainathan and Shleifer (2005) model the news consumers as the biased players. Baron (2006) assumes that journalists are biased. All of these papers on media bias assume information is costless and exogenously given to the firm. As a result, they all focus on the information loss created by a conflict of interests. In contrast, my paper shows benefits in having biased media firms.

The most closely related paper is Dewatripont and Tirole (1999), who include costly information. Our conclusions are similar in that we both provide arguments in favor of biased experts, however our approaches are different. Dewatripont and Tirole compare an
unbiased expert with two oppositely biased experts. Their argument in favor of biased experts depends on having two oppositely biased experts, while my argument does not. In my model, the decision maker is better off even in the case of a single biased expert. Furthermore, I show that having two experts of opposite biases does not improve the welfare of the decision maker any more than having two experts of the same bias.

2 Model Environment

The story of the media market told in the introduction is now formally modeled as a communication game between a potentially biased expert (the media firm) and a decision maker (the news consumers\textsuperscript{5}).

There is a binary state of the world, $S \in \{R, L\}$, unknown to all players. All players hold common prior beliefs about the state, $Pr(R) = \theta$ and $Pr(L) = 1 - \theta$. The expert can either acquire information or not acquire one piece of information about the state. The cost of acquiring information $c$ is strictly positive. If an expert acquires information, then she gets an imperfect signal $s \in \{r, l\}$. The accuracy of the signals is $Pr(r|R) = \pi_R$ and $Pr(l|L) = \pi_L$. After receiving a signal, the expert publishes a report $\hat{s} \in \{\hat{0}, \hat{r}, \hat{l}\}$. In her report, the expert can either reveal the true signal or withhold information, but not lie. For instance, if the expert acquired information and received signal $l$, then the report can be either $\hat{l}$ or $\hat{0}$, but not $\hat{r}$. If the expert did not acquire any information, then she must report $\hat{0}$. Simultaneous with the expert’s acquisition decision, the decision maker decides whether or not to read the expert’s report. Because reading a report takes time and effort, let $e$ denote the effort cost of reading one report. After reading the report, if any, the decision maker selects an action $A \in \{L, R\}$. Finally, the game ends, and all players receive their respective payoffs.

2.1 Strategies

The expert’s strategy is comprised of two decisions: acquiring information ($\alpha^E$) and reporting information ($\rho^E$). The expert decides on whether or not to acquire information, $\alpha^E$, where $\alpha^E$ is the probability of the expert acquiring information. Also, the expert decides on what to report given the signal she received. If she received signal $r$, then $\rho^E(\hat{r}|r)$ is the

\textsuperscript{5}The decision maker can be interpreted in two ways. He can represent a single consumer or he can represent a mass of identical consumers.
probability of reporting $\tilde{r}$, while $\rho^E(\tilde{0}|r)$ is the probability of reporting $\tilde{0}$. If she received signal $l$, then $\rho^E(\tilde{l}|l)$ is the probability of reporting $\tilde{l}$, while $\rho^E(\tilde{0}|l)$ is the probability of reporting $\tilde{0}$. If the expert did not acquire a signal, then she has no reporting decision; the expert must report $\tilde{0}$.

The decision maker’s strategy is also comprised of two decisions: what report to read, if any, ($\rho^{DM}$) and what action to take ($\alpha^{DM}$). The decision maker’s reading strategy $\rho^{DM}$ is the probability of reading the expert’s report. Here, a mixed strategy of $\rho^{DM} = 0.5$ means that with 50% probability the expert reads and with 50% probability the expert does not read.

Lastly, the decision maker decides on an action strategy depending on the report read, if any. Let $\alpha^{DM}(R|\tilde{r})$ be the probability that the decision maker takes action $R$ after reading report $\tilde{r}$ from the expert. Let $\alpha^{DM}(R|\tilde{l})$ be the probability that the decision maker takes action $R$ after reading report $\tilde{l}$ from the expert. Let $\alpha^{DM}(R|\tilde{0})$ be the probability that the decision maker takes action $R$ after reading report $\tilde{0}$ from the expert. If the decision maker does not read any report, then $\alpha^{DM}(R|\tilde{0})$ denotes the probability that the decision maker takes action $R$ after not reading anything. Notice that $\tilde{0}$ represents no report when the decision maker chooses to read a report while $\tilde{0}$ represents the lack of a report when the decision maker chooses not to read a report.

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6 Notice that $\alpha^{DM}(R|\tilde{l}) = 1 - \alpha^{DM}(L|\tilde{l})$. 

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2.2 Payoffs

The expert receives advertising revenue, \( \text{Rev}(\rho^{\text{DM}}) \), which depends on the probability of the decision maker reading the expert’s report. In particular, \( \text{Rev}(\rho^{\text{DM}}) \) is a strictly increasing function in \( \rho^{\text{DM}} \). If the decision maker does not read the expert’s report, then \( \text{Rev}(0) = 0 \). If the decision maker does read the expert’s report, then the expert receives the maximum amount of advertising revenue: \( \text{Rev}(1) \). In addition to advertising revenue, the expert cares about the truth and may be biased toward one action. In particular, the expert receives a payoff of 1 if the decision maker’s action matches the true state. Additionally, the expert receives a payoff of \( b \) if the decision maker takes action \( R \) regardless of the state. If \( b = 0 \), then the expert is unbiased and only cares about having the decision maker correctly match the state. If \( b > 0 \), then the expert is right-biased. If \( b < 0 \), then the expert is left-biased. Receiving a negative payoff when action \( R \) is chosen is equivalent to receiving a positive payoff when action \( L \) is chosen.

\[
U^E = \text{Rev}(\rho^{\text{DM}}) - \alpha Ec + \]

The decision maker receives a payoff of 1 when the action he selects matches the state. Furthermore, the decision maker incurs an effort cost \( e \) for each report read.

\[
U^{DM} = \]

3 Equilibrium Analysis

In this section, I present and discuss three variations of the model: (i) monopoly model, (ii) duopoly model with identical experts, (iii) duopoly model with asymmetrically biased experts. The equilibrium concept is sequential equilibrium.

I focus on equilibria in pure acquisition and pure reading strategies, and later discuss why the equilibria in mixed acquisition and mixed reading strategies are uninteresting. There
are only two kinds of equilibria in pure acquisition and pure reading strategies: informative and uninformative.

**Definition 1** An informative equilibrium in the monopoly game is one in which the expert acquires information and the decision maker reads the report.

**Definition 2** An uninformative equilibrium is one in which no information is acquired and no report is read.

I make two innocuous parameter assumptions throughout the paper.

Assume $\theta < \frac{1}{2}$ without loss of generality, because the game is symmetric to the prior beliefs.

Assume that a signal is informative, meaning that a signal is strong enough to change a player’s beliefs about the true state. Without this assumption an informative equilibrium would never be possible. Call this the assumption of informative signals.

$$
\begin{align*}
\Pr(R|r) &> \Pr(L|r) \\
\theta \pi_R (1-\theta)(1-\pi_L) &> (1-\theta)\pi_L - \theta (1-\pi_R)
\end{align*}
$$

The pure acquisition strategies for the expert are to acquire information and to not acquire. The pure reading strategies for the decision maker are to read and to not read. If the expert does not acquire, then it is a best response for the decision maker to not read. Conversely, if the decision maker does not read, it is a best response for the expert to not acquire. Such behavior leads us to the uninformative equilibrium.

**Proposition 1** For all parameter values ($c \in \mathbb{R}^+, e \in \mathbb{R}^+, \text{ and } b_i \in \mathbb{R} \text{ for all } i = 1, 2, ... n$) and for any number of $n$ experts, there exists an uninformative equilibrium.

In this equilibrium, the expected utilities are

$$
EU_{DM} = 1 - \theta \\
EU_{i} = Rev(1) + (1 - \theta)
$$

Having presented the uninformative equilibrium, the rest of the paper focuses on the informative ones.
3.1 Monopoly Model

Using a game with one biased expert, I show how it is possible for a decision maker to be better off with a biased expert than an unbiased one. The strategy that occurs last in the timing of the game is considered first: the decision maker’s action strategy. If the decision maker reads either $\hat{r}$ or $\hat{l}$, the action decision is simple. He selects $R$ given report $\hat{r}$, and $L$ given report $\hat{l}$. The more complicated decision occurs when the decision maker reads report $\hat{0}$.

When the decision maker reads a report of $\hat{0}$, he can hold three different beliefs about the expert’s actions: (i) the expert received an $r$ signal and withheld information, (ii) the expert received an $l$ signal and withheld information, or (iii) the expert didn’t acquire any information at all. Whatever reporting strategy the expert selects, the decision maker’s beliefs about $\hat{0}$ will be consistent with the expert’s strategies in equilibrium. In informative equilibria, reports of $\hat{0}$ represent either an $r$ signal or an $l$ signal. Hence, define the following two types: Type R and Type L.

**Type R:** The decision maker’s action upon reading $\hat{0}$ is the same as if he read $\hat{r}$. The expert reports $\hat{l}$ given a left signal and is indifferent between reporting $\hat{r}$ and $\hat{0}$ given a right signal.

**Type L:** The decision maker’s action upon reading $\hat{0}$ is the same as if he read $\hat{l}$. The expert reports $\hat{r}$ given a right signal and is indifferent between reporting $\hat{l}$ and $\hat{0}$ given a left signal.

With the exception of the uninformative equilibrium, all equilibria of the monopoly game is either Type R or Type L. If the expert acquires information, then she will report informatively according to either Type R or Type L.\(^7\) She will not adopt a mixed reporting strategy for both $r$ and $l$ signals. Why would the expert bother acquiring costly information to begin with, if she is planning on distorting the report so that it becomes useless to the decision maker? If she doesn’t acquire information at all, she can still report $\hat{0}$, which will yield the same expected utility as if she did acquire information save the cost of information.

Propositions 2 and 3 formally state the two informative equilibria\(^8\). The discussion of all the threshold values immediately follows.

\(^7\)To be clear, there exist equilibria in which the expert adopts a mixed acquisition strategy. With probability $\alpha^E$ the expert acquires information. When the expert acquires information, she will report informatively according to either Type R or Type L.

\(^8\)There exists multiple Type R informative equilibria and multiple Type L informative equilibria, but
Proposition 2 There exists a Type \( R \) informative equilibrium when the effort cost is sufficiently low (\( e \leq e^M \)), the expert is not too right-biased (\( b < b^{MR} \)), and the cost is sufficiently low (\( c \leq c^{MR} \)).

Proposition 3 There exists a Type \( L \) informative equilibrium when the effort cost is sufficiently low (\( e \leq e^M \)), the expert is not too left-biased (\( b > b^{ML} \)), and the cost is sufficiently low (\( c \leq c^{ML} \)).

In any informative equilibria, the decision maker reads the expert’s report. He reads only when the effort cost is sufficiently low (\( e \leq e^M \)).

\[
e^M = \frac{\theta \pi_R - (1 - \theta)(1 - \pi_L)}{\Pr(R|r) - \Pr(L|r)}
\]

If the decision maker does not read, he will rely on his priors and select action \( L \). Reading a report is worthwhile when the information in the report leads to a different action in the decision maker. Thus, the effort cost threshold is equal to the probability of correctly choosing action \( R \) minus the probability of a mistake, that is, \( \Pr(R|r) - \Pr(L|r) \).

In informative equilibria, the reporting strategy of the expert must be incentive compatible with her bias level. If the expert’s bias level is sufficiently low (\( b^{ML} < b < b^{MR} \)), then reporting according to either Type is credible.

\[
b^{ML} = \frac{-\theta \pi_R - (1 - \theta)(1 - \pi_L)}{\theta \pi_R + (1 - \theta)(1 - \pi_L)}
\]

\[
b^{MR} = \frac{(1 - \theta) \pi_L - \theta (1 - \pi_R)}{(1 - \theta) \pi_L + \theta (1 - \pi_R)}
\]

If the expert is too right-biased (\( b \geq b^{MR} \)), then a Type \( R \) equilibrium cannot exist. Such an expert has an incentive to deviate by reporting an \( l \) signal as \( \hat{0} \), because in a Type \( R \) equilibrium, the decision maker believes \( \hat{0} \) represents an \( r \) signal. For instance, knowing the multiplicity is irrelevant. To understand why the multiplicity is irrelevant, consider just the Type \( R \) informative equilibrium. The multiplicity arises because the expert is indifferent between reporting \( r \) signals as \( \hat{r} \) and as \( \hat{0} \). For instance, in one Type \( R \) informative equilibrium the expert always reports \( r \) signals as \( \hat{0} \), while in another Type \( R \) informative equilibrium, the expert reports \( r \) signals as \( \hat{0} \) with 50% probability. The argument is the similar for the Type \( L \) informative equilibrium.
that Ann Coulter strongly supports the right, a news consumer would never believe that her report of $\hat{0}$ represents an $r$ signal. A Type R equilibrium cannot exist for Ann Coulter. To understand why, suppose news consumers did believe that $\hat{0}$ from Ann Coulter represented an $r$ signal. Then she would have an incentive to withhold all information, thus leading consumers to vote right. Such behavior is sub-optimal for consumers.

Although the Type R equilibrium does not exist for an expert who is too right-biased ($b \geq b^{MR}$), the Type L one does. Type L is incentive compatible with such an expert. Here, the expert cannot gain by reporting an $l$ signal as $\hat{0}$, because the decision maker will correctly believe that it represents an $l$ signal. A Type L equilibrium exists for Ann Coulter. News consumers believe that all the facts Ann Coulter reports support the right, while all her omitted facts support the left.

Conversely, if the expert is too left-biased ($b \leq b^{ML}$), then a Type L equilibrium does not exist and a Type R equilibrium does. The argument is similar to above.

In informative equilibria, the expert acquires information, which she does only when the cost is sufficiently low. To identify the cost threshold, compare the expert’s expected utility of acquiring information to that when she does not.

For both Types of equilibria, the expert’s expected utility of acquiring information is the same because full information is achieved. It consists of advertising revenue, the cost of information, the payoff when the decision maker’s action matches the true state, and also the bias payoff when the decision maker selects action $R$.

$$EU^E = Rev(1) - c$$
$$+ [\theta \pi_R + (1 - \theta) \pi_L] + b [\theta \pi_R + (1 - \theta)(1 - \pi_L)]$$

If the expert does not acquire information, then her expected utility depends on what the decision maker’s believes about $\hat{0}$. In Type R, the decision maker believes $\hat{0}$ represents an $r$ signal, while in Type L, he believes $\hat{0}$ represents an $l$ signal.

$$\text{Type R: } EU^E = Rev(1) + \theta + b$$
$$\text{Type L: } EU^E = Rev(1) + (1 - \theta)$$

Hence, the acquisition strategy depends on the Type. In Type R, the expert acquires
information when \( c \leq c^{MR} \), while in Type L, the expert acquires information when \( c \leq c^{ML} \).

