ESSAYS ON MEDIA BIAS AND GOVERNMENT CONTROL OF MEDIA

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ABSTRACT

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The first portion of my dissertation studies the effects of foreign media entry on the quality of information provided to citizens through government controlled media. The government controlled media is tasked to maximize citizen's support or buy-in, and that they can influence it by misreporting the state. An imperfectly informed foreign media is then introduced as an additional independent information source. This removes the government's role as the sole provider of information and alters bias in the government media's report. I find that foreign media typically lowers local media bias. However, when quality of government is low, foreign media entry can exacerbate local media bias. The resulting deterioration in local media quality can outweigh the additional information from a foreign media of moderate quality, leaving citizens worse off. In addition, I analyze the government decision to suppress foreign media, and find suppression most heavily used in countries with moderate quality of governance.

The second portion of my dissertation studies the effects of an imperfectly informed foreign media entry on the government's and citizen's welfare. The model considers the existence of two government's type: one that maximizes citizen's welfare by requiring the controlled media to truthfully report the state, while the other tasks local media to persuade citizen's decision by misreporting the state. The presence of an independent foreign media has an ambiguous effect on local media bias because it reduces government's benefit from lying – as more information limits government's ability to influence, and its cost – as it limits future ability to influence and reduces the government's incentive to build reputa-

tion. A benevolent government that is perceived to be trustworthy may favor stricter media control because incorrect information from foreign media can misleads citizen into making poorer informed decisions. On the other hand citizen prefers the presence of an imperfectly informed foreign media's because the independent news source complements the potentially biased report from local media, and limits the government's influence that tasked local media to misinform the state. Lastly government may react differently to foreign media entry. However in cases where citizen is confident of the government's ability to promote public interest, both governments may be against foreign media entry. This gives rise to signaling equilibrium where government restrains from media control to signal themselves as a benevolent government.

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Chapter 1

Introduction

Freedom of speech and press freedom are widely regarded as crucial components in maintaining a well functioning democracy. There exist strong consensuses among political scientists and economists that greater press freedom is correlated with the improvement of quality of governance [1]. However the importance of press freedom is a relatively modern concept compared to the older views that press regulation is a necessary component of good governance. It was once believed that through careful regulation of press and media outlets, a government with good intention can promote good moral characters in individual citizens, and prevent subversive reports from threatening social stability[2]. Even today, paternalistic arguments were oftentimes employed to justify government control of media.

Nevertheless the desire for unbiased news reports, as well as mutual distrust of the ruling government drive citizens to seek news sources in addition to news from state controlled me-

[1]Representative literatures includes Brunetti and Weder (2003) on media freedom and corruption, Ravallion (1997) on presence of international news outlet on the incidence of famine, Snyder and Strömberg (2004) and Strömberg (2004) on impact of media on citizen's responsiveness to political issue.

[2]According to Plutarch, a Greek historian, governments are responsible for promoting good moral character in individual citizens. During the Qin Dynasty (221 BCE - 206 BCE), Li Si, the Chinese prime minister under emperor Qin Shi Huang, advocates the burning of books and suppression of intellectual discourse as a means to promote political unity.

dia. The dissemination of banned literature and subversive information have existed since the birth of postal services and printing press during the Middle Ages. At the turn of the century inventions such radio, television allows information to transcend international boarders. For example during the height of the Cold War, some of the Russian public listened to foreign broadcasts such as Voice of America or Radio Liberty as they "are interested in a source of information that they may not always believe, but that always be available as a check on the generally accepted unreliability of their own broadcast and newspapers" (Shanor (1985)). In recent years, further improvements in technology such as the introduction of personal computer, cellphones and widespread Internet access have made illegal news sources accessible even to the average person. Even a well designed Internet firewall designed to restrict the flow of digital information can be circumvented by hackers, which in turn distribute illicit information through blogs, cell phones, Internet forums, social media websites and[3]. Therefore the assumption that government can be in full control of all information outlets becomes untenable as communicating devices becomes cheaper and more accessible over time.

However little is known about government's response towards information outlets beyond its control. There is a sense that the appearance of a new foreign source of information enables the public to make better-informed choices. However, this simple story ignores the interaction between foreign media and pre-existing sources of information through government controlled media. This interaction and the resulting overall effect on information and citizen's welfare is the central focus of this dissertation. I find that the interaction effect can reinforce the basic story, or overturn it. In chapter 2 I follow Gehlbach and Sonin (2009) "voter mobilization" approach of modeling government control of media. A program is assumed that promises potential benefit to citizens that invest in it. This investment is a

[3]See Parry (2008) regarding role of mobile phones in spreading news on North Koreas food crisis.

metaphor to capture in a simple way a potential conflict of interest between government and individual citizens. Citizens' investment in this program represents any action that the government wants from individual citizens, to further its ideological goals, enhance its political power, or to seek collective support for implementing certain economic policies. However, these actions may be costly for individual citizens. The government thus has incentives to use the media to persuade citizens to undertake its desired action by exaggerating the degree to which the action is in the citizens' best interests. However, citizens are aware of the government's propensity to exaggerate, and so discounts its media reports accordingly.

In my dissertation, foreign media represents additional information sources for citizens to make better informed choices. The assumption where government cannot manipulate foreign media report is imposed, and its information is accessible to individual citizens at no additional cost. This departs from literatures that assume complete reliance on a single source of information (Gehlbach and Sonin (2009)), or from literatures (Besley and Prat (2006)) that assumes all information outlets are susceptible to government manipulation. Nevertheless two restrictions are imposed on the nature of information available to citizens. First, the foreign media, as an "outsider", relies on less accurate information sources compared to those available to government controlled media. This restriction will also be used to capture the government's ability to stifle foreign media's access to relevant information sources [4]. Second, it is assumed that foreign media maximizes its advertising profit by maintaining a truth-telling editorial policy. In doing so foreign media's profit motive that biases report to conforms with its audience's prior beliefs has been ignored[5]. These restrictions

[4]In an attempt to control news, government rewards inside scoops to media outlets that report favorably about the government, while preventing access of foreign media that strives to provide accurate information that maximize advertising revenue from its audience. See "D: Bribing as Access" from Besley and Prat (2006) for a brief discussion.

[5]Also known as 'demand-side bias', representative papers include Gentzkow and Shapiro (2006), which examines the reputation incentive of inaccurate media outlets to bias its report to conform

imply a government controlled media that is accurate but biased due to her propensity to exaggerate; and a foreign media that is unbiased but potentially inaccurate. Since both information sources are potentially inaccurate for different reasons, citizens treat them as complements. Therefore any changes in government's propensity to exaggerate, alters the quality of information available to citizen and affect their investment decisions.

The second portion of this dissertation analyzes the basis of media controls, which represents government ownership of news outlets and regulation of media content to meet the government's regulation. Proponents of greater media control typically invokes a paternalism arguments where the government acts as a steward to uninformed citizen by regulating news content and weed out false reports and biased news. In an unregulated news industry, uninformed consumers are exposed to potentially false and biased news information that misleads consumers into making poorer decisions. Opponents of media control reject the paternalistic arguments and instead argue that media control is used to cover up a government's true intention to mobilize citizen's decision that furthers the government's interest. Moreover they argue that media control that intends to promote citizen's interest makes little sense because citizen are oftentimes worse off when media control reduces the amount of information available for citizens to make informed decisions. This is especially true when citizen discounts government media report that is perceived to be biased and distrust the incumbent government. Despite mutual disagreements between proponents and opponents of media control, my dissertation shows that the argument from both sides have their merits. Deriving conditions in which media control can benefit and harm citizen's interest will be the central focus of chapter 3.

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with her consumer's prior belief. Shleifer and Mullainathan (2005) discuss media outlets incentive to bias report in order to segment consumers with different prior beliefs. Papers by Groseclose and Mylio (2005) and Gentzkow and Shapiro (2010) demonstrate a relation between media bias and audience's political beliefs in United States's newspaper market.

The modeling approach in chapter 3 is closely related to Morris (2001) two-period principal agent model where an uninformed citizen relies on information provided by media outlets. One of the media outlets is directly controlled by a government where its type is private information. In this model citizen form beliefs regarding the government's true intention that reflects a government's credibility (reputation). In this model, government's has strict incentive to maintain a favorable reputation and influence its decision to lie. In particular a government may benefit from tasking local media to lie persuade citizens to undertake its desired action. However its decision to lie is costly because the indication of a lying government signals the government as being dishonest, causing citizen to discount future government's report. Here the presence of additional information from foreign media lowers both the benefit – the extra source of information reduces influence the government can have through bias; and the cost - since there is less chance to influence future decisions as well, so building a reputation is less valuable.

The essays in this dissertation relates to a broader literature of *supply side* media bias in which the deliberate distortion of information originates from the provider of news. Unlike the agenda setting theory (McCombs, Shaw (1974), Knight Chiang (2011), Larcinese et al (2011)) that emphasizes on media outlet's influence on consumer's choice of information and beliefs, my paper is more closely related to the role of media on government accountability. Representative paper includes Besley and Pratt (2006) that models government's suppression of independent news sources through bribery. They show that the likelihood of an independent media industry is inversely proportional to the number of independent news outlets as the government is required to pay each media outlets the sum they would earn in a monopoly news market. However my model is different as the assumption that foreign media report cannot be silenced is maintained. Chapter 2 of my dissertation relates to the works of Gehlbach and Sonin (2009) that analyzes two different methods of media control, bribery or government ownership. They show that the increasing importance of advertising revenue to news outlets increases the appeal of government ownership of local media[6]. However the focus here is different because I am more interested in the interaction between foreign media's influence and the government's decision to lie. Chapter 2 also relates to literatures that link media freedom to better quality of governance. However the focus here is quite the opposite as I demonstrate how differences in quality of governance affect government's reaction towards foreign media entry. Chapter 3 of this dissertation relates to a game of strategic communication of Morris (2001) that builds upon previous work from Crawford and Sobel (1982) where those who controls information source strategically transmit noisy information to another that influences the welfare of both parties. In Morris (2001) the role of reputation is introduced to illustrate an advisor incentive to lie to signal as being trustworthy. My focus here is different because the role of reputation is introduced to highlight the presence of foreign media on government's incentive to maintain its reputation.

[6] In a different institutional settings, Gentzkow, Glaeser and Goldin (2004) attribute the increase in informativeness in United States' newspapers from 1870 to 1920 to increasing importance in advertising revenue.

Chapter 2

Does Foreign Media Entry Discipline or Provoke Local Media Bias

This chapter studies the interaction between information and citizen's well being through the extension of Gehlbach and Sonin (2009) voter mobilization framework, and is divided into the following sections. Section 2.1 incorporates the entry of an imperfectly informed foreign media into the existing Gehlbach and Sonin (2009) framework. Section 2.2 provides a benchmark that analyzes the role of government controlled media in mobilizing citizen investment without the presence of foreign media. Section 2.3 incorporates foreign media entry with a predetermined level of accuracy. Here conditions under which foreign media entry could temper or exacerbate bias in government media's report is derived. Section 2.4 derives the welfare implication from citizen investment choice based on government media behavior outlined in section 2.3. Section 2.5 modifies the basic model of section 2.1 to analyze government effort to reduce foreign media's accuracy at a cost. Section 2.6 summarizes the results.

2.1 Description of Model

This model considers a government and a group of individual citizens with population normalized to one. Similar to Gehlbach and Sonin (2009), the government goals is reflected through a program in which citizens can invest, and earn potential return at the end of the period. For every individual that invests, government receives 1 unit of utility. However, a citizen that invests must incur 1 unit of fixed (opportunity) cost, and the investment return to citizen i depends on realized state S. The high state H is used to indicate the state where investor i receives X_i, which is uniformly distributed in the range of $[0, 2b]$ [1]. Average benefit is assumed to satisfy $b > 1$, which implies that more than half of the population will choose to invest in the program if it succeeds with certainty[2]. Conversely low state L is used to indicate the state in which citizen receives nothing from their investment. The realized state is only revealed to the government at the beginning, while individual citizens only know that the likelihood of realized state H equals θ. Thus the conflict of interest is that the government always wants investment, while citizens only want to invest in the right conditions. Since the conflict of interest between the government and citizen is smaller at higher expected return from investment, average benefit b and program success rate θ are used to indicate quality of governance.

Before making investment decisions, citizens receive reports on realized state from two media outlets: government media and foreign media. Notations $r_G \in \{h, l\}$ and $r_F \in \{h, l\}$

[1] For compactness, b shall henceforth be referred to as average benefit. The difference in return could also be interpreted as different cost in investing in the program. Suppose the government requires support from individual citizens before implementing an income redistribution program that could potentially reduce crime rate through lower inequality. Assuming that citizens receive the same benefits from reduction in crime through lower inequality, a person with higher income may be subjected to a higher tax rate compared to a person with lower income, and thus face a higher cost of participation.

[2] One could also consider a more general case in which initial investment cost c such that $b > c$. Since the key conditions in the analysis will involve benefit relative to cost, little is lost by normalizing cost c to 1.

are used to indicate, respectively, government media's report and foreign media's report on realized state H and L. The role of government media is to follow editorial policies that maximize citizen's investment in the program. Though the model supports multiple editorial policies, equilibrium attention is restricted such that government media always truthfully reports state H. [3] In state L, it may be optimal for government media to occasionally lie by reporting h. Let bias parameter σ be the likelihood that government media reports h in state L. It is assumed that bias σ, as well as any changes in bias, is observable by citizens. [4] Though the government has no influence over foreign media's report, it could restrict foreign media's access to relevant information sources. Relying on potentially inaccurate source, foreign media may occasionally misreport the realized state S. The accuracy of foreign media is characterized such that its signal $s \in \{h, l\}$ correctly matches the state $S \in \{H, L\}$ with probability π. This implies that with probability $1 - \pi$, foreign media's receives incorrect signal regarding state S. It is assumed that $\pi > 1/2$, and that the value of π is common knowledge. Foreign media truthfully reports its signal, thereby minimizing its probability of making incorrect reports. Finally, it is assumed that both government media and foreign media simultaneously make their reports to individual citizens.

To summarize the framework discussed in chronological order:

1. State $S \in \{H, L\}$ is revealed to the government media only. Foreign media receives signal $s \in \{h, l\}$ such that with probability π, its signal s matches true state S.

[3] Since government objective is to encourage citizen investment through controlled media, it would be natural to focus on cases where government never discourages investment in state H by reporting L. This restriction is also used in Gehlbach and Sonin (2009).

[4] If citizens could not observe bias σ, some other mechanism is needed to provide government media with sufficient incentives to follow a particular editorial policy. Otherwise, the only credible editorial policy is that government media only reports h ($\sigma = 1$). In Gehlbach and Sonin (2009) the ideological beliefs of the editor-in-chief reflects the editorial policy of the state controlled media, and changes in media bias is reflected by the announcement regarding the replacement of the editor-in-chief.

2. Foreign media reports its signal truthfully while government media reports according to government's editorial policy. Citizens observes bias, σ.

3. Upon receiving reports from all media outlets, citizens decides whether to invest in program or do nothing. Government receives a unit of utility for every citizen that invests.

4. Citizens' investment returns are realized at the end of period.

2.2 Government Media Bias in Absence of Foreign Media

Consider a benchmark case where citizens rely only on government controlled media. Alternatively one could assume that the foreign media that is perfectly inaccurate $\pi = 1/2$. Focusing on an editorial policy where government media truthfully reports state H, but reports h in state L with probability σ, let $Pr(H|r_G)$ be citizen's belief of state H upon hearing government media report r_G. Upon hearing government media report of h, citizens update their belief of state H as follows:

$$Pr(H|r_G = h) = \frac{Pr(r_G = h|H)Pr(H)}{Pr(r_G = h)} = \frac{\theta}{\theta + (1-\theta)\sigma}, \tag{2.1}$$

which is increasing in program success rate θ and decreasing in bias σ. Note that when bias σ equal 1, reports from government media cease to be informative and citizen posterior belief $Pr(H|r_G = h)$ remains at θ upon observing government report of h. In addition since government media truthfully reports state H, citizen places zero likelihood of state H upon observing government report l, $(Pr(H|r_G = l) = 0)$.

After hearing government report r_G, citizens invest only when their expected benefit from investment $Pr(H|h)X_i$, exceeds the cost of 1; and do nothing otherwise. Let X_{r_G} be the cutoff level at which an individual would be indifferent between investing in the program and doing nothing upon hearing report r_G. The cutoff level X_h satisfies

$$\begin{aligned} X_h \Pr(H|r_G = h) + 0 \Pr(L|r_G = h) = 1 \Rightarrow X_h \frac{\theta}{\theta + (1-\theta)\sigma} = 1 \\ \Rightarrow X_h = 1 + \left(\frac{1-\theta}{\theta}\right)\sigma \end{aligned} \tag{2.2}$$

while the cutoff level X_l is undefined since all citizens strictly prefer to do nothing upon hearing $r_G = l$.

Let citizen investment I_{r_G} be the fraction of total population that invests upon observing government media report r_G. One can show that $I_h = \max\left\{1 - \frac{X_h}{2b}, 0\right\}$. Of course citizen investment I_l equals 0 since no one invest upon hearing government report of l. Since I assume that $X_h \leq 2b$, which is always the case at the optimum, government maximizes (expected) citizen investment by setting bias level σ as follows:

$$\max_{\sigma \in [0,1]} \left[1 - \frac{1}{2b}\left(1 + \left(\frac{1-\theta}{\theta}\right)\sigma\right)\right] [\theta + (1-\theta)\sigma], \tag{2.3}$$

where the expression $\left[1 - \frac{1}{2b}\left(1 + \left(\frac{1-\theta}{\theta}\right)\sigma\right)\right]$ equals I_h, which is citizen investment upon hearing report $r_G = h$, and expression $[\theta + (1-\theta)\sigma]$ is the likelihood of observing report $r_G = h$. Let σ_n^* be the optimal bias that maximizes citizen investment, equation (2.3). Bias σ_n^* equals:

$$\sigma_n^* = \begin{cases} (b-1)\left(\frac{\theta}{1-\theta}\right) & \theta b \leq 1 \\ 1 & \theta b \geq 1 \end{cases} \tag{2.4}$$

Let V_n be the maximal citizen investment. The expression of V_n simplifies to:

$$V_n = \begin{cases} V_n^i = \frac{\theta b}{2} & \text{for } \theta b \leq 1 \\ \bar{V}_n = 1 - \frac{1}{2\theta b} & \text{for } \theta b \geq 1 \end{cases} \tag{2.5}$$

Basic comparative statics on maximal citizen investment V_n demonstrates that:

$$\begin{array}{lll} \frac{\partial \sigma_n^*}{\partial \theta} \geq 0 & \frac{\partial V_n^i}{\partial \theta} > 0 & \frac{\partial \bar{V}_n}{\partial \theta} > 0 \\ \frac{\partial \sigma_n^*}{\partial b} \geq 0 & \frac{\partial V_n^i}{\partial b} > 0 & \frac{\partial \bar{V}_n}{\partial b} > 0, \end{array}$$

i.e. bias σ_n^* and maximal citizen investment V_n is strictly increasing in program success rate θ and average benefit b. Intuitively when citizens expect higher return from investment, bias σ plays a smaller role in influencing citizen investment. This reduces the cost of bias and allows the government to gain larger investment through more biased policy. The results are summarized in the following proposition:

Proposition 1. *Gehlbach and Sonin (2009): In absence of foreign media, bias in government controlled government media σ_n^*, and maximal citizen investment V_n, is increasing in program success rate θ and average benefit b. Probability of lying $(1-\theta)\sigma_n^*$, is increasing in θ and b for $\theta b < 1$, and is decreasing in θ and b for $\theta b \geq 1$, when government controlled media ceases to be informative.*

2.3 Foreign Media and Government Media Bias

In this section, foreign media is introduced that provides citizens with an unbiased news report, but has a predetermined accuracy level of π. The entry of foreign media remove the role of government media as the sole provider of information, as citizens now rely on both sources of information. With the restriction that government media always truthfully reports state H, citizen places zero likelihood on state H whenever government media reports l. Therefore the central focus lies in foreign media influence on government media's report of h.

In the event where reports $\{r_G = h, r_F = h\}$ is observed (i.e. both media outlets reporting h), citizen's belief of state H equals:

$$\Pr(H|r_G = h, r_F = h) = \frac{\pi\theta}{\pi\theta + (1-\pi)(1-\theta)\sigma} \tag{2.6}$$

which is increasing in foreign media's accuracy, π. This is derived from the observation that there are two paths to observing $\{r_G = h, r_F = h\}$. First, the true state may be H (probability θ) in which case the government media reports h for sure and the foreign media reports h with probability π. Second, the true state may be L (probability $1-\theta$), in which case the government media reports h with probability σ and the foreign media errs and reports h with probability $1-\pi$.

Denote cutoff level $X_{h,h}$ at which an individual would be indifferent between investing in the program and doing nothing upon observing $\{r_G = h, r_F = h\}$. Mathematically, $X_{h,h}$ satisfies $X_{h,h}Pr(H|r_G = h, r_F = h) + 0Pr(L|r_G = h, r_F = h) = 1$. Therefore, citizen investment $I_{h,h}$ equals $\max\left\{1 - \frac{X_{h,h}}{2b}, 0\right\}$ where:

$$X_{h,h} = 1 + \left(\frac{1-\pi}{\pi}\right)\left(\frac{1-\theta}{\theta}\right)\sigma \tag{2.7}$$

Conversely in the event of observing reports $\{r_G = h, r_F = l\}$, citizen's belief of state H now equals:

$$\Pr(H|r_G = h, r_F = l) = \frac{\theta(1-\pi)}{\theta(1-\pi) + \pi(1-\theta)\sigma} \tag{2.8}$$

which is decreasing in foreign media's accuracy π. This is derived from the observation that there are two paths to observing $\{r_G = h, r_F = l\}$. First, the true state may be H (probability θ) in which case government media reports h for sure and foreign media errs and reports l with probability $1-\pi$. Second, the true state may be L (probability $1-\theta$), in which case the government media reports h with probability σ and foreign reports l with probability π. Denote cutoff level $X_{h,l}$ at which an individual would be indifferent between investing in the program and doing nothing after observing government media report of h and foreign media report of l. Mathematically, $X_{h,l}$ satisfies $X_{h,l}Pr(H|r_G = h, r_F = l) + 0Pr(H|r_G = h, r_F = l) = 1$. Therefore citizen investment $I_{h,l}$ equals $\max\left\{1 - \frac{X_{h,l}}{2b}, 0\right\}$ where:

$$X_{h,l} = 1 + \left(\frac{\pi}{1-\pi}\right)\left(\frac{1-\theta}{\theta}\right)\sigma \tag{2.9}$$

Note that $X_{h,l} > X_{h,h}$, since $\pi > \frac{1}{2}$. Thus fewer citizens invest when hearing $\{r_G = h, r_F = l\}$, than when hearing $\{r_G = h, r_F = h\}$. Of course no one invests when $r_G = l$ since government media does not lie in that direction, and has perfect information. Denote $\bar{\sigma} = (2b-1)\left(\frac{\theta(1-\pi)}{(1-\theta)\pi}\right)$ as the upper bound for bias such that for $\sigma \leq \bar{\sigma}$, $X_{h,l} \leq 2b$; that is if $\sigma \leq \bar{\sigma}$, someone at least weakly prefers investing when government media reports h and when foreign reports l. If $\sigma > \bar{\sigma}$, no one invests when either media reports l. Therefore in response to foreign media entry, assuming that $X\_\{h,h\} \leq 2b$, which will always be the case at the optimum, government media chooses bias σ that maximizes the following citizen investment:

$$\begin{aligned}\max_{\sigma\in[0,1]} \quad & \left[1 - \frac{1}{2b}\left(1 + \left(\frac{1-\pi}{\pi}\right)\left(\frac{1-\theta}{\theta}\right)\sigma\right)\right][\theta\pi + (1-\theta)(1-\pi)\sigma] \\ & + \max\left\{0, \left[1 - \frac{1}{2b}\left(1 + \left(\frac{\pi}{1-\pi}\right)\left(\frac{1-\theta}{\theta}\right)\sigma\right)\right]\right\}[\theta(1-\pi) + (1-\theta)\pi\sigma]\end{aligned} \tag{2.10}$$

Focusing on bias below $\bar{\sigma}$, citizen investment of equation (2.10) consists of two parts: the former corresponds to citizen investment upon hearing $\{r_G = h, r_F = h\}$, while the latter corresponds to citizen investment upon hearing $\{r_G = h, r_F = l\}$. When bias σ exceeds $\bar{\sigma}$, the latter expression is zero, indicating that citizen investment only occurs when citizens observe h from both government media and foreign media. This gives rise to two potential local investment optima that correspond to two levels of bias. The local optima are first characterized, followed by the derivation of global optimum.

2.3.1 Low Bias

Denote low bias σ_l as the bias below $\bar{\sigma}$ that maximizes citizen investment (equation (2.10)). In other words, bias is restricted to be sufficiently *small* that someone at least weakly prefers investing whenever the government media reports h, even if foreign media reports l. Denote $k(\pi) = \frac{\pi(1-\pi)}{1-3\pi+3\pi^2}$, the expression of σ_l simplifies to:

$$\sigma_l = \min\left[(b-1)\left(\frac{\theta}{1-\theta}\right)k(\pi), 1\right] \tag{2.11}$$

With assumptions $b > 1$ and $\pi \in \left(\frac{1}{2}, 1\right)$, one could show that low bias σ_l lies in the interior of $[0, \bar{\sigma}]$ The inequality $\overline{\sigma} > \sigma_l$ is equivalent to $\overline{\sigma} - \sigma_l = \left(\frac{\theta(1-\pi)}{(1-\theta)\pi}\right)\left(2b - 1 - (b - 1)\frac{\pi^2}{1-3\pi+3\pi^2}\right) > 0$. This is equivalent to $\left(\frac{1-3\pi+3\pi^2}{\pi^2} > \frac{b-1}{2b-1}\right)$ for $b > 1$ and $\frac{1}{2} < \pi < 1$. To show that this is true, note that $\frac{b-1}{2b}$ is increasing in b, and reaches its upper bound of $\frac{1}{2}$ as b approaches ∞. On the other hand the expression $\frac{1-3\pi+3\pi^2}{\pi^2}$ is a convex function of π that reaches its minimum of $\frac{3}{4}$ at $\pi = \frac{2}{3}$, therefore the inequality $\left(\frac{1-3\pi+3\pi^2}{\pi^2} > \frac{b-1}{2b-1}\right)$ holds for $b > 1$ and $\frac{1}{2} < \pi < 1$.

Thus whenever bias follows σ_l, citizen investment is strictly positive whenever government media reports h. Note that the expression $k(\pi)$ is decreasing in foreign media's accuracy π, reaching its upper bound of 1 at $\pi = \frac{1}{2}$, and its lower bound of 0 at $\pi = 1$. Thus, bias σ_l is decreasing in foreign accuracy π (see equation (2.11)). In this region of the objective function, foreign media essentially provides greater discipline on local media bias. With a more accurate foreign media, citizens put more stock in foreign report. This raises the expected cost of bias as fewer citizens are willing to invest upon hearing foreign media's report of l[5]. As such bias is lowered, so that more citizens will invest even after hearing foreign media's report of l. A more accurate foreign media implies lower government media bias, and bias approaches zero as foreign accuracy gets closer to perfect.

For $\theta b \geq 1$, bias σ_l is at its upper bound of one at low levels of foreign media's accuracy π. Denote $\hat{\pi}_l = \frac{1}{2}\left(1 + \sqrt{\frac{\theta b - 1}{3-(4-b)\theta}}\right)$ such that for $\theta b \geq 1$ and $\pi \leq \hat{\pi}_1$, bias equals $\sigma_l = 1$ and for $\theta b \leq 1$ or $\pi \geq \hat{\pi}_1$, bias equals $\sigma_l = (b-1)\left(\frac{\theta}{1-\theta}\right)k(\pi) < 1$. Let V_l be maximal citizen when bias follows σ_l. V_l equals:

$$V_l = \begin{cases} V_l^i = \frac{\theta}{2b}\left[(2b-1) + k(\pi)(b-1)^2\right] & \text{for } \theta b \leq 1, \text{ or } \pi \geq \hat{\pi}_l \\ \bar{V}_l = \frac{1}{b}\left[(b-1) - \frac{\theta}{2b}\left(1 + \left(\frac{1-\theta}{\theta}\right)^2 \frac{1}{k(\pi)}\right)\right] & \text{for } \theta b \geq 1 \text{ and } \pi \leq \hat{\pi}_l \end{cases} \tag{2.12}$$

Basic comparative statics on maximal citizen investment V_l give

$$\frac{\partial V_l^i}{\partial \pi} < 0 \qquad \frac{\partial \bar{V}_l}{\partial \pi} < 0,$$

i.e. improvements in foreign media's accuracy π reduces maximal citizen investment V_l.

[5]Occasionally, foreign media errs in favor of government whenever it reports h in state L. However this is less likely when foreign media becomes more accurate

2.3.2 High Bias

As long as $\bar{\sigma}$ is below 1, let high bias σ_h be the locally optimal bias between $[\bar{\sigma}, 1]$ that maximizes citizen investment of equation 2.10. In other words, citizen investment occurs only when both media outlets report h. Solving for bias σ_h, the expression of σ_h equals:

$$\sigma_h = \min\left\{(b-1)\left(\frac{\theta}{1-\theta}\right)\left(\frac{\pi}{1-\pi}\right), 1\right\} \tag{2.13}$$

Note that in this region, bias σ_h, is increasing in foreign media's accuracy π. This reverses the common sense result of the previous section, where a more accurate foreign media provides greater discipline on local bias. Here, greater foreign accuracy provokes local bias. The intuition is as follows. Given that $\sigma_h \geq \bar{\sigma}$, investment only occurs when both media outlets report h. With greater foreign accuracy, citizens put more stock in the foreign report and is more willing to invest when both media outlets report h. As such government media bias σ_h plays a smaller role in influencing citizen decision. This lowers the cost of bias, which outweighs the decreased benefit of bias, allowing the government to set a more biased policy that increases the likelihood of citizens hearing report $\{r_G = h, r_F = h\}$. The intuition here is similar to the intuition where bias σ_h is increasing in program success rate θ. Higher program success rate θ implies citizen are more likely to benefit from investment, as well as higher likelihood of state H when both media reports h. Although higher foreign media's accuracy π does not imply higher (expected) benefit from investment, it increases the likelihood of state H *conditional on both media reporting* h (equation(2.6)). Both cases imply that government bias σ_h plays a smaller role in influencing citizen's investment decision, which allows the government to set higher bias σ_h that increases the likelihood of citizen hearing $\{r_G = h, r_F = h\}$.