**Type R:**
\[
c^{MR} = \frac{\left\{ (1 - \theta)\pi_L - \theta(1 - \pi_R) \right\} - b\left\{ \theta(1 - \pi_R) + (1 - \theta)\pi_L \right\}}{\Pr(L,I) - \Pr(R,I)}
\]

**Type L:**
\[
c^{ML} = \frac{\left\{ \theta\pi_R - (1 - \theta)(1 - \pi_L) \right\} + b\left\{ \theta\pi_R + (1 - \theta)(1 - \pi_L) \right\}}{\Pr(R,r) - \Pr(L,r)}
\]

The two cost thresholds, \( c^{MR} \) and \( c^{ML} \), are typically not equal\(^9\) because the different Types lead to different outcomes when information is not acquired as shown by (2) and (3). This difference affects the incentives for acquiring information.

**Proposition 4** In an informative equilibrium of the monopoly game, regardless of type, the decision maker’s expected utility is
\[
EU^{DM} = [\theta\pi_R + (1 - \theta)\pi_L] - c
\]

and the expert’s expected utility is
\[
EU^E = Rev(1) - c + [\theta\pi_R + (1 - \theta)\pi_L] + b[\theta\pi_R + (1 - \theta)(1 - \pi_L)]
\]

Since all informative equilibria are outcome equivalent, what matters is the existence of at least one of the informative equilibria and not which one. Hence, it is only the larger of the two cost thresholds that matters. To understand this point, suppose \( 0 < c^{MR} < c^{ML} \). If \( 0 < c \leq c^{MR} \), then both Types of informative equilibria exist. However, if \( c^{MR} < c \leq c^{ML} \), then only the Type L informative equilibrium exists. Thus, it is the larger of the two cost thresholds, \( c^{MR} \) and \( c^{ML} \), that matters in determining the existence of at least one informative equilibrium. Denote \( c^M = \max\{c^{MR}, c^{ML}\} \). The main result is stated in Theorem 1.

**Theorem 1** As the bias level increases, whether it be right or left, \( c^M \) increases.

\(^9\) Generally, if \((1 - 2\theta) > b\), then \( c^{MR} > c^{ML} \). If \((1 - 2\theta) < b\), then \( c^{MR} < c^{ML} \). And lastly, if \((1 - 2\theta) = b\), then \( c^{MR} = c^{ML} \).

\(^{10}\) The order, \( 0 < c^{MR} < c^{ML} \), holds true when \((1 - 2\theta) < b < b^{MR} \). There are many possible orderings depending on the parameters, and I have taken this particular order just as an example.
Proof. There are two cases to discuss: when the expert is increasingly left-biased and when the expert is increasingly left-biased.

When the bias level is increasingly left-biased ($b$ becomes more negative), the cost thresholds $c_{MR}$ increases, while $c_{ML}$ decreases until it hits the minimum of zero. In this case, $c_M = c_{MR}$. Hence, $c_M$ increases as the bias level is increasingly left-biased.

When the bias level is increasingly right-bias ($b$ becomes more positive), the cost threshold $c_{ML}$ increases, while $c_{MR}$ decreases until it hits the minimum of zero. In this case, $c_M = c_{ML}$. Hence, $c_M$ increases as the bias level is increasingly right-biased.

The interpretation of Theorem 1 is that a more biased expert has a larger willingness to pay for information than a less biased one. The driving force behind this result is what happens when the expert does not acquire information. When Ann Coulter does not acquire information, she must report $\hat{0}$. Because the news consumers are aware of her extreme right bias level, they believe that she in fact acquired a left signal and chose not to report it. Thus, not acquiring information results in the left action; this is the exact opposite of Ann Coulter’s preference. If she does acquire information, there is a chance for her to receive a right signal. Since she reports all right signals as $\hat{r}$, a right signal allows her to convince the consumers to vote right. It is the certainty of the unfavorable outcome when she does not acquire information that provides the incentive for her to acquire it.

In addition to the two informative equilibria, there also exist two equilibria in mixed acquisition and mixed reading strategies: Type R and Type L. In both types of mixed strategy equilibria, the decision maker is indifferent between reading and not and the expert is indifferent between acquiring and not. Therefore, the equilibrium expected utilities of both players are the same as that in the uninformative equilibrium. For that reason, I do not pay much attention to these mixed equilibria.

Proposition 5 There exist two equilibria in mixed acquisition and mixed reading strategies: one in Type R and one in Type L. In both of these equilibria, the decision maker’s expected utility and the expert’s expected utility is the same as that in the uninformative equilibrium.

Below, I summarize the equilibrium expected utilities of the decision maker, since we are concerned with the welfare of news consumers. Figure 2 and Lemma 1 express the same information. One is graphical, while the other is verbal. They summarize the region in which the informative equilibria exist. As the bias level of an expert increases, that region increases.
Let $Z^{(i)}$ be the set of all the equilibrium expected utilities for the decision maker in a game with one expert.

Let $z_0 = 1 - \theta$, the expected utility of the decision maker in an uninformative equilibrium. Let $z_1 = [\theta \pi_R + (1 - \theta) \pi_L] - e$, the expected utility of the decision maker in an informative equilibrium with one report.

![Figure 2: Equilibrium $EU^{DM}$ in the monopoly model](image)

**Lemma 1** For any $b \in \mathbb{R}$, there exists a cost threshold $c^M > 0$ and an effort threshold $e^M > 0$, such that (i) if $c < c^M$ and $e < e^M$, then $Z^{(i)} = \{z_0, z_1\}$, and (ii) if either $c \geq c^M$ or $e \geq e^M$, then $Z^{(i)} = \{z_0\}$.

### 3.2 Duopoly Model with Two Identical Experts

Using a duopoly model with two identical experts, I show that competition improves the welfare of the decision maker. Competition allows for the possibility of more information. In a duopoly model, two informative reports are possible, whereas in the monopoly model, only one informative report was possible. The decision maker is never worse off with two identical experts than with one expert.

Now that there are two experts, each expert has an acquisition strategy ($\alpha^F_i$) and a reporting strategy ($\rho^E_i$), where $i = 1, 2$. If both experts acquire information, then the signals they receive are independent. The decision maker’s reading strategy, $\rho^{DM} = [\rho^{DM}_1, \rho^{DM}_2]$, is now a vector, where $\rho^{DM}_i$ is the probability of reading expert $i$’s report\(^{11}\) for all $i = 1, 2$.

\(^{11}\)If the decision maker reads both reports, then $\rho^{DM} = [\rho^{DM}_1, \rho^{DM}_2] = [1, 1]$. If the decision maker does not read any report, then $\rho^{DM} = [\rho^{DM}_1, \rho^{DM}_2] = [0, 0]$. To be clear on the meaning of a mixed strategy,
The decision maker’s action strategy now depends on two possible reports if he chooses to read them. Lastly, if the decision maker reads both experts’ reports, the total effort cost is $2e$.

In the duopoly model, there are two kinds of informative equilibria: one in which only one report is read and one in which two reports are read.

**Definition 3** An informative equilibrium with one (two) report(s) is an equilibrium in which one (two) expert(s) acquires (acquire) information and the decision maker reads that expert’s (both) reports.

The informative equilibria with one report in the duopoly game is very similar to that in the monopoly game. In the duopoly game, all informative equilibria with one report requires one of the two experts to be dormant (that is, to not acquire information and for the decision maker to not read that expert’s report). With one of the two experts dormant, the remaining game between the non-dormant expert and decision maker is the same as the game with one expert. There are potentially four different informative equilibria with one report, because either expert could be the non-dormant one and there are two types of informative equilibria (Type R and Type L).

The remainder of this section examines the informative equilibria with two reports. The strategy that occurs last in the timing of the game is considered first: the decision maker’s action strategy. If the decision maker reads either $(\hat{r}, \hat{r})$ or $(\hat{l}, \hat{l})$, then the decision is simple: $R$ and $L$, respectively. If the decision maker reads $(\hat{r}, \hat{l})$ or $(\hat{l}, \hat{r})$, it is possible for either state $R$ to be more likely or state $L$ to be more likely. Since, it is uninteresting to read through both cases when they share so many similarities, I assume the first possibility ($\Pr(R|r,l) > \Pr(L|r,l)$) for the main discussion and relegate the second possibility ($\Pr(L|r,l) > \Pr(R|r,l)$) to the footnotes.

Similar to the monopoly model, when the decision maker reads a report of $\hat{0}$ from expert $i$, he can hold three different beliefs about the actions of expert $i$. He could believe that expert $i$ (i) received an $r$ signal and withheld information, (ii) received an $l$ signal and withheld information, or (iii) didn’t acquire any information at all. In any informative equilibrium, a report of $\hat{0}$ from expert $i$ can mean either an $r$ signal or an $l$ signal.

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consider the strategy $\rho^{DM} = [0.5, 0.5]$. Here, $\rho^{DM} = [0.5, 0.5]$ means that with 25% chance the decision maker reads both reports, with 50% chance the decision maker reads one and not the other, and with 25% chance the decision maker reads neither. It does not mean that the decision maker reads half of expert 1’s report and half of expert 2’s report.
The duopoly model is more complicated than the monopoly one, because each expert can adopt different reporting strategies. Thus, the decision maker can hold different beliefs about the meaning of \( \hat{0} \), depending on which expert reports \( \hat{0} \). Reading reports \( (\hat{0}, \hat{0}) \) can represent any one of the four possible sets of signals: \((r, r), (l, l), (r, l), (l, r)\). Hence, define the following 4 types: Type RR, Type LL, Type RL, and Type LR.

**Type RR:** The decision maker’s action upon reading \((\hat{0}, \hat{0})\) is the same as if he read \((\hat{r}, \hat{r})\). Each expert reports \( \hat{l} \) given a left signal and is indifferent between reporting \( \hat{r} \) and \( \hat{0} \) given a right signal.

**Type LL:** The decision maker’s action upon reading \((\hat{0}, \hat{0})\) is the same as if he read \((\hat{l}, \hat{l})\). Each expert reports \( \hat{r} \) given a right signal and is indifferent between reporting \( \hat{l} \) and \( \hat{0} \) given a left signal.

**Type RL:** The decision maker’s action upon reading \((\hat{0}, \hat{0})\) is the same as if he read \((\hat{r}, \hat{l})\). The first expert reports \( \hat{l} \) given a left signal and is indifferent between reporting \( \hat{r} \) and \( \hat{0} \) given a right signal. The second expert reports \( \hat{r} \) given a right signal and is indifferent between reporting \( \hat{l} \) and \( \hat{0} \) given a left signal.

**Type LR:** The decision maker’s action upon reading \((\hat{0}, \hat{0})\) is the same as if he read \((\hat{l}, \hat{r})\). The first expert reports \( \hat{r} \) given a right signal and is indifferent between reporting \( \hat{l} \) and \( \hat{0} \) given a left signal. The second expert reports \( \hat{l} \) given a left signal and is indifferent between reporting \( \hat{r} \) and \( \hat{0} \) given a right signal.

For the same reason as was mentioned in the monopoly model, all equilibria of the duopoly game is of a defined Type except for the uninformative equilibrium. An expert will not adopt a mixed reporting strategy for both \( r \) and \( l \) signals.

I first focus on only Type RR and Type LL. Propositions 6 and 7 formally state those two types of informative equilibria with two reports. The Type RL and Type LR informative equilibria with two reports will be discussed later.

**Proposition 6** There exists a Type RR informative equilibrium with two reports when the effort cost is sufficiently low \( (e \leq e^D) \), the experts are not too right-biased \( (b < b^{DR}) \), and the cost is sufficiently low \( (c \leq c^{DR}) \).
Proposition 7 There exists a Type LL informative equilibrium with two reports when the
effort cost is sufficiently low \( (e \leq e^D) \), the expert are not too left-biased \( (b > b^{DL}) \), and the
cost is sufficiently low \( (c \leq c^{DL}) \).

In informative equilibria with two reports, the effort cost of reading must be sufficiently
low \(^{12} (e \leq e^D)\). \[
e^D = \theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L)
\]
The decision maker reads both experts’ reports rather than just one if the additional informa-
tion gained exceeds the effort cost of reading. The threshold is determined by comparing
his expected utility from reading two informative reports \(^{13}\)
\[
EU^{DM} = \theta \left[ \pi^2_R + 2 \pi_R (1 - \pi_R) \right] + (1 - \theta) \pi^2_R - 2e
\]

with that from reading only one informative report.
\[
EU^{DM} = [\theta \pi_R + (1 - \theta) \pi_L] - e
\]

In informative equilibria with two reports, the reporting strategy of each expert must
be incentive compatible with her bias level. If the expert’s bias level is sufficiently low \(^{14}\)
\( (b^{DL} < b < b^{DR}) \), then reporting according to either Type is credible.
\[
b^{DR} = \frac{(1 - \theta) \pi^2_L - \theta (1 - \pi_R)^2}{(1 - \theta) \pi^2_L + \theta (1 - \pi_R)^2}
\]
\[
b^{DL} = -\left[ \frac{\theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L)}{\theta \pi_R (1 - \pi_R) + (1 - \theta) \pi_L (1 - \pi_L)} \right]
\]

However, if the experts are too right-biased \( (b \geq b^{DR}) \), then the Type RR equilibrium
cannot exist. The argument is similar to that in the monopoly model. Because the experts

---

\(^{12}\)Under the assumption \( \Pr(L|r,l) > \Pr(R|r,l) \), the effort cost threshold is \( e^D = (1 - \theta) \pi_L (1 - \pi_L) - \theta \pi_R (1 - \pi_R) \).

\(^{13}\)Under the assumption \( \Pr(L|r,l) > \Pr(R|r,l) \), the expected utility from reading two informative reports
is \( EU^{DM} = \theta \pi^2_R + (1 - \theta) \left[ \pi^2_L + 2 \pi_L (1 - \pi_L) \right] \).

\(^{14}\)Under the assumption \( \Pr(L|r,l) > \Pr(R|r,l) \), the bias thresholds are \( b^{DR} = \frac{(1 - \theta) \pi_L (1 - \pi_L) - \theta \pi_R (1 - \pi_R)}{(1 - \theta) \pi^2_L + \theta \pi_R (1 - \pi_R)} \)
\( b^{DL} = -\left[ \frac{\theta \pi^2_R (1 - \theta) (1 - \pi_L)^2}{\theta \pi^2_R (1 - \theta) (1 - \pi_L)^2} \right] \)
are so right-biased, they have an incentive to deviate and report \( l \) signals as \( \hat{0} \). If there were two Ann Coulters, the Type RR equilibrium cannot exist for them.

Although the Type RR equilibrium does not exist in this case, the Type LL one does. Type LL is incentive compatible with experts who are too right-biased \(( b \geq b^{DR} )\). Here, the experts cannot gain by reporting \( l \) signals as \( \hat{0} \), because the decision maker will correctly believe that \( \hat{0} \) represents an \( l \) signal. The Type LL equilibrium does exist for two Ann Coulters.

Conversely, if the experts are too left-biased \(( b \leq b^{DL} )\), then a Type LL equilibrium does not exist and a Type RR one does. The argument is similar to above.

In informative equilibria with two reports, both experts must acquire information, which they do only when the cost is sufficiently low. To identify the cost threshold, compare expert \( i \)'s expected utility of acquiring information to that when she does not, assuming that expert \( j \) behaves according to equilibrium play. For all four Types of equilibria, expert \( i \)'s expected utility of acquiring information is the same.\(^{15}\)

\[
EU^{iE} = Rev(1) - c \\
+ \left[ \theta \left[ \pi_R^2 + 2\pi_R(1 - \pi_R) \right] + (1 - \theta) \pi_L^2 \right] \\
+ b \left[ \theta \left[ \pi_R^2 + 2\pi_R(1 - \pi_R) \right] + (1 - \theta) \left( 1 - \pi_L^2 \right) \right]
\]

If expert \( i \) does not acquire information, then her expected utility depends on the Type.

Type RR : \[
EU^{iE}_i = Rev(1) + \theta + b
\]

Type LL : \[
EU^{iE}_i = Rev(1) + \left[ \theta\pi_R + \pi_L \left( 1 - \theta \right) \right] + b \left[ (1 - \theta) \left( 1 - \pi_L \right) + \theta\pi_R \right]
\]

In Type RR, the decision maker believes \( \hat{0} \) from expert \( i \) represents an \( r \) signal. Because of the assumption \( \Pr(R|r, l) > \Pr(L|r, l) \), in Type RR the only time the decision maker selects action \( L \) is after reading reports \( \left( \hat{l}, \hat{l} \right) \). If expert \( i \) does not acquire information, then the decision maker will never receive reports \( \left( \hat{l}, \hat{l} \right) \). Therefore, if expert \( i \) does not acquire information, the decision maker will always select \( R \), regardless of expert \( j \)'s report.\(^{16}\)

\(^{15}\)Under the assumption \( \Pr(L|r, l) > \Pr(R|r, l) \), expert \( i \)'s expected utility of acquiring information is \( EU^{iE}_i = Rev(1) - c + \left[ \theta\pi_R^2 + (1 - \theta) \left( 2\pi_L \left( 1 - \pi_L \right) + \pi_L^2 \right) \right] + b \left[ \theta\pi_R^2 + (1 - \theta) \left( 1 - \pi_L \right)^2 \right] \)

\(^{16}\)Under the assumption \( \Pr(L|r, l) > \Pr(L|r, l) \), if expert \( i \) does not acquire information, then the decision maker’s action depends entirely on expert \( j \)'s informative reports. Because the decision maker believes \( \hat{0} \) from expert \( i \) is an \( r \) signal, he selects \( R \) given reports \( \left( \hat{0}, \hat{r} \right) \) and \( L \) given reports \( \left( \hat{0}, \hat{l} \right) \).
By comparing the expected utilities, (4) and (5), I determine the Type RR cost threshold\(^{17}\). Below this threshold, expert \(i\) acquires information and above, she does not.

\[
\text{Type RR: } c^{DR} = \begin{bmatrix}
(1 - \theta) \pi^2_L - \theta (1 - \pi_R)^2 \\
-b \left( \theta (1 - \pi_R)^2 + (1 - \theta) \pi^2_L \right)
\end{bmatrix}
\]

In Type LL, the decision maker believes \(\hat{0}\) from expert \(i\) represents an \(l\) signal. Under the assumption that \(\Pr(R|l, \hat{0}) > \Pr(L|l, \hat{0})\), the decision maker selects \(R\) given reports \((\hat{r}, \hat{l})\) and \((\hat{l}, \hat{r})\). Because in Type LL the decision maker believes expert \(i\)'s report of \(\hat{0}\) is an \(l\) signal, he selects \(R\) given reports \((\hat{0}, \hat{r})\) and \(L\) given reports \((\hat{0}, \hat{l})\). Therefore, if expert \(i\) does not acquire information, then the decision maker’s action decision is determined entirely by expert \(j\)'s informative reports.\(^{18}\) In other words, expert \(i\) is able to free ride from the information acquired by expert \(j\).

By comparing the expected utilities, (4) and (6), I determine the Type LL cost threshold\(^{19}\). Below this threshold, expert \(i\) acquires information and above, she does not.

\[
\text{Type LL: } c^{DL} = \begin{bmatrix}
\theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \\
+b \left[ \theta \pi_R (1 - \pi_R) + (1 - \theta) \pi_L (1 - \pi_L) \right]
\end{bmatrix}
\]

The incentives for information acquisition greatly differ between the two Types, because of what occurs when an expert does not acquire. In Type RR, if an expert does not acquire information, the decision maker will choose \(R\). In Type LL, an expert has an incentive to free ride off of the information provided by the other expert.\(^{20}\)

Having fully discussed the Type RR and Type LL informative equilibria with two reports, I now examine equilibria in which the experts adopt asymmetric reporting strategies. There exists a Type RL informative equilibrium with two reports when the cost of information is lower than the minimum of \(c^{DR}\) and \(c^{DL}\). If the cost lies above \(c^{DR}\), then the first expert will no longer acquire information given that the second is acquiring information.

\(^{17}\)Under the assumption \(\Pr(L|r, \hat{b}) > \Pr(R|r, \hat{b})\), the cost threshold is \(c^{DR} = [(1 - \theta) \pi_L (1 - \pi_L) - \theta \pi_R (1 - \pi_R)] - b [(1 - \theta) \pi_L (1 - \pi_L) + \theta \pi_R (1 - \pi_R)]\)

\(^{18}\)Under the assumption \(\Pr(L|r, \hat{b}) > \Pr(L|r, \hat{b})\), if expert \(i\) does not acquire information, then the decision maker’s always selects action \(L\). The only time the decision maker selects action \(R\) is after reading reports \((\hat{r}, \hat{r})\). If expert \(i\) does not acquire information, then the decision maker will never receive reports \((\hat{r}, \hat{r})\).

\(^{19}\)In the second case, where \(\Pr(L|r, \hat{b}) > \Pr(R|r, \hat{b})\), the cost threshold is \(c^{DL} = \theta \pi^2 - (1 - \theta) (1 - \pi_L)\) + \(b \left[ \theta \pi^2 + (1 - \theta) (1 - \pi_L) \right]\)

\(^{20}\)In the second case, where \(\Pr(L|r, \hat{b}) > \Pr(R|r, \hat{b})\), Type RR would provide the incentive to free ride, while Type LL would provide the expert with complete power to convince the decision maker to choose \(L\).
Likewise, if the cost lies above \( c_{DL} \), then the second expert will no longer acquire information given that first is acquiring information. When the cost lies between \( c_{DR} \) and \( c_{DL} \), one of the two experts will no longer find it in her best interests to acquire information. For the same reason, the Type LR informative equilibrium with two reports exists when the cost of information is lower than the minimum of \( c_{DR} \) and \( c_{DL} \).

**Proposition 8** There exist Type RL and Type LR informative equilibria with two reports when the effort cost is sufficiently low (\( e \leq e^D \)), the experts are not too left- nor too right-biased (\( b_{DL} < b < b_{DR} \)), and the cost is sufficiently low (\( c \leq \min\{c_{DR}, c_{DL}\} \)).

Equilibria with asymmetric reporting strategies are not particularly interesting. Their existence requires \( c \leq \min\{c_{DR}, c_{DL}\} \). When the two experts adopt symmetric reporting strategies, an informative equilibrium with two reports exists when \( c \leq \max\{c_{DR}, c_{DL}\} \). Therefore, whenever an informative equilibrium with asymmetric reporting strategies exists, so does an informative equilibrium with symmetric reporting strategies.

Since all informative equilibria with two reports are outcome equivalent, what matters is the existence of at least one of those equilibria and not which one. Hence, it is only the larger of the two cost thresholds that matters. Let \( c^D = \max\{c_{DR}, c_{DL}\} \).

**Proposition 9** In any informative equilibrium with two reports, the decision maker’s expected utility\(^{21}\) is

\[
EU^{DM} = \theta \left[ \pi_R^2 + 2\pi_R (1 - \pi_R) \right] + (1 - \theta) \pi_L^2 - 2e
\]

and the expected utility of each expert is

\[
EU^E_i = Rev(1) - c \\
+ \left[ \theta \left( \pi_R^2 + 2\pi_R (1 - \pi_R) \right) + (1 - \theta) \pi_L^2 \right] \\
+ b \left[ \theta \left( \pi_R^2 + 2\pi_R (1 - \pi_R) \right) + (1 - \theta) \left( 1 - \pi_L^2 \right) \right]
\]

\(^{21}\)Under the assumption \( \Pr(L|r, l) > \Pr(R|r, l) \),

\[
EU^{DM} = \left[ \theta \pi_R^2 + (1 - \theta) \left( \pi_L^2 + 2\pi_L (1 - \pi_L) \right) \right] - 2e
\]

\[
EU^E_i = Rev(1) - c \\
+ \theta \pi_R^2 \left( 1 - \theta \right) \left( \pi_L^2 + 2\pi_L (1 - \pi_L) \right) \\
+ b \left[ \theta \pi_R^2 + (1 - \theta) \left( 1 - \pi_L^2 \right) \right]
\]
Equilibria with mixed acquisition strategies and mixed reading strategies do exist in the duopoly model, but they are not particularly interesting. One set of mixed strategy equilibria occur when the decision maker is indifferent between not reading and reading one report. This set of mixed strategy equilibria is outcome equivalent to the uninformative equilibrium. Another set of mixed strategy equilibria occur when the decision maker is indifferent between reading one report and reading two reports. This set of mixed strategy equilibria is outcome equivalent to the informative equilibria with one report. The decision maker will never be indifferent between reading no report and two reports, because the marginal cost of reading is constant, while the marginal benefit of reading decreases. A more formal discussion of the mixed strategy equilibria appears in the appendix.

Competition improves welfare because more information can be acquired. In the duopoly model, two signals can be acquired and reported, whereas, in the monopoly model, only one signal was possible. Below, I summarize the set of equilibrium expected utilities for the decision maker in the duopoly game.

Let $Z^{(i,i)}$ be the set of all the equilibrium expected utilities for the decision maker in a game with two identical experts.

Recall that $z_0 = 1 - \theta$, the expected utility of the decision maker in an uninformative equilibrium.

Recall that $z_1 = [\theta \pi_R + (1 - \theta) \pi_L] - e$, the expected utility of the decision maker in an informative equilibrium with one report.

Let $z_2 = [\theta \pi_R^2 + 2 \theta \pi_R (1 - \pi_R) + (1 - \theta) \pi_L^2] - 2e$, the expected utility of the decision maker in an informative equilibrium with two reports.

The following two lemmas and two graphs express the set $Z^{(i,i)}$, that is, the set of all the equilibrium expected utilities for the decision maker in a game with two identical experts.

**Lemma 2** If $e < e^M$ and $c < c^M$, then $z_1 \in Z^{(i,i)}$ and $z_1 \in Z^{(i)}$.

**Lemma 3** If $e \leq e^D$ and $c \leq c^D$, then $z_2 \in Z^{(i,i)}$.

Depending on the parameters, it is possible for either $c^M > c^D$ or $c^D > c^M$. Figure 3
depicts the case when $c^M > c^D$.

![Figure 3: Equilibria $EU^{DM}$ when $c^M > c^D$](image)

Figures 4 depicts the opposite case when $c^D > c^M$.

![Figure 4: Equilibria $EU^{DM}$ when $c^D > c^M$](image)

Informally speaking, the decision maker is better off in the game with two experts than the game with only one expert in the following sense. In the monopoly game, the figure consists of the shaded regions with $z_0$ and $z_1$, while in the duopoly game, the figure consists of the shaded regions $z_0$, $z_1$, and $z_2$. Thus, for all parameters, the set $Z^{(i,i)}$ is never "worse" than the set $Z^{(i)}$, while for other parameters, the set $Z^{(i,i)}$ is "better" than the set $Z^{(i)}$. Theorem 2 formally states how the decision maker is better off in the game with two experts than the game with only one expert.

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Theorem 2

For any $c \in \mathbb{R}^+, b \in \mathbb{R}, e \in \mathbb{R}^+$, and for all $z^M \in Z^{(i)}$, there exists $z^D \in Z^{(i,j)}$ such that $z^D \geq z^M$

For some $c \in \mathbb{R}^+, b \in \mathbb{R}, e \in \mathbb{R}^+$, and for all $z^M \in Z^{(i)}$, there exists $z^D \in Z^{(i,i)}$ such that $z^D > z^M$

3.3 Duopoly Model with Two Asymmetrically Biased Experts

There is a notion that having two equally biased experts may not improve the welfare of the population as much as having two oppositely biased experts. I explore this notion using the game with two asymmetrically biased experts and show that additional welfare improvements do not emerge.

Let one expert be more right-biased than another ($b_j < b_i$). There are three possible cases. (i) Both of them could be right-biased with expert $i$ being more right-biased ($0 < b_j < b_i$). (ii) Both of them could be left-biased with expert $j$ being more left-biased ($b_j < b_i < 0$). (iii) Lastly, the two experts could be oppositely biased ($b_j < 0 < b_i$). It is not necessary to consider each case individually for the analysis. All that is necessary is $b_j < b_i$. Without loss of generality, let the first expert be expert $i$, and the second be expert $j$. I first examine the informative equilibria with one report and then that with two reports.