Since bias σ_h reaches its upper bound of 1 when foreign media's accuracy π approaches perfect, denote $\hat{\pi}_h = \frac{1-\theta}{\theta(b-1)+(1-\theta)}$ such that for $\pi \geq \hat{\pi}_h$, $\sigma_h = 1$. When bias follows σ_h, maximal citizen investment V_h equals:

$$V_h = \begin{cases} V_h^i = \frac{\theta\pi b}{2} & \text{for } \pi \leq \hat{\pi}_h \\ \bar{V}_h = \left[1 - \frac{1}{2b}\left(1 + \left(\frac{(1-\theta)(1-\pi)}{\theta\pi}\right)\right)\right](\theta\pi + (1-\theta)(1-\pi)) & \text{for } \pi \geq \hat{\pi}_h \end{cases} \tag{2.14}$$

When bias follows σ_h, higher foreign media's accuracy π has an ambiguous effect on maximal citizen investment V_h:

$$\frac{\partial V_h^i}{\partial \pi} > 0 \qquad\qquad \frac{\partial \bar{V}_h}{\partial \pi} < 0 \quad \text{for } \theta \leq \frac{1}{2}$$

To see why this is so, note that citizen investment V_h depends on two components: investment when citizen hears $\{r_G = h, r_F = h\}$ ($I_{h,h}$), and the likelihood of hearing $\{r_G = h, r_F = h\}$. Holding bias σ_h fixed, improvements in foreign accuracy π raises $I_{h,h}$ as the likelihood of state H is higher upon hearing $\{r_G = h, r_F = h\}$. On the other hand, higher foreign media's accuracy π reduces the likelihood of citizen hearing $\{r_G = h, r_F = h\}$, unless program success rate θ is sufficiently large. Therefore for bias $\sigma_h = 1$, citizen investment $\bar{V}_h$ is increasing in π only when program success rate θ exceeds $\frac{1}{2}$. However for bias $\sigma_h < 1$, higher foreign media's accuracy π increases bias σ_h, which in turn increases the likelihood of hearing $\{r_G = h, r_F = h\}$. Investment $I_{h,h}$ however remains unchanged because the increased bias in government media report counteracts with the increase in investment $I_{h,h}$ from higher foreign media's accuracy π. The combined effects describes citizen investment V_h^i, which is increasing in foreign accuracy π.

Even though locally, a better foreign media can raise investment, using results from sections 2.2 and 2.3, It is demonstrated that foreign media entry is undesirable to incumbent government by reducing overall citizen investment in the program.

Proposition 2. *Maximal citizen investment in absence of foreign media* V_n *is greater than maximal citizen investment with presence of foreign media* V*.*

2.3.3 Globally Optimal Bias

From section 2.3.1 and 2.3.2, it is established that foreign media entry could discipline government media, or exacerbate biased reporting to an extreme level. Using the expressions of maximal citizen investment V_l (equation (2.12)) and V_h (equation (2.14)), mathematical conditions under which bias follows σ_l or σ_h can be derived. Since government media adopts bias that yields the highest citizen investment, bias that follows σ_l, or σ_h, is outlined in the following proposition:

Proposition 3. *In the case of a government media and a single foreign media:*
For $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$, *bias* σ^* *follows* σ_l *and therefore decreases in* π *for* $\pi \in \left(\frac{1}{2}, 1\right)$ *and approaches* 0 *as* π *approaches* 1*.*
For $\theta < \frac{2(b-1)}{b^2+2(b-1)}$, *there exists a critical level of* $\pi' \in \left(\frac{1}{2}, 1\right)$ *such that: 1) For* $\pi \in \left(\frac{1}{2}, \pi'\right)$, *bias* σ^* *follows* σ_l *and therefore decreases in* π*. Some people invest in the program whenever the government media reports h. 2) For* $\pi \in \left(\pi', 1\right)$ *bias follows* σ_h *and therefore (weakly) increases in* π *and reaches* $\sigma = 1$ *for* $\pi < 1$ *high enough. No one invests whenever the foreign media reports l.*

For illustrative purposes, figure 2.1 divides the parameter space (b, θ) into the key regions for bias behavior. In particular, areas A and AA, which lies above the $\theta = \frac{2(b-1)}{b^2+2(b-1)}$ curve

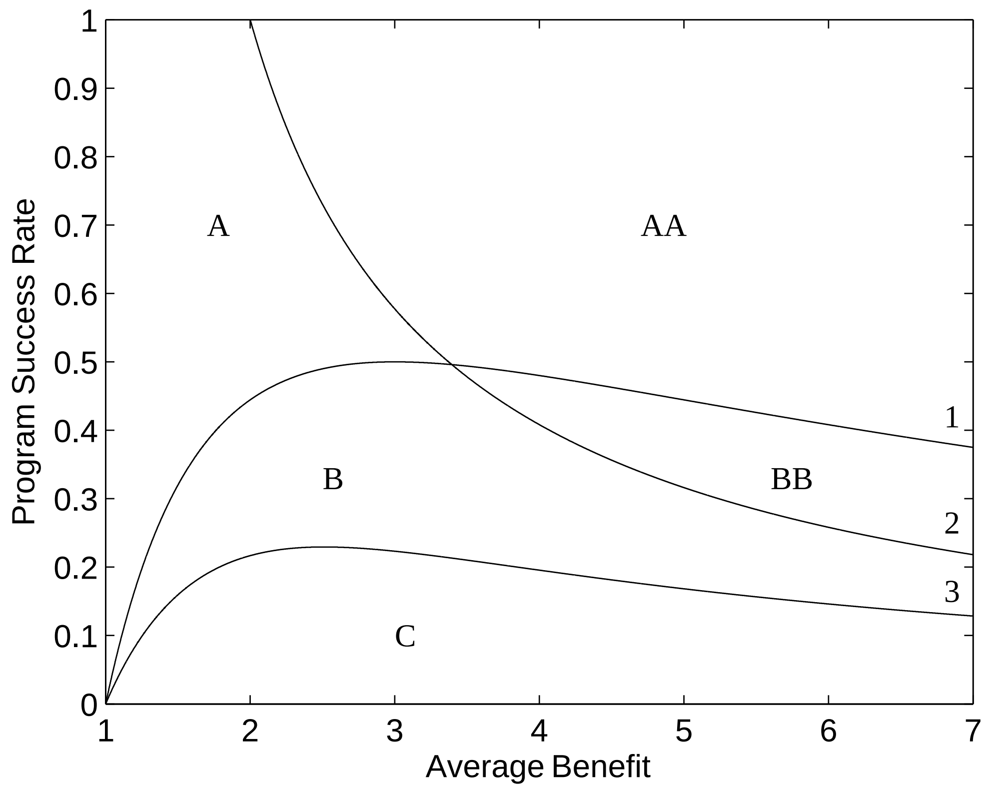

Figure 2.1: Mapping of Government Media Bias

(curve 1), bias follows σ_l and is decreasing in foreign media's accuracy π. In areas B, BB and C, bias follows σ_l and is decreasing in π when foreign media's accuracy is low. However once foreign accuracy π exceeds some threshold π', bias follows σ_h, and is increasing in π until it hits 1. The difference between areas B, BB and area C is as follows: In areas B or BB, bias increases from $\sigma_l \leq 1$ for $\pi < \pi'$ to $\sigma_h = 1$ for $\pi > \pi'$ where π' solves $V_l^i = \bar{V}_h$. In area C, bias increases from $\sigma_l < 1$ for $\pi < \pi''$ to $\sigma_h < 1$ for $\pi'' < \pi < \hat{\pi}_h$ where π'' solves $V_l^i = V_h^i$, and remains at $\sigma_h = 1$ for $\pi > \hat{\pi}_h$.

To illustrate, figure 2.2 and figure 2.3 compute bias in government media σ^* (solid line), and probability of lying $(1-\theta)\sigma^*$ (dashed line), as a function of foreign media's accuracy π. In particular, figure 2.2 sets program success rate at $\theta = 0.15$ and average benefit at $b = 2.5$, which satisfy $\theta < \frac{2(b-1)}{b^2+2(b-1)}$ and is located in area C. For low values of accuracy π,

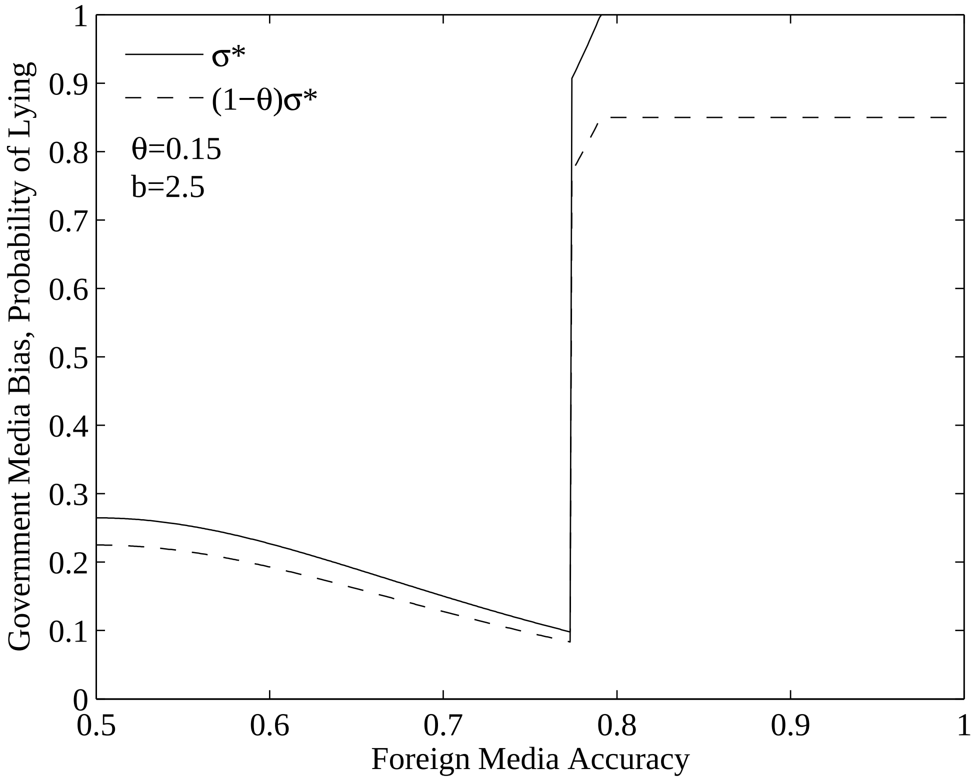

Figure 2.2: Government Media Bias and Probability of Lying Under Poor Quality Government

bias follows σ_l, and is strictly decreasing in π. Once π exceeds 0.774, bias discontinuously increases from $\sigma^* = \sigma_l = 0.098$ to $\sigma^* = \sigma_h = 0.905$, and is weakly increasing in accuracy π. figure 2.3 on the other hand fixed program success rate at $\theta = 0.30$ and average benefit at $b = 5$, which satisfy $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$. Located in area AA bias σ^* equals $\sigma_l = 1$ for $\pi \leq \hat{\pi}_l = 0.695$, is strictly decreasing in π for $\pi > 0.695$, and approaches zero when π is close to 1.

This result is important because it demonstrates that while foreign media typically disciplines local bias, it can have the opposite effect, pushing local media to extreme levels of bias. It also suggests the increase in bias tends to occur in countries with low quality of governance (low θ and low b), while foreign media entry typically tempers government media's bias in countries with high quality of governance.

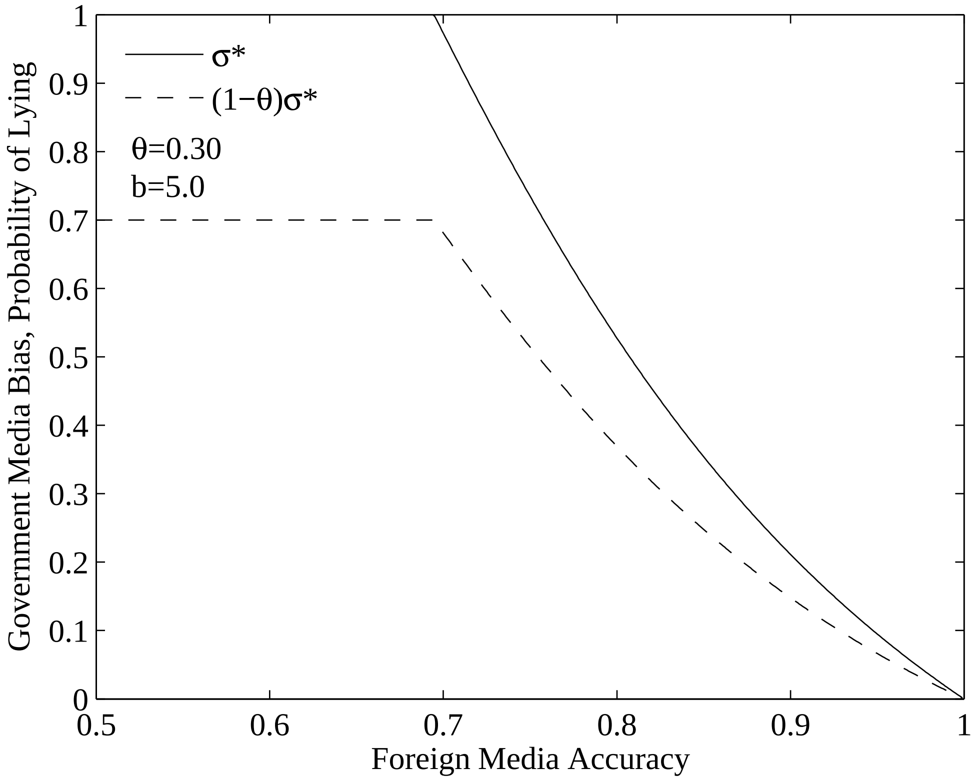

Figure 2.3: Government Media Bias and Probability of Lying Under Good Quality Government

In order to provide some intuitions behind the behavior of bias, the term "$\{h,h\}$-market" is used to denote the magnitude of investment that comes from citizens hearing $\{r_G = h, r_F = h\}$. Likewise, the term "$\{h,l\}$-market" will be used to denote the magnitude of investment that comes from citizen hearing $\{r_G = h, r_F = l\}$. Loosely speaking high bias σ_h, optimizes for the $\{h,h\}$-market and gives up on the $\{h,l\}$ market, since no one invests when foreign media reports l. Similarly a government that follows low bias σ_l caters to the $\{h,l\}$-market instead of more heavily exploiting the $\{h,h\}$-market. The intuition behind local media's bias behavior is as follows:

1. *In response to foreign media entry, a higher quality government (higher θ) is more likely to follow low bias σ_l.* Using program success rate θ as an indicator of quality of

governance, more citizens will invest if the program has a high likelihood of success. When success rate θ is small, few will invest upon hearing foreign media report of l. Since $\{h, l\}$-market is less valuable at low success rate θ, the government would be better off following σ_h that optimizes for the $\{h, h\}$-market and gives up on the $\{h, l\}$-market. However at high success rate θ, citizens are more willing to invest even after hearing foreign media report of l. Therefore the $\{h, l\}$-market is more valuable to the government, and it would be costly for the government to ignore it by following bias σ_h.

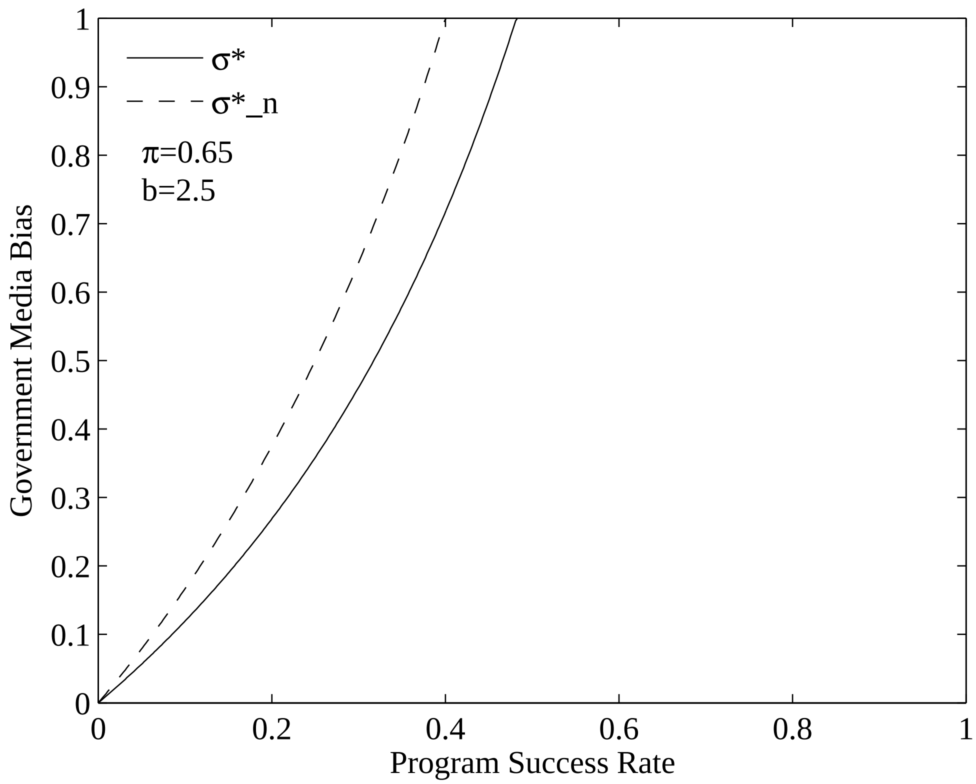

Figure 2.4: Government Media Bias from Entry of Inaccurate Foreign Media

2. *A government is more likely to follow high bias σ_h in response to entry of more accurate foreign media (higher π).* When foreign media is relatively inaccurate (low π), the $\{h, l\}$-market is relatively important to the government as citizens puts little stock in

foreign media's report. Therefore it is costly to ignore the $\{h, l\}$-market by following high bias σ_h. As foreign accuracy improves, citizens put greater stock in foreign media report. Thus citizens are more willing to invest upon hearing foreign report of h, but less willing to invest upon hearing foreign report of l. This implies a larger $\{h, h\}$-market, as well as a smaller $\{h, l\}$-market. Therefore when foreign media is sufficiently accurate, the cost from ignoring the $\{h, l\}$-market is smaller while the benefit from catering to the $\{h, h\}$-market is higher. Therefore bias σ_h is more relatively more appealing when foreign media is more accurate.

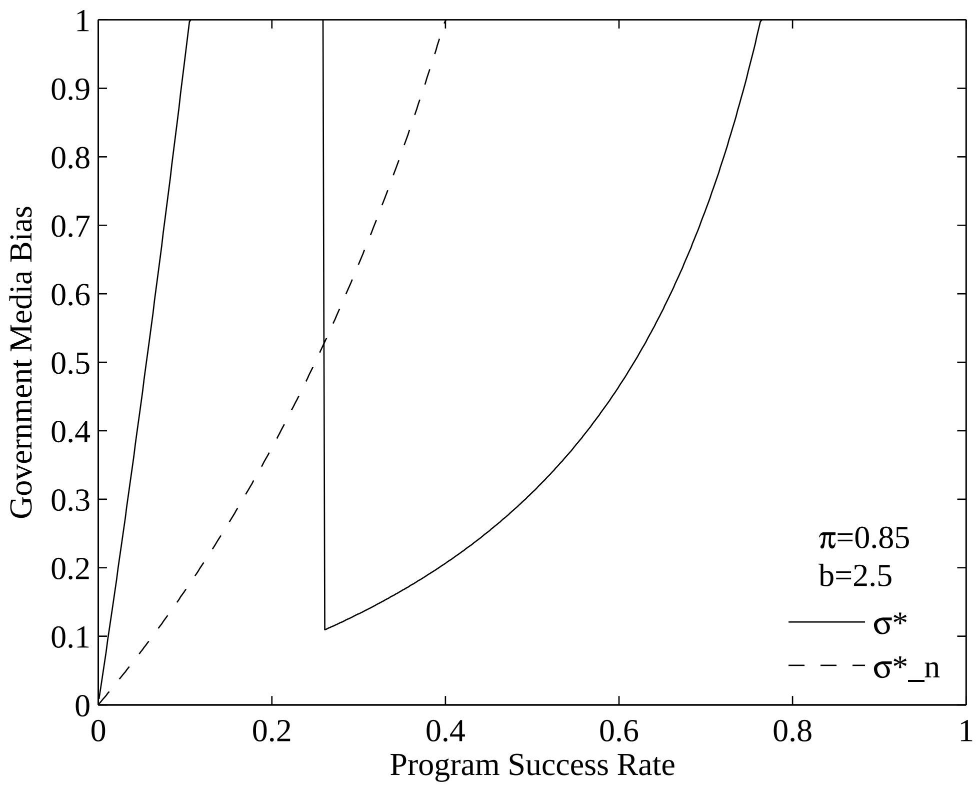

Figure 2.5: Government Media Bias from Entry of Accurate Foreign Media

Proposition 3 suggests that even with very low quality of governance, foreign media entry disciplines government media bias if accuracy π is sufficiently low. Figure 2.4 and figure 2.5 illustrate local media bias σ^* (solid line), and bias without foreign media (σ_n^*) (dashed line), as a function of program success rate θ. In particular, figure 2.4 sets average benefit at $b = 2.5$ but with relatively low accuracy of $\pi = 0.65$. Here bias σ^* follows σ_l as foreign media's accuracy π is below the threshold π'. Note too that bias σ^* is smaller than bias without foreign media σ_n^* for success rate θ in the region of $(0, 0.482)$. Figure 2.5 on the other hand, sets similar average benefit at $b = 2.5$, but at higher foreign accuracy of $\pi = 0.85$. For success rate θ in the region of $(0, 0.261)$), bias σ^* follows σ_h, and is higher than bias without foreign media σ_n^*. However once success rate θ is in the region of $(0.261, 0.763)$, bias σ^* follows σ_l, and is smaller than bias without foreign media σ_n^*. Also note that foreign media could potentially reduce bias σ_l for $\theta > 0.763$, if its accuracy level π exceeds 0.85.

2.4 Citizen's Welfare

In the previous section, when foreign media entry disciplines local media bias, citizens not only benefit from information source provided by foreign media, but enjoy higher quality content from government controlled media. In addition foreign media entry can cause government media to respond with a more biased report, thus reducing the quality of domestic information available to citizens. Does the presence of foreign media as a new source of information make up for more biased government media content? To provide a useful measure of the choice made by individual citizens, recall from section 2.1 that those who invest must incur a fixed cost of 1, in return for benefit X_i in state H. Therefore citizen's welfare can be quantified as the total surplus from citizen investment in state H after subtracting losses from citizen investment in state L [6].

[6] As the term suggests, government payoffs is ignored from the measure of citizen's welfare.

2.4.1 Citizen's Welfare in Absence of Foreign Media

The *first best* outcome requires government media's commitment to report the observed state truthfully. If this is possible, then whenever government media announces h, those with benefit X_i that exceeds the cost of 1 will invest in the program. Denote first best citizen's welfare as W_{FB}. Mathematically:

$$W_{FB} = \theta \int_{1}^{2b} (X-1)\,\frac{dX}{2b} = \theta b \left(1 - \frac{1}{2b}\right)^2 \tag{2.15}$$

aggregates net citizen benefit, $(X-1)$, for those who invest at state H (which occurs with probability θ).

Conversely when government media is tasked to maximize citizen's investment, denote W_n as citizen's welfare in absence of foreign media. W_n equals:

$$W_n = \theta \int_{X_h}^{2b} (X-1)\,\frac{dX}{2b} - (1-\theta)\sigma_n^* \int_{X_h}^{2b} \frac{dX}{2b}$$

where X_h (from equation (2.2)) is the benefit level at which an individual is indifferent between investing in the program and doing nothing upon hearing government media report h, and σ_n^* (from equation (2.4)) is bias without foreign media. The first expression of W_n is total surplus from citizen investment in state H (which occurs with probability θ) from hearing government media's report of h. The second expression of W_n represents citizen losses from investing in state L. Recall that in state L, government media reports h with probability σ_n^*. This induces $\left(1 - \frac{X_h}{2b}\right)$ fraction of total population to invest, but receive zero benefit in return. Recall from equation (2.4) for $\theta b \geq 1$, σ_n^* reaches its upper bound of

1 . Thus the expression W_n could be further simplified to:

$$W_n = \begin{cases} W_n^i = \frac{\theta b}{4} & \text{for } \theta b \leq 1 \\ \overline{W}_n = \theta b \left(1 - \frac{1}{2b\theta}\right)^2 & \text{for } \theta b \geq 1 \end{cases} \tag{2.16}$$

Note that citizen's welfare in absence of foreign media W_n, is lower than first best citizen's welfare W_{FB}, for two reasons. First, some of the citizens that receive positive net benefit from investment in state H (namely $X_i \in [1, X_h)$), chooses not to do so because of the expectation that government media may be manipulating its news. Second, citizens lose from investing in state L whenever government media falsely reports h.

2.4.2 Citizen's Welfare from Foreign Media Entry

Focusing first on welfare of citizen when government media adopts low bias σ_l, denote W_l as the corresponding citizen's welfare. W_l takes the following expression:

$$\begin{aligned} W_l = \theta \left[\pi \int_{X_{h,h}}^{2b} (X-1) \frac{dX}{2b} + (1-\pi) \int_{X_{h,l}}^{2b} (X-1) \frac{dX}{2b} \right] \\ - (1-\theta) \left[(1-\pi)\sigma_l \int_{X_{h,h}}^{2b} \frac{dX}{2b} + \pi\sigma_l \int_{X_{h,l}}^{2b} \frac{dX}{2b} \right] \end{aligned}$$

where $X_{h,h}$ (from equation (2.7)) is the benefit level at which an individual would be indifferent between investing in the program and doing nothing upon observing report h from both media outlets; $X_{h,l}$ (from equation (2.9)) is the benefit level at which an individual is indifferent between investing in the program and doing nothing upon hearing $\{r_G = h, r_F = l\}$; and low bias σ_l (from equation (2.11)) is the probability of government media report h in state L. The first two expressions of W_l is the total surplus from citizen investment at state

H. In state H, foreign media correctly reports h with probability π, but errs in reporting l with probability $(1-\pi)$. This in turn induces citizen investment of $\left(1-\frac{X_{h,h}}{2b}\right)$ and $\left(1-\frac{X_{h,l}}{2b}\right)$ respectively. The last two expressions of W_l represent citizen losses from investing in state L. Recall that when bias follows σ_l, government media reports h in state L with probability σ_l. Foreign media in turn, correctly reports l with probability π and errs in reporting h with probability $1-\pi$. Therefore in state L, citizen investment of $\left(1-\frac{X_{h,h}}{2b}\right)$ and $\left(1-\frac{X_{h,l}}{2b}\right)$ occurs when citizens hears $\{r_G = h, r_F = h\}$ and hears $\{r_G = h, r_F = l\}$ respectively. For $\theta b \geq 1$, since bias equals $\sigma_l = 1$ for $\pi < \hat{\pi}_l$, citizen's welfare W_l can be simplified to:

$$W_l = \begin{cases} W_l^i = \theta b \left[\left(1-\frac{1}{2b}\right)^2 - \frac{(3b-1)(b-1)\pi(1-\pi)}{4b^2(1-3\pi+3\pi^2)}\right] & \text{for } \theta b \leq 1 \text{ or } \pi \geq \hat{\pi}_l \\ \overline{W}_l = \theta b \Bigg\{ \pi \left[1-\frac{1}{2b}\left(1+\frac{(1-\theta)(1-\pi)}{\theta\pi}\right)\right]^2 & \\ \qquad +(1-\pi)\left[1-\frac{1}{2b}\left(1+\frac{(1-\theta)\pi}{\theta(1-\pi)}\right)\right]^2 \Bigg\} & \text{for } \theta b \geq 1 \text{ and } \pi \leq \hat{\pi}_l \end{cases} \tag{2.17}$$

Note that for low bias σ_l, citizen's welfare W_l^i equals W_n when foreign media's accuracy is at $\pi = \frac{1}{2}$, which is equivalent to its nonexistence. Also note that as foreign media's accuracy π approaches perfect at $\pi = 1$, citizen's welfare W_l^i approaches first best welfare W_{FB}. Furthermore, citizen's welfare W_l is strictly increasing in foreign media's accuracy π for two reasons. First, citizens benefits from higher quality contents provided by foreign media. Second, higher foreign media's accuracy π tempers bias in local media's report, improving its information quality.