For the informative equilibria with one report, the asymmetric bias levels do not change the decision maker’s effort condition. Similar to the previous games, the decision maker reads one report when $e \leq e^M$. However, the asymmetric bias levels do change the experts’ acquisition decisions. The different bias levels leads to different cost thresholds.

$$
c_{i}^{MR} = [(1 - \theta)\pi_L - \theta(1 - \pi_R)] - b_i [\theta(1 - \pi_R) + (1 - \theta)\pi_L]
$$

$$
c_{j}^{MR} = [(1 - \theta)\pi_L - \theta(1 - \pi_R)] - b_j [\theta(1 - \pi_R) + (1 - \theta)\pi_L]
$$

$$
c_{i}^{ML} = [\theta\pi_R - (1 - \theta)(1 - \pi_L)] + b_i [\theta\pi_R + (1 - \theta)(1 - \pi_L)]
$$

$$
c_{j}^{ML} = [\theta\pi_R - (1 - \theta)(1 - \pi_L)] + b_j [\theta\pi_R + (1 - \theta)(1 - \pi_L)]
$$

Let $c^{MA} = \max\{c_{i}^{MR}, c_{j}^{MR}, c_{i}^{ML}, c_{j}^{ML}\} = \max\{c_{j}^{MR}, c_{i}^{ML}\}$. The more left-biased expert (that is, expert $j$) has a higher cost threshold than expert $i$ under Type R, while the more right-biased expert (that is, expert $i$) has a higher cost threshold than expert $j$ under Type
Type R: \( c_j^{MR} > c_i^{MR} \)
Type L: \( c_i^{ML} > c_j^{ML} \)

Let \( Z^{(i,j)} \) = the set of equilibrium \( EU^{DM} \) in the duopoly game with asymmetrically biased experts, \( b_i > b_j \).

Lemma 4 summarizes when an informative equilibrium with one report exists.

**Lemma 4** If \( e \leq e^M \) and \( c \leq c^M_A \), then \( z_1 \in Z^{(i,j)} \).

Now consider informative equilibria with two reports. Again, the different bias levels do not change the decision maker’s effort condition. The decision maker reads two reports when \( e \leq e^D \). However, the asymmetric bias levels do change the experts’ acquisition decisions. The different bias levels lead to different cost thresholds.

\[
\begin{align*}
    c_i^{DR} &= \left[ \begin{array}{c}
        (1 - \theta) \pi_L^2 - \theta (1 - \pi_R)^2 \\
        -b_i \left[ \theta (1 - \pi_R)^2 + (1 - \theta) \pi_L^2 \right]
    \end{array} \right] \\
    c_j^{DR} &= \left[ \begin{array}{c}
        (1 - \theta) \pi_L^2 - \theta (1 - \pi_R)^2 \\
        -b_j \left[ \theta (1 - \pi_R)^2 + (1 - \theta) \pi_L^2 \right]
    \end{array} \right]
\end{align*}
\]

\[
\begin{align*}
    c_i^{DL} &= \left[ \begin{array}{c}
        \theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \\
        +b_i \left[ \theta \pi_R (1 - \pi_R) + (1 - \theta) \pi_L (1 - \pi_L) \right]
    \end{array} \right] \\
    c_j^{DL} &= \left[ \begin{array}{c}
        \theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \\
        +b_j \left[ \theta \pi_R (1 - \pi_R) + (1 - \theta) \pi_L (1 - \pi_L) \right]
    \end{array} \right]
\end{align*}
\]

The more left-biased expert (that is, expert \( j \)) has a higher cost threshold than expert \( i \) under Type RR, while the more right-biased expert (that is, expert \( i \)) has a higher cost threshold than expert \( j \) under Type LL.

Type RR: \( c_j^{DR} > c_i^{DR} \)
Type LL: \( c_i^{DL} > c_j^{DL} \)
Proposition 10 A Type RR informative equilibrium with two reports exists when the effort cost is sufficiently low \((e \leq e^D)\), the experts are not too too right-biased \((b_i < b^{DR}, b_j < b^{DR})\), and the cost is sufficiently low \((c \leq c^{DR}_i)\).

Proposition 11 A Type LL informative equilibrium with two reports exists when the effort cost is sufficiently low \((e \leq e^D)\), the experts are not too too left-biased \((b_i > b^{DL}, b_j > b^{DL})\), and the cost is sufficiently low \((c \leq c^{DL}_j)\).

Proposition 12 A Type RL informative equilibrium with two reports exists when the effort cost is sufficiently low \((e \leq e^D)\), the first expert is not too right-biased \((b_i < b^{DR})\), the second is not too left-biased \((b_j > b^{DL})\), and the cost is sufficiently low \((c \leq \min\{c^{DR}_i, c^{DL}_j\})\).

Proposition 13 A Type LR informative equilibrium with two reports exists when the effort cost is sufficiently low \((e \leq e^D)\), the first expert is not too left-biased \((b_i > b^{DL})\), the second is not too right-biased \((b_j < b^{DR})\), and the cost is sufficiently low \((c \leq \min\{c^{DL}_i, c^{DR}_j\})\).

The cost thresholds are constructed based on the assumption that the other expert is acquiring information and reporting informatively. To understand what is going on in this game, let’s momentarily restrict attention to Type RR. Given that expert \(j\) is acquiring and reporting informatively, expert \(i\) will acquire information when \(c \leq c^{DR}_i\). Similarly, given that expert \(i\) is acquiring and reporting information, expert \(j\) will acquire information when \(c \leq c^{DR}_j\). However, since \(c^{DR}_j > c^{DR}_i\), the equilibrium with two informative reports only exists when the cost of information is less than the smaller of the two thresholds \((c \leq c^{DR}_i)\).

When \(c \in (c^{DR}_i, c^{DR}_j)\), expert \(i\) no longer acquires information even though expert \(j\) would acquire.

Let \(c^{DA} = \max\{c^{DR}_i, c^{DL}_j, \min\{c^{DR}_i, c^{DL}_j\}, \min\{c^{DR}_i, c^{DL}_j\}\} = \max\{c^{DR}_i, c^{DL}_j, \min\{c^{DR}_i, c^{DL}_j\}\}\).

Lemma 5 If \(e \leq e^D\) and \(c \leq c^{DA}\), then \(z_2 \in Z^{(i,j)}\).

Let \(Z^{(i,i)}\) = the set of equilibrium \(EU^{DM}\) in the duopoly game with identical experts with bias level of \(b_i\).

Let \(Z^{(j,j)}\) = the set of equilibrium \(EU^{DM}\) in the duopoly game with identical experts with bias level of \(b_j\).

The duopoly model with asymmetrically biased experts does not offer any welfare improvements in addition to what was already present in a duopoly model with identical experts. For every equilibrium in the duopoly model with asymmetrically biased experts, there exists a corresponding outcome equivalent game with identically biased experts.
Theorem 3. For any fixed set of parameters \((c \in \mathbb{R}^+, e \in \mathbb{R}^+, b_i \in \mathbb{R}, b_j \in \mathbb{R} \text{ with } b_j < b_i)\) and for any \(z^A \in Z^{(i,j)}\), there exists \(z \in (Z^{(i,i)} \cup Z^{(j,j)})\) such that \(z \geq z^A\).

For some parameters, \((c \in \mathbb{R}^+, e \in \mathbb{R}^+, b_i \in \mathbb{R}, b_j \in \mathbb{R} \text{ with } b_j < b_i)\) and for any \(z^A \in Z^{(i,j)}\), there exists \(z \in (Z^{(i,i)} \cup Z^{(j,j)})\) such that \(z \geq z^A\).

Proof. In the duopoly game with asymmetric experts, the highest duopoly cost threshold (that is, \(c^{DA} = \max\{c^{DR}_i, c^{DL}_j, \min\{c^{DL}_i, c^{DR}_j\}\}) can be any one of four values, and the highest monopoly cost threshold (that is, \(c^{MA} = \max\{c^{MR}_j, c^{ML}_i\}\)) can be any one of two values. Initially, it appears that there are eight cases to consider. In fact, there are only four cases to consider, because some cases can be considered together.

1. Case 1: Suppose \(c^{DL}_i < c^{DR}_j\), then \(c^{DA} = \max\{c^{DR}_i, c^{DL}_j, c^{DL}_i\} = \max\{c^{DR}_i, c^{DL}_i\} = c^{DR}_i\).

(a) Sub-case 1.1: \(c^{MA} = c^{MR}_j\)

In this case, having two expert j’s is better than having one expert i and one expert j.

If \(e \leq e^M\) and \(c \leq c^{MA}\), then \(z_1 \in Z^{(j,j)}\) and \(z_1 \in Z^{(i,j)}\).

If \(e \leq e^M\) and \(c \leq c^{DA}\), then in the interval \(c \in (c^{MA}, c^{DR}_j]\), \(z_2 \in Z^{(j,j)}\) but \(z_2 \notin Z^{(i,j)}\). This means a higher equilibrium \(EU^{DM}\) can be achieved in the interval \(c \in (c^{DA}, c^{DR}_j]\) in a game with two expert j’s than in a game with one expert i and one expert j.

(b) Sub-case: 1.2: \(c^{MA} = c^{ML}_i\)

In this case, having two expert i’s is the same as having one expert i and one expert j.

If \(e \leq e^M\) and \(c \leq c^{MA}\), then \(z_1 \in Z^{(i,i)}\) and \(z_1 \in Z^{(i,j)}\).

If \(e \leq e^M\) and \(c \leq c^{DA}\), then \(z_2 \in Z^{(i,i)}\) and \(z_2 \in Z^{(i,j)}\).

2. Case 2: Suppose \(c^{DL}_i > c^{DR}_j\), then \(c^{DA} = \max\{c^{DR}_i, c^{DL}_j, c^{DR}_j\} = \max\{c^{DL}_j, c^{DR}_j\}\).

(a) Sub-case 2.1: \(c^{MA} = c^{MR}_j\)

In this case, having two expert j’s is the same as having one expert i and one expert j.

If \(e \leq e^M\) and \(c \leq c^{MA}\), then \(z_1 \in Z^{(j,j)}\) and \(z_1 \in Z^{(i,j)}\).

If \(e \leq e^M\) and \(c \leq c^{DA}\), then \(z_2 \in Z^{(j,j)}\) and \(z_2 \in Z^{(i,j)}\).
(b) **Sub-case: 2.2:** \( c^{MA} = c^{ML}_i \\
In this case, having two expert \( i \)'s is better than having one expert \( i \) and one expert \( j \).

If \( e \leq e^M \) and \( c \leq c^{MA} \), then \( z_1 \in Z^{(i,i)} \) and \( z_1 \in Z^{(i,j)} \).

If \( e \leq e^M \) and \( c \leq c^{DA} \), then in the interval \( c \in (c^{DA}, c^{DL}_i) \), \( z_2 \in Z^{(i,i)} \) but \( z_2 \notin Z^{(i,j)} \). This means a higher equilibrium \( EU^{DM} \) can be achieved in the interval \( c \in (c^{DA}, c^{DL}_i) \) in a game with two expert \( i \)'s than in a game with one expert \( i \) and one expert \( j \).

Aside from shifting some cost thresholds, having asymmetrically biased experts does not alter the model with identical duopolists by much. The basic results remain the same. Since full information is already achieved in this model, having asymmetrically biased experts does not yield any further welfare improvements. In other words, there are no additional incentives for experts to acquire information if they are of opposite bias levels or of the same bias level.

4 **Conclusion**

This paper shines a spotlight on an often neglected aspect of the media market: information is costly. The assumption that it is both free and exogenous is common in the economics community. Agents in numerous models receive signals; some signals are public and some are private, but almost all fall freely from the sky. While the assumption is reasonable in some applications, it is not in others. In a model about the media market, it definitely is not.

Given that information is costly, bias provides an incentive for firms to acquire information. With the model presented in this paper, I have shown that a more biased firm has a larger willingness to pay for information than an unbiased firm. The incentive for a more biased firm to acquire information arises from what occurs when the firm does not acquire information. By not acquiring information, the consumers believe the firm did acquire information and is merely withholding it. Thus, the unfavorable action occurs with certainty. It is the threat of punishment rather than a reward that drives the result.

The results of this paper caution against policies and regulations that attempt to eliminate or alter the biases of firms, because there is a benefit in having biased firms. Instead,
the social goal should focus on ensuring no information loss, possibly through the following three suggestions.

1. *Published reports may be one-sided, but cannot contain fabrications.* Market forces alone appear to be sufficient in achieving this goal. While fabricated news can emerge in the short-run, it cannot last in the long-run. Firms that present fabricated information are severely punished with reduced credibility among its audience. No one would waste valuable time consuming lies. Both firms as well as consumers can expose the lies. While competing firms may have stronger incentives than consumers in exposing lies, the Internet offers such a low cost publication method for everyone that consumers often expose lies. For instance, average bloggers were the ones who first pointed out that Reuters published a digitally manipulated photograph of smoke in Beirut, Lebanon.

2. *The bias level should be publicly known.* With the model presented in this paper, reports are fully revealing in the informative equilibria. The result of fully informative reports depends on the structure of the game. In particular, fully informative reports may not be achievable with a richer signal space even when bias levels are known. Recent work by Chakraborty and Harbaugh (2007) explore the extent to which reports are informative when the biases are publicly known. They conclude that while the transparency of the expert’s bias level positively impacts communication, full revelation is not generally attained.

3. *Competition among asymmetrically biased firms may help.* Since fully informative reports were achievable in this paper, having asymmetrically biased firms was not necessary for welfare improvements from competition. There was no benefit in having asymmetrically biased firms in terms of information acquisition. However, if full information is not achievable, then perhaps asymmetrically biased firms helps in reducing information loss. Milgrom and Roberts (1986) suggest that having firms with opposing biases helps to achieve full information when the population is unable to make the correct inferences.

I conclude that media bias may not be bad. In fact, having biased media firms may be good, so long as their bias is known and information is not lost.
Appendix

Proof of Proposition 1:

Let $n$ be the number of experts. For all parameter values, $c \in \mathbb{R}^+$, $e \in \mathbb{R}^+$, $b_i \in \mathbb{R}$ for $i = 1, 2, \ldots, n$, there exists an equilibrium for all $n$ experts to not acquire any information ($\alpha^E_i = 0$ for all $i = 1, 2, \ldots, n$) and for the decision maker to not read any reports ($\rho^D_M = 0$ for all $i = 1, 2, \ldots, n$). Given that all experts do not acquire any information, the decision maker’s best response is to not read reports. Conversely, given that the decision maker does not read any reports, each expert’s best response is to not acquire information. Thus, the decision maker will select an action based on his prior beliefs. If the common prior beliefs are $\theta < \frac{1}{2}$, then he will select $L$. The equilibrium expected utilities are $EU^D_M = 1 - \theta$ and $EU^E = Rev(1) + (1 - \theta)$.