Conversely when optimal bias σ^* follows σ_h, citizen investment only occurs when both media outlets report h. Denote the corresponding citizen's welfare as W_h, which takes the following expression:

$$W_h = \theta\pi \int_{X_{h,h}}^{2b} (X-1)\,\frac{dX}{2b} - (1-\theta)(1-\pi)\sigma_h \int_{X_{h,h}}^{2b} \frac{dX}{2b}$$

where σ_h (from equation (2.13)) is probability that government media reports h in state L. The first expression of W_h is the total surplus from citizen investment at state H, which occurs when foreign media correctly reports h (probability π). The second expression is the expected public losses from investment in state L, which occurs when foreign media errs in reporting h with probability $1-\pi$, and bias government report of h with probability σ_h. Since bias σ_h reaches the upper bound of 1 when accuracy π exceeds $\hat{\pi}_h$, the expression of citizen's welfare W_h simplifies to:

$$W_h = \begin{cases} W_h^i = \frac{\pi\theta b}{4} & \text{for } \pi \leq \hat{\pi}_h \\ \overline{W}_h = \pi\theta b\left[1 - \frac{1}{2b}\left(1 + \frac{(1-\theta)(1-\pi)}{\theta\pi}\right)\right]^2 & \text{for } \pi \geq \hat{\pi}_h \end{cases} \tag{2.18}$$

Recall that when foreign media accuracy exceeds the critical threshold π' (section 2.3.3), bias follows σ_l for $\pi < \pi'$ and follows σ_h for $\pi > \pi'$. Therefore when bias follows σ_h, for accuracy π and lies between $(\pi', \hat{\pi}_h]$, citizen's welfare W_h^i *is less than* W_n(as can be seen by comparing equation (2.18) and equation (2.16)). In this region, the loss in citizen's welfare from more biased government media content exceeds the benefit from additional information source from foreign media. Therefore in a special case where foreign media's accuracy is in the neighborhood of $\hat{\pi}_h$ in area C, *citizens makes more informed choices without the presence foreign media*. Nevertheless even if bias follows σ_h, citizen's welfare W_h is strictly increasing in π, and approaches first best level W_{FB} when foreign media's accuracy approaches perfect.

2.4.3 The Effect of Foreign Media on Citizen's Welfare

Combining the results from proposition 3 and the welfare computation from sections 2.4.1 and 2.4.2, the proposition that outlines citizen's welfare from foreign media entry is as follows:

Proposition 4. *In a case of single media and single foreign media:*

For $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$*, citizen's welfare strictly increases in* π*.*

For $\theta < \frac{2(b-1)}{b^2+2(b-1)}$*, there exist a critical level of* π' *where citizen's welfare is strictly increases in* $\left(\frac{1}{2}, \pi'\right)$*, falls to lower level at* π'*, and monotonically increases in* π *for* $\pi \in \left(\pi', 1\right)$*.*

For θ *low enough, i.e, below some strictly positive function* $f(b)$*, welfare is lower with a foreign media of accuracy* π *in a right neighborhood of* π' *than without a foreign media.*

To demonstrate the first part of proposition 4 consider first citizen's welfare where foreign media entry reduces bias in local media's report. Let W be citizen's welfare with foreign media entry. Figure 2.6 below compute citizen's welfare relative to first best, $\frac{W}{W_{FB}}$ (solid line), bias in government media, σ^* (dashed lines) as a function of foreign media's accuracy π. Here citizen's welfare W relative to first best citizen's welfare W_FB is used so that the range lies between $[0, 1]$. Note too that W_{FB} does not depend on foreign media's accuracy π. Therefore any change in W/W_FB from changes in foreign media's accuracy π is attributed to effects of π on W. In figure (2.6) program success rate is set at $\theta = 0.28$ and average benefit at $b = 5$, which satisfy the $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$ inequality and is located in area AA. For $\pi \leq 0.674$, welfare improvement is driven only by improvement in foreign media content as government media's bias σ^* remains unchanged at $\sigma_l = 1$. When foreign media's accuracy π exceeds 0.674, the pace of welfare improvement in this region is faster due to improvements in government media content as bias σ_l is strictly decreasing in π.

The second part of proposition 4 states that for sufficiently low program success rate θ, citizen's welfare is not monotonically increasing in foreign media's accuracy π, when bias σ^*

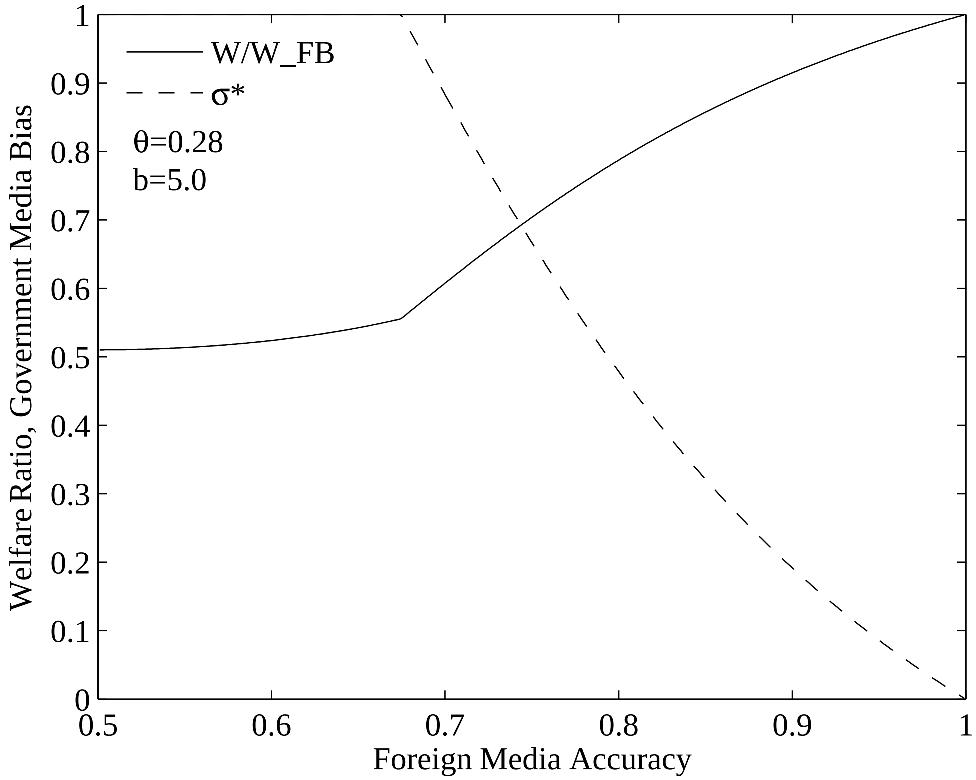

Figure 2.6: Citizen's Welfare and Government Media Bias Under Good Quality Government

discontinuously increase to extreme level once accuracy π exceeds some threshold π^*. Figure 2.7 compute citizen's welfare relative to first best $\frac{W}{W_{FB}}$ (solid line) and bias σ^* (dotted line) as a function of foreign media's accuracy π. Here average benefit is set at $b = 5$ but program success rate is set at a very low value of $\theta = 0.07$. Located in the interior of area C, even though citizen's welfare is piecewise increasing in foreign media's accuracy π, for π between the range of $(0.709, 0.796)$, citizen's welfare lower than the case without foreign media (W for $\pi = \frac{1}{2}$). Note further that in this region, welfare is increasing in π at a slower rate, because the increase bias σ^* (that follows σ_h) reduces the quality of local media content and dampens improvement in citizen's welfare. Nevertheless citizen's welfare approaches first best case W_{FB} when foreign media's accuracy π approaches perfect.

Using proposition 4 and the results from figure 2.1 of section 2.3.3, the effect of foreign

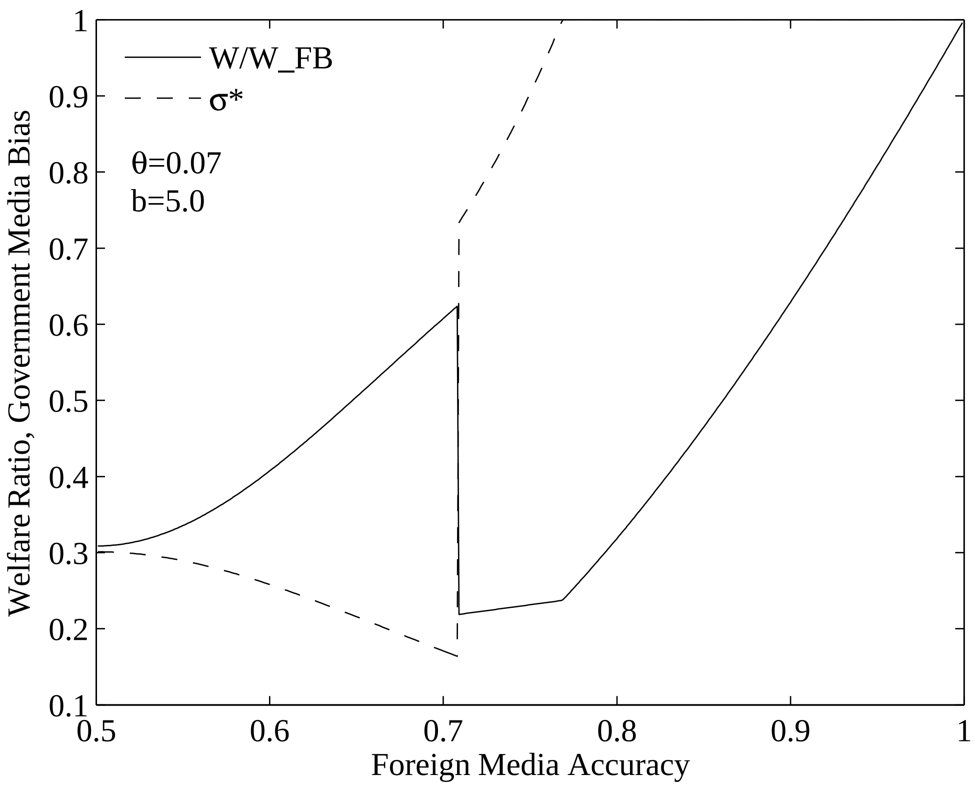

Figure 2.7: Citizen's Welfare and Government Media Bias Under Poor Quality Government

media on citizen's welfare depends on the quality of governments. For high quality of governance (areas A and AA), welfare improvements from higher foreign accuracy comes from two distinct sources. First, citizens benefit from the additional information source provided by foreign media. Second, the quality of local media report is higher from lower bias. For countries with moderate level of governance (area BB and the upper portion of area B), foreign media entry improves citizen's welfare despite provoking bias to extreme level of $\sigma^* = 1$ because citizens replace preexisting government media source with information provided by foreign media. However for countries low level of governance (area C, as well as area B in the neighborhood of area C), the effect of foreign media entry on citizen's welfare is ambiguous and depends on quality of foreign media content. In particular, when foreign media is moderately accurate [7], welfare is smaller from foreign media entry because the loss in quality of local media content outweighs the gain from having an unbiased but semi-accurate foreign media report. Regardless of the quality of governance, citizens always make better informed decisions from a highly accurate foreign media.

2.5 Endogenous Foreign Media Accuracy and Government Suppression

So far the results hinge on foreign media entry with a predetermined level of accuracy. This raises further questions on how foreign media obtains a particular level of accuracy π. This depends on two factors. First, foreign media relies on advertising revenue derived from maintaining an audience that values accuracy in the foreign media report. Second, the quality in foreign media's content depends on government's ability to suppress information of the program from reaching foreign media. Here, a simple model is considered that allows foreign accuracy π to be a choice variable that maximizes advertising revenue, subject to government suppression. In turn, the government faces costs from suppressing foreign media. This cost is modeled using a quadratic functional form of $\kappa\delta^2$, where δ is the level of suppression imposed to foreign media, and κ is a fixed parameter.

Foreign media's decision process as follows. First it is assumed that foreign media's revenue depends only on viewership, and the viewership is monotonically increasing in its accuracy π. The following revenue function $R(\pi) = A\left(\pi - \frac{1}{2}\right)^{\alpha}$ is used, where parameters $A > 0$ and $\alpha < 1$ are predetermined constant. On the other hand, higher accuracy π comes

[7] This only occurs when program success rate θ is low, and when foreign media's accuracy π, is is not too far from π', where π' is minimum value of foreign media's accuracy that causes bias to increase to extreme level.

at a cost, as greater resources are spent to ensure more accurate reporting and complying with government imposed restriction. Foreign media's cost function takes the form of $C(\pi) = \delta\left(\pi - \frac{1}{2}\right)^2$, with suppression level δ determined by the government. Let $\pi^* \in \left(\frac{1}{2}, 1\right)$ be the optimal accuracy that maximizes net revenue $A\left(\pi - \frac{1}{2}\right)^\alpha - \delta\left(\pi - \frac{1}{2}\right)^2$. One could show that

$$\pi^* = \min\left\{\frac{1}{2} + \left(\frac{\alpha A}{2\delta}\right)^{\frac{1}{2-\alpha}}, 1\right\} \tag{2.19}$$

and is strictly decreasing in government suppression δ

How would the result change if foreign media's audience consists primarily of local citizens, then changes in bias in government media affect advertising revenue as local demand for foreign news is increasing in bias σ. Notationally, assume that revenue is directly proportional to $\frac{X_{h,l}-X_{h,h}}{2b}$, which is the fraction of citizens whose investment decision depends on foreign media's report. Specifically for $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$ and assuming zero cost faced by foreign media ($C(\pi) = 0$), optimal foreign media accuracy solves $\pi^* = \operatorname{argmax} \frac{1-\theta}{2b\theta}\left(\frac{\pi}{1-\pi} - \frac{1-\pi}{\pi}\right)\sigma_l$. One could show that $\pi^* = \max\{\hat{\pi}_l, \frac{3+\sqrt{3}}{6}\}$, which is strictly less than one despite facing no cost to higher accuracy π. The reason is that when foreign media accuracy π increases, it improves quality of government media by reducing its bias σ. This reduces citizen reliance on foreign media report, which reduces its revenue. One could observe that when foreign media accuracy approaches perfect ($\pi = 1$), its advertising revenue approaches zero since government media's report is free from bias and individuals no longer rely on foreign media report. Throughout this section, I shall maintain the assumption that foreign media's viewership is strictly increasing in its accuracy π.

The initial framework of section 2.1 is modified to incorporate the following interaction between government and foreign media. First, government chooses suppression level δ^* that maximizes *government profit* $V - \kappa\delta^2$ where V is maximal citizen investment and $\kappa\delta^2$ the cost from choosing suppression level δ. I assume that government choice of suppression level δ^*, is observable to both citizens and foreign media. Once suppression level δ^* is observed, foreign media chooses π^* and enters into the news industry. I assume that π^* is common knowledge[8]. Here the optimal accuracy π^*, implies that foreign media correctly identifies a true state S with probability π^*. The game proceeds in the usual manner where both media outlets simultaneously make reports according to their respective editorial policies, and investment returns are realized at the end of the period.

The following procedure is used to derive government choice of suppression δ^*. First optimal bias σ^* is expressed in terms of suppression level δ; which is denoted as $\sigma^*(\delta)$. Next both expressions $\sigma^*(\delta)$ and $\pi^*(\delta)$ (from equation (2.19)) are used to rewrite maximal citizen investment V as a function of government suppression δ. Finally the optimal level of government suppression is solved that satisfies $\delta^* = \operatorname{argmax} V(\sigma^*(\delta), \pi^*(\delta)) - \kappa\delta^2$ [9].

Since program success rate θ and average benefit b is used as indicators for quality of governance, little is lost by focusing on the interaction between government choice of suppression δ^* as a function of success rate θ. Computation is used to derive equilibrium choice of government and foreign media. Figure 2.8 computes three curves: optimal foreign accuracy π^* (solid line), government choice of suppression δ^* (dashed line), and local media bias σ^* (dash-dotted line) as a function of program success rate (θ). The remaining parameters are fixed at $b = 5$, $A = 2$, $\kappa = 0.01$ and $\alpha = 0.50$. For low program success rate θ between $(0, 0.193)$, government follows high bias σ_h, while suppression δ^* is weakly increasing in $\theta \in (0, 0.135)$, but is decreasing in $\theta \in (0.135, 0.193)$. For $\theta \in (0.193, 1)$, bias σ^* follows

[8]The assumption that foreign media's accuracy π^* is common knowledge can be realistic for two reasons. First citizen can deduce optimal accuracy π^* after observing government's choice of suppression δ^*. Second, once foreign media enters the industry it may be prohibitively expensive to change optimal accuracy π^* in the short run.

[9]Since the analytical procedure is quite involved, it is omitted in favor of computational result in figure 2.8 .

low bias $\sigma_l < 1$ for $\theta \in (.0193, 0.388)$ and follows low bias $\sigma_l = 1$ for $\theta \in (0.388, 1)$. More importantly a general trend is found where suppression level δ^* is increasing in θ for low values of θ, is decreasing in θ for high values of θ, and peaks at moderate values of θ.

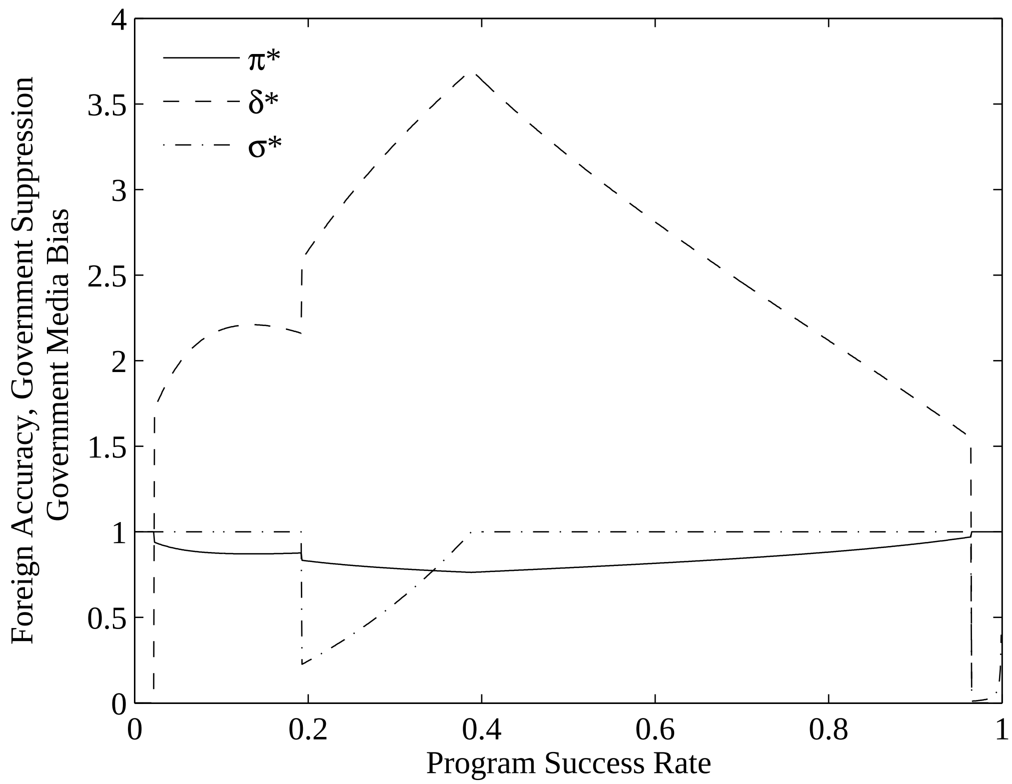

Figure 2.8: Government's Suppression, Local Bias and Accuracy Chosen by Foreign Media

The intuition behind this pattern of suppression is as follows. Recall that suppression δ is higher when foreign media's accuracy π has greater (negative) impact on citizen investment V. From figure 2.8, when program success rate θ close is to either 0 or 1, foreign media plays a minimal role in influencing citizens' investment decisions. Therefore optimal suppression δ^* in both of these region is small and close to zero. From figure 2.8, note the two distinct regions separated by peak government suppression at $\theta = 0.388$. At low values of program success rate θ, further improvements in θ increases citizen's willingness to invest, and citizens becomes increasingly reliant on foreign media report. This provides greater incentives for local government to suppress foreign media. Therefore it is predicted that at low quality governance, marginal improvement success rate θ is met with higher suppression on foreign media's content. On the other hand for countries with very high quality of governance, further improvements in success rate θ increases citizen desire to invest despite foreign media report of l. In this region, the smaller relevance of foreign media in influencing citizen's decision making process reduces government's desire to suppress foreign media. Thus it is predicted that for countries with very high quality of governance, further improvements in success rate θ actually reduces government suppression on foreign media.

2.6 Summary

This chapter focuses on the changes in government media bias when citizens gain access to new foreign information source, and its implication on citizen's welfare. Since foreign media entry reduces the effectiveness of government media's report, one might expect bias to be lower from foreign media entry. However the entry of a highly informative foreign media can provoke local media bias in countries with low quality of governance. This raises the question of whether the increase in bias would make up for the loss in information content in government media. Despite lower quality government media content from foreign media entry, citizens could still make better inform choices when they substitute bias local report with foreign media. However it is shown that an entry of a semi-accurate foreign media can cause citizens to make poorer informed decision because the quality content from foreign media does not make up for the increase in local media bias. On the role of government suppression in reducing the quality of foreign media's content, it was demonstrated that government suppression is not monotonically increasing in quality of governance. If any, it suggests that government suppression is highest in country with moderate level of governance.

Chapter 3

Do Citizen Benefits from Media Control

The chapter studies both sides of the arguments for and against media control using a model similar to Morris (2001) two period principal agent model. This chapter is divided into the following sections: Section 3.1 provides a formal description of the model. Section 3.2 solves the model and derive equilibrium government's reporting strategy (i.e government's likelihood of lying) and citizen's equilibrium decision. Since government's incentive to lie depends on the accuracy of foreign media, section 3.3 focuses on the government's reporting strategy at different level of foreign media accuracy and derives conditions in which a more informative foreign media raises the government's likelihood of lying. Section 3.4 focuses on how foreign media's presence affects the government's utility, and derives cases where additional news source can potentially harm citizen's interest. Section 3.5 focuses on citizen's welfare at different level of foreign media's accuracy, and demonstrates why citizen strictly prefers foreign media's presence despite the possibility of being misinformed. Section 3.6 summarizes the findings in this chapter.

3.1 Description of the Model

Consider first the decision faced by a representative citizen in a two period model $t \in \{1, 2\}$. In every period t he takes action a_t and by the end of period t receives utility $W_t = -(a_t - S_t)^2$ that depends on two possible state $S_t \in \{1, 0\}$, where state $S_t = 1$ occurs with probability $\theta \in (0, 1)$. Since representative citizen only learns state S_t *after* action a_t is taken, he relies on news reports r (regarding state S_t) from two media outlets: a perfectly accurate local media controlled by the government, and an imperfectly informed foreign media that truthfully reports its signal $s_t \in \{1, 0\}$, but the signal correctly reflects underlying state S_t with probability $\pi \in \left(\frac{1}{2}, 1\right)$. After hearing reports $r = \{r_l, r_f\}$ from the local media and foreign media respectively, citizen updates his posterior beliefs and decides on optimal action $a_t(r)$. From a representative citizen's perspective, let $\Pr(S_t = 1|r)$ be likelihood of state $S_t = 1$ after hearing reports $r = \{r_l, r_f\}$ where citizen's optimal action $a_t(r)$ satisfies

$$a_t(r) = \text{argmax} - \Pr(S_t = 1|r)(1 - a_t)^2 - (1 - \Pr(S_t = 1|r))\, a_t^2\,, \tag{3.1}$$

One could show that citizen maximizes utility by setting $a_t(r, \lambda_t)$ to equal $\Pr(S_t = 1|r, \lambda_t)$.

Focus now on the local media's reporting strategy, which depends on two possible types of government (I): a "good" type (G) where its utility coincides with its citizen's: $U_t = -(a_t - S_t)^2$, and a"bad" type (B) where its utility equals $V_t = a_t$ and wants citizen to take the highest action possible regardless of state S_t. Both governments type and representative citizen discounts period 2 return by $\delta \in (0, 1)$. Citizen cannot differentiate between both types of government and only knows that the likelihood of the good government equals $\lambda_t \in [0, 1]$ at the beginning of period t. As mentioned in Morris (2001), there exists more than one possible equilibria, which includes an uninformative local media equilibrium where both government types randomizes and reports $r_l = 1$ and $r_l = 0$ with equal probability. Such equilibrium outcome is ignored, and the analysis is restricted to consider only equilibria where good type government has strict incentives to truthfully report state S_t, while the bad government's may occasionally lie in state $S_t = 0$. The restriction simplifies equilibrium analysis and focuses only on the bad government's incentive lie in state $S_t = 0$. Let bias parameter $\sigma_t \in (0, 1]$ be the likelihood that bad government reports 1 in state $S_t = 0$. Given both government's equilibrium outcome citizen expects the government on average to truthfully report the state with probability $1 - (1 - \theta)(1 - \lambda_t)\sigma_t$, which is used to indicate quality of the local media.

The events are summarized in the following chronological order:

1. State S_1 is realized. Government media observes state S_1 while foreign media observes private signals s_1 that accurately predicts state S_1 with probability π.

2. Both media outlets simultaneously make reports $r = \{r_l, r_f\}$. Citizen takes action $a_1(r)$ after hearing reports r.

3. Citizen learns state S_1 and updates the likelihood of the good government λ_2. Period 1 ends with returns realized.

4. Period 2 begins with citizen's prior beliefs of λ_2. Events of 1 to 3 are repeated in the similar chronological fashion. Games ends after period 2 with returns realized.

3.2 Government's and Citizen's Equilibrium Behavior

I use backward induction to derive government's equilibrium behavior in period 2. Given the utility function of both governments: the good type has strict incentive to truthfully report state S_2, while the bad type has strict incentive to always report $r_l = 1$. To show that this is an equilibrium outcome, consider an informative equilibria where upon hearing $r = \{r_l = 1, r_f\}$, the likelihood of state $S_2 = 1$ is higher than after hearing $r = \{r_l = 0, r_f\}$. From equation (3.1), citizen's optimal action satisfies $a_2(1, r_f) = \Pr(S_2 = 1|r_l = 1, r_f) > \Pr(S_2 = 1|r_0 = 1, r_f) = a_2(0, r_f)$. Let $\sigma_2^I(S_2)$ be the likelihood that the government of type $I \in \{G, B\}$ reports 1 in state S_2. In the cases of a good government (G), it faces the following objective function:

$$\begin{aligned}\max_{\sigma_2^G(1),\sigma_2^G(0)} \quad & -\theta\Big\{\sigma_2^G(1)\left[\pi\left(1-a_2(1,1)\right)^2+(1-\pi)\left(1-a_2(1,0)\right)^2\right] \\ & \qquad +\left(1-\sigma_2^G(1)\right)\left[\pi\left(1-a_2(0,1)\right)^2+(1-\pi)\left(1-a_2(0,0)\right)^2\right]\Big\} \\ & -(1-\theta)\Big\{\sigma_2^G(0)\left[(1-\pi)a_2(1,1)^2+\pi a_2(1,0)^2\right] \\ & \qquad +\left(1-\sigma_2^G(0)\right)\left[(1-\pi)a_2(0,1)^2+\pi a_2(0,0)^2\right]\Big\},\end{aligned}$$

which is increasing in $\sigma_2^G(1) = 1$, is decreasing in $\sigma_2^G(0) = 0$. Therefore the government's period 2 utility is maximized by setting $\sigma_2^G(1) = 1$ and $\sigma_2^G(0) = 0$ which implies truthful reporting of state S_2. Conversely the bad government (B) faces the following objective function:

$$\begin{aligned}\max_{\sigma_2^B(1),\sigma_2^B(0)} \quad & \theta\Big\{\sigma_2^B(1)\left[\pi\, a_2(1,1)+(1-\pi)\, a_2(1,0)\right] \\ & \qquad +\left(1-\sigma_2^B(1)\right)\left[\pi\, a_2(0,1)+(1-\pi)\, a_2(0,0)\right]\Big\} \\ & +(1-\theta)\Big\{\sigma_2^B(0)\left[(1-\pi)\, a_2(1,1)+\pi\, a_2(1,0)\right] \\ & \qquad +\left(1-\sigma_2^B(0)\right)\left[(1-\pi)\, a_2(0,1)+\pi\, a_2(0,0)\right]\Big\},\end{aligned}$$

which is increasing in both $\sigma_2^B(1)$ and $\sigma_2^B(0)$. Therefore the bad government's period 2 utility is maximized by setting $\sigma_2^B(1) = \sigma_2^B(0) = 1$, that is to always report $r_1 = 1$ regardless of realized state S_2.

How does a representative citizen react to media report $r = \{r_l, r_f\}$? First, note that since governments never lie in state 1, citizen knows the realized state is $S_2 = 0$ after hearing $r_l = 0$ and takes action $a_2(0, r_f) = 0$. However since the bad government always report $r_l = 1$, citizen factors potential exaggeration in local media's report of $r_l = 1$, which also depends on foreign media's report r_f. In particular, upon hearing $\{r_l = 1, r_f = 1\}$, citizen know that the likelihood of state $S_2 = 1$ equals

$$\Pr(S_2 = 1 | r_l = 1, r_f = 1) = \frac{\theta\pi}{\theta\pi + (1-\theta)(1-\pi)(1-\lambda_2)},$$

and takes action $a_2(1,1) = \Pr(S_2 = 1 | r_l = 1, r_f = 1)$, which is increasing in both foreign media's accuracy π and likelihood of good government λ_2. Conversely after hearing $\{r_l = 1, r_f = 0\}$, citizen knows that the likelihood of state $S_2 = 1$ is now

$$\Pr(S_2 = 1 | r_l = 1, r_f = 0) = \frac{\theta(1-\pi)}{\theta(1-\pi) + (1-\theta)\pi(1-\lambda_2)},$$

and takes action $a_2(1,0) = \Pr(S_2 = 1 | r_l = 1, r_f = 0)$, which is smaller than $a_2(1,1)$, and is decreasing in π but increasing in λ_2.