Proof of Propositions 2, 3, and 5

The game with one biased expert is solved backwards by identifying the best responses of the expert and decision maker. The four strategies are analyzed in the following order: (1) the decision maker’s action strategy, (2) the decision maker’s reading strategy, (3) the expert’s reporting strategy, and (4) the expert’s acquisition strategy.

Step 1: The Decision Maker’s Action Strategy

There are four components to the decision maker’s action strategy: $\alpha^D_M (R|0)$, $\alpha^D_M (R|\bar{r})$, $\alpha^D_M (L|\bar{r})$, and $\alpha^D_M (R|\bar{r})$. The first three are simple, while the fourth is more complicated. The first, $\alpha^D_M (R|0)$, deals with the decision maker’s best response given that he does not read a report. Since $\theta < \frac{1}{2}$, $\alpha^D_M (R|0) = 0$ (which is the same as $\alpha^D_M (L|0) = 1$). Next, from the assumption of informative signals, the decision maker follows the advice of truthful reports, that is, $\alpha^D_M (R|\bar{r}) = 1$ and $\alpha^D_M (L|\bar{r}) = 1$. The last, $\alpha^D_M (R|\bar{r})$, is more complicated.

Suppose the decision maker has reached the information set where the decision maker reads report $\bar{o}$. When the decision maker reads a report of $\bar{o}$, he can hold three different beliefs about the expert’s actions. He could believe that the expert (i) didn’t acquire any information at all, (ii) received an $l$ signal and withheld information, or (iii) received an $r$ signal and withheld information.

\[
Pr(\bar{o}) = (1 - \theta) \left[ (1 - \alpha^E) + \alpha^E \pi L \rho^E (\bar{0}|l) + \alpha^E (1 - \pi L) \rho^E (\bar{0}|r) \right] + \theta \left[ (1 - \alpha^E) + \alpha^E (1 - \pi R) \rho^E (\bar{0}|l) + \alpha^E \pi R \rho^E (\bar{0}|r) \right]
\]

The decision maker’s expected utilities are

\[
EU^D_M [\alpha^D_M (L|\bar{o}) = 1] = \frac{(1 - \theta) (1 - \alpha^E) + (1 - \theta) \pi L \rho^E (\bar{0}|l) + (1 - \theta) \alpha^E (1 - \pi L) \rho^E (\bar{0}|r)}{Pr(\bar{o})}
\]

\[
EU^D_M [\alpha^D_M (R|\bar{o}) = 1] = \frac{\theta (1 - \alpha^E) + \theta \alpha^E (1 - \pi R) \rho^E (\bar{0}|l) + \theta \alpha^E \pi R \rho^E (\bar{0}|r)}{Pr(\bar{o})}
\]

The decision maker’s best response is as follows:

- select action $L$ if $EU^D_M [\alpha^D_M (L|\bar{o}) = 1] > EU^D_M [\alpha^D_M (R|\bar{o}) = 1]$
- select action $R$ if $EU^D_M [\alpha^D_M (L|\bar{o}) = 1] < EU^D_M [\alpha^D_M (R|\bar{o}) = 1]$
- Be indifferent between $L$ and $R$ if $EU^D_M [\alpha^D_M (L|\bar{o}) = 1] = EU^D_M [\alpha^D_M (R|\bar{o}) = 1]$
Step 2: The Expert’s Reporting Strategy

If the expert receives a signal, then she must have purchased a signal. Take $\alpha^E = 1$ as given. The reporting strategy is analyzed in two steps. The first step identifies the best reporting strategy given an $r$ signal, while the second step identified the best reporting strategy given an $l$ signal.

**Sub-Step 1:** Suppose the expert receives an $r$ signal. Compare her expected utility of reporting $\hat{r}$ with that of reporting $\hat{0}$.

$$EU^E\left[\rho^E (\hat{r}|r) = 1\right] = Rev(\rho^{DM}) - c$$

$$+ \rho^{DM} \left[\Pr(R|r) + b\right]$$

$$+ (1 - \rho^{DM}) \left[\theta \alpha^{DM}(R|0) + (1 - \theta)\alpha^{DM}(L|0)\right] + \alpha^{DM}(R|0)b$$

$$EU^E\left[\rho^E (\hat{0}|r) = 1\right] = Rev(\rho^{DM}) - c$$

$$+ \rho^{DM} \left[\Pr(R|r)\alpha^{DM}(R|\hat{0}) + \Pr(L|r)\alpha^{DM}(L|\hat{0})\right] + \alpha^{DM}(R|\hat{0})b$$

$$+ (1 - \rho^{DM}) \left[\theta \alpha^{DM}(R|0) + (1 - \theta)\alpha^{DM}(L|0)\right] + \alpha^{DM}(R|0)b$$

The expert will prefer to report $\hat{r}$ over $\hat{0}$ when

$$EU^E\left[\rho^E (\hat{r}|r) = 1\right] > EU^E\left[\rho^E (\hat{0}|r) = 1\right]$$

$$\rho^{DM} \left[\Pr(R|r) + b\right] > \rho^{DM} \left[\Pr(R|r)\alpha^{DM}(R|\hat{0}) + \Pr(L|r)\alpha^{DM}(L|\hat{0})\right] + \alpha^{DM}(R|\hat{0})b$$

If $\rho^{DM} = 0$, then the expert will be indifferent between reporting $\hat{r}$ and $\hat{0}$.

If $\rho^{DM} > 0$, the above inequality reduces to

$$\Pr(R|r) + b > \Pr(R|r)\alpha^{DM}(R|\hat{0}) + \Pr(L|r)\alpha^{DM}(L|\hat{0})\left[1 - \alpha^{DM}(R|\hat{0})\right] + \alpha^{DM}(R|\hat{0})b$$

$$\Pr(R|r) + b > \Pr(R|r)\alpha^{DM}(R|\hat{0}) + \Pr(L|r)\left[1 - \alpha^{DM}(R|\hat{0})\right] + \alpha^{DM}(R|\hat{0})b$$

If $\alpha^{DM}(R|\hat{0}) = 1$, then the expert will be indifferent between reporting $\hat{r}$ and $\hat{0}$ ($\rho^E (\hat{r}|r) \in [0, 1]$).

If $\alpha^{DM}(L|\hat{0}) > 0$, the above inequality reduces to

$$- \Pr(R|r) + \Pr(L|r) < b$$

Denote the bias threshold as $b^{ML} = - \Pr(R|r) - \Pr(L|r)$. Notice that $b^{ML}$ is a negative value. The expert will report $r$ signals as $\hat{r}$ if she is not too left-biased ($b > b^{ML}$). However, if she is too left-biased ($b < b^{ML}$), then she will report $r$ signals as $\hat{0}$. Lastly, if $b = b^{ML}$, then the expert will be indifferent between reporting $\hat{r}$ and reporting $\hat{0}$.

**Sub-step 2:** Suppose the expert receives an $l$ signal. Compare her expected utility of reporting $\hat{r}$ with that of
in the decision maker selecting expert is too right-biased (indi

0. If she is too right-biased (\(b > b_{MR}\)), the expert will report \(l\) signals as \(\hat{l}\). However, if the expert is too right-biased (\(b > b_{MR}\)), then the expert will report \(l\) signals as \(\hat{0}\). Lastly, if \(b = b_{MR}\), the expert will be indifferent between reporting \(\hat{l}\) and reporting \(\hat{0}\).

The best response is summarized below.

1. If \(0 \leq \alpha_{DM}(R|\hat{0}) < 1\) and \(\rho_{DM} > 0\), then the expert’s reporting strategy given an \(r\) signal depends on her bias level. The expert will report \(r\) signals as \(\hat{r}\) if she is not too left-biased (\(b > b_{ML}\)). If she is too left-biased (\(b < b_{ML}\)), then the expert reports \(\hat{0}\) given an \(r\) signal (\(\rho^E(\hat{0}|r) = 1\)). Lastly, if the expert’s bias level is equal to the threshold value (\(b = b_{ML}\)), then the expert is indifferent between reporting \(\hat{r}\) and reporting \(\hat{0}\) given an \(l\) signal (\(\rho^E(\hat{0}|l) \in [0, 1]\)).
2. If $a^{DM}(R(\hat{0})) = 1$ and $\rho^{DM} > 0$, then the expert is indifferent between reporting $\hat{r}$ and reporting $\hat{0}$ given an $r$ signal ($\rho^{E}(\hat{r}|r) \in [0, 1]$).

3. If $0 < a^{DM}(R(\hat{0})) \leq 1$ and $\rho^{DM} > 0$, then the expert’s reporting strategy for an $l$ signal depends on her bias level. She reports $\hat{r}$ given an $l$ signal ($\rho^{E}(\hat{l}|l) = 1$) when she is not too right-biased ($b < b^{MR}$). If she is too right-biased ($b > b^{MR}$), then the expert reports $\hat{0}$ given an $l$ signal ($\rho^{E}(\hat{0}|l) = 1$). Lastly, if the expert’s bias level is equal to the threshold value ($b = b^{MR}$), then the expert is indifferent between reporting $\hat{r}$ and reporting $\hat{0}$ given an $l$ signal ($\rho^{E}(\hat{l}|l) \in [0, 1]$).

4. If $a^{DM}(R(\hat{0})) = 0$ and $\rho^{DM} > 0$, then the expert is indifferent between reporting $\hat{r}$ and reporting $\hat{0}$ given an $l$ signal ($\rho^{E}(\hat{l}|l) \in [0, 1]$).

5. If $\rho^{DM} = 0$, then the expert will be indifferent in reporting strategies ($\rho^{E}(\hat{r}|r) \in [0, 1]$ and $\rho^{E}(\hat{l}|l) \in [0, 1]$).

**Step 3: The Decision Maker’s Reading Strategy**

To identify the best reading response, compare the expected utility of the decision maker when he does not read with that when he does read.

If the decision maker does not read a report, then he must select an action based on his prior beliefs. Since the prior beliefs are $\theta < \frac{1}{2}$, then $a^{DM}(L|0) = 1$ and

$$EU^{DM}[\rho^{DM} = 0] = 1 - \theta$$

If the decision maker does read a report from the monopolist expert, then

$$EU^{DM}[\rho^{DM} = 1] = \alpha^{E} \left[ \theta \pi_R \left[ \frac{\rho^{E}(\hat{r}|r)}{\rho^{E}(\hat{r}|r) \alpha^{DM}(R|\hat{0})} \right] + (1 - \theta) \pi_L \left[ \frac{\rho^{E}(\hat{l}|l)}{\rho^{E}(\hat{l}|l) \alpha^{DM}(L|\hat{0})} \right] \left[ \rho^{E}(\hat{l}|l) \right] + (1 - \theta)(1 - \pi_L) \rho^{E}(\hat{l}|l) \rho^{DM}(L|\hat{0}) \right] - e$$

With a monopolist expert, the decision maker must choose whether or not to read the expert’s report. He will read the report when

$$EU^{DM}(\rho^{DM} = 1) > EU^{DM}(\rho^{DM} = 0)$$

The best response is summarized below.

1. In Type R, the best response is as follows.

   Read when $e < \alpha^{E} \left[ (1 - \theta) \pi_L - \theta (1 - \pi_R) \right] - (1 - 2\theta)$

   Do not read when $e > \alpha^{E} \left[ (1 - \theta) \pi_L - \theta (1 - \pi_R) \right] - (1 - 2\theta)$

   Be indifferent when $e = \alpha^{E} \left[ (1 - \theta) \pi_L - \theta (1 - \pi_R) \right] - (1 - 2\theta)$
2. In Type L, the best response is as follows.

Read when \( e < \alpha^E \left[ \theta \pi_R - (1 - \theta)(1 - \pi_L) \right] \)
Do not read when \( e > \alpha^E \left[ \theta \pi_R - (1 - \theta)(1 - \pi_L) \right] \)
Be indifferent when \( e = \alpha^E \left[ \theta \pi_R - (1 - \theta)(1 - \pi_L) \right] \)

When \( \alpha^E = 1 \), the best response of the two Types converges to

Read when \( e < e^M \)
Do not read when \( e > e^M \)
Be indifferent when \( e = e^M \)

where \( e^M = \theta \pi_R - (1 - \theta)(1 - \pi_L) \).

**Step 4: The Expert’s Acquisition Strategy**

The acquisition strategy is analyzed in 3 steps.

1. Type R and \( b < b^{MR} \)
2. Type L and \( b > b^{ML} \)
3. All remaining cases.

**Sub-step 1: Type R and \( b < b^{MR} \)**

Compare the expected utility of the expert when she acquires information to that when she does not.

\[
EU^E \left[ \alpha^E = 1 \right] = Rev(\rho^{DM}) - c + \rho^{DM} \left[ \theta \pi_R + (1 - \theta)\pi_L + \theta \pi_R + (1 - \theta)(1 - \pi_L) \right] + (1 - \rho^{DM}) \left[ \theta \alpha^{DM}(R|0) + (1 - \theta)\alpha^{DM}(L|0) \right] + \alpha^{DM}(R|0) b
\]

\[
EU^E \left[ \alpha^E = 0 \right] = Rev(\rho^{DM}) + \rho^{DM} \left[ \theta + b \right] + (1 - \rho^{DM}) \left[ \theta \alpha^{DM}(R|0) + (1 - \theta)\alpha^{DM}(L|0) \right] + \alpha^{DM}(R|0) b
\]

The expert prefers to acquire information when

\[
EU^E \left[ \alpha^E = 1 \right] > EU^E \left[ \alpha^E = 0 \right]
\]

\[
-c + \rho^{DM} \left[ \theta \pi_R + (1 - \theta)\pi_L + \theta \pi_R + (1 - \theta)(1 - \pi_L) \right] b > \rho^{DM} \left[ \theta + b \right]
\]

\[
\rho^{DM} \left[ (1 - \theta)\pi_L - \theta(1 - \pi_R) \right] - b \left[ \theta (1 - \pi_R) + (1 - \theta)\pi_L \right] > c
\]

\[
\rho^{DM} e^{MR} > c
\]
where

\[ c_{MR} = [(1 - \theta)\pi_L - \theta(1 - \pi_R)] - b[\theta(1 - \pi_R) + (1 - \theta)\pi_L] \]

**Sub-step 2:** Type L and \( b < b_{ML} \).

Compare the expected utility of the expert when she acquires information to that when she does not.

\[
EU^E[\alpha^E = 1] = Rev(\rho_{DM}) - c + \rho_{DM} \left[ \theta\pi_R + (1 - \theta)\pi_L \right] + \left[ \theta\pi_R + (1 - \theta)(1 - \pi_L) \right] b \\
+ (1 - \rho_{DM}) \left[ \theta\alpha_{DM}(R|0) + (1 - \theta)\alpha_{DM}(L|0) \right] + \alpha_{DM}(R|0)b
\]

\[
EU^E[\alpha^E = 0] = Rev(\rho_{DM}) + \rho_{DM}(1 - \theta) \\
+ (1 - \rho_{DM}) \left[ \theta\alpha_{DM}(R|0) + (1 - \theta)\alpha_{DM}(L|0) \right] + \alpha_{DM}(R|0)b
\]

The expert prefers to acquire information when

\[
EU^E[\alpha^E = 1] > EU^E[\alpha^E = 0]
\]

The best response is summarized below.