Given citizen's optimal action $a_2(r)$, good government's period 2 utility $U_2(\pi, \lambda_2)$, which reflect citizen's utility under a truth-telling government, equals:

$$
\begin{aligned}
U_2(\pi, \lambda_2) &= -\Pr(S=1)\Big[\Pr(r_1=1, r_f=1|S=1)(1-a_2(1,1))^2 \\
&\qquad\qquad + \Pr(r_1=1, r_f=0|S=1)(1-a_2(1,0))^2\Big] \\
&= -\theta\left[\pi\left(1-\frac{\theta\pi}{\theta\pi+(1-\theta)(1-\pi)(1-\lambda_2)}\right)^2\right. \\
&\qquad \left.+(1-\pi)\left(1-\frac{\theta(1-\pi)}{\theta(1-\pi)+(1-\theta)\pi(1-\lambda_2)}\right)^2\right],
\end{aligned} \tag{3.2}
$$

which reflects citizen's disutility in state $S_2 = 1$ due to perceived bias in local media's report. In particular with citizen's utility equals $-(1-a_2(1,1))^2$ after hearing $\{r_l = 1, r_f = 1\}$ (probability π), but experiences a higher disutility of $-(1-a_2(1,0))^2$ when foreign media errs and citizen hears in $\{r_l = 1, r_f = 0\}$ instead (probability $1-\pi$). Conversely the bad government's utility $V_2(\pi, \lambda_2)$ that always reports $r_l = 1$ equals

$$
\begin{aligned}
V_2(\pi, \lambda_2) &= \Pr(r_l=1, r_f=1)\, a_2(1,1) + \Pr(r_l=1, r_f=0)\, a_2(1,0) \\
&= \left(\frac{(\theta\pi+(1-\theta)(1-\pi))\,\theta\pi}{\theta\pi+(1-\theta)(1-\pi)(1-\lambda_2)}\right)+\left(\frac{(\theta(1-\pi)+(1-\theta)\pi)\,\theta(1-\pi)}{\theta(1-\pi)+(1-\theta)\pi(1-\lambda_2)}\right).
\end{aligned} \tag{3.3}
$$

Note that both government's utility $U_2(\pi, \lambda_2)$ and $V_2(\pi, \lambda_2)$ is strictly increasing in period 2 reputation λ_2. Since the good government utility represents reflects citizen's welfare under a truth-telling government, higher reputation λ_2 implies greater government credibility. As a result citizen a more willing to take higher action $a_2(r)$ after hearing reports $r_l = 1$, and experiences smaller disutility $-(1-a_2(1, r_f))^2$ in state $S_2 = 1$. Conversely greater trust towards a government enables the bad type government to more effectively influence citizen's action to its preferred direction.

3.2.1 Equilibrium Behavior in State 0

Unlike in period 2 where local media report according to their government's preference. Local media's report r_l in period 1 influences citizen's posterior beliefs regarding the likelihood of a good type government λ_2, which in turn influences government's utility $U_2(\lambda_2)$ and $V_2(\lambda_2)$. Let $\lambda_2 \equiv \Lambda(r, S_1)$ be citizen's likelihood of a good type government after hearing reports $r = \{r_l, r_f\}$ and realized state $S_1 \in \{1, 0\}$. Since foreign media's report r_f depends only on the signal it receives, and it's independent from government's influences, report r_f does not provide additional information beyond what representative citizen learns from hearing report r_l and state S_1, Therefore citizen's posterior λ_2 can be expressed as a function of local media report r_l and realized state S_1. For now attention is restricted to equilibria where good government truthfully reports state S_1, while the bad government occasionally and reports 1 in state $S_1 = 0$ with probability σ. Thus there exists up to three possible equilibrium beliefs $\Lambda(r_l, S_1)$ since citizen will never hear $r_l = 0$ in state $S_1 = 1$ in equilibrium. First, the likelihood of a good type government after hearing $\{r_l = 1, S_1 = 1\}$ remains unchanged at $\Lambda(1, 1) = \lambda_1$ since both governments never lies in state $S_1 = 1$. Second, citizen's posterior after hearing $\{r_l = 1, S_1 = 0\}$ equals $\Lambda(1, 0) = 0$ since only the bad government lies. Finally since the good government on average reports $r_l = 0$ more often than the bad type, citizen posterior after observing $\{r_l = 0, S_1 = 0\}$ equals $\Lambda(0, 0) = \frac{\lambda_1}{\lambda_1 + (1-\lambda_1)(1-\sigma_E)}$ where σ_E is citizen's expectation regarding the likelihood that a bad government report 1 in state 0. As long as citizen expects bias to equals $\sigma_E > 0$ posterior belief satisfies $\Lambda(0, 0) > \lambda_1$, and is strictly increasing in expected bias σ_E since truthful reporting of $r_l = 0$ is a better indicator of good type government when government media is perceive to be more biased.

Using the government's equilibrium behavior, citizen's optimal action $a_1(r)$ is derived. From equation (3.1), action $a_1(r)$ reflects the likelihood of state $S_1 = 1$ after hearing reports

$r = \{r_l, r_f\}$, $\Pr(S_1 = 1|r_l, r_f)$. Since governments in equilibrium truthfully reports state 1, citizen's knows that the state is 0 after hearing $r_l = 0$ and thus takes action $a_1(0, r_f) = 0$. Conversely if local media reports $r_l = 1$, citizen's action $a_1(r)$ depends on foreign media reports r_l. In particular when citizen hears reports $r_l = 1, r_f = 1$, he takes action

$$a_1(1,1) = \Pr(S_1 = 1|r_l = 1, r_f = 1) = \frac{\theta\pi}{\theta\pi + (1-\theta)(1-\pi)(1-\lambda_1)\sigma_E},$$

which is strictly increasing in foreign media's accuracy π and λ_1. Conversely if he hears $r_l = 1, r_f = 0$, citizen takes action

$$a_1(1,0) = \Pr(S_1 = 1|r_l = 1, r_f = 0) = \frac{\theta(1-\pi)}{\theta(1-\pi) + (1-\theta)\pi(1-\lambda_1)\sigma_E},$$

which is smaller than $a_1(1,1)$ and strictly decreasing in π and strictly increasing in λ_1.

The bad government's incentive to lie in state $S_1 = 0$ is as follows. If the bad government truthfully reports state $S_1 = 0$, it receives nothing in period 1 since citizen's action equals $a_1(0, r_f) = 0$, but receives a higher period 2 utility of $\delta V_2(\Lambda(0,0))$ when citizen revises the likelihood of a good type government to $\Lambda(0,0)$. In contrast when government lies and reports $r_l = 1$, the government is expected to gain a higher period 1 return of $\pi\, a_1(1,0) + (1-\pi)a_1(1,1)$ when citizen takes action $a_1(1,0)$ in response to foreign media's accurate report of state 0 (probability π), but takes action $a_1(1,1)$ in response to foreign media's erroneous report of $r_f = 1$ (probability $1-\pi$). However citizen learns the bad government's true identity by the end of period 1, and thus expected utility in period 2 equals $\delta V_2(0)$.

What does the bad government gain from lying in state $S_1 = 0$? Let $B(\pi, \sigma_E)$ be the bad government's benefit from lying (in state $S_1 = 0$). Instead of truthfully reporting S_1, the bad type government gains $B(\pi, \sigma_E) = \pi a_1(1,0) + (1-\pi)a_1(1,1) - 0$ in additional period 1 utility from reporting $r_1 = 1$. Straightforward algebra allows the expression of benefit $B(\pi, \sigma_E)$ to take a more compact notation of $\frac{a_1(1,1)\, a_1(1,0)}{a_{1,N}(1)}$ where $a_{1,N}(1)$ equals $\frac{\theta}{\theta + (1-\theta)(1-\lambda_1)\sigma_E}$ reflects citizen's optimal action in response to only government's report of $r_l = 1$. Basic comparative statics on benefit of lying $B(\pi, \sigma_E)$ demonstrates that:

$$\begin{aligned}
\frac{\partial B(\pi, \sigma_E)}{\partial \pi} &= \left((1-\pi)\frac{\partial a_1(1,1)}{\partial \pi} - a_1(1,1)\right) + \left(\pi \frac{\partial a_1(1,0)}{\partial \pi} + a_1(1,0)\right) \\
&= -\left(\frac{1}{a_{1,N}(1)} - 1\right) \frac{(2\pi - 1)}{(\pi(1-\pi))^2} \left(\frac{a_1(1,1)\, a_1(1,0)}{a_{1,N}(1)}\right)^2 \leq 0 \qquad (3.4) \\
\frac{\partial B(\pi, \sigma_E)}{\partial \sigma_E} &= \pi \frac{\partial a_1(1,1)}{\partial \sigma_E} + (1-\pi)\frac{\partial a_1(1,0)}{\partial \sigma_E} \leq 0
\end{aligned}$$

where the benefit from lying is decreasing in foreign media's accuracy π because a more informative foreign media's limits the bad government's ability to influence citizen's decision. Benefit from lying $\partial B(\pi, \sigma_E)$ is also decreasing in bias expectation σ_E and reaches its minimum at $\sigma_E = 1$, because citizen is less willing to take action $a_1(1, r_f)$ in response to a less informative government media.

However whenever the government lies (in state $S_1 = 0$), it loses its credibility and thus its ability to influence in period 2. Let $C(\pi, \sigma_E)$ be the reputation cost from lying. By lying in period 1, the government's reveals itself as a bad type and therefore only receive $\delta V_2(\Lambda(0,1)) = \delta\theta$ in period 2. If the government instead choose truthfully report $S_1 = 0$, period 2 return would be higher at $\delta V_2(\Lambda(0,0))$. Therefore the cost from lying in state $S_1 = 0$, which represents the gain in period 2 utility from truthfully reporting $S_1 = 0$ equals $C(\pi, \sigma_E) = \delta[V_2(\Lambda(0,0)) - \theta]$. Straightforward algebra allows the expression of cost $C(\pi, \sigma_E)$ to be expressed in a more compact notation of $\delta(1-\theta)\Lambda(0,0)\frac{a_2(1,1)\, a_2(1,0)}{a_{2,N}(1)}$ where expression $a_{2,N}(1)$ equals $\frac{\theta}{\theta + (1-\theta)(1-\Lambda(0,0))}$ and reflect citizen's period 2 optimal action in response to only government media report of $r_l = 1$. Basic comparative statics on bad government's cost of lying demonstrates that

$$\begin{aligned}\frac{\partial C(\pi,\sigma_E)}{\partial \pi} &= \delta(1-\theta)\frac{\Lambda(0,0)}{a_{2,N}(1)}\frac{\partial}{\partial \pi}\left(a_2(1,1)\,a_2(1,0)\right)\\ &= -\delta\frac{(1-\theta)^2}{\theta}\frac{\Lambda(0,0)(1-\Lambda(0,0))}{a_{2,N}(1)}\frac{(2\pi-1)\left(a_2(1,1)\,a_2(1,0)\right)^2}{(\pi(1-\pi))^2} \leq 0 \qquad (3.5)\\ \frac{\partial C(\pi,\sigma_E)}{\partial \sigma_E} &= \frac{\partial V_2\left(\Lambda(0,0)\right)}{\partial \Lambda(0,0)}\frac{\partial \Lambda(0,0;\sigma_E)}{\partial \sigma_E} \geq 0\end{aligned}$$

which is decreasing in foreign media's accuracy π because a more informative foreign media limits bad government's ability to influence in period 2 and reduces its incentive to maintain its reputation. Unlike the benefit from lying, the cost from lying $C(\pi, \sigma_E)$ increasing in σ_E and attains an suprenum of $\delta(1-\theta)$ when bias σ_E approaches 0. Intuitively a truthful reporting of $r_l = 0$ is a stronger indicator of good government if citizen expects the bad government to decrease it likelihood of truthfully reporting state $S_1 = 0$.

How does a bad government respond to citizen bias expectation σ_E? Let $\sigma_R(\sigma_E)$ as government's likelihood of reporting 1 in state 0 based on citizen's bias expectation σ_E. Before determining equilibrium bias σ^*, consider first bias expectation at $\sigma_E = 0$. At $\sigma_E = 0$, observe that the benefit from lying reaches its maximum of $B(\pi, 0) = 1$, which is strictly larger than the cost of lying[1], which attains its minimum at $C(\pi, 0) = \delta(1-\theta)$. Since benefit from lying is strictly larger than its cost, the government strictly prefers reporting 1 ($\sigma_R = 1$), which contradicts citizen's expectation for a truth telling bad government ($\sigma_E = 0$).

Ruling out the possibility of equilibrium at bias $\sigma_E = 0$, equilibrium bias $\sigma^* > 0$ takes on two possible cases:

[1]Under a truth telling equilibrium $\sigma^* = 0$, citizen do no expect governments to lie in state 1. Nevertheless it is plausible to restrict citizen's off belief equilibria such that only the bad type government would deviate from equilibrium and lie in state 0, ($\Lambda(1,0) = 0$).

1. *Always lying equilibrium* ($\sigma^* = 1$): At bias level $\sigma^* = 1$, government reports 1 if only if the cost of lying at $\sigma^* = 1$ $C(\sigma_E = 1) = \delta(1-\theta)$ is smaller than its benefit, which equals

$$B(\pi, 1) = \frac{\theta\pi(1-\pi)(\theta + (1-\theta)(1-\lambda_1))}{[\theta\pi + (1-\theta)(1-\pi)(1-\lambda_1)][\theta(1-\pi) + (1-\theta)\pi(1-\lambda_1)]}$$

and can be expressed in more compact notation of: $\frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)}$. Moreover since benefit from lying $B(\pi, \sigma_E)$ is decreasing in σ_E and attains its minimum at $\sigma_E = 1$, while the cost from lying $C(\pi, \sigma_E)$ is increasing in σ_E and attains its maximum at $\sigma_E = 1$, the government therefore has strict incentives to lie for any bias level $\sigma_E < 1$.

2. *Interior lying equilibrium* $0 < \sigma^* < 1$: An interior equilibrium bias $\sigma^* < 1$ requires at bias $\sigma_E = 1$, the cost of lying $C(\pi 1) = \delta(1-\theta)$ must exceed the benefit of lying $B(\pi, 1) = \frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)}$, otherwise the government has a strict incentive to report $r_l = 1$ for all possible values of $\sigma_E \in (0, 1]$. It has been established that equilibrium bias $\sigma^* = 0$ is not credible since the government has strict incentive to report $r_l = 1$ at bias level $\sigma_E = 0$. Since benefit $B(\pi, \sigma_E)$ is monotonically increasing in σ_E while cost $C(\pi, \sigma_E)$ is monotonically decreasing in σ_E, there exist a bias level σ^* such that for bias $\sigma_E > \sigma^*$, the government has strict incentive to report $r_l = 1$, and for bias $\sigma_E < \sigma^*$ the government has a strict incentive to report 0. At σ^*, the government is indifferent between reporting 1 or 0 as shown by the vertical correspondence portion of σ_R in figure 3.1. Here equilibrium bias is where the 45 degree curve $\sigma_R = \sigma_E$ intersects with the government's best response function σ_R at σ^*, implying that the government reports $r_l = 1$ with probability σ^* after observing state $S_1 = 0$,

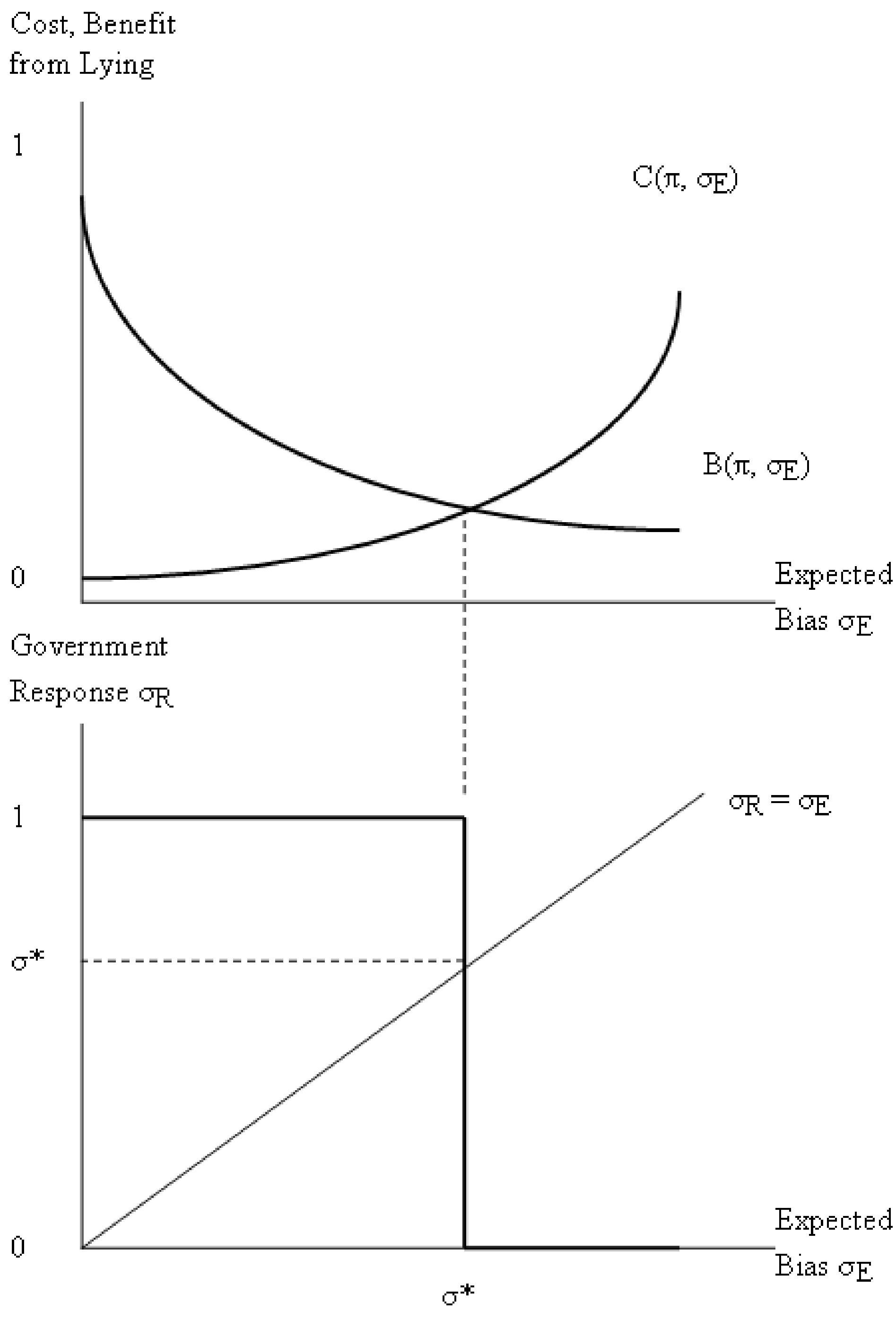

Figure 3.1: Determination of Equilibrium Bias

Therefore equilibrium bias σ^* satisfies

$$\sigma^* \begin{cases} \in (0,1) & \text{if } \delta(1-\theta) > \frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)} \\ = 1 & \text{if } \delta(1-\theta) \leq \frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)} \end{cases} \tag{3.6}$$

such that for $\delta(1-\theta) > \frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)}$, bias $\sigma^* < 1$ satisfies $B(\pi, \sigma^*) = C(\pi, \sigma^*)$ and bias equals $\sigma^* = 1$ for $\delta(1-\theta) \leq \frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)}$.

3.2.2 Equilibrium Behavior in State 1

This section analyzes government's reporting strategy in state $S_1 = 1$. Consider first the decision of the good government. Since the good government utility reflects citizen's utility, it's expected utility from truthfully reporting $S_t = 1$ in period 1 is $1 - \pi(1 - a_1(1,1))^2 - (1-\pi)(1-a_1(1,0))^2$ higher than lying and reporting $r_l = 0$. On the other hand, if citizen's off equilibrium belief satisfies $\Lambda(0,1) \geq \Lambda(1,1) = \lambda_1$, the government benefits from lying in period 1 from higher reputation. Therefore the 'cost' from truthfully reporting 1 equals $\delta[U_2(\Lambda(0,1)) - U_2(\Lambda(1,1))]$ where attention is restricted to off equilibrium beliefs $\Lambda(0,1) \geq \lambda_1$. Therefore the good government would only lie in state $S_1 = 1$ if discount rate δ exceeds threshold $\delta_G = \frac{1-\pi(1-a_1(1,1))^2-(1-\pi)(1-a_1(1,0))^2}{U_2(\Lambda(0,1))-U_2(\Lambda(1,1))}$. Similarly the bad government strictly prefer reporting 1 because its utility from truthfully reporting $S_1 = 1$ is $\pi\, a_1(1,1) + (1-\pi)\, a_1(1,0) - 0$ higher than reporting $r_l = 0$. However if citizen's off equilibrium beliefs satisfies $\Lambda(0,1) > \Lambda(1,1) = \lambda_1$, the cost from truthfully reporting 1 equals $\delta[V_2(\Lambda(0,1)) - V_2(\Lambda(1,1))]$. Therefore the good government would only lie in state $S_1 = 1$ if discount rate δ exceeds threshold bias $\delta_B = \frac{\pi\, a_1(1,1)+(1-\pi)\, a_1(1,0)}{V_2(\Lambda(0,1))-V_2(\Lambda(1,1))}$.

Using computation, threshold discount rate δ_G is demonstrated to be consistently larger

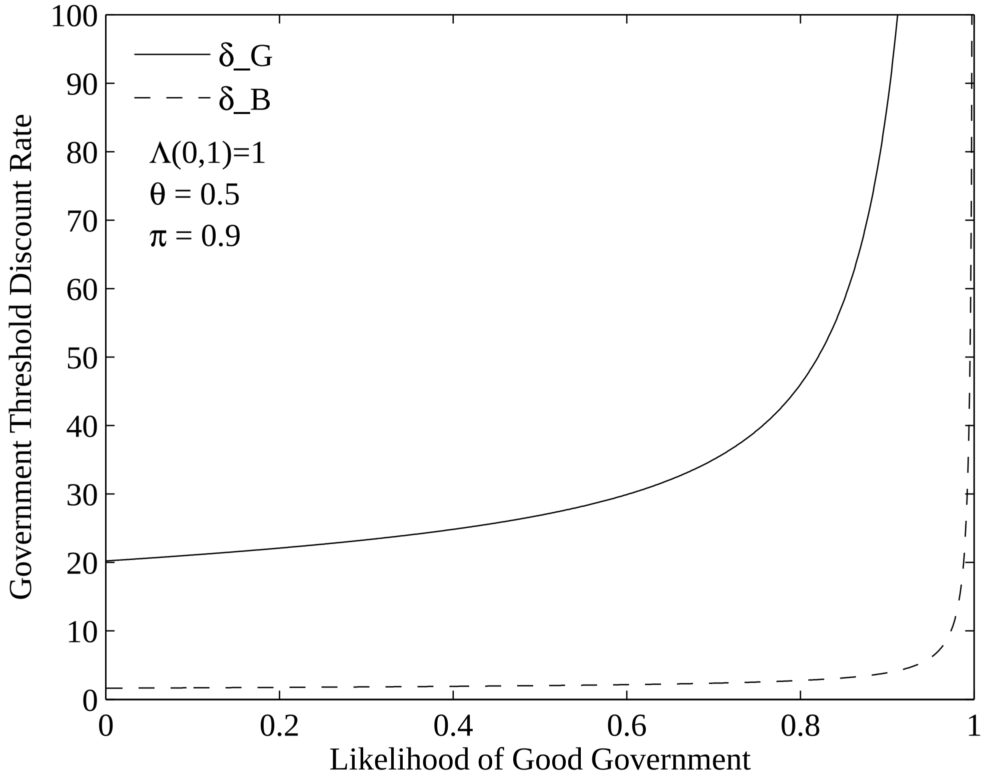

Figure 3.2: Government Threshold Discount Rate

than δ_B for off equilibrium beliefs $\Lambda(0,1) > \Lambda(1,1)$. This implies that there exists discount rate $\delta \in (\delta_B, \delta_G)$ in which the bad type government strictly prefers to lie in state 1 while the good type government has strict incentive to report $S_l = 1$. Figure 3.2 considers only $\Lambda(0,1) = 1$ and plots threshold bias δ_G and δ_B as a function of λ_1 for parameters $\theta = 0.5$ and $\pi = 0.9$. Observe that the threshold discount rate δ_G is strictly larger than δ_B, implying that there exist a range of discount rate $\delta \in (\delta_B, \delta_G)$ where the bad government has strict incentive to report 1 while the good government has strict incentive to truthfully report 1. Since attention is focused only on equilibrium where good government truthfully report state S_t and a bad government only lies in state 0, it is sufficient to restrict off equilibrium to $\Lambda(0,1) \leq \lambda_1$ to ensure that both governments have strict incentives to report 1.

3.3 Foreign Media Entry on Government Media Bias

It was demonstrated from section 3.2.1 that the accuracy of independent (foreign) news sources influences government's benefit and cost from lying. This section is devoted to how improvements in foreign media's accuracy affects equilibrium bias σ^* which influences citizen's perception regarding the quality of government media. However without an explicit expression for equilibrium bias σ^*, I focus instead on equilibrium bias in cases where foreign media is *absent* or uninformative $\left(\pi = \frac{1}{2}\right)$, and the government is the sole provider of information (regarding state S_t). Let σ_N^* be the equilibrium likelihood that a bad type governments lies in state $S_1 = 0$ without foreign media's presence. Reworking analysis from section (3.2.1), bias σ_N^* equals

$$\sigma_N^* = \begin{cases} \frac{1-(1-\theta)\lambda_1(1+\delta\theta)}{(1-\lambda_1)(1+\delta\lambda_1(1-\theta)^2)} < 1 & \text{if } \delta(1-\theta) > \frac{\theta}{\theta+(1-\theta)(1-\lambda_1)} \\ 1 & \text{if } \delta(1-\theta) \leq \frac{\theta}{\theta+(1-\theta)(1-\lambda_1)} \end{cases} \tag{3.7}$$

and basic comparative statics on equilibrium bias σ_N^* demonstrates that

$$\frac{\partial\sigma_N^*}{\partial\delta} \leq 0 \qquad \frac{\partial\sigma_N^*}{\partial\theta} \geq 0 \qquad \frac{\partial\sigma_N^*}{\partial\lambda} \gtrless 0 \qquad \frac{\partial^2\sigma_N^*}{\partial\lambda^2} \geq 0$$

where bias σ_N^* is decreasing in discount rate δ because a government that places greater importance in second period incentive has smaller incentive to lie. Bias σ_N^* is increasing in likelihood of state 1, θ because when the government's preference is closer to its citizen's, the benefit from lying is higher because citizen takes higher action $a_{1,N}(r_l)$ after hearing $r_l = 1$. Lastly bias σ_N^* is highest when government reputation λ_1 approaches 0 or 1, and is lowest for moderates value of λ_1. Observe that the cost from lying depends on the reputation gain from truthfully reporting 0: $\left(\frac{\lambda_1}{\lambda_1+(1-\lambda_1)(1-\sigma_E)} - \lambda_1\right)$, which is highest for moderate values of λ_1 (when citizen is uncertain of government true intention), and approaches 0 when λ_1 approaches 0 (certain that the government is bad) or 1 (certain that the government is good).

Under what condition do a more informative foreign media increase the government's incentive to lie? Consider first bias $\sigma^* = 1$ where $\delta(1-\theta) < \frac{a_1(1,1;\sigma_E=1)\, a_1(1,0;\sigma_E=1)}{a_{1,N}(1;\sigma_E=1)}$, and typically reflects a combination of low discount rate δ, a relatively inaccurate foreign media (small π) and a trustworthy government (large θ or λ_1). Evaluated at bias $\sigma^* = 1$ marginal improvements in foreign media accuracy lower government's incentive to lie $\frac{\partial B(\pi,1)}{\partial \pi} < 0$, but does not affect the cost from lying: $\frac{\partial C(\pi,1)}{\partial \pi} = 0$. However as long as the conditions holds with strict inequality, the decrease in the benefit from lying $B(\pi, \sigma_E)$ is insufficient to deter the government from always reporting $r_l = 1$, ($\sigma^* = 1$).