1. If Type R and \( b < b_{MR} \), then

   Acquire if \( \rho_{DM}c_{MR} > c \)
   Do not acquire if \( \rho_{DM}c_{MR} < c \)
   Be indifferent if \( \rho_{DM}c_{MR} = c \)

2. If Type L and \( b > b_{ML} \), then

   Acquire if \( \rho_{DM}c_{ML} > c \)
   Do not acquire if \( \rho_{DM}c_{ML} < c \)
   Be indifferent if \( \rho_{DM}c_{ML} = c \)

Sub-step 3: The remaining cases include: (i) Type R and \( b \geq b_{MR} \), and (ii) Type L and \( b \leq b_{ML} \).

In these remaining cases, the expert does not strictly prefer to report truthfully for at least one of the two signals.

In these cases, the following two statements are true.

Given an l signal, \( EU^E[\rho^E(\tilde{0}|l)] \leq EU^E[\rho^E(\tilde{0}|l)] \).

Given an r signal, \( EU^E[\rho^E(\tilde{0}|r)] \leq EU^E[\rho^E(\tilde{0}|r)] \).

If the above two statements are true, then expert is better off not acquiring information at all. If she doesn’t acquire information at all, she can still report \( \tilde{0} \), which will yield the same expected utility as if she did acquire information save the cost of acquiring information.

The best response is summarized below.

1. If Type R and \( b < b_{MR} \), then

   Acquire if \( \rho_{DM}c_{MR} > c \)
   Do not acquire if \( \rho_{DM}c_{MR} < c \)
   Be indifferent if \( \rho_{DM}c_{MR} = c \)

2. If Type L and \( b > b_{ML} \), then

   Acquire if \( \rho_{DM}c_{ML} > c \)
   Do not acquire if \( \rho_{DM}c_{ML} < c \)
   Be indifferent if \( \rho_{DM}c_{ML} = c \)
3. If Type R and \( b \geq b_{MR} \), then do not acquire information (\( \alpha^E = 0 \)).

4. If Type L and \( b \leq b_{ML} \), then do not acquire information (\( \alpha^E = 0 \)).

From the results of Sub-step 3, it is clear that the only informative equilibria are of Type R or Type L. The expert would not bother acquiring costly information if she did not strictly prefer to report truthfully for at least one of the two signals.

**Step 5: The equilibria in mixed acquisition and mixed reading strategies**

1. There exists a Type R equilibrium in which the expert adopts a mixed acquisition strategy (\( \alpha^E = \frac{e + (1 - \theta)}{\theta \pi_L - (1 - \theta) \pi_R} \)) and the decision maker adopts a mixed reading strategy (\( \rho_{DM} = \frac{c}{c_{MR}} \)) if the effort cost is sufficiently low (\( e \leq e_M \)), the expert is not too right-biased (\( b < b_{MR} \)), and the cost is sufficiently low (\( c \leq c_{MR} \)).

2. There exists a Type L equilibrium in which the expert adopts a mixed acquisition strategy (\( \alpha^E = \frac{e}{\theta \pi_R - (1 - \theta)(1 - \pi_L)} \)) and the decision maker adopts a mixed reading strategy (\( \rho_{DM} = \frac{c}{c_{ML}} \)) if the effort cost is sufficiently low (\( e \leq e_M \)), the expert is not too left-biased (\( b > b_{ML} \)), and the cost is sufficiently low (\( c \leq c_{ML} \)).

3. In all of the equilibria with mixed acquisition and mixed reading strategies, the equilibrium expected utilities are

\[
EU^E = Rev(1) + \theta \pi_R + (1 - \theta)(1 - \pi_L) + b(\theta \pi_R + (1 - \theta)(1 - \pi_L))
\]

If the expert adopts a mixed acquisition strategy, then her expected utility of acquiring is the same as if she did not. Similarly, if the decision maker adopts a mixed reading strategy, then his expected utility of reading is the same as if he did not. Therefore, the equilibrium expected utilities of these mixed strategy equilibria is the same as the uninformative equilibrium.

**Proof of Proposition 4:**

By definition of informative equilibria, the expert acquires information and the decision maker reads the report. If the expert acquires information, then the expert will report informatively (as shown in Step 4 of the Proof to Proposition 2, 3, and 5). The Type of equilibria is relevant only in determining what reporting strategy the expert adopts and what beliefs the decision maker holds about \( \theta^0 \). But the Type does not affect the equilibria expected utilities.

\[
EU^DM = [\theta \pi_R + (1 - \theta) \pi_L] - e
\]

\[
EU^E = Rev(1) - c + \theta \pi_R + (1 - \theta) \pi_L + b(\theta \pi_R + (1 - \theta)(1 - \pi_L))
\]

**Proof of Lemma 1:**

**Step 1:** There exists a cost threshold \( c^M > 0 \), where \( c^M = \max\{c_{MR}, c_{ML}\} \). If \( c_{MR} > 0 \) and \( c_{ML} > 0 \), then there is no question about the existence of a cost threshold \( c^M > 0 \). The question remains: is it possible for \( c^M = 0 \)?

It is possible for \( c_{MR} = 0 \) if the expert’s bias level is too right-biased (that is, \( b \geq b_{MR} \)). However, if \( b \geq b_{MR} \), then \( c_{MR} > 0 \).

It is possible for \( c_{ML} = 0 \) if the expert’s bias level is too left-biased (that is, \( b \leq b_{ML} \)). However, if \( b \leq b_{ML} \), then \( c_{MR} > 0 \).
Hence, it is not possible for \( c^M = 0 \).

**Step 2:** By the assumption of informative signals \( e^M > 0 \).

**Step 3:** By Proposition 2 and 3, if \( c < c^M \) and \( e < e^M \), then \( z_1 \in Z^{(i)} \). By Proposition 1, for all \( c > 0 \) and \( e > 0 \), \( z_0 \in Z^{(i)} \). Hence, if \( c < c^M \) and \( e < e^M \), then \( Z^{(i)} = \{z_0, z_1\} \).

**Step 4:** By Proposition 5, if \( c = c^M \) and \( e = e^M \), then \( z_0 \in Z^{(i)} \). Suppose \( c^M = e^ML \). Furthermore, for all \( c > 0 \) and \( e > 0 \), \( z_0 \in Z^{(i)} \) by Proposition 1. Hence, if either \( c \geq c^M \) or \( e \geq e^M \), then \( Z^{(i)} = \{z_0\} \).

**Proof of Proposition 6 and 7:**

The game with two identical experts is solved backwards. Step 1 identifies the best responses of the decision maker when he reads a report, except for reports that involve \( \bar{0} \). Step 2 identifies that all equilibria, except for the uninformative one, is one of four possible Types. Step 3 identifies the decision maker’s reading strategy. Step 4 identifies experts’ acquisition strategy in Type RR, while Step 5 identifies the experts’ acquisition strategy in Type LL.

**Step 1: Decision maker’s action strategy**

With two experts the decision maker’s action strategy is a plan involving 16 possible reports: 3\(^2\) possible reports if he reads two reports, 2\(3(2)\) possible reports if he reads one report, and 1 possibility if he doesn’t read a report.

Based on the assumption of informative signals, the following best responses are obvious: \( \alpha^D_M(R|\bar{r},\bar{t}) = 1 \), \( \alpha^D_M(L|\bar{r},\bar{t}) = 1 \), \( \alpha^D_M(R|\bar{r},0) = 1 \), \( \alpha^D_M(L|\bar{r},0) = 1 \), \( \alpha^D_M(L|0,\bar{t}) = 1 \), \( \alpha^D_M(L|0,0) = 1 \). Additionally, \( \alpha^D_M(R|\bar{r},\bar{t}) \) and \( \alpha^D_M(R|\bar{r},\bar{t}) \) is also obvious, but they depend on the parameters. Under the assumption \( \Pr(R|r,l) \geq \Pr(L|r,l) \), \( \alpha^D_M(R|\bar{r},\bar{t}) = \alpha^D_M(R|\bar{r},\bar{t}) = 1 \). Under the assumption \( \Pr(R|r,l) \leq \Pr(L|r,l) \), \( \alpha^D_M(R|\bar{r},\bar{t}) = \alpha^D_M(L|\bar{r},\bar{t}) = 0 \).

The more complicated best responses involve all reports with \( \bar{0} \): \( (\bar{r},\bar{0}) \), \( (\bar{t},\bar{0}) \), \( (\bar{r},\bar{t}) \), \( (\bar{0},\bar{t}) \), \( (\bar{0},\bar{t}) \), \( (\bar{0},\bar{t}) \), and \( (\bar{0},\bar{t}) \).

**Step 2: Type RR, Type LL, Type RL, and Type LR**

With the exception of the uninformative equilibria, all equilibria is of a type. If the expert acquires information with some positive probability, then the expert will report informatively (as shown in Step 4 of the Proof to Proposition 2, 3, and 5). The bias levels of the experts must be incentive compatible with the Types.

- For Type R to exist (that is, one expert is dormant), the bias level cannot be too right \( (b < b^{MR}) \).
- For Type L to exist (that is, one expert is dormant), the bias level cannot be too right \( (b < b^{ML}) \).
- For Type RR to exist (that is, neither expert is dormant), both experts cannot be too right-biased \( (b < b^{DR}) \).
- For Type LL to exist (that is, neither expert is dormant), both experts cannot be too left-biased \( (b > b^{DL}) \).

For either Type RL or Type LR to exist (whether in pure or mixed acquisition and reading strategies), both experts cannot be too right- nor too left-biased \( (b^{DL} < b < b^{DR}) \).

**Step 3: Decision maker’s reading strategy**

Find the decision maker’s best response by identifying his expected utility when he does not read, when he reads one report, and when he reads two reports. Then compare the expected utilities.

If the decision maker reads no report, then his expected utility is

\[
EU^{DM} \begin{bmatrix} \rho^D_M = 0, \rho^D_M = 0 \end{bmatrix} = 1 - \theta
\]

If the decision maker reads only expert 1’s report, then his expected utility is
If the decision maker reads only expert 2’s report, then his expected utility is

$$
EU_{DM}^{DM} \left[ \rho_1^{DM} = 1, \rho_2^{DM} = 0 \right] = \alpha_2^E \left[ \begin{array}{c} 
\theta \pi_R \left[ \rho_2^E(\tilde{r}|r) + \rho_2^E(\tilde{0}|r) \alpha_{DM}^{DM}(R|\tilde{0}, \tilde{0}) \right] \\
+ \theta (1 - \pi_R) \rho_2^E(\tilde{0}|l) \alpha_{DM}^{DM}(R|\tilde{0}, \tilde{0}) \\
+ (1 - \theta) \pi_L \left[ \rho_2^E(\tilde{0}|l) + \rho_2^E(\tilde{0}|l) \alpha_{DM}^{DM}(L|\tilde{0}, \tilde{0}) \right] \\
+ (1 - \theta)(1 - \pi_L) \rho_2^E(\tilde{0}|l) \alpha_{DM}^{DM}(L|\tilde{0}, \tilde{0}) \\
\end{array} \right] \\
+ (1 - \alpha_2^E) \left[ \theta \alpha_{DM}^{DM}(R|\tilde{0}, \tilde{0}) + (1 - \theta) \alpha_{DM}^{DM}(L|\tilde{0}, \tilde{0}) \right] \\
- e
\right]
$$

If the decision maker reads both experts’ reports, then his expected utility is

$$
EU_{DM}^{DM} \left[ \rho_1^{DM} = 0, \rho_2^{DM} = 1 \right] = \alpha_2^E \left[ \begin{array}{c} 
\theta \pi_R \left[ \rho_2^E(\tilde{r}|r) + \rho_2^E(\tilde{0}|r) \alpha_{DM}^{DM}(R|0, \tilde{0}) \right] \\
+ \theta (1 - \pi_R) \rho_2^E(\tilde{0}|l) \alpha_{DM}^{DM}(R|0, \tilde{0}) \\
+ (1 - \theta) \pi_L \left[ \rho_2^E(\tilde{0}|l) + \rho_2^E(\tilde{0}|l) \alpha_{DM}^{DM}(L|0, \tilde{0}) \right] \\
+ (1 - \theta)(1 - \pi_L) \rho_2^E(\tilde{0}|l) \alpha_{DM}^{DM}(L|0, \tilde{0}) \\
\end{array} \right] \\
+ (1 - \alpha_2^E) \left[ \theta \alpha_{DM}^{DM}(R|0, \tilde{0}) + (1 - \theta) \alpha_{DM}^{DM}(L|0, \tilde{0}) \right] \\
- e
\right]
$$

If the decision maker reads both experts’ reports, then his expected utility is
The decision maker reads only expert 1’s report over no report when

\[ EU^{DM} [\rho_1^{DM} = 1, \rho_2^{DM} = 0] > EU^{DM} [\rho_1^{DM} = 0, \rho_2^{DM} = 0] \]

The decision maker reads only expert 2’s report over no report when

\[ EU^{DM} [\rho_1^{DM} = 0, \rho_2^{DM} = 1] > EU^{DM} [\rho_1^{DM} = 0, \rho_2^{DM} = 0] \]

The decision maker reads both experts’ reports over reading only one report when
The best response is summarized below.

For all types, the best response for reading only one expert’s report is the same as the monopoly model. The difference here is that one expert is dormant, that is, she does not acquire information and is not read.

Given that the decision maker is already reading expert 2’s report, the following is his best response.

- Read both reports when $e < \alpha^E E_1 \left[ \theta \pi_R \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \right]$
- Read only expert 2 when $\alpha^E E_1 \left[ \theta \pi_R \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \right] < e < e^M$
- Be indifferent when $e = \alpha^E E_1 \left[ \theta \pi_R \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \right]$

When $\alpha^E = 1$, then the best response is

- Read both reports when $e < e^D$
- Read only expert 2 when $e^D < e < e^M$
- Be indifferent when $e = e^D$

where $e^D = \theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L)$.

**Step 4: Expert’s acquisition strategy under Type RR**

To find the expert’s best response, compare the expected utilities from acquiring information and not acquiring information. Without loss of generality, consider the acquisition strategy for only expert 1.

Given an $r$ signal in Type RR, her expected utility is

$$EU_1^E = R \left( \rho_1^{DM} \right) - c + \rho_1^{DM} \left[ \Pr(R|r) + b \right]$$

$$+ \left( 1 - \rho_1^{DM} \right) \rho_2^{DM} \left[ \alpha_2^E \left[ \Pr(R|r) \pi_R (1 + b) + \Pr(L|r) \pi_L \pi_2^E \left( \frac{\hat{L}}{e} \right) b \right] + \Pr(L|r) \pi_L (1 - \rho_2^E) (\Pr(R|r) + b) \right]$$

Given an $l$ signal in Type RR, her expected utility is

$$EU_1^E = R \left( \rho_1^{DM} \right) - c + \rho_1^{DM} \left[ \Pr(R|r) \pi_R (1 + b) + \Pr(L|r) \pi_L \pi_2^E \left( \frac{\hat{L}}{e} \right) b \right] + \left( 1 - \rho_1^{DM} \right) \left( 1 - \rho_2^{DM} \right) (1 - \theta)$$
\[
\begin{align*}
\left[ EU_1^E \mid l \right] &= Rev(\rho_{DM}^1) - c \\
+ \rho_{DM}^1 \rho_{DM}^2 
&\begin{bmatrix}
\alpha_E^E \\
\frac{Pr(R\mid l)\pi_R(1 + b)}{Pr(L\mid l)\pi_L(1 - \pi_L)b} \\
+ \frac{Pr(R\mid l)\pi_R(1 + b)}{Pr(L\mid l)\pi_L(1 - \pi_L)b} \\
+ \frac{Pr(L\mid l)\pi_L(1 - \pi_L)b}{(1 - \alpha_E^E)(Pr(R\mid l) + b)} \\
\end{bmatrix} \\
+ (1 - \rho_{DM}^1) \rho_{DM}^2 
&\begin{bmatrix}
\alpha_E^E \\
\frac{Pr(R\mid l)\pi_R(1 + b)}{Pr(L\mid l)\pi_L(1 - \pi_L)b} \\
+ \frac{Pr(R\mid l)\pi_R(1 + b)}{Pr(L\mid l)\pi_L(1 - \pi_L)b} \\
+ \frac{Pr(L\mid l)\pi_L(1 - \pi_L)b}{(1 - \alpha_E^E)(Pr(R\mid l) + b)} \\
\end{bmatrix} \\
+ (1 - \rho_{DM}^1) (1 - \rho_{DM}^2) (1 - \theta)
\end{align*}
\]

If the expert acquires information, her expected utility is

\[
EU_1^E \left[ \alpha_E^E = 1 \right] = Pr(r) \left[ EU_1^E \mid r \right] + Pr(l) \left[ EU_1^E \mid l \right]
\]

If the expert does not acquire information, her expected utility is
\[
EU_1^E \left[ \alpha_1^E = 0 \right] = R \left( \rho_1^{DM} \right) + \rho_1^{DM} \left[ \Pr(R) + b \right] \\
+ \left( 1 - \rho_1^{DM} \right) \rho_2^{DM} \left[ \frac{\text{Pr}(R)\pi_R (1 + b)}{\text{Pr}(L)\pi_L \rho_2^E \left( \bar{l}l \right) + \text{Pr}(L) (1 - \pi_L)b} + (1 - \alpha_2^E) \left( \text{Pr}(R) + b \right) \right] \\
+ \left( 1 - \rho_1^{DM} \right) \left( 1 - \rho_2^{DM} \right) (1 - \theta)
\]

It is a best response for the expert to acquire information when

\[
EU_1^E \left[ \alpha_1^E = 1 \right] > EU_1^E \left[ \alpha_1^E = 0 \right]
\]

\[
\left[ -c + \rho_1^{DM} \left[ \Pr(R|\bar{R}) + b \Pr(R) \right] \begin{array}{c}
\Pr(L|\bar{L}) \\
\Pr(R|\bar{R}) - \Pr(L|\bar{L}) \\
\text{Pr}(R)\pi_R \left( \text{Pr}(R|\bar{R}) + \text{Pr}(L|\bar{L}) (1 - \pi_R) \right)
\end{array}
\left( \begin{array}{c}
\rho_2^{DM} \left( \bar{l}l \right) \left( \Delta \frac{\text{Pr}(R)\pi_R (1 + b)}{\text{Pr}(L)\pi_L \rho_2^E \left( \bar{l}l \right) + \text{Pr}(L) (1 - \pi_L)b} + (1 - \alpha_2^E) \left( \text{Pr}(R) + b \right) \right) \\
- \rho_2^{DM} \left( \bar{l}l \right) \left( \Delta \frac{\text{Pr}(R)\pi_R (1 + b)}{\text{Pr}(L)\pi_L \rho_2^E \left( \bar{l}l \right) + \text{Pr}(L) (1 - \pi_L)b} + (1 - \alpha_2^E) \left( \text{Pr}(R) + b \right) \right)
\end{array} \right)
\right)
\]

\[
> \rho_1^{DM} \left[ \Pr(R) + b \right]
\]

\[
\left( 1 - \theta \right) \pi_L - \theta \left( 1 - \pi_R \right) - b \left( \theta (1 - \pi_R) + (1 - \theta) \pi_L \right)
\]

\[
\frac{\theta (1 - \pi_R) + (1 - \theta) \pi_L b}{\left( 1 - \theta \right) \pi_L b}
\]

\[
\left( 1 - \theta \right) \pi_L \left( \begin{array}{c}
\text{Pr}(R|\bar{R}) + \text{Pr}(L|\bar{L}) (1 - \pi_R) \right)
\end{array} \right)
\]

\[
> c
\]

In Type RR, assuming that expert 2 is acquiring and reporting informatively, the best response for expert 1 is

\[
\text{Acquire if } \rho_1^{DM} c^{DR} > c
\]

\[
\text{Do Not Acquire if } \rho_1^{DM} c^{DR} < c
\]

\[
\text{Be indifferent if } \rho_1^{DM} c^{DR} = c
\]

where

\[
c^{DR} = \left[ \frac{(1 - \theta) \pi_L^2 - \theta (1 - \pi_R)^2}{-b \left( \theta (1 - \pi_R)^2 + (1 - \theta) \pi_L^2 \right)} \right]
\]
In Type R, assuming that expert 2 is not acquiring information, the best response for expert 1 is

\[
\begin{align*}
\text{Acquire if } & \rho^{DM}_{1} c_{MR} > c \\
\text{Do Not Acquire if } & \rho^{DM}_{1} c_{MR} < c \\
\text{Be indifferent if } & \rho^{DM}_{1} c_{MR} = c
\end{align*}
\]

where

\[
c_{MR} = \begin{bmatrix}
(1 - \theta)\pi_L - \theta(1 - \pi_R) \\
- b((1 - \theta)\pi_L + \theta(1 - \pi_R))
\end{bmatrix}
\]

**Step 5: Expert’s acquisition strategy under Type LL**

To find the expert’s best response, compare the expected utilities from acquiring information and not acquiring information. Without loss of generality, consider the acquisition strategy for only expert 1.

Given an \( r \) signal in Type LL, her expected utility is

\[
\begin{align*}
\left[EU^E_{1}\right| r] &= R \left(\rho^{DM}_{1}\right) - c \\
&\quad + \rho^DM_{1} \left[Pr(R|r) + b\right] \\
&\quad + \left(1 - \rho^DM_{1}\right) \rho^DM_{2} \left[\alpha^E_{2} \left[Pr(R|r)\pi_R(1 + b) + Pr(L|r)\pi_L + Pr(L|r)(1 - \pi_L)b\right] \right. \\
&\quad \left. + \left(1 - \rho^DM_{1}\right) \left(1 - \rho^DM_{2}\right) (1 - \theta)\right]
\end{align*}
\]

Given an \( l \) signal in Type LL, her expected utility is

\[
\begin{align*}
\left[EU^E_{1}\right| l] &= Rev(\rho^DM_{1}) - c \\
&\quad + \rho^DM_{1} \rho^DM_{2} \left[\alpha^E_{2} \left[Pr(R|\bar{l})\pi_R(1 + b) + Pr(L|\bar{l})\pi_L + Pr(L|\bar{l})(1 - \pi_L)b\right] \right. \\
&\quad \left. + \left(1 - \rho^DM_{1}\right) \left(1 - \rho^DM_{2}\right) \left[Pr(L|\bar{l}) \pi_L(1 - \pi_L)(\alpha^E_{2})Pr(L|l)\right] \right] \\
&\quad + \rho^DM_{1} \left(1 - \rho^DM_{2}\right) Pr(L|l) \\
&\quad + \left(1 - \rho^DM_{1}\right) \rho^DM_{2} \left[\alpha^E_{2} \left[Pr(R|\bar{l})\pi_R(1 + b) + Pr(L|\bar{l})\pi_L + Pr(L|\bar{l})(1 - \pi_L)b\right] \right. \\
&\quad \left. + \left(1 - \rho^DM_{1}\right) \left(1 - \rho^DM_{2}\right) (1 - \theta)\right]
\end{align*}
\]
\[\begin{align*}
&= \text{Rev}(\rho_1^{DM}) - c \\
&\quad + \rho_1^{DM} \left[ \Pr(L|R) + \rho_2^{DM} \alpha_2^E (\tilde{r}|r) \alpha_2^E \left[ \frac{\Pr(R|L)\pi_R - \Pr(L|L)(1 - \pi_L)}{1 - \alpha_2^E} \right] \right] \\
&\quad + \left( 1 - \rho_1^{DM} \right) \rho_2^{DM} \left[ \alpha_2^E \left[ \frac{\Pr(R|L)\pi_R(1 + b) + \Pr(L|L)\pi_L + \Pr(L|L)(1 - \pi_L)b}{1 - \alpha_2^E} \right] \Pr(L) \right] \\
&\quad + \left( 1 - \rho_1^{DM} \right) \left( 1 - \rho_2^{DM} \right) (1 - \theta)
\end{align*}\]

The expected utility from acquiring is

\[EU_1^E [\alpha_1^E = 1] = \Pr(r) \left[ EU_1^E | r \right] + \Pr(l) \left[ EU_1^E | l \right] = \rho_1^{DM} \left[ \Pr(R|r) + b \Pr(r) \right]\]

The expected utility from not acquiring is

\[EU_1^E [\alpha_1^E = 0] = \text{Rev}(\rho_1^{DM}) \]

\[\begin{align*}
&\quad + \rho_1^{DM} \left[ \Pr(L) + \rho_2^{DM} \alpha_2^E (\tilde{r}|r) \alpha_2^E \left[ \frac{\Pr(R)\pi_R - \Pr(L)(1 - \pi_L)}{1 - \alpha_2^E} \right] \right] \\
&\quad + \left( 1 - \rho_1^{DM} \right) \rho_2^{DM} \left[ \alpha_2^E \left[ \frac{\Pr(R)\pi_R(1 + b) + \Pr(L)\pi_L + \Pr(L)(1 - \pi_L)b}{1 - \alpha_2^E} \right] \Pr(L) \right] \\
&\quad + \left( 1 - \rho_1^{DM} \right) \left( 1 - \rho_2^{DM} \right) (1 - \theta)
\end{align*}\]

It is a best response for the expert to acquire information when

\[EU_1^E [\alpha_1^E = 1] > EU_1^E [\alpha_1^E = 0]\]
\[
\begin{aligned}
&\left[ -c + \rho_1^{DM} \left[ \Pr(R|r) + b \Pr(r) \right] \right] \\
&+ \rho_1^{DM} \left[ \rho_2^{DM} \left( \rho_2^{E} \frac{\Pr(L)}{\Pr(R)} \left( \Pr(R|\bar{r}) - \Pr(L|\bar{r}) \right) \right) \right] \\
&> \rho_1^{DM} \left[ \rho_2^{DM} \left( \rho_2^{E} \frac{\Pr(L)}{\Pr(R)} \left( \Pr(R|\bar{r}) - \Pr(L|\bar{r}) \right) \right) \right] \\
&\left[ \Pr(R|\bar{r}) + b \Pr(r) + \Pr(L|\bar{r}) + \rho_2^{DM} \rho_2^{E} \frac{\Pr(L)}{\Pr(R)} \left( \Pr(R|\bar{r}) - \Pr(L|\bar{r}) \right) \right] \\
&> c \\
&\left[ \rho_1^{DM} \left( \frac{\Pr(R|\bar{r})}{\Pr(L)} \right) \left( \frac{\Pr(L)}{\Pr(R)} \right) \left( \Pr(R|\bar{r}) - \Pr(L|\bar{r}) \right) \right] \\
&\left[ \rho_1^{DM} \left( \frac{\Pr(R|\bar{r})}{\Pr(L)} \right) \left( \frac{\Pr(L)}{\Pr(R)} \right) \left( \Pr(R|\bar{r}) - \Pr(L|\bar{r}) \right) \right] \\
&> c \\
\end{aligned}
\]

In Type LL, assuming that expert 2 is acquiring and reporting informatively, the best response for expert 1 is

- Acquire if \( \rho_1^{DM} c^{DL} > c \)
- Do Not Acquire if \( \rho_1^{DM} c^{DL} < c \)
- Be indifferent if \( \rho_1^{DM} c^{DL} = c \)

\[
c^{DL} = \left[ \theta \pi_R (1 - \theta) \left( \pi_L \right) + b \left( \theta \pi_R (1 - \theta) \left( \pi_L \right) \right) \right]
\]

In Type LL, assuming that expert 2 is not acquiring, the best response for expert 1 is

- Acquire if \( \rho_1^{DM} c^{ML} > c \)
- Do Not Acquire if \( \rho_1^{DM} c^{ML} < c \)
- Be indifferent if \( \rho_1^{DM} c^{ML} = c \)

\[
c^{ML} = \left[ \theta \pi_R (1 - \theta) \left( \pi_L \right) + b \left( \theta \pi_R (1 - \theta) \left( \pi_L \right) \right) \right]
\]

**Proof of Proposition 8:**

The Type RL and Type LR informative equilibria with two reports is very similar to the Type RR and Type LL ones. The difference arises with the bias level and the cost threshold. Step 1 examines the bias threshold. Steps 2 and 3...
examine the cost threshold.