For interior equilibrium bias $\sigma^* < 1$ where benefit from lying equals to its cost $B(\pi, \sigma^*) = C(\pi, \sigma^*)$, recall that improvements in foreign media's accuracy π reduces both the benefits from lying $\frac{\partial B(\pi,\sigma^*)}{\partial \pi} \leq 0$, as well as its cost $\frac{\partial C(\pi,\sigma^*)}{\partial \pi} \leq 0$. However since $B(\pi, \sigma^*) = C(\pi, \sigma^*)$, it can be shown that the total differential satisfies $\frac{\partial B(\pi,\sigma^*)}{\partial \pi} d\pi + \frac{\partial B(\pi,\sigma^*)}{\partial \sigma_E} d\sigma^* = \frac{\partial C(\pi,\sigma^*)}{\partial \pi} d\pi + \frac{\partial C(\pi,\sigma^*)}{\partial \sigma_E} d\sigma^*$, which implies that

$$\frac{d\sigma^*}{d\pi} = \frac{\frac{\partial B(\pi,\sigma^*)}{\partial \pi} - \frac{\partial C(\pi,\sigma^*)}{\partial \pi}}{\frac{\partial C(\pi,\sigma^*)}{\partial \sigma_E} - \frac{\partial B(\pi,\sigma^*)}{\partial \sigma_E}}$$

which is strictly positive if and only if $\frac{\partial B(\pi,\sigma^*)}{\partial \pi} - \frac{\partial C(\pi,\sigma^*)}{\partial \pi} > 0$. Therefore a more informative foreign media raises government media bias $\frac{d\sigma^*}{d\pi} > 0$ if and only if

$$\begin{aligned}
&\frac{\partial B(\pi,\sigma^*)}{\partial \pi} > \frac{\partial C(\pi,\sigma^*)}{\partial \pi} \\
&\Leftrightarrow -\frac{(1-\theta)(1-\lambda_1)\sigma^*(2\pi-1)}{\theta(\pi(1-\pi))^2}\frac{(a_1(1,1)\,a_1(1,0))^2}{a_{1,N}(1)} \\
&\qquad\qquad > -\frac{\delta(1-\theta)^2(2\pi-1)}{\theta(\pi(1-\pi))^2}\Lambda(0,0)(1-\Lambda(0,0))\frac{(a_2(1,1)\,a_2(1,0))^2}{a_{2,N}(1)} \\
&\Leftrightarrow -(1-\lambda_1)\sigma^*\,a_{1,N}(1)\left[\frac{a_1(1,1)\,a_1(1,0)}{a_{1,N}(1)}\right]^2 \\
&\qquad\qquad > -\frac{(1-\Lambda(0,0))\,a_{2,N}(1)}{\delta(1-\theta)\Lambda(0,0)}\left[\frac{\delta(1-\theta)\Lambda(0,0)\,a_2(1,1)\,a_2(1,0)}{a_{2,N}(1)}\right]^2
\end{aligned}$$

where the expressions $\left[\frac{a_1(1,1)\,a_1(1,0)}{a_{1,N}(1)}\right]^2$ and $\left[\frac{\delta(1-\theta)\Lambda(0,0)\,a_2(1,1)\,a_2(1,0)}{a_{2,N}(1)}\right]^2$ cancels outs because the benefit from lying $B(\pi,\sigma^*) = \frac{a_1(1,1)\,a_1(1,0)}{a_{1,N}(1)}$ equals costs from lying $C(\pi,\sigma^*) = \frac{\delta(1-\theta)\Lambda(0,0)\,a_2(1,1)\,a_2(1,0)}{a_{2,N}(1)}$ at bias level $\sigma^* \leq 1$. Rearranging the terms the decrease in benefit from lying exceeds its cost when the following condition holds:

$$\frac{\partial B(\pi,\sigma^*)}{\partial \pi} > \frac{\partial C(\pi,\sigma^*)}{\partial \pi} \Leftrightarrow \delta \leq \left[\frac{1-\sigma^*}{(1-\theta)\lambda_1\,\sigma^*}\right]\left[\frac{\theta+(1-\theta)(1-\lambda_1)\sigma^*}{\theta+(1-\theta)\left(1-\frac{\lambda_1}{1-(1-\lambda_1)\sigma^*}\right)}\right] \tag{3.8}$$

With only the explicit expression for bias σ_N^* (equation (3.7)), comparative statics can be derived in the neighborhood where foreign media is uninformative $\pi = \frac{1}{2}$. At bias $\sigma_N^* \leq 1$, the right hand side expression equals $\frac{(1+\delta)[\delta(1-\theta)(1-(1-\theta)\lambda_1)-\theta]}{\delta(1-\theta)(1+\delta\lambda(1-\theta)^2)[1-\lambda_1(1-\theta)(1+\delta\theta)]}$, which is decreasing in both λ_1 and θ. This implies when citizen finds their government untrustworthy (low λ_1), or when the (bad) government's preference is very different from its citizen's (low θ), improvements in foreign media's accuracy π in the neighborhood of $\pi = \frac{1}{2}$ raises government media bias. In fact given parameters δ and θ, improvement in foreign media accuracy in the neighborhood of $\pi = \frac{1}{2}$ raises government media bias if and only if the likelihood of good government λ_1 is below some threshold level $\underline{\lambda}$ that equals

$$\underline{\lambda} = \max\left\{0, \frac{\delta - \theta(1+2\delta)}{\delta(1-\theta)^2(1+\delta\theta)}\right\}, \tag{3.9}$$

which satisfies $\delta = \frac{(1+\delta)(\delta(1-\theta)(1-(1-\theta)\underline{\lambda}-\theta)}{\delta(1-\theta)(1+\delta\underline{\lambda}(1-\theta)^2)[1-\underline{\lambda}(1-\theta)(1+\delta\theta)]}$ for $\theta \in \left(0, \frac{\delta}{1+2\delta}\right)$ and equals $\underline{\lambda} = 0$ for $\theta \geq \frac{\delta}{1+2\delta}$. The threshold reputation $\underline{\lambda}$ can also be used in deriving conditions when foreign media entry raises government media bias $\sigma^* - \sigma_N^* > 0$. Since foreign media entry represents a discrete change in accuracy from $\pi = \frac{1}{2}$ to $\pi \in \left(\frac{1}{2}, 1\right)$ bias is higher only if the discrete change in benefit from lying $B(\pi, \sigma_N^*) - B\left(\frac{1}{2}, \sigma_N^*\right)$ exceeds discrete changes in cost from lying $C(\pi, \sigma_N^*) - C\left(\frac{1}{2}, \sigma_N^*\right)$. Since the benefit from lying $B\left(\frac{1}{2}, \sigma_N^*\right) = a_{1,N}(1)$ equals to its cost $C\left(\frac{1}{2}, \sigma_N^*\right) = \delta\, a_{2,N}(1)$ at $\sigma_N^* \leq 1$, the expression $B(\pi, \sigma_N^*) - B\left(\frac{1}{2}, \sigma_N^*\right) > C(\pi, \sigma_N^*) - C\left(\frac{1}{2}, \sigma_N^*\right)$ simplifies to $B(\pi, \sigma_N^*) > C(\pi, \sigma_N^*)$. Substituting bias σ_N^* into expression $B(\pi, \sigma_N^*)$ and $C(\pi, \sigma_N^*) \geq 0$ and rearranging terms:

$$B(\pi, \sigma_N^*) - C(\pi, \sigma_N^*) > 0 \Leftrightarrow \Phi\left[\delta - \theta(1+2\delta) - \delta(1-\theta)^2(1+\delta\theta)\lambda_1)\right] > 0$$

where expression $\Phi = \frac{(1-\lambda(\delta(1-\theta))^2)(2\pi-1)^2(a_2(1,1)\, a_2(1,0))}{(1+\delta)^2\pi(1-\pi)} B(\pi, \sigma_N^*)$ is positive, and thus $B(\pi, \sigma_N^*) - C(\pi, \sigma_N^*) > 0$ is equivalent to $\delta - \theta(1+2\delta) - \delta(1-\theta)^2(1+\delta\theta)\lambda_1) > 0$, which holds only if $\lambda_1 < \frac{\delta-\theta(1+2\delta)}{\delta(1-\theta)^2(1+\delta\theta)} = \underline{\lambda}$.

For completeness, equation (3.6) is used to define threshold reputation $\bar{\lambda}$ such that for $\lambda_1 \geq \bar{\lambda}$, government media bias equals $\sigma^* = 1$ under the presence of foreign media of accuracy π. Threshold reputation $\bar{\lambda}$ equals

$$\bar{\lambda} = \max\Bigg\{0, \frac{\theta}{2(1-\theta)}\Bigg[\frac{2}{\theta} + \frac{(2\pi-1)^2}{\pi(1-\pi)} - \frac{1}{\delta(1-\theta)}\left(1 + \sqrt{1 + \frac{\delta(1-\theta)(2\pi-1)^2[\delta(1-\theta) - 2\pi(1-\pi)]}{\pi^2(1-\pi)}}\right)\Bigg]\Bigg\} \tag{3.10}$$

where threshold equals $\bar{\lambda} = 0$ if the likelihood of state 1, θ exceeds threshold level $\breve{\theta}$ that satisfies $\delta(1-\breve{\theta}) = \frac{\breve{\theta}\pi(1-\pi)}{(\breve{\theta}\pi+(1-\breve{\theta})(1-\pi))(\breve{\theta}(1-\pi)+(1-\breve{\theta})\pi)}$. The purpose of introducing threshold parameter $\bar{\lambda}$ is when citizen's becomes sufficiently confident of the incumbent government $\lambda_1 > \bar{\lambda}$, equilibrium bias remains at $\sigma^* = \sigma_N^* = 1$ despite foreign media's presence with accuracy $\pi' \in \left(\frac{1}{2}, \pi\right]$. Here threshold $\bar{\lambda}$ is strictly increasing in λ_1 that approaches $\bar{\lambda} \to 1$ as foreign media's accuracy approaches $\pi \to 1$ because a more informative foreign media exerts greater influence on government's decision to lie and only the most trustworthy government $\lambda_1 \in (\bar{\lambda}, 1]$ would be unaffected by its presence.

The findings are summarized into the following proposition.

Proposition 5. *Using equilibrium bias in absence of foreign media σ_N^* as a benchmark, as well as threshold reputation $\bar{\lambda} > \underline{\lambda}$ from equation (3.10) and (3.9), if period 1 likelihood of good government λ_1 satisfies*

1. $1 > \lambda_1 \geq \bar{\lambda}$*: entry of foreign media of accuracy π leaves bias unchanged at $\sigma^* = \sigma_N^* = 1$.*

2. $\bar{\lambda} > \lambda_1 \geq \underline{\lambda}$*: entry of foreign media of accuracy $\pi < 1$ lowers equilibrium bias ($\sigma^* - \sigma_N^* < 0$).*

3. $\underline{\lambda} > \lambda_1 > 0$*: entry of foreign media raises government media bias ($\sigma^* - \sigma_N^* > 0$).*

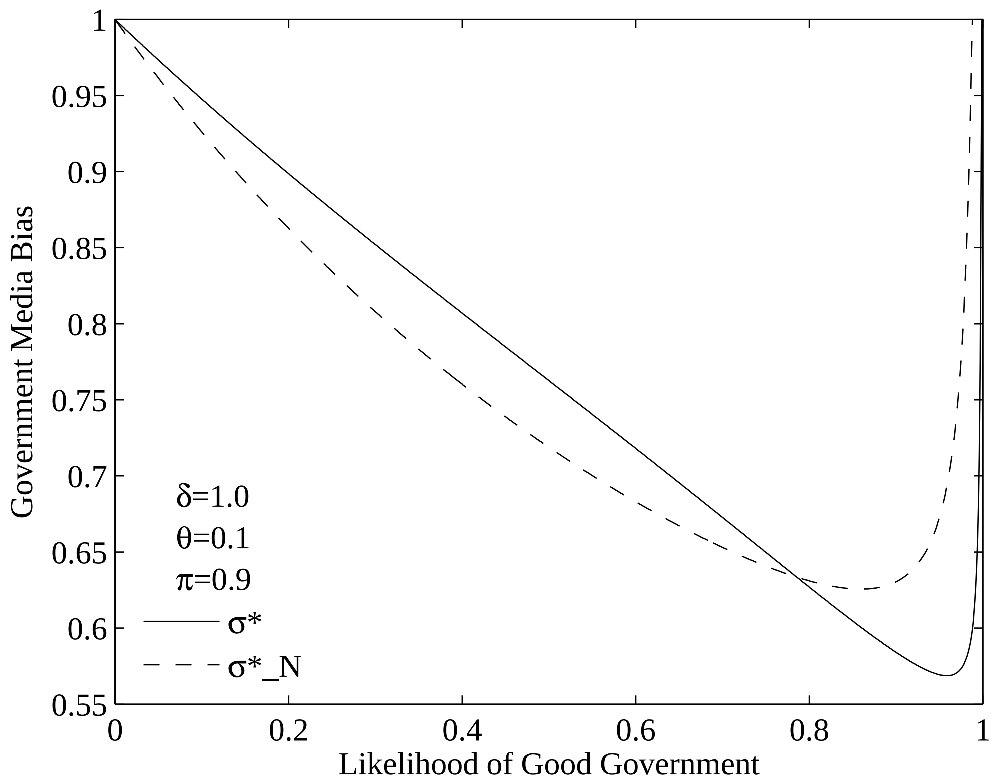

Figure 3.3: Local Media Bias

Alternatively the government's incentive to lie can be analyzed based on the the conflict of interest between the government citizen, where the conflict of interest is inversely proportional to the likelihood of state 1, θ. Let threshold parameter be $\underline{\theta} = \frac{\delta}{1+2\delta}$ and threshold parameter $\breve{\theta}$ that satisfies equality $\delta = \frac{\breve{\theta}\pi(1-\pi)}{(1-\breve{\theta})(\breve{\theta}\pi+(1-\breve{\theta})(1-\pi))(\breve{\theta}(1-\pi)+(1-\breve{\theta})\pi)}$. There threshold parameter $\breve{\theta}$ is strictly increasing in π and ranges from $\frac{1}{1+\delta}$ $\left(\pi = \frac{1}{2}\right)$ to 1, $(\pi = 1)$.

Proposition 6. *Using equilibrium bias in absence of foreign media σ_N^* and threshold parameters $\breve{\theta} > \underline{\theta}$ defined above, if the likelihood of state 1 θ satisfies*

1. $1 > \theta \geq \breve{\theta}$*: entry of foreign media with accuracy π leaves bias unchanged at $\sigma^* = \sigma_N^* = 1$.*

2. $\breve{\theta} > \theta \geq \underline{\theta}$*: entry of foreign media of accuracy π leaves biased unchanged at $\sigma_N^* = 1$*

only if the likelihood of good government satisfies $\lambda_1 \geq \bar{\lambda}$ (equation (3.10)), and lowers equilibrium bias ($\sigma^* - \sigma^*_N < 0$) otherwise.

3. *$\underline{\theta} > \theta > 0$: entry of foreign media lowers equilibrium bias $\sigma^* - \sigma^*_N \leq 0$ if the likelihood of good government exceeds $\lambda_1 \geq \underline{\lambda}$ (equation (3.9)), and raises equilibrium bias $\sigma^* - \sigma^*_N > 0$ otherwise.*

Proposition 5 and 6 (respectively) implies that when government is perceived to be untrustworthy (small λ_1), or when the conflict of interest between government's and citizen is sufficiently large (small θ), the entry of foreign media tends to raise equilibrium bias and reduces the quality of government media. Conversely if citizen's preferences is not too different from his government's (moderate θ) or if the government is perceived to be moderately trustworthy (moderate λ_1), foreign media entry tends to reduce (bad) government's incentive to lie and increases the quality of government media. Lastly if representative citizen's finds the government to be sufficiently trustworthy (λ_1 approaches 1) or when government's preference is sufficiently similar to its citizen's (θ approaches 1), the government's always lie and even foreign media's presence is insufficient to alter its incentive to always report 1.

Computation is used to show the change in equilibrium bias from foreign media entry. Figure 3.3 hold parameters fixed at $\theta = 0.1$ and $\delta = 1$ and plots two curves as a function of reputation λ_1: equilibrium bias with foreign media of accuracy $\pi = 0.9$, σ^* (solid line), and equilibrium bias in absence of foreign media (dashed line). Observe that equilibrium bias is higher $\sigma^* > \sigma^*_N$ for reputation $\lambda_1 \in (0, 0.785)$ and is lower $\sigma^* \leq \sigma^*_N$ for reputation $\lambda_1 \in (0.785, 1)$. Figure 3.4 sets parameters at $\pi = 0.9$ and $\delta = 1$ and graph the difference in bias $\sigma^* - \sigma^*_N$ as a function of λ_1 for three different values of θ: $\theta = 0.2$ (solid line) $\theta = 0.4$ (dashed line) and $\theta = 0.6$ (dashed-dotted line). Observe that when the likelihood of state 1 is small such as in the case of $\theta = 0.2$, foreign media entry raises government media bias

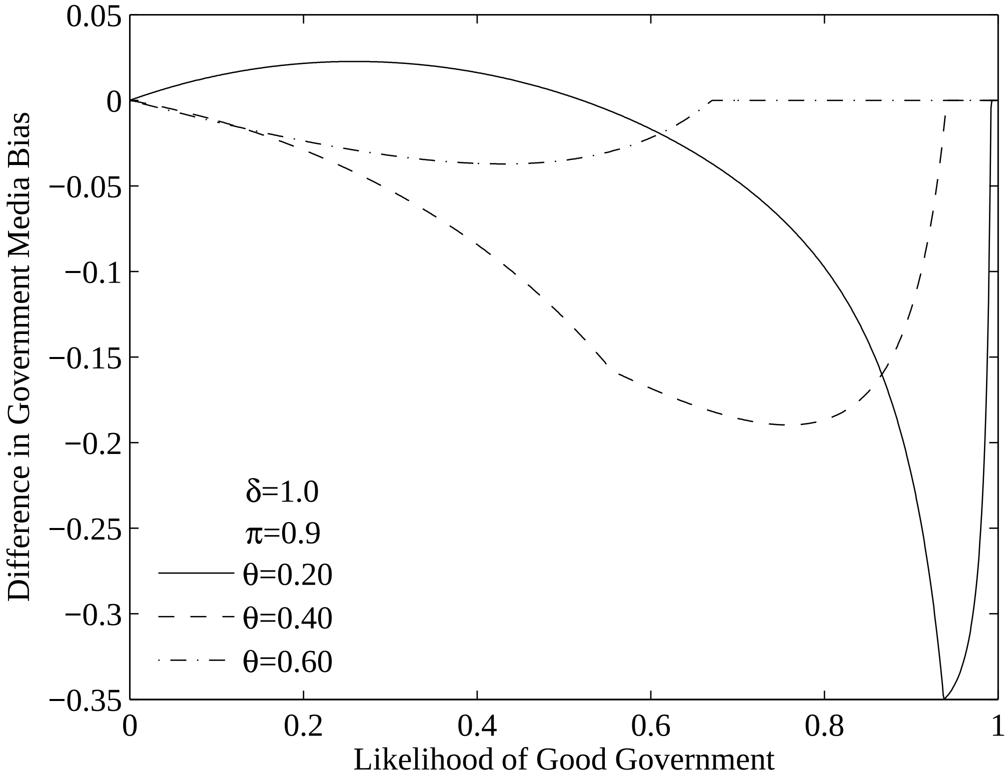

Figure 3.4: Difference in Local Media Bias at Different Levels of Conflict of Interest

$\lambda_1 \in (0, 0.521)$ and lower bias for $\lambda_1 \in (0.521, 1)$. For larger values of θ (say $\theta = 0.6$), foreign media entry foreign media entry lowers government media bias for $\lambda \in (0, 0.671)$ but remains unchanged at $\sigma^* = 1$ for $\lambda \in (0.671, 1)$. To examine the difference in equilibrium bias $\sigma^* - \sigma_N^*$ for different values of π, figure 3.5 sets parameters at $\theta = 0.2$ and $\delta = 1$ and plots bias difference $\sigma^* - \sigma_N^*$ for three different levels of foreign media's accuracy: $\pi = 0.7$ (solid line) $\pi = 0.8$ (dashed line) and $\pi = 0.9$ (dashed-dotted line). Observe that the absolute difference in bias level $|\sigma^* - \sigma_N^*|$ increases as the bad type government is confronted with a more accurate foreign media.

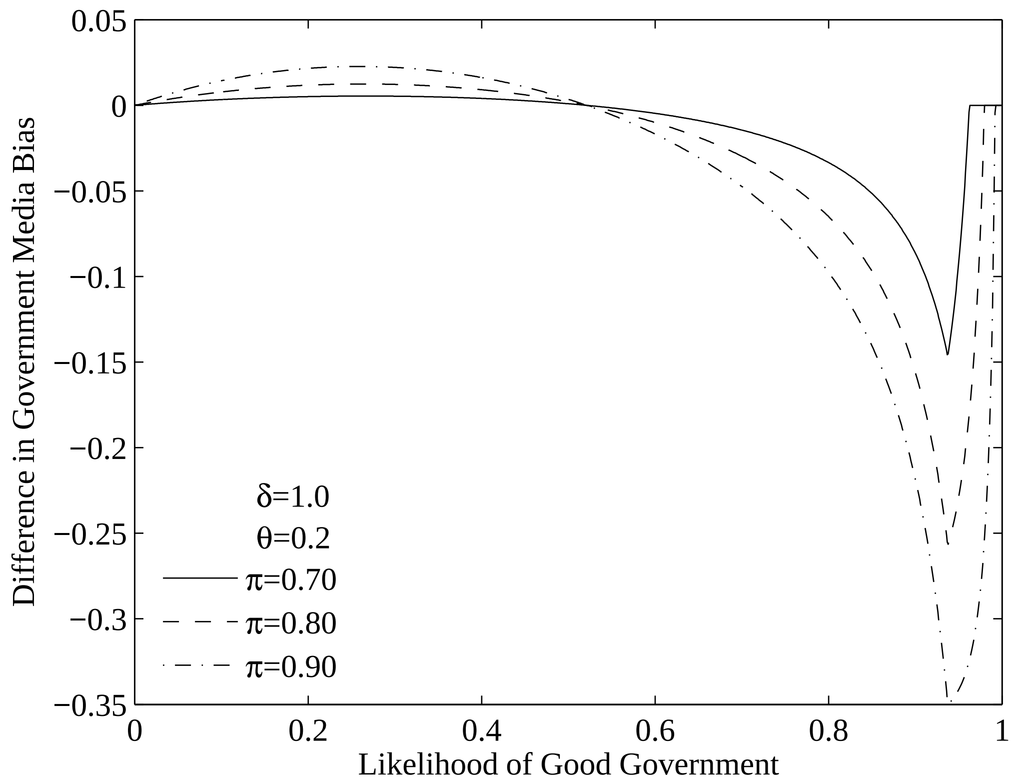

Figure 3.5: Difference in Local Media Bias at Different Levels of Foreign Media Accuracy

3.4 Government's Return

This section analyzes how the presence of foreign media affects government's utility. Here the good government's utility reflects citizen's overall utility under a truth telling local media, while the bad government's utility represents its goal of maximizing citizen's support by tasking local media to potentially misreport the state. Without explicit expressions for equilibrium bias σ^*, the analysis in this section serves an exposition purpose and relying primarily on computation to derive welfare implication of foreign media entry on government's overall utility.

3.4.1 Good Government's Utility

Despite the good government's incentive to truthfully report the state S_t, citizen's utility in state 1 is negative, which less than ideal outcome due to a combination of potential exaggeration (bias) in local media and potential inaccuracy in foreign media's report. Let $U \equiv U(\pi, \sigma^*, \lambda_t)$ be the good government's overall utility that represents citizen's utility under a truth-telling local media and a foreign media that accurately reports state S_t with probability π. Utility $U(\pi, \sigma^*, \lambda_t)$ equals:

$$\begin{aligned} U(\pi, \sigma^*, \lambda_t) &= U_1(\pi, \sigma^*) + \delta\, E[U_2(\pi; \lambda_2)] \\ &= -\theta \left\{ \pi(1 - a_1(1,1))^2 + (1-\pi)(1 - a_1(1,1))^2 \right\} \\ &\quad + \delta \left\{ \theta\, U_2(\pi, \Lambda(1,1)) + (1-\theta)\, U_2(\pi, \Lambda(0,0)) \right\} \end{aligned} \tag{3.11}$$

$$U_2(\pi, \lambda_2) = -\theta \left\{ \pi(1 - a_2(1,1;\lambda_2))^2 + (1-\pi)(1 - a_2(1,1;\lambda_2))^2 \right\}$$

where $U_1(\pi, \sigma^*)$ and $E[U_2(\pi; \lambda_2)]$ represents good government's period 1 and period 2 expected utility respectively. Here period t utility $U_1(\pi, \sigma^*)$ and $U_2(\pi, \lambda_2)$ is negative and reflects citizen's disutlity in state 1. In particular citizen's utility equals $-(1 - a_1(1,1))^2$ when foreign media accurately reports $r_f = 1$ (probability π), but experiences a higher disutility of $-(1 - a_1(1,0))^2$ when foreign media errs and report $r_f = 0$ (probability $1 - \pi$). In period 2 government's expected utility $\delta\, E[U_2(\pi; \lambda_2)]$ depends on citizen's perceived likelihood of good government λ_2, which in turn depends on period 1 local media report r_l and state S_1: $\lambda_2 \equiv \Lambda(r_l, S_1)$. In particular after observing truthful reporting of state $S_1 = 1$ (probability θ), citizen updates his beliefs to $\Lambda(1,1) = \lambda_1$, and his period 2 utility on average equals $\delta\, U_2(\pi, \Lambda(1,1))$. If citizen instead observes truthful reporting of state $S_1 = 0$, (probability

$1-\theta$), he updates the likelihood of good government to $\Lambda(0,0) = \frac{\lambda_1}{\lambda_1+(1-\lambda_1)(1-\sigma^*)} > \lambda_1$ and with greater confidence toward his government, citizen's period 2 utility is higher at $\delta\, U_2(\pi, \Lambda(0,0))$.

How does improvements in foreign media's accuracy affects citizen's overall utility under a truth-telling local media: $\frac{dU(\pi,\sigma^*,\lambda_t)}{d\pi}$? Taking the total differential with respect to π, the change in good government's overall utility equals:

$$\begin{aligned}\frac{dU(\pi,\sigma^*,\lambda_t)}{d\pi} &= \frac{\partial U_1(\pi,\sigma^*)}{\partial\pi} + \delta\left[\theta\frac{\partial U_2(\pi;\Lambda(1,1))}{\partial\pi} + (1-\theta)\frac{\partial U_2(\pi;\Lambda(0,0))}{\partial\pi}\right] \\ &+ \left[\frac{\partial U_1(\pi,\sigma^*)}{\partial\sigma^*} + \delta(1-\theta)\frac{\partial U_2(\pi;\Lambda(0,0))}{\partial\Lambda(0,0)}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*}\right]\frac{d\sigma^*}{d\pi}\end{aligned}$$

where the expression $\frac{\partial U_1(\pi,\sigma^*)}{\partial\pi} + \delta\left[\theta\frac{\partial U_2(\pi;\Lambda(1,1))}{\partial\pi} + (1-\theta)\frac{\partial U_2(\pi;\Lambda(0,0))}{\partial\pi}\right]$ represents a *direct change* in good government's overall utility from marginal improvements in π, holding bias fixed at σ^*. The remaining expression $\frac{\partial U_1(\pi,\sigma^*)}{\partial\sigma^*} + \delta(1-\theta)\frac{\partial U_2(\pi;\Lambda(0,0))}{\partial\Lambda(0,0)}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*}$ represents the *indirect change* in government's overall utility due to changes in equilibrium bias $\frac{d\sigma^*}{d\pi}$. Without explicit expression for equilibrium bias σ^*, the extent of higher bias on good government's overall utility $U(\pi,\sigma^*,\lambda_t)$ cannot be precisely determined. Nevertheless it can be shown that the expression $\frac{\partial U_1(\pi,\sigma^*)}{\partial\sigma^*}$ is negative because representative citizen on average makes poorer decision when he relies less on a truth-telling local media that he perceives to be of lower quality. On the other hand the expression $\frac{\partial U_2(\pi;\Lambda(0,0))}{\partial\Lambda(0,0)}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*}$ is positive because period 1 truthful reporting of state $S_1 = 0$ is a stronger indicator of a good type government, and greater confidence towards an honest local media allows citizen on average to make better informed decisions.

The key analysis lies in expression $\frac{\partial U_t(\pi,\sigma_t^*,\lambda_t)}{\partial\pi}$. Here, the notation σ_t^* indicates the likelihood that a bad type government report lies and report $r_l = 1$ in state $S_t = 0$. Therefore bias equals $\sigma_1^* \equiv \sigma^*$ in period 1, and equals $\sigma_2^* = 1$ in period 2. Rearranging terms $\frac{\partial U_t(\pi,\sigma_t^*;\lambda_t)}{\partial \pi}$ equals

$$\frac{\partial U_t(\pi,\sigma_t^*;\lambda_t)}{\partial \pi} = -\theta\left\{\frac{\partial}{\partial \pi}\left(\pi(1-a_t(1,1))^2\right) + \frac{\partial}{\partial \pi}\left((1-\pi)(1-a_t(1,0))^2\right)\right\}$$
$$= \frac{\theta(2\pi-1)}{(\pi(1-\pi))^2}\left(1-\frac{1}{a_{t,N}(1)}\right)^3 (a_t(1,1)\,a_t(1,0))^2\,\Gamma_t(\pi) \gtrless 0\,;$$

$$\Gamma_t(\pi) = \frac{(2\pi-1)^2}{\pi(1-\pi)} + \left(\frac{(1-\theta)(1-\lambda_t)\sigma_t^*}{\theta}\right)\left(3+\frac{2(1-\theta)(1-\lambda_t)\sigma^*}{\theta}\right) - \frac{\theta}{(1-\theta)(1-\lambda_t)\sigma_t^*} \tag{3.12}$$

and is positive only if $\Gamma_t(\pi) \geq 0$. A positive expression of $\frac{\partial U_t(\pi,\sigma_t^*,\lambda_t)}{\partial \pi}$ implies that holding equilibrium bias fixed at σ^*, a more informative foreign media enables citizens on average to make better informed decision *under a truth-telling government*. Likewise, a negative expression of $\frac{\partial U_t(\pi,\sigma_t^*,\lambda_t)}{\partial \pi}$ implies the opposite: that a more informative foreign media on average reduces citizen's ability to make informed choices.

Without explicit expression for σ^*, inference on $\Gamma_t(\pi)$ can only be made for a subset parameters of $\{\lambda_1, \theta\}$. From equation (3.6) bias approaches $\sigma^* = 1$ when likelihood of good government (λ_1) approaches 1 or when likelihood of state $S_t = 1$ (θ) approaches 1. Also note that $\Gamma_t(\pi)$ approaches negative (infinity) when both λ_1 or θ approaches 1. This implies that when citizen finds the governments increasingly trustworthy (high λ_1) or when the incumbent government's preference on average is very similar to its citizen's (high θ), a more informative foreign media on average reduces citizen overall utility under a truth telling government. Conversely bias approaches $\sigma^* = 1$ when $\lambda_1 \to 0$, and approaches $\sigma^* = \frac{1}{1+\delta\lambda}$ when $\theta \to 0$, and when both λ_1 *and* θ approaches 0 the expression of $\Gamma_t(\pi)$ approaches positive (infinity). This implies that when government's preference is sufficiently different from its citizen, and when citizen finds the incumbent government untrustworthy, a more informative foreign media enables representative citizen on average to make better informed decisions.

The intuition is as follows: when there is large conflict of interest between government and citizen's, and when government is perceived to be untrustworthy, citizen's overall utility from relying only on truth-telling local media's report r_l is low because he distrust the local media report and as a result experiences large disutility $-(1 - a_t(1, r_f))^2$ in state $S_t = 1$. Here foreign media presence's on average enables citizen to make better informed decisions (in state $S_t = 1$) because he experiences smaller disutility in state $S_t = 1$ whenever foreign media accurately reports $r_f = 1$. Keep in mind that foreign media occasionally errs and harms citizen's interest. However the benefit from foreign media's benefit outweighs the cost. However when citizen finds the government trustworthy, or if the conflict of interest between government and citizen is low, the welfare gain whenever foreign media's accurately reports state $S_t = 1$ is small, and can be outweighed by potential inaccurate report $r_f = 0$ in state $S_t = 1$.

Based on the limited comparative statics on $\frac{\partial U_t(\pi, \sigma_t^*, \lambda_t)}{\partial \pi}$ foreign media's presence on good government's utility can be interpreted as follows. When government's is perceived to be trustworthy (large θ or λ_1), a more informative foreign media on average harms citizen's ability to make informed decision under a truth-telling government. From a good government's perspective, citizen's overall welfare is higher when foreign media is less accurate because citizen's relies more on the truth telling local media when making his decision. However the opposite is true when citizen's confidence toward the incumbent government is low (small θ and λ_1) because it is established that improvements in foreign media's accuracy

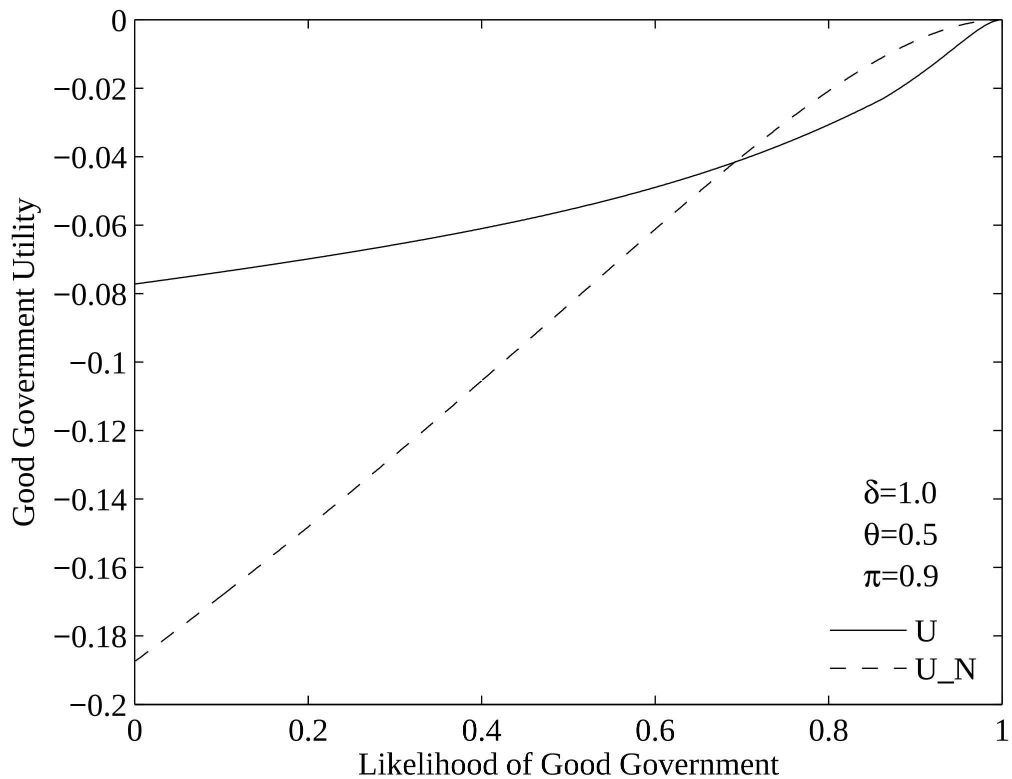

Figure 3.6: Good Government Utility

enables citizen's to make better informed decisions under a truth-telling government. If this is the case, a good government would not restrict citizen's access from foreign media, but would enact policies that enables the foreign media to receive more accurate information about the state S_t.

Discrete changes in government's utility $U - U_N$ from foreign media entry will be estimated using computation. The direction of change in government's utility $U - U_N$ follows very closely to the limited comparative statics of $\frac{\partial U(\pi, \sigma_t^*, \lambda_t)}{\partial \pi}$. Consider first figure 3.6, which holds parameters fixed at $\theta = 0.5$ and $\delta = 1$ and graph two curves as a function of reputation λ_1: good government's utility U with foreign media of accuracy $\pi = 0.9$ (solid line), and utility in absence of foreign media U_N (dotted line). Observe that under an honest local media, when the government is perceived to be relatively untrustworthy, $\lambda_1 \in (0, 0.692)$,

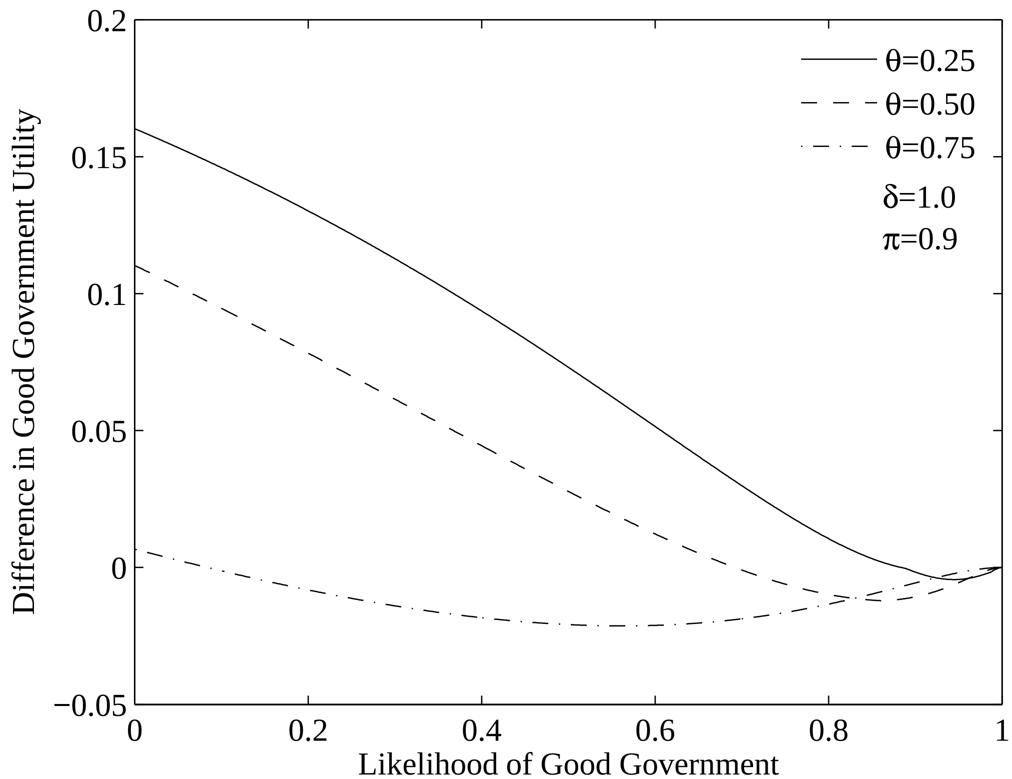

Figure 3.7: Difference in Good Government Utility at Different Levels of Conflict of Interest

foreign media entry enables citizen to make better informed decision, while for sufficiently large reputation $\lambda_1 \in (0.692, 1)$, citizen on average make poorer decisions from foreign media's presence. Figure 3.7, holds parameters fixed at $\pi = 0.9$ and $\delta = 1$, and graph the difference in government's utility $U - U_N$ as a function of λ_1, for three different values of θ: $\theta = 0.25$ (solid line) $\theta = 0.50$ (dashed line) and $\theta = 0.75$ (dash-dotted line). Observe that when government's preference is closer to its citizen's (higher θ), such as in the case of $\theta = 0.75$, when foreign media's accuracy equals $\pi = 0.9$ the government is only supportive of foreign media entry if citizen's prior reputation is very low: $\lambda_1 \in (0, 0.084)$, and would strictly prefer foreign media's absence if government's reputation λ_1 exceeds 0.084. However in the case where (bad) government's preference is very different from its citizen's, as in the case of $\theta = 0.25$, the government prefers foreign media entry for a larger range of reputation

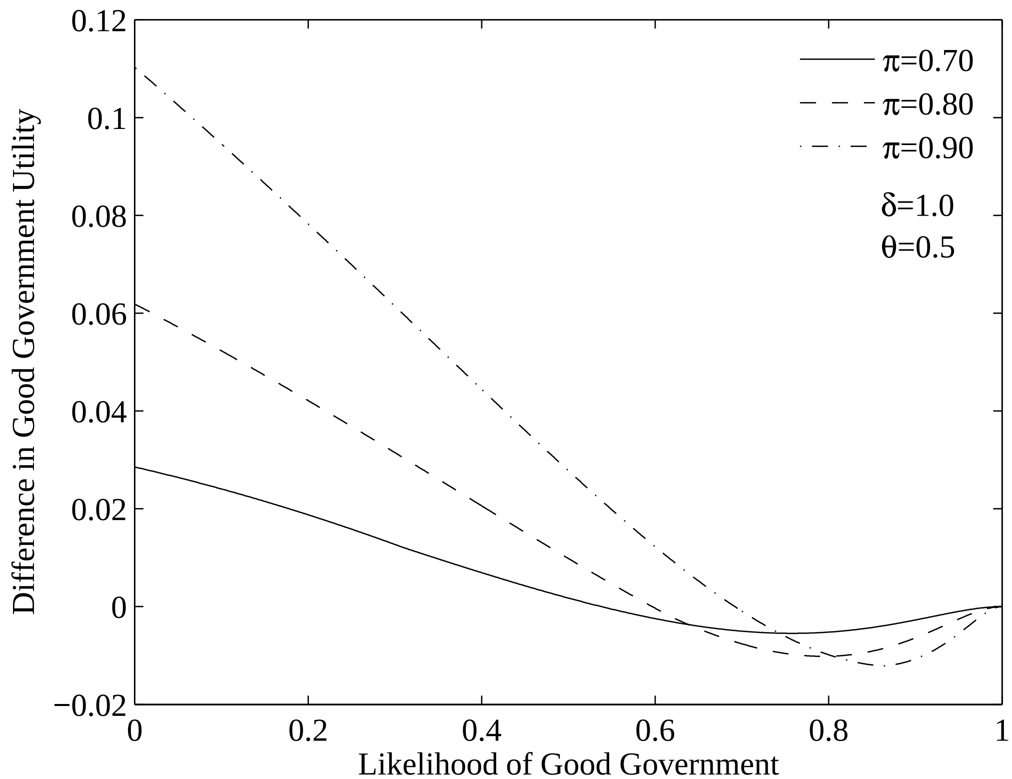

Figure 3.8: Difference in Good Government Utility at Different Levels of Foreign Media Accuracy

$\lambda_1 \in (0, 0.913)$. Figure 5.3 holds parameter fixed at $\theta = 0.5$ and $\delta = 1$ and graph the change in government's utility $U - U_N$ as a function of λ_1, for three different parameters values of π: $\pi = 0.70$ (solid line) $\pi = 0.80$ (dashed line) and $\pi = 0.90$ (dash-dotted line). Observe that for sufficiently large λ_1, citizen's welfare is actually worse off with a more accurate foreign media. Moreover for reputation in the neighborhood of $\lambda_1 = 0.9$, a more accurate foreign media π implies that citizen's make poorer decision as expression $U - U_N$ becomes increasingly negative. Nevertheless it is worth noting that for moderate values of θ and λ_1, a sufficiently large increase in foreign media's accuracy π enables citizen's to make better informed decisions ($U - U_N > 0$).

3.4.2 Bad Government's Utility

Unlike the good government, the bad government strictly prefers not having foreign media even if it enables citizen to make better decision in state 1, (which benefits the bad government). The reason is that the expected losses in state 0 outweighs any expected gain in state 1. Let $V \equiv V(\pi, \sigma^*; \lambda_t)$ be the bad government's overall utility when citizen relies on biased government media, and a foreign media with accuracy π, which equals:

$$\begin{aligned}
V(\pi, \sigma^*; \lambda_t) &= V_1(\pi, \sigma^*) + \delta E[V_2(\pi, \lambda_2)] \\
&= \theta \left[\pi a_1(1,1) + (1-\pi) a_1(1,0)\right] + (1-\theta)\sigma^* \left[(1-\pi) a_1(1,1) + \pi a_1(1,0)\right] \\
&+ \delta \left\{\theta V_2(\pi, \Lambda(1,1)) + (1-\theta)\left[\sigma^* V_2(0) + (1-\sigma^*) V_2(\pi, \Lambda(0,0))\right]\right\} \\
V_2(\pi, \lambda_2) &= \theta \left[\pi a_2(1,1) + (1-\pi) a_2(1,0)\right] + (1-\theta)\left[(1-\pi) a_2(1,1) + \pi a_2(1,0)\right]
\end{aligned} \tag{3.13}$$

where $V_1(\pi, \sigma^*)$ and $\delta E[V_2(\pi, \lambda_2)]$ represent bad government's period 1 and period 2 utility respectively. In both periods, bad government's utility depends on its likelihood of reporting $r_l = 1$. In particular the government truthfully reports state $S_t = 1$, and citizen takes action $a_t(1,1)$ when foreign media correctly reports $r_f = 1$ (probability π) and takes (smaller) action $a_t(1,0)$ when foreign media errs and reports $r_f = 0$ instead. In state $S_t = 0$, the government lies with probability σ^* in period 1, and always report 1 in period 2. In turn, citizen takes smaller action $a_2(1,0)$ when foreign media accurately reports 0 (probability π), but takes a higher action when foreign media errs and report $r_l = 1$ (probability $1-\pi$). In period 2 government's expected utility $\delta E[V_2(\pi, \lambda_2)]$ depends on citizen's perception regarding the likelihood of a good government λ_2, which in turn depends on period 1 state S_1 and report r_l, $\lambda_2 \equiv \Lambda(r_l, S_1)$. In particular citizen updates his beliefs to $\Lambda(1,1)$ from truthfully reporting $r_l = 1$ (probability $1-\theta$), and the bad government's period 2 utility equals $\delta V_2(\Lambda(1,1))$. With remaining probability $(1-\theta)$ citizen learns state $S_1 = 0$ and update his posterior $\Lambda(r_l, 0)$ based on government's report r_l. If government lies and report $r_l = 1$, citizen revises posterior to $\Lambda(1,0) = 0$ and the bad government's utility in period 2 only equals $\delta V_2(0) = \delta\, tht$. If the government choose to truthfully reports state $S_1 = 0$, citizen's revises his posterior to $\Lambda(0,0) = \frac{\lambda_1}{\lambda_1 + (1-\lambda_1)(1-\sigma^*)}$ and enable the government to earn a higher period 2 return of $\delta V_2(\Lambda(0,0))$.

Focus on marginal changes in government's utility from incremental improvements in foreign media's accuracy: $\frac{dV(\pi,\sigma^*,\lambda_t)}{d\pi}$. Taking the total differential with respect to π, the change in government's overall utility equals:

$$
\begin{aligned}
\frac{dV(\pi,\sigma^*;\lambda_t)}{d\pi} &= \frac{\partial V_1(\pi,\sigma^*)}{\partial \pi} + \delta\left\{\theta \frac{\partial V_2(\pi,\Lambda(1,1))}{\partial \pi} + (1-\theta)(1-\sigma^*)\frac{\partial V_2(\pi,\Lambda(0,0))}{\partial \pi}\right\} \\
&= \left[\theta \frac{\partial}{\partial \sigma^*}[\pi a_1(1,1) + (1-\pi)a_1(1,0)] \right. \\
&\qquad \left. + \delta(1-\theta)\frac{\partial V_2(\pi,\Lambda(0,0))}{\partial \Lambda(0,0))}\frac{\partial \Lambda(0,0;\sigma^*)}{\partial \sigma^*}\right]\frac{d\sigma^*}{d\pi}
\end{aligned}
$$

where expression $\frac{\partial V_1(\pi,\sigma^*)}{\partial \pi} + \delta\left\{\theta \frac{\partial V_2(\pi,\Lambda(1,1))}{\partial \pi} + (1-\theta)(1-\sigma^*)\frac{\partial V_2(\pi,\Lambda(0,0))}{\partial \pi}\right\}$ represents the *direct change* in government's utility from marginal improvements in foreign media's accuracy (holding bias fixed at σ_t^*). The remaining expression $\left[\theta \frac{\partial}{\partial \sigma^*}[\pi a_1(1,1) + (1-\pi)a_1(1,0)] + \delta(1-\theta)\frac{\partial V_2(\pi,\Lambda(0,0))}{\partial \Lambda(0,0))}\frac{\partial \Lambda(0,0;\sigma^*)}{\partial \sigma^*}\right]$ represents the *indirect change* in government's utility from changes in equilibrium bias $\frac{d\sigma^*}{d\pi}$. Observe that the full expression of marginal increase in equilibrium bias $\sigma^* \leq 1$ on government's overall utility $V(\pi,\sigma^*,\lambda_t)$

equals:

$$\frac{\partial V(\pi,\sigma^*,\lambda_t)}{\partial\sigma^*} = \theta\frac{\partial}{\partial\sigma^*}[\pi a_1(1,1)+(1-\pi)a_1(1,0)] + \delta(1-\theta)\frac{\partial V_2(\pi,\Lambda(0,0))}{\partial\Lambda(0,0))}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*}$$
$$+ (1-\theta)\frac{\partial}{\partial\sigma^*}\sigma^*\{[\pi a_1(1,0)+(1-\pi)a_1(1,1)] - \delta[V_2(\pi,\Lambda(0,0)) - V_2(0)]]$$

where the latter expression equals 0 because at equilibrium bias σ^*, benefit from lying $B(\pi,\sigma^*) = \pi\, a_1(1,0)+(1-\pi)\, a_1(1,1)$ equals to the cost of lying $C(\pi,\sigma^*) = \delta[V_2(\pi\Lambda(0,0)) - V_2(0)]$. Without an expression of σ^*, the change in bias on bad government's utility cannot be precisely determined except that $\theta\frac{\partial}{\partial\sigma^*}[\pi a_1(1,1)+(1-\pi)a_1(1,0)]$ is negative since citizen are more averse to take higher action $a_1(1,rf)$ from a more noisy local media, and $\delta(1-\theta)(1-\sigma^*)\frac{\partial V_2(\Lambda(0,0))}{\partial\Lambda(0,0)}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*}$ is positive because a higher reputation $\Lambda(0,0)$ from truthfully reporting $S_1 = 0$ enables the bad government to more effectively influence citizen's action.

The key analysis lies in expression $\frac{\partial V_t(\pi,\sigma_t^*,\lambda_t)}{\partial\pi}$ which equals:

$$\begin{aligned}\frac{\partial V_t(\pi,\sigma_t^*,\lambda_t)}{\partial\pi} &= \theta\frac{\partial}{\partial\pi}[\pi a_t(1,1)+(1-\pi)a_t(1,0)] \\ &\quad + (1-\theta)\sigma_t^*\frac{\partial}{\partial\pi}[(1-\pi)a_t(1,1)+\pi a_t(1,0)] \\ &= \theta\left(1-\frac{1}{a_{t,N}(1)}\right)^2\left(\frac{2\pi-1}{(\pi(1-\pi))^2}\right)\frac{(a_t(1,1)\,a_t(1,0))^2}{a_{t,N}(1)} \\ &\quad + (1-\theta)\sigma^*\left(1-\frac{1}{a_{t,N}(1)}\right)\left(\frac{2\pi-1}{(\pi(1-\pi))^2}\right)\frac{(a_t(1,1)\,a_t(1,0))^2}{a_{t,N}(1)} \le 0\end{aligned}$$

where the first and second expression represents the change in government's utility in state $S_t = 1$ and $S_t = 0$ (respectively) from improvement in foreign media's accuracy π. Though foreign media enhances the government's ability to influence in state $S_t = 1$, it limits the government's ability to influence in period $S_t = 0$ This losses on average outweighs any gains,

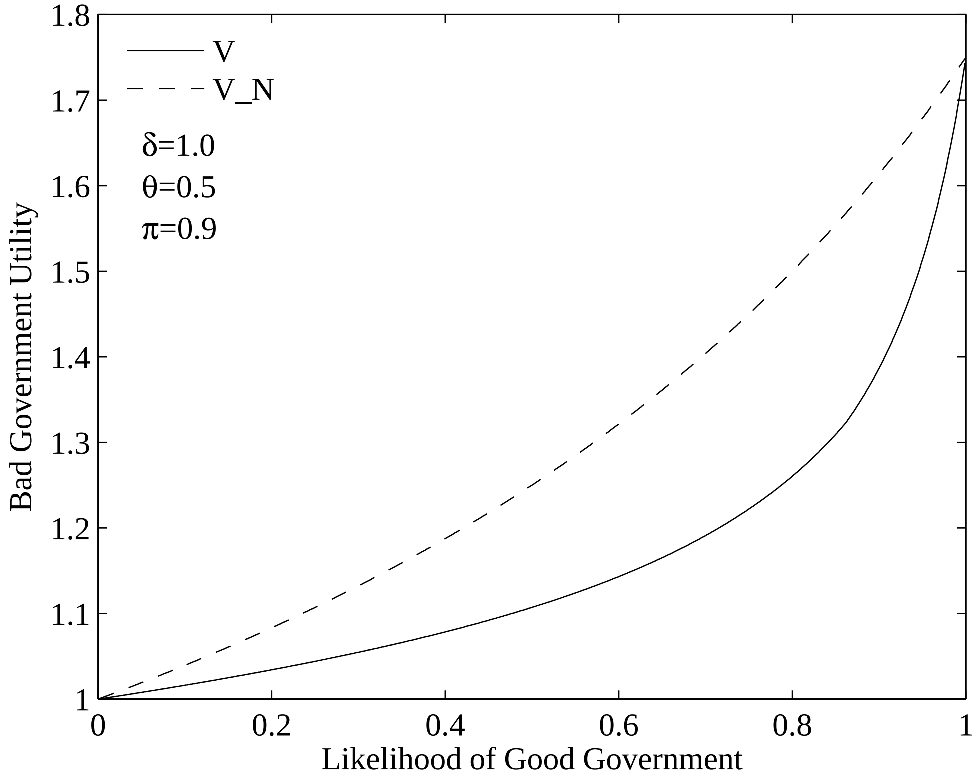

Figure 3.9: Bad Government Utility

causing the overall effect to be strictly negative. The negative expression of $\frac{\partial V_t(\pi,\sigma_t^*,\lambda_t)}{\partial \pi}$ implies that a more informative foreign media's on average hurts a bad government's overall ability to influence citizen's action, and thus strictly prefers less informative foreign media or ideally strive to be the sole provider of information. This is very different from the good government's behavior that strictly prefers foreign media's presence when citizen perceives the incumbent to be untrustworthy (low π and low θ).

The results of foreign media entry on bad government's utility is demonstrated using computation. Figure 3.9 holds parameters fixed at $\theta = 0.5$ and $\delta = 1$ and graph two utility curves with respect to λ_1: bad government's utility with foreign media of accuracy $\pi = 0.9$, V (solid line), and utility without foreign media V_N (dashed line). Observe that bad government's return V and V_N are both strictly increasing in λ_1, but government's

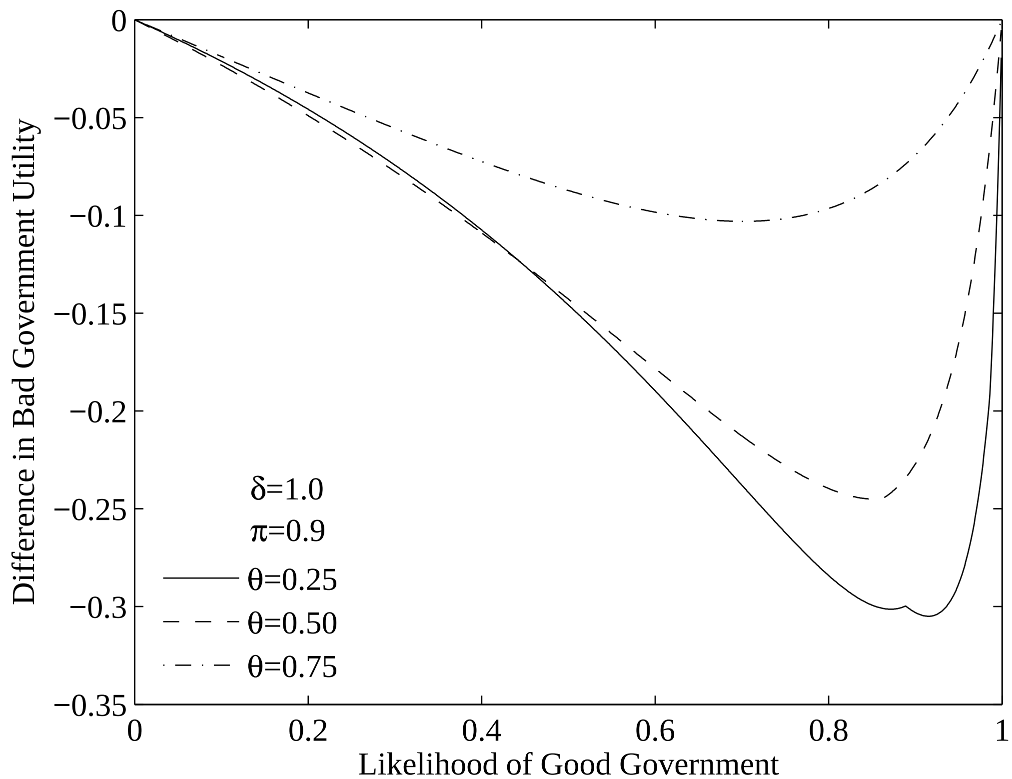

Figure 3.10: Difference in Bad Government Utility at Different Levels of Conflict of Interest

utility V is strictly smaller than its utility absent of foreign media V_N for any values of $\lambda_1 \in (0, 1)$. The negative impact of foreign media entry also holds for different values of θ. Figure 3.10 holds parameters fixed at $\delta = 1$ and $\pi = 0.9$ and graph the difference in government's utility $V - V_N$ as a function of reputation λ_1 for three different values of θ: $\theta = 0.25$ (solid line), $\theta = 0.50$ (dashed line) and $\theta = 0.75$ (dash-dotted line). In all three cases, government's utility with foreign media is strictly smaller than utility in absence of foreign media. The results also holds for various levels of foreign media's accuracy π. Figure 3.11 holds parameter fixed at $\theta = 0.5$ and $\delta = 1$, and plots utility difference $V - V_N$ for three different levels of π: $\pi = 0.70$ (solid line), $\pi = 0.80$ (dashed line) and $\pi = 0.90$ (dash-dotted line). In all three cases, foreign media entry not only reduces bad government's utility $V - V_N \leq 0$, but the loss in government's utility is strictly increasing in foreign media's

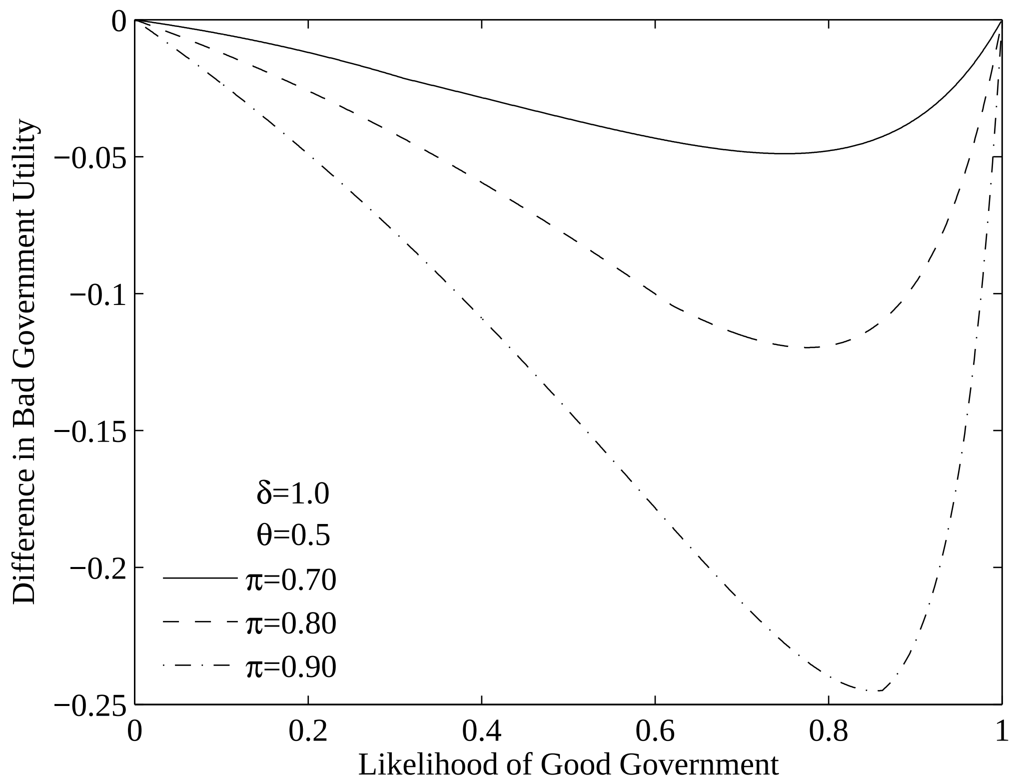

Figure 3.11: Difference in Bad Government Utility at Different Levels of Foreign Media Accuracy

accuracy π.

The summary of foreign media entry on government's utility is as follows. From a good government's perspective, foreign media entry hurts its ability in promoting citizen's interest when citizen finds their government relatively trustworthy (high θ or λ_1). The reason is the presence of imperfectly informed news outlet undermines citizen's ability to make informed decisions in state 1. On the other hand foreign media entry always hurts the bad government's ability to influence citizen's action. Though the bad government gains in ability to influence in period 1, the loss in its ability to influence in state 0 outweighs any potential gains.

The difference in government's response toward foreign media entry gives rise to the analysis of "abstinence" from media control as a signal for being a good government. Consider a very simple media control game where at the beginning of period 1, a government can decide the entry of foreign media. In cases where citizen distrusts the government (low λ_1 and low θ), the good government is always in favor of foreign media entry while the bad government is worse off with foreign media. Therefore any attempt by the government to restricts foreign media entry signals to the representative citizen that the government is of bad type. In this case, the bad government is better off tolerating foreign media's presence than a complete loss in citizen's trust. Therefore a pooling equilibrium exists where both governments allow free entry of foreign media just to signal that the government is good.