**Step 1:** For either Type RL or Type LR to exist, it is necessary that their bias levels are incentive compatible with their Types. For Type RL to exist, Expert 1 cannot be too right-biased \((b < b^{DR})\) and Expert 2 cannot be too left-biased \((b > b^{DL})\). Conversely, for Type LR to exist, Expert 1 cannot be too left-biased \((b > b^{DL})\) and Expert 2 cannot be too right-biased \((b < b^{DR})\). Since the experts are identical, they cannot be too right- nor too left-biased \((b^{DL} < b < b^{DR})\).

**Step 2:** For the Type RL informative equilibrium with two reports, assuming that Expert 2 is acquiring and reporting informatively, the best response for Expert 1 is

\[
\begin{align*}
&\text{Acquire if } c^{DR} > c \\
&\text{Do Not Acquire if } c^{DR} < c \\
&\text{Be indifferent if } c^{DR} = c
\end{align*}
\]

where

\[
c^{DR} = \left[ (1 - \theta) \pi^2_L - \theta (1 - \pi_R)^2 \\ -b \left( \theta (1 - \pi_R)^2 + (1 - \theta) \pi^2_L \right) \right]
\]

Assuming that Expert 1 is acquiring and reporting informatively, the best response for Expert 2 is

\[
\begin{align*}
&\text{Acquire if } c^{DL} > c \\
&\text{Do Not Acquire if } c^{DL} < c \\
&\text{Be indifferent if } c^{DL} = c
\end{align*}
\]

where

\[
c^{DL} = \left[ \theta \pi_R (1 - \pi_R) - (1 - \theta) \pi_L (1 - \pi_L) \\ +b [\theta \pi_R (1 - \pi_R) + (1 - \theta) \pi_L (1 - \pi_L)] \right]
\]

Therefore, a Type RL informative equilibrium with two reports exists when the \(c \leq \min\{c^{DR}, c^{DL}\}\). It is the minimum value that is relevant because in between \(c^{DR}\) and \(c^{DL}\), one expert will not be willing to acquire information.

**Step 3:** For the Type LR informative equilibrium with two reports, the conditions are just the opposite of Step 2. A Type LR informative with two reports equilibrium exists when the \(c \leq \min\{c^{DR}, c^{DL}\}\).

**Proof of Proposition 9:**

By definition of informative equilibria with two reports, both experts acquire information and the decision maker reads both report. If the expert acquires information, then the expert will report informatively (as shown in Step 4 of the Proof to Proposition 2, 3, and 5). The Type of equilibria is relevant only in determining what reporting strategy the experts adopt and what beliefs the decision maker holds about \(\hat{\theta}\), but the Type does not affect the equilibria.
expected utilities.

\[
EU^{DM} = \theta [\pi_R^2 + 2\pi_R(1-\pi_R)] + (1-\theta) \pi_L^2 - 2e
\]

\[
EU^E = Rev(1) - c + [\theta (\pi_R^2 + 2\pi_R(1-\pi_R)) + (1-\theta) \pi_L^2]
+ b [\theta (\pi_R^2 + 2\pi_R(1-\pi_R)) + (1-\theta) (1-\pi_L^2)]
\]

**Equilibria in mixed acquisition and mixed reporting strategies**

In the first four equilibria, the decision maker is indifferent between reading no reports and reading one report.

In the last four equilibria, the decision maker is indifferent between reading one report and reading two reports.

1. There exists a Type R equilibrium in which expert 1 adopts a mixed acquisition strategy \((a_1^E = \frac{\epsilon(1-2\theta)}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_1 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^M)\), expert 1 is not too right-biased \((b_1 < b^{MR})\), and the cost is sufficiently low \((c \leq c^{MR})\). Expert 2 does not acquire information \((a_2^E = 0)\) and is not read by the decision maker \((\rho^{DM}_2 = 0)\).

2. There exists a Type R equilibrium in which expert 2 adopts a mixed acquisition strategy \((a_2^E = \frac{\epsilon(1-2\theta)}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_2 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^M)\), expert 2 is not too right-biased \((b_2 < b^{MR})\), and the cost is sufficiently low \((c \leq c^{MR})\). Expert 1 does not acquire information \((a_1^E = 0)\) and is not read by the decision maker \((\rho^{DM}_1 = 0)\).

3. There exists a Type L equilibrium in which expert 1 adopts mixed acquisition strategy \((a_1^E = \frac{\epsilon}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_1 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^M)\), expert 1 is not too left-biased \((b_1 > b^{ML})\), and the cost is sufficiently low \((c \leq c^{ML})\). Expert 2 does not acquire information \((a_2^E = 0)\) and is not read by the decision maker \((\rho^{DM}_2 = 0)\).

4. There exists a Type L equilibrium in which expert 2 adopts a mixed acquisition strategy \((a_2^E = \frac{\epsilon}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_2 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^M)\), expert 2 is not too left-biased \((b_2 > b^{ML})\), and the cost is sufficiently low \((c \leq c^{ML})\). Expert 1 does not acquire information \((a_1^E = 0)\) and is not read by the decision maker \((\rho^{DM}_1 = 0)\).

5. There exists Type RR and Type RL equilibria in which expert 1 adopts a mixed acquisition strategy \((a_1^E = \frac{\epsilon}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_1 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^D)\), expert 1 is not too right-biased \((b_1 < b^{DR})\), and the cost is sufficiently low \((c \leq c^{DL})\). Expert 2 does acquire information \((a_2^E = 1)\) and is read by the decision maker \((\rho^{DM}_2 = 1)\).

6. There exists Type RR and Type LR equilibria in which expert 2 adopts a mixed acquisition strategy \((a_2^E = \frac{\epsilon}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_2 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^D)\), expert 2 is not right-biased \((b_2 < b^{DR})\), the cost is sufficiently low \((c \leq c^{DL})\). Expert 1 does acquire information \((a_1^E = 1)\) and is read by the decision maker \((\rho^{DM}_1 = 1)\).

7. There exists Type LL and Type LR equilibria in which expert 1 adopts a mixed acquisition strategy \((a_1^E = \frac{\epsilon}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_1 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low \((e \leq e^D)\), expert 1 is not too left-biased \((b_1 > b^{DL})\), the cost is sufficiently low \((c \leq c^{DL})\). Expert 2 does acquire information \((a_2^E = 1)\) and is read by the decision maker \((\rho^{DM}_2 = 1)\).

8. There exists Type LL and Type RL equilibria in which expert 2 adopts a mixed acquisition strategy \((a_2^E = \frac{\epsilon}{2\theta})\) and the decision maker adopts a mixed reading strategy \((\rho^{DM}_2 = \frac{\epsilon}{2\theta})\) if the effort cost is sufficiently low
Proof of Lemma 2:

The cost threshold $c^M$ can take on two values: $c^{MR}$ and $c^{ML}$. Consider both cases.

**Case 1:** If $c^M = c^{MR}$ and $e \leq e^M$, there exist two possible Type R equilibria with one informative report. In one Type R equilibrium, expert 1 acquires information and is read by the decision maker, while expert 2 is dormant. In the second Type R equilibrium, expert 2 acquires information and is read by the decision maker, while expert 1 is dormant.

**Case 2:** If $c^M = c^{ML}$ and $e \leq e^M$, there exist two possible Type L equilibria with one informative report. In one Type L equilibrium, expert 1 acquires information and is read by the decision maker, while expert 2 is dormant. In the second Type L equilibrium, expert 2 acquires information and is read by the decision maker, while expert 1 is dormant.

Proof of Lemma 3:

The cost threshold $c^D$ can take on two values: $c^{DR}$ and $c^{DL}$. Consider both cases.

**Case 1:** If $c^D = c^{DR}$ and $e \leq e^D$, then the equilibrium in which both experts adopt the reporting strategy of Type RR exists by Proposition 6.

**Case 2:** If $c^D = c^{DL}$ and $e \leq e^D$, then the equilibrium in which both experts adopt the reporting strategy of Type LL exists by Proposition 7.

Proof of Theorem 2:

**Step 1:** By Proposition 1, for all the parameter values, $z_0 \in Z^{(i)}$ and $z_0 \in Z^{(i,i)}$.

**Step 2:** Given a set of parameters, $c^M$ of the game with one expert equals $c^M$ of the game with two experts, and $e^M$ of the game with one expert equals $e^M$ of the game with two experts by Lemma ???. Therefore, for $c < c^M$ and $e < e^M$, $z_1 \in Z^{(i)}$ and $z_1 \in Z^{(i,i)}$.

**Step 3:** For some parameter values (that is, $c \leq c^D$ and $e < e^D$), there exists an equilibrium expected utility for the decision maker in the duopoly game that is strictly greater than the highest equilibrium expected utility for the decision maker in the monopoly game. If $c \leq c^D$ and $e < e^D$, then $z_2 \notin Z^{(i)}$ and $z_2 \in Z^{(i,i)}$. The highest possible equilibrium expected utility for the decision maker in the monopoly game is $z_1$ and $z_2 > z_1$ when $e < e^D$.

Proof of Proposition 10, 11, 12, and 13:

The informative equilibria of the duopoly model with asymmetrically biased experts is very similar to that of the duopoly model with identical experts. The difference is the bias levels and the cost thresholds.

All of the bias levels for both experts must be incentive compatible with the Types. Otherwise, the expert would have an incentive to deviate and that equilibrium would no longer exist, as shown in Step 2 of the Proof of Propositions 2, 3, and 5.

1. For the Type RR informative equilibrium with two reports to exist, both experts cannot be too right-biased ($b_i < b^{DR}$ and $b_j < b^{DR}$).

2. For the Type LL informative equilibrium with two reports to exist, both experts cannot be too left-biased ($b_i > b^{DL}$ and $b_j > b^{DL}$).
3. For the Type RL informative equilibrium with two reports to exist, the first expert cannot be too right-biased and the second expert cannot be too left-biased \((b_i < b^{DR} \text{ and } b_j > b^{DL})\).

4. For the Type LR informative equilibrium with two reports to exist, the first expert cannot be too left-biased and the second expert cannot be too left-biased \((b_i > b^{DL} \text{ and } b_j < b^{DR})\).

For each Type, the informative equilibrium with two reports exists when the cost of information is less than the smaller of the two thresholds.

1. Type RR. Given that expert \(i\) is acquiring and reporting informatively, expert \(j\) will acquire information when \(c \leq c_i^{DR}\). Similarly, given that expert \(i\) is acquiring and reporting information, expert \(j\) will acquire information when \(c \leq c_j^{DR}\). It was established that \(c_j^{DR} > c_i^{DR}\). When \(c \in (c_i^{DR}, c_j^{DR})\), expert \(i\) no longer acquires information even though expert \(j\) would acquire. The equilibrium with two informative reports only exists when the cost of information is less than the smaller of the two thresholds \((c \leq c_i^{DR})\).

2. Type LL. Given that expert \(j\) is acquiring and reporting informatively, expert \(i\) will acquire information when \(c \leq c_i^{DL}\). Similarly, given that expert \(i\) is acquiring and reporting information, expert \(j\) will acquire information when \(c \leq c_j^{DL}\). It was established that \(c_i^{DL} > c_j^{DL}\). When \(c \in (c_i^{DL}, c_j^{DL})\), expert \(j\) no longer acquires information even though expert \(i\) would acquire. The equilibrium with two informative reports only exists when the cost of information is less than the smaller of the two thresholds \((c \leq c_j^{DL})\).

3. Type RL. Given that expert \(j\) is acquiring and reporting informatively, expert \(i\) will acquire information when \(c \leq c_i^{DR}\). Similarly, given that expert \(i\) is acquiring and reporting information, expert \(j\) will acquire information when \(c \leq c_j^{DL}\). However, in this case, either cost threshold could be the smaller one depending on the parameters. Therefore, the equilibrium with two informative reports only exists when the cost of information is less than the minimum of the two thresholds \((c \leq \min\{c_i^{DR}, c_j^{DL}\})\).

4. Type LR. Given that expert \(j\) is acquiring and reporting informatively, expert \(i\) will acquire information when \(c \leq c_i^{DL}\). Similarly, given that expert \(i\) is acquiring and reporting information, expert \(j\) will acquire information when \(c \leq c_j^{DR}\). However, in this case, either cost threshold could be the smaller one depending on the parameters. Therefore, the equilibrium with two informative reports only exists when the cost of information is less than the minimum of the two thresholds \((c \leq \min\{c_i^{DL}, c_j^{DR}\})\).

**Proof of Lemma 4:**

The cost threshold \(c_i^{MA}\) can be either \(c_i^{MR}\) or \(c_i^{ML}\), depending on the parameters. Consider both cases.

1. **Case 1:** Suppose \(c_i^{MA} = c_i^{MR}\). When \(c \leq e^M\) and \(c \leq c_i^{MR}\), the following Type R informative equilibrium with one report exists: Expert \(j\) acquires information, and the decision maker reads Expert \(j\)’s report. Expert \(i\) is dormant, that is, she does not acquire information and her report is not read by the decision maker.

2. **Case 2:** Suppose \(c_i^{MA} = c_i^{ML}\). When \(e \leq e^M\) and \(c \leq c_i^{ML}\), the following Type L informative equilibrium with one report exists: Expert \(i\) acquires information, and the decision maker reads Expert \(i\)’s report. Expert \(j\) is dormant, that is, she does not acquire information and her report is not read by the decision maker.

**Proof of Lemma 5:**

The cost threshold \(c_i^{DA}\) can be either \(c_i^{DR}\) or \(c_i^{DL}\), depending on the parameters. Consider both cases.

1. **Case 1:** Suppose \(c_i^{DA} = c_i^{DR}\). This is the Type RR equilibrium. Given that expert \(j\) is acquiring information and reporting informatively, expert \(i\) acquires information when \(c \leq c_i^{DR}\). Given that expert \(i\) is acquiring information and reporting informatively, expert \(j\) also acquires information when \(c \leq c_j^{DR}\). If \(b_j < b_i\), then \(e_i^{DR} < e_j^{DR}\). Thus if \(c \leq e_i^{DA}\) and \(e_i^{DA} = c_i^{DR}\), then certainly \(c \leq c_j^{DR}\).
**Case 2:** Suppose $c_{DA} = c_{DL}^j$. This is the Type LL equilibrium. Given that expert $j$ is acquiring information and reporting informatively, expert $i$ acquires information when $c \leq c_{DL}^i$. Given that expert $i$ is acquiring information and reporting informatively, expert $j$ also acquires information when $c \leq c_{DL}^j$. If $b_j < b_i$, then $c_{DL}^j < c_{DL}^i$. Thus if $c \leq c_{DA}$ and $c_{DA} = c_{DL}^j$, then certainly $c \leq c_{DR}^i$.

**References**


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