There are multiple signaling equilibrium when both governments strongly prefer foreign media's absence (high θ or high λ_1). Since both governments strictly prefer foreign media absence, a pooling equilibrium exists where both governments prohibit foreign media entry[2]. In addition there exists an informative signaling (separating) equilibrium where a good government is more likely to permit foreign media entry than the bad government. Therefore the likelihood of a good government conditional on allowing foreign media entry is higher than citizen's prior λ_1, and is lower when government restrict foreign media entry. In this separating equilibrium, both governments are indifferent between 1) permitting foreign media entry and experiencing disutility from foreign media presence and 2) restricting foreign media entry and experiences a decrease in its reputation. A more elaborate signaling issue between government media control is a subject for future research.

[2]In addition I restrict citizen's off-equilibrium beliefs such that both governments are equally likely to deviate by allowing foreign media entry.

3.5 Citizen's Welfare

From section 3.4.1, it is established that improvements in foreign media's accuracy can harm citizen's ability to make informed decisions especially when citizen finds their government's trustworthy, citizen are always against media control due to the possibility of encountering a bad government that lies in state 0. To provide a measure of citizen's welfare from citizen's point of view, denote $W \equiv W(\pi, \sigma^*, \lambda_t)$ as the welfare parameter that measures the expected utility that relies on a potentially biased local media, and a potentially inaccurate foreign media of accuracy π. Observe that even though good type government and citizen shares the same utility of $-(S_t - a_t(r))^2$, they do not share the same information set because the government's type is private and citizen only knows that the likelihood of the good government equals λ_1. Therefore welfare expression $W(\pi, \sigma^*, \lambda_t)$ takes into account the likelihood of encountering a bad type government that lies in state $S_t = 0$ (probability $(1-\theta)(1-\lambda_t)\,\sigma_t^*$). The good government utility $U(\pi, \sigma^*, \lambda_t)$ on the other hand, reflects citizen's utility *under a truth-telling government media.* Welfare expression equals

$$\begin{aligned}
W(\pi, \sigma^*, \lambda_t) &= W_1(\pi, \sigma^*) + \delta E\left[W_2(\pi, \lambda_2)\right] \\
&= -\theta\left[\pi(1-a_1(1,1))^2 + (1-\pi)(1-a_1(1,0))^2\right] \\
&\quad - (1-\theta)(1-\lambda_1)\sigma^*\left[(1-\pi)(a_1(1,1))^2 + \pi(a_1(1,0))^2\right] \\
&+ \delta\Big\{\theta W_2(\pi, \Lambda(1,1)) \\
&\quad + (1-\theta)\Big[(1-(1-\lambda)\sigma^*)W_2(\pi, \Lambda(0,0)) + (1-\lambda_1)\sigma^* W_2(0)\Big]\Big\} \\
W_2(\pi, \lambda_2) &= -\theta\left[\pi(1-a_2(1,1))^2 + (1-\pi)(1-a_2(1,0))^2\right] \\
&\quad - (1-\theta)(1-\lambda_2)\left[(1-\pi)(a_2(1,1))^2 + \pi(a_2(1,0))^2\right]
\end{aligned} \tag{3.14}$$

where $W_1(\pi, \sigma^*)$ and $\delta[E(W_2(\pi, \lambda_2))]$ represents citizen's welfare in period 1 and 2 respectively. Though governments always truthfully report state 1, citizen utility equals $-(1 - a_t(1,1))^2$ when foreign media accurately reports $r_l = 1$ (probability π) but suffers from a higher disutility of $-(1 - a_t(1,0))^2$ in response to foreign media's inaccurate report of $r_l = 0$. Observe that when compared with good government's utility (equation (3.11)) citizen's welfare incorporates potential disutility in state $S_t = 0$ when he encounters a bad government that lies in state $S_t = 0$ (probability $(1-\theta)(1-\lambda_t)\sigma_t^*$). In particular, citizen experiences a smaller disutility $-(a_t(1,0))^2$ when foreign media accurately reports 0 (probability π), but experiences a larger disutility of $-(a_t(1,1))^2$ when foreign media errs and reports 1 (probability $(1-\pi)$). Period 2 welfare depends on citizen's expectation on meeting a good type government λ_2, which in turn depends on period 1 government report r_l and state S_1. In particular his beliefs regarding the likelihood of a good type government remains unchanged at $\Lambda(1,1) = \lambda_1$ after hearing reports $r_l = 1$ in state 1, and expects period 2 utility to equal $\delta\, W_2(\Lambda(1,1))$. With remaining probability $(1-\theta)(1-(1-\lambda_1)\,\sigma^*)$, citizen is expected to revise his beliefs to $\Lambda(0,0) = \frac{\lambda_1}{\lambda_1+(1-\lambda_1)(1-\sigma^*)}$ after hearing truthful report on state $S_1 = 0$. However with remaining probability $(1-\theta)(1-\lambda_1)\,\sigma^*$, he expects to hear report $r_l = 1$ in state 0, knows that it is the bad government and expects to receive a minimal utility of $\delta\, W_2(0)$ from an uninformative government media.

Similar to previous section 3.4 it is shown that foreign media entry on average, increases citizen's ability to make better informed decisions $W - W_N \geq 0$, by focusing on changes in citizen's welfare from marginal improvements in foreign media's accuracy $\frac{dW(\pi,\sigma^*,\lambda_t)}{d\pi}$, which equals:

$$
\begin{aligned}
\frac{dW(\pi,\sigma^*,\lambda_t)}{d\pi} = \frac{\partial W_1(\pi,\sigma^*)}{\partial \pi} + \delta\Bigg\{\theta\frac{\partial W_2(\pi,\Lambda(1,1))}{\partial\pi} \\
+ (1-\theta)\Bigg[(1-(1-\lambda_1)\sigma^*)\frac{\partial W_2(\pi,\Lambda(0,0))}{\partial\pi} \\
+ (1-\lambda_1)\sigma^*\frac{\partial W_2(\pi,\Lambda(1,0))}{\partial\pi}\Bigg]\Bigg\} \\
+ \Bigg\{\frac{\partial W_1(\pi,\sigma^*)}{\partial\sigma^*} + \delta(1-\theta)(1-\lambda_1)\Bigg[(1-\sigma^*)\frac{\partial W_2(\pi,\Lambda(0,0))}{\partial\Lambda(0,0)}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*} \\
- [W_2(\pi,\Lambda(0,0)) - W_2(0)]\Bigg]\Bigg\}\frac{d\sigma^*}{d\pi}
\end{aligned}
$$

where $\frac{\partial W_1(\pi,\sigma^*)}{\partial\pi} + \delta\Big\{\theta\frac{\partial W_2(\pi,\Lambda(1,1))}{\partial\pi} + (1-\theta)\Big[(1-(1-\lambda_1)\sigma^*)\frac{\partial W_2(\pi,\Lambda(0,0))}{\partial\pi} + (1-\lambda_1)\sigma^*\frac{\partial W_2(\pi,\Lambda(1,0))}{\partial\pi}\Big]\Big\}$ represents the *direct change* in citizen's welfare from an increase in π (holding bias fixed at σ^*). The latter expression $\Big\{\frac{\partial W_1(\pi,\sigma^*)}{\partial\sigma^*} + \delta(1-\theta)(1-\lambda_1)\Big[(1-\sigma^*)\frac{\partial W_2(\pi,\Lambda(0,0))}{\partial\Lambda(0,0)}\frac{\partial\Lambda(0,0;\sigma^*)}{\partial\sigma^*} - [W_2(\pi,\Lambda(0,0)) - W_2(0)]\Big]\Big\}$ represents that change in citizen's welfare from incremental changes in equilibrium bias $\frac{\partial\sigma^*}{\partial\pi}$, which is negative because an increase in equilibrium bias σ^* lowers citizen's overall ability to make informed decisions. However without an explicit expression on bias σ^*, the extent of disutility citizen experiences from an increase in government bias cannot be precisely determined.

Nevertheless the key analysis lies in the direct effect of a more informative foreign media on citizen's welfare. In period t improvements in accuracy π affects welfare $\frac{\partial W_t(\pi,\sigma_t^*,\lambda_t)}{\partial\pi}$

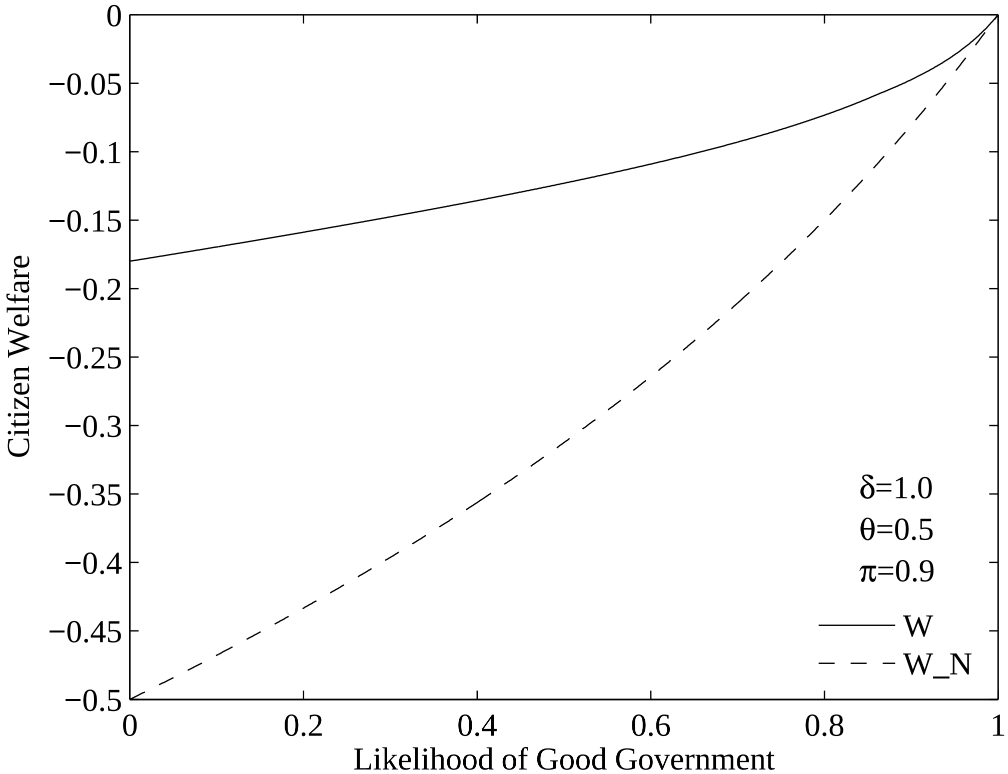

Figure 3.12: Citizen Welfare

as follows:

$$\begin{aligned}\frac{\partial W_t(\pi,\sigma_t^*,\lambda_t)}{\partial \pi} &= -\theta\left\{\frac{\partial}{\partial\pi}\left(\pi(1-a_t(1,1))^2\right)+\frac{\partial}{\partial\pi}\left((1-\pi)(1-a_t(1,0))^2\right)\right\}\\ &\quad-(1-\theta)(1-\lambda_t)\sigma^*\left\{\frac{\partial}{\partial\pi}\left(\pi\,(a_t(1,0))^2\right)+\frac{\partial}{\partial\pi}\left((1-\pi)\,(a_t(1,1))^2\right)\right\}\\ &= \theta\left(1-\frac{1}{a_{t,N}(1)}\right)^2\frac{(2\pi-1)}{[\pi(1-\pi)]^2}\frac{(a_t(1,1)\,a_t(1,0))^2}{a_{t,N}(1)}\geq 0\,,\end{aligned} \tag{3.15}$$

which is strictly positive. More importantly, when compared to equation (3.12), observe that the change in citizen's welfare in state $S_t=1$ coincides with good government's utility $\frac{\partial U_t(\pi,\sigma^*)}{\partial\pi}$, which from previous section 3.4.1 is ambiguous and is negative for sufficiently large θ and λ_1. Though citizen on average may end up making poorer decision in state 1

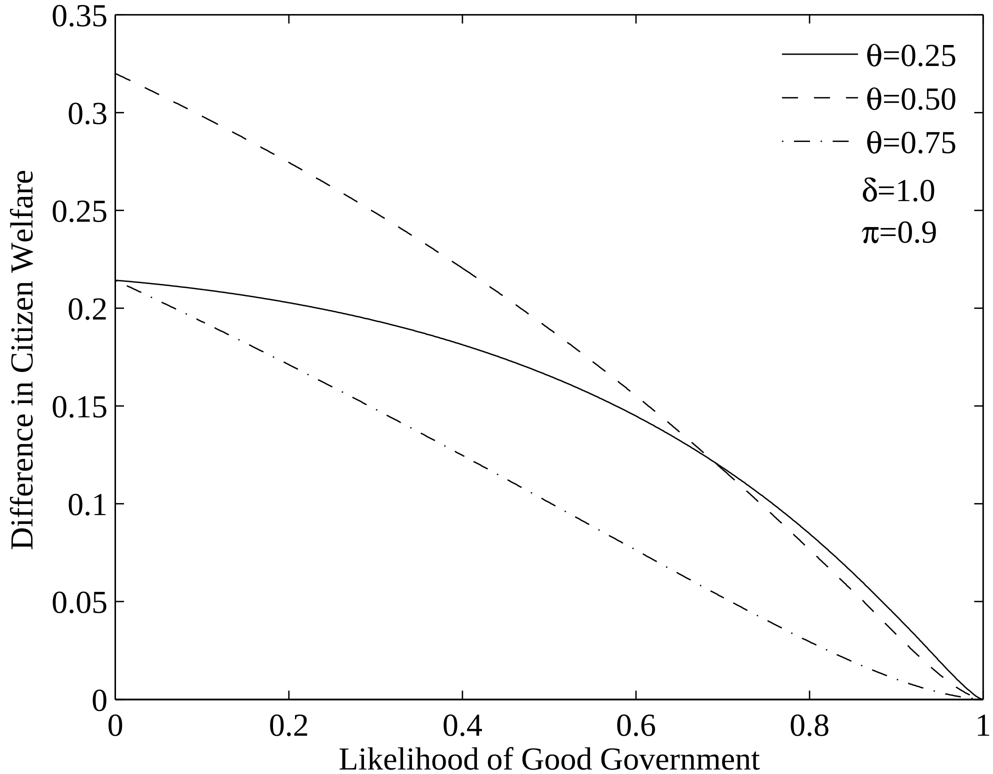

Figure 3.13: Difference in Citizen Welfare at Different Levels of Conflict of Interest

(in cases of high θ and λ_1). Citizen benefit from foreign media's presence in state $S_t = 0$ because it limits a bad government ability to mislead citizen into taking higher action $a_t(r)$ whenever it lies in state $S_t = 0$ (probability $(1-\theta)(1-\lambda_1)\sigma_t^*$). The gain in from making better decision in state $S_1 = 0$ outweighs any potential losses in state $S_1 = 1$, and on average improves citizen's overall welfare.

Computation is used to demonstrate overall improvement in citizen's welfare from the presence of additional foreign information source. Figure 3.12 hold parameters fixed at $\theta = 0.5$ and $\delta = 1$, and graph two curves as a function of reputation λ_1: welfare W with foreign media's of accuracy $\pi = 0.9$ (solid line) and welfare without foreign media W_N. Observe that citizen's welfare with foreign media presence is higher than welfare without foreign media $W > W_N$ for all values of $\lambda_1 \in (0, 1)$. The result also holds for different

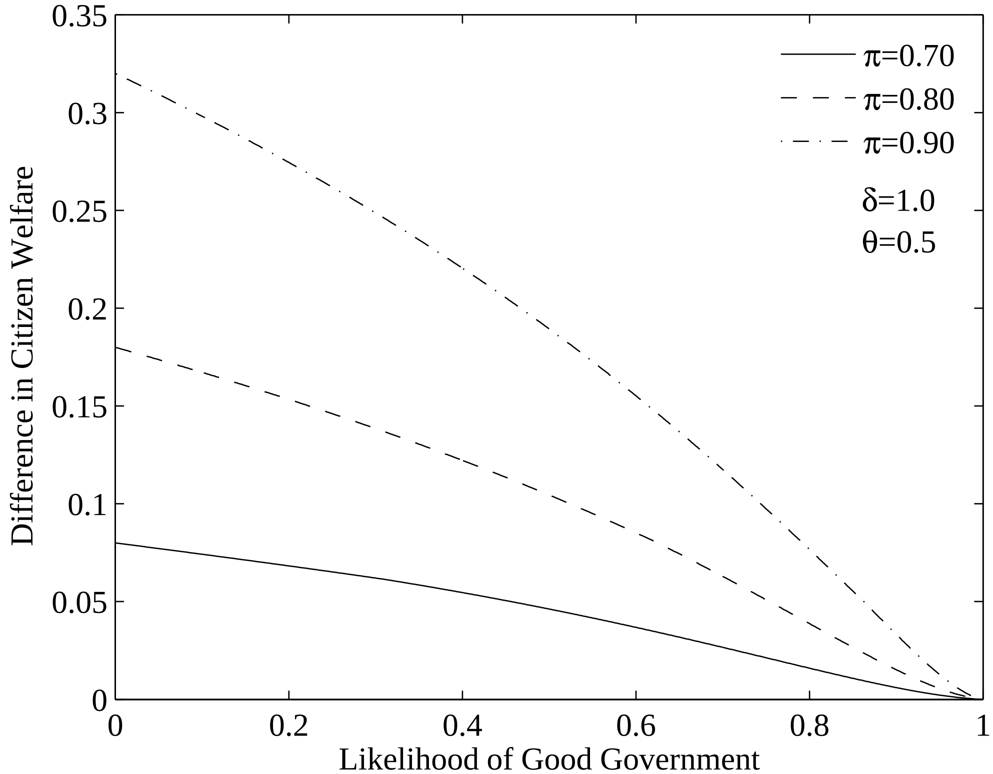

Figure 3.14: Difference in Bad Government Utility at Different Levels of Foreign Media Accuracy

values of θ. Figure 3.13 holds parameter fixed at $\delta = 1$ and $\pi = 0.9$ and graph the difference in citizen's welfare $W - W_N$ for three different values of θ: $\theta = 0.25$ (solid line), $\theta = 0.50$ (dashed line) and $\theta = 0.75$ (dash-dotted line). In all three cases, welfare differences $W - W_N$ is strictly positive. Similar results also holds at different level of accuracy π. Figure 3.14 holds parameter fixed at $\theta = 0.5$ and $\delta = 1$ and plots welfare difference $W - W_N$ for three different values of π: $\pi = 0.70$ (solid line), $\pi = 0.80$ (dashed line) and $\pi = 0.90$ (dash-dotted line). Observe that not only that citizen's welfare on average is better off with foreign media entry, but the welfare improvement is higher as foreign media becomes more informative (higher π).

Despite sharing a common utility preference, why do good government and citizen reacts differently to foreign media's presence? The answer is that they both have different sets of information. The good government knows that with truthful reporting, citizen never makes ill informed decisions in state 0. However from a citizen's perspective, he is concerned of potential lying in state 0 (probably $(1-\lambda_1)\sigma^*$), which is reflected in the less than perfect action $a_1(1, r_f)$ in state 1. Unlike the good government, representative citizen takes into consideration potential gains from foreign media presence in state 0 that limits the bad government ability to misrepresent the state. Alternatively citizen views foreign media's report which is unbiased but inaccurate, as a complement to the local media that is accurate but potentially biased. Therefore a suppression of foreign news source reduces the amount of information available to make informed decision. This is of course different from a good government's perspective that knows that the local media is both accurate and unbiased, which is superior to foreign media that is unbiased but potentially inaccurate.

3.6 Summary

In summary citizen can potentially benefit from stricter media control only when the benevolent government is perceived to be trustworthy. Even when it is in the good government and citizen best interests to enact media control, representative citizen strictly prefer foreign media's presence because the presence of additional information limits the a bad government's ability to mislead citizen's decision. This chapter demonstrated a seemingly counterintuitive result from previous chapter 2 where the appearance of additional information source from foreign media raises the level of government media bias. Here foreign media entry reduces both the government's ability to influence in both periods, hence reducing the benefit from lying as well as its cost from lying from smaller incentive to maintain its reputation. Lastly both types of government is strictly against foreign media entry when citizen is confident that the government is acting in citizen's best interest. This gives rise to a potential equilibrium where government is restrained from media control to signal itself as a good type government, and is a subject for future research.

Chapter 4

Conclusion

This dissertation extends the work of government control of media using game theoretical approach. In this process I have overturned some basic preconceived notions. First, the notion that new foreign source of information enables the public to make better-informed choices. In chapter 2, the entry of moderately informative foreign news source causes a poor quality government to raise a government media bias to the point that citizen makes poorer informed decision. The reason is citizen still relies on the official government sources and the benefit from the appearance of foreign news source is outweighed by the loss from lower quality information from the government source. The result where government media bias is higher from foreign media's presence in itself challange the argument that additional new information reduces from lying, which in turn lowers government media bias. However it was shown in chapter 3 that the additional news source also reduces government's ability to influence in the future. As a result, the government's cost from lying is smaller as it has smaller incentive to maintain reputation and this pushes the government to raise its bias level.

This dissertation also challenges the notion that media control is purely used as a cover up for governments to more effectively persuade citizen's action. I demonstrated in chapter 3 that citizen can benefit from media control only when citizen is confident on the benevolent government's ability to promote citizen's interest. The reason is by relying more on the official report, citizen substitute away from a less informed foreign media to a more reliable truth-telling government media. Interestingly even when citizen and government share a common interest, they may not necessary have the same response toward foreign media presence. I have established that while citizen can end up making poorer decision from the appearance of additional foreign information source, citizen strictly prefer foreign media's presence because it limits a bad government's ability to mislead citizen. This additional benefit is not taken into consideration under a good type government because by definition it has no incentive to mislead its people.

I propose several topics for further analysis. When analyzing the interaction between government media bias and foreign news sources, I ignore the role of advertising revenue (Gehlbach and Sonin (2009)), the role of foreign media suppression (that was briefly explored in section 2.5) and electoral politics (Besley and Pratt (2006)). Future research should incorporating these factors into the analysis of government control of media. Second the model assume the existence of a representative citizen (chapter 3) or the behavior of citizen's with homogeneous beliefs and preferences (chapter 2). In reality, the consumers' heterogeneous beliefs and preferences gives rise to the demand of a variety of information news sources as well as different perception towards their incumbent government. Though preliminary research on information heterogeneity of beliefs system has been explored in works of Wing (2003) and Acemoglu, Chernozhukov and Yildiz (2006), the aspects of government control of media has not been incorporated into this line of research. Last but not the least; I have demonstrated that even benevolent governments may be in favor or media control and aligns its decision with an opportunist government (section 3.4.2). This gives rise to a signaling mechanism where despite welfare losses governments allows foreign media entry to signal as being a benevolent government. Very little is known about the signaling mechanism from media control restraint and is a subject for future research.

APPENDICES

Appendix A

Proof of Proposition 2

Before proving proposition 2, some of the expression of maximal citizen investment is rewritten as follows:

In absence of foreign media, maximal citizen investment (equation (2.5)) equals:

$$V_n = \begin{cases} V_n^i = \frac{\theta b}{2} & \text{for } \theta b \leq 1 \\ \bar{V}_n = 1 - \frac{1}{2b\theta} & \text{for } \theta b \geq 1 \end{cases}$$

When government follow high bias σ_h, maximal citizen investment (equation (2.14)) equals:

$$V_h = \begin{cases} V_h^i = \frac{\theta \pi b}{2} & \text{for } \pi \leq \hat{\pi}_h \\ \bar{V}_h = \left[1 - \frac{1}{2b}\left(1 + \left(\frac{(1-\theta)(1-\pi)}{\theta\pi}\right)\right)\right](\theta\pi + (1-\theta)(1-\pi)) & \text{for } \pi \geq \hat{\pi}_h \end{cases}$$

When government follow low bias σ_l, maximal citizen investment (equation (2.14)) equals:

$$V_l = \begin{cases} V_l^i = \theta\left[\left(1 - \frac{1}{2b}\right)(1 - k(\pi)) + \frac{bk(\pi)}{2}\right] & \text{for } \theta b \leq 1, \text{ or } \pi \geq \hat{\pi}_l \\ \bar{V}_l = \frac{1}{b}\left[(b-1) - \frac{\theta}{2b}\left(1 + \left(\frac{1-\theta}{\theta}\right)^2 \frac{1}{k(\pi)}\right)\right] & \text{for } \theta b \geq 1 \text{ and } \pi \leq \hat{\pi}_l \end{cases}$$

To prove proposition 2, it remains to be shown that regardless of government's choice of bias (σ_l or σ_h), maximal citizen investment $V \in \{V_l, V_h\}$, is smaller than maximal investment in absence of foreign media V_n. I shall focus first on proving $V_n \geq V_h$, followed by $V_n \geq V_l$.

To show that $V_n - V_h \geq 0$, the following conditions must be satisfied:

1. For $\pi \leq \hat{\pi}_h$, show that $V_n^i - V_h^i \geq 0$

2. For $\pi \geq \hat{\pi}_h$

   (a) If $\theta b \leq 1$, show that $V_n^i - \bar{V}_h \geq 0$

   (b) If $\theta b \geq 1$, show that $\bar{V}_n - \bar{V}_h \geq 0$

For case (1), the expression of $V_n^i - V_h^i$ simplifies to $\frac{b\theta(1-\pi)}{2} \geq 0$.

For case (2a), the expression of $V_n^i - \bar{V}_h$ simplifies to

$$\frac{b(1-\theta)}{2} + \frac{(b\theta\pi - [\theta\pi + (1-\theta)(1-\pi)])^2}{2b\theta\pi} \geq 0$$

. For case (2b), note that the two restrictions: $\theta b \geq 1$ and $\pi \geq \hat{\pi}_h$, imply that for given values of accuracy π and benefit b, success rate θ can only take values between $\left[\frac{1}{b}, \frac{(1-3\pi+3\pi^2)}{(2\pi-1)^2+b(1-\pi)\pi}\right]$. For $\theta = \frac{1}{b}$, the expression of $\bar{V}_n - \bar{V}_h$ simplifies to

$$\frac{(b\pi - 2(2\pi-1))^2}{2b^2} \geq 0\,;$$

while for $\theta = \frac{(1-3\pi+3\pi^2)}{(2\pi-1)^2+b(1-\pi)\pi}$, the expression of $\bar{V}_n - \bar{V}_h$ simplifies to

$$\frac{(b-1)^2(1-\pi)(2\pi-1)^2((2\pi-1)+\pi(1-\pi)) + b^2(1-3\pi+3\pi^2)^2}{2b(1-3\pi+3\pi^2)((2\pi-1)^2+b(1-\pi)\pi)} \geq 0\,.$$

Lastly the expression of $\frac{\partial^2 \bar{V}_n - \bar{V}_h}{\partial\theta^2}$ equals $-\frac{((2\pi-1)+\pi(1-\pi))}{b\theta^3\pi}$, which is negative. Since the expression $\bar{V}_n - \bar{V}_h \geq 0$ at both endpoints for permissible values of θ and $\frac{\partial^2 \bar{V}_n - \bar{V}_h}{\partial\theta^2} < 0$, it follows by concavity that $\bar{V}_n - \bar{V}_h \geq 0$ for $\theta \in \left[\frac{1}{b}, \frac{(1-3\pi+3\pi^2)}{(2\pi-1)^2+b(1-\pi)\pi}\right]$.

This concludes the proof that $V_n \geq V_h$ under the appropriate conditions.

Next, to show that $V_n - V_h \geq 0$, the following conditions must be satisfied:

1. For $\theta b \leq 1$, show that $V_n^i - V_l^i \geq 0$
2. For $\theta b \geq 1$
   (a) If $\pi \geq \hat{\pi}_l$, show that $\bar{V}_n - V_l^i \geq 0$
   (b) If $\pi \leq \hat{\pi}_l$, show that $\bar{V}_n - \bar{V}_l \geq 0$

Recall from section 2.3.1 that $k(\pi) = \frac{\pi(1-\pi)}{1-3\pi+3\pi^2}$ and lies between $(0, 1)$.

For case (1), the expression of $V_n^i - V_l^i$ simplifies to $\theta(1 - k(\pi))\left(\frac{(b-1)^2}{2b}\right) \geq 0$.

For case 2(b), the expression of $\bar{V}_n - \bar{V}_l$ simplifies to $\frac{1}{2b\theta}\left[(1-\theta)^2\left(1 - \frac{1-3\pi+3\pi^2}{\pi(1-\pi)}\right)\right] \geq 0$.

For case 2(a), note that the two restrictions inequality $\theta b \geq 1$ and $\pi \geq \hat{\pi}_l$, imply that for given values of accuracy π and benefit b, success rate θ can only take values between $\left[\frac{1}{b}, \frac{1}{bk(\pi)+(1-k(\pi))}\right]$. For $\theta = \frac{1}{b}$, the expression of $\bar{V}_n - V_l^i$ simplifies to $\frac{(b-1)^2}{b}(1-k(\pi)) \geq 0$; while for $\theta = \frac{1}{bk(\pi)+(1-k(\pi))}$, the expression of $\bar{V}_n - V_l^i$ simplifies to

$$\frac{(1-k(\pi))k(\pi)(b-1)^2}{2b(bk(\pi) + (1-k)} \geq 0\,.$$

Lastly the expression of $\frac{\partial^2 \bar{V}_n - V_l^i}{\partial\theta^2}$ equals $-\frac{1}{b\theta^3}$, which is negative. Since the expression of $\bar{V}_n - V_l^i \geq 0$ at both endpoints for permissible values of θ and $\frac{\partial^2 \bar{V}_n - V_l^i}{\partial\theta^2} < 0$, it follows by concavity that $\bar{V}_n - V_l^i \geq 0$ for $\theta \in \left[\frac{1}{b}, \frac{1}{bk(\pi)+(1-k(\pi))}\right]$.

This concludes the proof that $V_n \geq V_l$ under the appropriate condition. This concludes the proof of proposition 2.

Appendix B

Proof of Proposition 3

Define parameter $\breve{\pi}$, $\breve{\theta}$ and $\breve{b}$ and s such that:

$$\breve{\pi} = \left(\frac{\pi}{1-\pi}\right) \qquad \breve{\theta} = \left(\frac{\theta}{1-\theta}\right) \qquad \breve{b} = 2b - 1 \qquad s = \left(\frac{\sigma}{\breve{\theta}}\right)$$

The purpose of redefining parameters of π, b, θ, and σ to $\breve{\pi}$, $\breve{b}$, $\breve{\theta}$ and s respectively is to allow easier comparison between expected level of investment V_l, V_h and $\bar{V}_h$. Note that each is a strictly monotonic transformation. Also, note that $\pi \in \left(\frac{1}{2}, 1\right) \Rightarrow \breve{\pi} \in (1, \infty)$, $b > 1 \Rightarrow \breve{b} > 1$, and $\theta \in (0,1) \Rightarrow \breve{\theta} \in (0, \infty)$. Parameter s takes on values in $[0, \frac{1}{\breve{\theta}}]$, since bias σ must lie in $[0,1]$. Let $\bar{s} = \frac{\breve{b}}{\breve{\pi}}$; $\overline{s}$ corresponds to $\overline{\sigma}$, giving the level of bias above which no one invests when the foreign media reports $\hat{l}$. Then the expected level of investment (equation (2.10)) can be re-written in terms of $\breve{\pi}$, $\breve{b}$, $\breve{\theta}$ and s as:

$$E[I] = \begin{cases} V_1 \equiv \frac{\theta(1-\pi)}{\breve{b}+1} \left[\left(\breve{b} - \frac{s}{\breve{\pi}}\right)(\breve{\pi} + s) + \left(\breve{b} - \breve{\pi}s\right)(1 + \breve{\pi}s)\right] & \text{if } s \leq \overline{s} \\ V_2 \equiv \frac{\theta(1-\pi)}{\breve{b}+1} \left(\breve{b} - \frac{s}{\breve{\pi}}\right)(\breve{\pi} + s) & \text{if } \overline{s} \leq s \leq \breve{\pi}\breve{b} \\ 0 & \text{if } \breve{\pi}\breve{b} \leq s \end{cases} \tag{B.1}$$

Define s_l and s_h as

$$s_l = \underset{s}{\operatorname{argmax}} \frac{\theta(1-\pi)}{\breve{b}+1} \left[\left(\breve{b} - \frac{s}{\breve{\pi}}\right)(\breve{\pi}+s) + \left(\breve{b} - \breve{\pi}s\right)(1+\breve{\pi}s) \right] = \frac{(\breve{b}-1)(\breve{\pi}(\breve{\pi}+1))}{(1+\breve{\pi}^3)}$$

$$s_h = \underset{s}{\operatorname{argmax}} \frac{\theta(1-\pi)}{\breve{b}+1} \left(\breve{b} - \frac{s}{\breve{\pi}}\right)(\breve{\pi}+s) = \frac{(\breve{b}-1)\breve{\pi}}{2}$$

It is straightforward to show that $s_l < \overline{s}$ and $s_h < \breve{\pi}\breve{b}$. Next define V_l, V_h, and $\bar{V}_h$ as $V_1(s_l)$, $V_2(s_h)$, and $V_2(\frac{1}{\breve{\theta}})$, respectively.

$$V_l^i = \frac{\theta(1-\pi)}{\breve{b}+1}(\breve{\pi}+1)\left[\breve{b} + \frac{\breve{\pi}(\breve{\pi}+1)}{1+\breve{\pi}^3}\left(\frac{\breve{b}-1}{2}\right)^2\right]$$

$$V_h^i = \frac{\theta(1-\pi)}{\breve{b}+1}\breve{\pi}\left(\frac{\breve{b}+1}{2}\right)^2$$

$$\bar{V}_h = \frac{\theta(1-\pi)}{\breve{b}+1}\left(\breve{b} - \frac{1}{\breve{\pi}\breve{\theta}}\right)\left(\breve{\pi} + \frac{1}{\breve{\theta}}\right)$$

Note that the government's objective function (equation (B.1)) is continuous and piecewise quadratic in s – with one or two pieces, in the latter case meeting at $s = \overline{s}$. Maximizing the function then requires finding up to two local peaks, corresponding to functions V_1 and V_2, and comparing the two values of the objective function to find the global maximum.

I proceed by analyzing potential second quadratic piece, defined by V_2. First, note that if $\overline{s} \geq \frac{1}{\breve{\theta}}$, this piece does not exist; that is, since s must lie in $[0, \frac{1}{\breve{\theta}}]$, V_1 is the only relevant piece. One can show that $\overline{s} \geq \frac{1}{\breve{\theta}}$ is equivalent to $\breve{\pi} \leq \breve{b}\breve{\theta} \equiv Q_1$. Next, given the quadratic shape of V_2, if s_h (the unconstrained argmax of V_2) is lower than $\overline{s}$, then V_2 is maximized in the relevant range at $s = \overline{s}$. Similarly, if s_h is higher than $\frac{1}{\breve{\theta}}$, then V_2 is maximized in the relevant range at $s = \frac{1}{\breve{\theta}}$ (Recall that $s_h < \breve{\pi}\breve{b}$.). One can show that $s_h \leq \overline{s}$ is equivalent to $\breve{\pi} \leq \sqrt{\frac{2\breve{b}}{\breve{b}-1}} \equiv Q_2$. Also, $s_h \geq \frac{1}{\breve{\theta}}$ is equivalent to $\breve{\pi} \geq \frac{2}{\breve{\theta}(\breve{b}-1)} \equiv Q_3$. Finally, one can show that if $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} \geq \sqrt{2}$, then $Q_1 \geq Q_2 \geq Q_3$, and $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$ implies

$Q_1 < Q_2 < Q_3$.

The shape of the objective function thus breaks into several cases.

1. $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} \geq \sqrt{2}$.

   (a) $\breve{\pi} \leq Q_1$. $\quad s^* = \min\left\{s_l\,, \frac{1}{\breve{\theta}}\right\}$

   Here V_1 applies for all $s \in [0, \frac{1}{\breve{\theta}}]$, so the objective function is single-peaked and maximized at $\min\{s_l, \frac{1}{\breve{\theta}}\}$.

   (b) $Q_1 < \breve{\pi}$. $\quad s^* = s_l$ or $\frac{1}{\breve{\theta}}$

   Here the objective function has two local maxima, one each above and below $\overline{s}$. Since $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} \geq \sqrt{2}$, it is known that $Q_3 \leq Q_2 \leq Q_1$. Thus, $Q_3 < \breve{\pi}$, so the second peak is maximized at $s = \frac{1}{\breve{\theta}}$. One can also show that $Q_1 < \breve{\pi}$ ensures $s_l \leq \frac{1}{\breve{\theta}}$; also recall that $s_l \leq \bar{s}$. Thus the unconstrained maximum of V_1, V_l, is the constrained maximum. Thus, the global maximum is found by comparing V_l^i with $\bar{V}_h$.

2. For $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$;

   (a) $\breve{\pi} \leq Q_2$. $\quad s^* = \min\left\{s_l\,, \frac{1}{\breve{\theta}}\right\}$

   Here, either V_1 applies for all $s \in [0, \frac{1}{\breve{\theta}}]$, or the V_1 peak is globally maximal because V_2 is maximized below $\overline{s}$ and thus decreasing in the relevant range. Thus the objective function is single-peaked and maximized at $\min\{s_l, \frac{1}{\breve{\theta}}\}$.

   (b) $Q_2 < \breve{\pi} < Q_3$. $\quad s^* = s_l$ or s_h

   Here the objective function has two local maxima, one each above and below $\overline{s}$. Since $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$, it is known that $Q_3 > Q_2 > Q_1$. $\breve{\pi} > Q_1$ ensures the first peak maximizes at $s_l < \frac{1}{\breve{\theta}}$. For the second peak, $Q_2 < \breve{\pi} < Q_3$ ensures

$\bar{s} < s_h < \frac{1}{\breve{\theta}}$. Thus V_2 is maximized in the interior of the relevant range of s_h, and the global maximum is found by comparing V_l^i with V_h^i.

(c) $Q_3 \leq \breve{\pi}$. $\qquad s^* = s_l$ or $\frac{1}{\breve{\theta}}$

Here the objective function has two local maxima, one each above and below $\bar{s}$. Since $\breve{\pi} > Q_3 > Q_1$, the first peak maximizes at $s_l < \frac{1}{\breve{\theta}}$, while $Q_3 \leq \breve{\pi}$ ensures the second peak is maximized at $s = \frac{1}{\breve{\theta}}$. The global maximum is found by comparing V_l^i with $\bar{V}_h$.

Next I compare V_l^i and $\bar{V}_h$. Observe that:

$$V_l^i > \bar{V}_h \Leftrightarrow \frac{\theta(1-\pi)}{\breve{b}+1}(\breve{\pi}+1)\left[\breve{b} + \frac{\breve{\pi}(\breve{\pi}+1)}{1+\breve{\pi}^3}\left(\frac{\breve{b}-1}{2}\right)^2\right] > \frac{\theta(1-\pi)}{\breve{b}+1}\left(\breve{b} - \frac{1}{\breve{\pi}\breve{\theta}}\right)\left(\breve{\pi} + \frac{1}{\breve{\theta}}\right)$$

$$\Leftrightarrow \frac{\breve{\pi}(\breve{\pi}+1)^2}{1+\breve{\pi}^3}\left(\frac{\breve{b}-1}{2}\right)^2 + \frac{1}{\breve{\pi}\breve{\theta}^2} > \frac{\breve{b}-1}{\breve{\theta}} - \breve{b} \tag{B.2}$$

I then show that the LHS expression reaches its lower bound as $\breve{\pi}$ approaches ∞. The first term in the LHS is single-peaked in $\breve{\pi}$, reaching its maximum at $\breve{\pi} = \frac{1+\sqrt{3}}{2}$ and decreasing beyond that. It suffices then to compare endpoints ($\breve{\pi} = 1$ and $\breve{\pi} \to \infty$) to establish that the first term approaches its lower bound at $\breve{\pi} \to \infty$. The second term $\frac{1}{\breve{\pi}\breve{\theta}^2}$ strictly decreases in $\breve{\pi}$, and so also reaches its lower bound at $\breve{\pi} \to \infty$.

Since the LHS expression of equation (B.1) is bounded below by its value as $\breve{\pi} \to \infty$, a sufficient condition to ensure $V_l^i > \bar{V}_h$ for all $\pi \in \left(\frac{1}{2}, 1\right)$ is:

$$\left(\frac{\breve{b}-1}{2}\right)^2 \geq \frac{\breve{b}-1}{\breve{\theta}} - \breve{b} \quad \Leftrightarrow \breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2} \tag{B.3}$$

The expression $\breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$ can be rewritten in terms of b and θ as $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$.

Assume the reverse, i.e. $\breve{\theta} < \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$, so that $\left(\frac{\breve{b}-1}{2}\right)^2 < \frac{\breve{b}-1}{\breve{\theta}} - \breve{b}$. First note that for $\breve{\pi} \in [1,2]$, LHS>RHS of equation (B.2), since LHS expression is minimized over $[1,2]$ at $\breve{\pi} = 2$ and LHS>RHS when $\breve{\pi} = 2$. Note that the LHS expression of equation (B.2) is strictly decreasing in $\breve{\pi}$ for $\breve{\pi} > 2$ and LHS < RHS when $\breve{\pi} \to \infty$. Therefore there exist a critical value of $\breve{\pi}^* \in [2,\infty)$ such that for $\breve{\pi} \in (1,\breve{\pi}^*)$, $V_l^i > \bar{V}_h$ and for $\breve{\pi} > \breve{\pi}^*$, $V_l^i < \bar{V}_h$.

At this point it has been established that given restriction $\breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$, $V_l^i > \bar{V}_h$. What is left is to derive restriction that ensures $V_l^i > V_h^i$ for $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$ and $Q_2 < \breve{\pi} < Q_3$. It turns out that the restriction $\breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$ is sufficient to ensure that $V_l^i > V_h^i$ for $Q_2 < \breve{\pi} < Q_3$. To see why this is true, observe the difference of $V_l^i - V_h^i$, in terms of θ, π and b:

$$V_l^i - V_h^i = \frac{\theta}{2b}\left[2b - 1 + \frac{(1-\pi)\pi}{1-3\pi+3\pi^2}(b-1)^2\right] - \frac{\theta\pi b}{2},$$

is strictly decreasing in π. Hence it is sufficient to show $V_l^i > V_h^i$ for π ($\breve{\pi}$) at the upper end of the range, i.e $\breve{\pi} = Q_3$. Under restriction $\breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$, it has been established that $V_l^i > \bar{V}_h$. Of course when $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$, at $\breve{\pi} = Q_3$, $V_h^i = \bar{V}_h$ since $\breve{\pi} = Q_3 \Rightarrow s_h = \frac{1}{\breve{\theta}}$; thus $V_l^i > V_h^i$ at $\breve{\pi} = Q_3$. This concludes the proof that for $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$, $V_l > V_h$ for $Q_2 < \breve{\pi} < Q_3$, under restriction $\breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$.

Even though the inequality $\left(\breve{\theta} \geq \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}\right)$ is sufficient for V_l^i to be greater than V_h^i, it would be interesting to derive a necessary and sufficient condition for $V_l^i \geq V_h^i$ for $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} < \sqrt{2}$ and $Q_2 < \breve{\pi} < Q_3$. The expression of $V_l^i \geq V_h^i$ can be simplified as follows:

$$
\begin{aligned}
V_l^i \geq V_h^i &\Leftrightarrow (\breve{\pi}+1)\left[\breve{b}+\frac{\breve{\pi}(\breve{\pi}+1)}{1+\breve{\pi}^3}\left(\frac{\breve{b}-1}{2}\right)^2\right] \geq \breve{\pi}\left(\frac{\breve{b}+1}{2}\right)^2 \\
&\Leftrightarrow \frac{4\breve{b}}{(\breve{b}+1)^2} \geq \frac{\breve{\pi}^2(\breve{\pi}-2)}{(\breve{\pi}+1)(\breve{\pi}-1)^2}
\end{aligned} \tag{B.4}
$$

One can show that this holds with strict inequality at $\breve{\pi} = Q_2$. It is also straightforward to show that the RHS of (equation (B.4)) is strictly increasing in $\breve{\pi}$ (since $\breve{\pi} > 1$). Thus if the inequality holds at $\breve{\pi} = Q_3$, it holds for all $\breve{\pi}$ in the range; if not $V_l^i > V_h^i$ for $\breve{\pi} < \breve{\pi}''$ and $V_l^i < V_h^i$ for $\breve{\pi} > \breve{\pi}''$, for some $\breve{\pi}'' \in (Q_2, Q_3)$. Substitute $\breve{\pi} = Q_3$ to the above inequality to obtain:

$$
\begin{aligned}
\frac{4\breve{b}}{(\breve{b}+1)^2} &\geq \frac{\left(\frac{2}{\breve{\theta}(\breve{b}-1)}\right)^2\left[\left(\frac{2}{\breve{\theta}(\breve{b}-1)}\right)-2\right]}{\left[\left(\frac{2}{\breve{\theta}(\breve{b}-1)}\right)+1\right]\left[\left(\frac{2}{\breve{\theta}(\breve{b}-1)}\right)-1\right]^2} \\
\Leftrightarrow \frac{4\breve{b}}{(\breve{b}+1)^2} &\geq \frac{8-8(\breve{b}-1)\breve{\theta}}{[2+(\breve{b}-1)\breve{\theta}][2-(\breve{b}-1)\breve{\theta}]^2}
\end{aligned} \tag{B.5}
$$

For a given $\breve{b}$ denote $\breve{\theta}_0$ such that equation (B.5) holds with equality. Since RHS of (equation (B.5)) is strictly decreasing in $\breve{\theta}$ for $\breve{\theta} < \sqrt{\frac{2}{\breve{b}(\breve{b}-1)}}$, $\breve{\theta} > \breve{\theta}_0$ implies that $V_l^i > V_h^i$ for $\breve{\pi} \in (Q_2, Q_3)$. Conversely for $\breve{\theta}$ such that $\breve{\theta} < \breve{\theta}_0$, there exist a $\breve{\pi}''$ in (Q_2, Q_3) such that $V_l > V_h$ for $\breve{\pi} < \breve{\pi}''$ and $V_l^i < V_h^i$ for $\breve{\pi} > \breve{\pi}''$.

Taking into account the restrictions which ensure σ_l is the global solution, figure (B.1) below plots three curves: $\theta = \frac{2(b-1)}{b^2+2(b-1)}$ (curve (1)), $\theta = \frac{1}{b}$ (curve (2)), and $\frac{2b-1}{b^2} = \frac{(1-\theta)^2(1-\theta(2b-1))}{(1+\theta(b-2))(1-\theta b)^2}$ (curve (3)) with θ on the vertical axis and b on the horizontal axis. The three curves corresponds to equation $\breve{\theta} = \frac{4(\breve{b}-1)}{(\breve{b}+1)^2}$ (equation B.1), equation $\breve{\theta} = \frac{1}{\breve{b}}$ and equation $\frac{4\breve{b}}{(\breve{b}+1)^2} = \frac{8-8(\breve{b}-1)\breve{\theta}}{[2+(\breve{b}-1)\breve{\theta}][2-(\breve{b}-1)\breve{\theta}]^2}$ (equation B.2) respectively. The area below curve (2) ensures that $\sigma_l < 1$ for $\pi \in \left(\frac{1}{2}, 1\right)$. This is derived from equation (2.11), noting that $k(\pi)$ strictly decreases from 1 as π increases from $\frac{1}{2}$. Three areas of interest, namely A (AA), B (BB), and C are labeled in figure (B.1) below. Area A (AA), which lies above the $\theta = \frac{2(b-1)}{b^2+2(b-1)}$ curve, corresponds to a combination of θ and b where σ_l is the global solution for $\pi \in \left(\frac{1}{2}, 1\right)$ since it was established earlier that $\theta \geq \frac{2(b-1)}{b^2+2(b-1)}$ is a necessary and sufficient condition for $V_l^i > V_h$ in the relevant ranges of $\breve{\pi}$. The difference between A and AA is that in A, bias $\sigma_l < 1$ is decreasing in π for $\pi \in \left(\frac{1}{2}, 1\right)$, while in AA, bias remains at $\sigma_l = 1$ for low values of π and strictly decreasing in π for $\pi \geq k^{-1}\left(\frac{1-\theta}{\theta(b-1)}\right)$, where$k(\pi) = \frac{(1-\pi)\pi}{1-3\pi+3\pi^2}$ as defined before equation (2.11). Since σ_l declines in π, this establishes the first part of proposition 3.

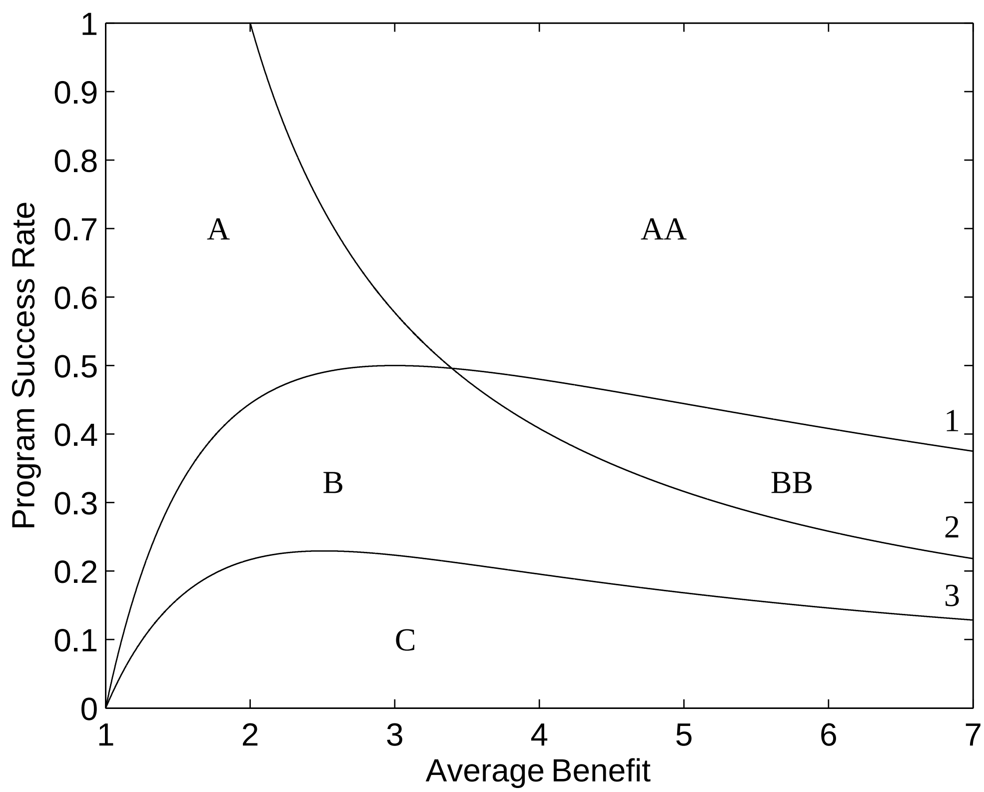

Figure B.1: Replication of Figure 2.1

Area B (BB), which lies below curve (1), indicates that $\bar{V}_h > V_l^i$ given sufficiently high π.

It lies above curve (3), indicating that the V_h^i will never be larger than V_l^i. More specifically, area B corresponds to a combination of θ and b such that there exist $\pi' \in \left(\frac{1}{2}, 1\right)$ such that σ_l is the global solution for $\pi \in \left(\frac{1}{2}, \pi'\right)$. For $\pi \in \left(\pi', 1\right)$, $\bar{V}_h > V_l^i$ and $\sigma_h = 1$ is the global solution. This is true as it was established earlier that for $\theta < \frac{2(b-1)}{b^2+2(b-1)}$, there exist a critical $\breve{\pi}' \in (2, \infty)$ such that $V_l^i > \bar{V}_h$ for $\breve{\pi} < \breve{\pi}'$, and $\bar{V}_h > V_l^i$ for $\breve{\pi} > \breve{\pi}'$. Moreover it has been demonstrated that since RHS of equation (B.5) is strictly decreasing in $\breve{\theta}$ (θ) in the relevant range; any point that lies above curve 3 implies $V_l^i > V_h^i$ for $\breve{\pi} \in (Q_2, Q_3)$. The difference between area B and area BB is that in the interior of area B, $\sigma_l < 1$ for $\pi \in \left(\frac{1}{2}, \pi'\right)$, and is strictly decreasing in π. In the interior of area BB, bias remains at $\sigma_l = 1$ for $\pi \in \left(\frac{1}{2}, k^{-1}\left(\frac{1-\theta}{\theta(b-1)}\right)\right]$. Bias equals $\sigma_l < 1$ for $\pi \in \left(k^{-1}\left(\frac{1-\theta}{\theta(b-1)}\right), \pi'\right)$ and is strictly decreasing in π before switching to $\sigma_h = 1$ for $\pi \in \left(\pi', 1\right)$. Furthermore since $\breve{\pi} \geq Q_1$ ensures $s_l < \frac{1}{\theta}$ for the interior of area BB (which involves case 1, since $\theta > \frac{1}{b}$ implies $\breve{\theta}\sqrt{\breve{b}(\breve{b}-1)} \geq \sqrt{2}$), one could show that the range of $\pi \in \left[k^{-1}\left(\frac{1-\theta}{\theta(b-1)}\right), \pi'\right]$ (the range where bias is strictly decreasing in π), is non-empty.

The interior of area C, which lies below curve (3), corresponds to parameters b and θ such that there exists $\breve{\pi}'' \in (Q_2, Q_3)$, such that for $\breve{\pi} < \breve{\pi}''$, $V_l^i > V_h^i$ and bias equals $\sigma_l < 1$, strictly decreasing in π, while for $\breve{\pi} \in \left(\breve{\pi}'', Q_3\right)$, $V_l^i < V_h^i$ and bias equals $\sigma_h < 1$, strictly increasing in π. For $\breve{\pi} \in [Q_3, \infty)$, $\bar{V}_h > V_l$ and bias $\sigma = 1$. To show that this is true, note that at $\breve{\pi} = Q_3$, $V_h^i = \bar{V}_h$. Since $V_l^i < V_h^i$ at Q_3, thus $V_l^i < \bar{V}_h$ at Q_3. It was shown that below curve (2), there exist $\breve{\pi} \in (2, \infty)$ such that $\bar{V}_h > V_l^i$ for $\breve{\pi} > \breve{\pi}'$ and $V_l^i > \bar{V}_h$ for $\breve{\pi} < \breve{\pi}'$. Evidently, $\breve{\pi}' < Q_3$, so $\bar{V}_h > V_l$ for $\breve{\pi} > Q_3$.

Appendix C

Proof of Proposition 4

To show that citizen's welfare W_l falls to a lower level at W_h at π', note first that in a case of $\theta b \geq 1$ $\pi \leq \hat{\pi}_l$, citizen's welfare $\overline{W}_l$ is strictly increasing in π. For $\pi \geq \hat{\pi}_l$ and $\pi < \hat{\pi}_h$, one needs to show that $W_l^i > W_h$ for given values of θ and b. Since $W_n^i > W_h^i$ and $W_l^i > W_n^i$ since W_l^i is strictly increasing in π and $\lim_{x \to \frac{1}{2}} W_l^i = W_n^i$, it follows that $W_l^i > W_h^i$.

For $\pi > \hat{\pi}_h$ I need to show that $W_l^i > \overline{W}_h$. The restriction $\pi > \hat{\pi}_l$ and $\pi > \hat{\pi}_h$ also implies that θ can only take values between $\left[\frac{(1-\pi)}{(b-1)\pi+(1-\pi)}, \frac{(1-3\pi+3\pi^2)}{b\pi(1-\pi)+(2\pi-1)^2}\right]$ for $b > 1$ and $\pi \in \left(\frac{1}{2}, 1\right)$. At $\theta = \frac{(1-\pi)}{(b-1)\pi+(1-\pi)}$, $W_l^i - \overline{W}_h$ simplifies to

$$\left[\frac{(2b-1)^2(2\pi-1)^2 + b^2(\pi^2(2\pi-3))}{4b(1-3\pi+3\pi^2)^2}\right]\left(\frac{(1-\pi)}{b\pi+(2\pi-1)}\right) \geq 0\,.$$

For $\theta = \frac{(1-3\pi+3\pi^2)}{b\pi(1-\pi)+(2\pi-1)^2}$, $W_l^i - \overline{W}_h$ simplifies to

$$\left(\frac{(1-3\pi+3\pi^2)}{b(1-\pi)\pi+(2\pi-1)^2}\right)\left[\frac{(1-\pi)\left(2b(-2+6\pi-5\pi^2)+(2-6\pi+4\pi^2)\right)^2}{16b(1-3\pi+3\pi^2))^2}\right] \geq 0\,.$$

Finally, one could show that $\frac{\partial^2\left(W_l^i-\overline{W}_h\right)}{\partial\theta^2} = -\frac{(1-\pi)^2}{2b\theta^3\pi} < 0$. Given that $W_l^i \geq \overline{W}_h$ at end points for permissible values of θ, as well as $\frac{\partial^2\left(W_l^i-\overline{W}_h\right)}{\partial\theta^2} < 0$ it follows by concavity that $W_l^i - \overline{W}_h \geq 0$ for $\theta \in \left(\frac{(1-\pi)}{(b-1)\pi+(1-\pi)}, \frac{(1-3\pi+3\pi^2)}{(b-1)(1-\pi)\pi+(1-3\pi+3\pi^2)}\right)$ and thus $W_l^i \geq \overline{W}_h$ holds for $\pi > \hat{\pi}_l$ and $\pi > \hat{\pi}_h$. Since the critical threshold π', lies in similar range, it follows then that $W_l^i \geq \overline{W}_h$ holds at critical value π'.

To show that for a given level of average benefit $b > 1$, there exist a positive function $\theta = f(b)$ such that for $\theta \leq f(b)$, citizen's welfare without foreign media W_n, is higher than welfare with foreign media W in a right neighborhood of π'. Recall from section 3 that for any points in area C, the presence of foreign media induces bias $\sigma_h < 1$ in a right neighborhood of π' inducing citizen's welfare W_h^i which is *strictly smaller than citizen's welfare without foreign media* W_n^i (by inspection see equation (2.17) and equation (2.18)). Denote $g(b)$ as the boundary between area B and C (curve 3); computation of section 3 shows that $\theta = g(b)$ is defined implicitly by $\frac{2b-1}{b^2} = \frac{(1-\theta)^2(1-\theta(2b-1))}{(1+\theta(b-2))(1-\theta b)^2}$. One can show $g(b) > 0$ for (b, ∞). It was established that for $\theta \leq g(b)$, $W_n^i < W_h^i$ in the right neighborhood of π'. Therefore $f(b) > g(b)$ for $b \in (1, \infty)$, which proves the second part of proposition 4.

BIBLIOGRAPHY

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[1] Acemoglu, Daron, Chernozhukov, Viktor and Yildiz, Muhamet. Learning and Disagreement in an Uncertain World, *NBER Working Paper w12648*, October 2006.

[2] Besley, Timothy and Burgess, Robin. The Political Economy of Government Responsiveness: The theory and Evidence from India, *The Quarterly Journal of Economics*, Vol. 117, No. 4 (Nov., 2002), pp. 1415-1451.

[3] Besley, Timothy and Prat, Andrea. Handcuffs for the Grabbing Hand? Media Capture and Government Accountability, *The American Economic Review*, Vol. 96, No. 3 (Jun, 2006), pp. 720-736.

[4] Brunetti, Aymo and Weder, Beatrice. A Free Press is Bad for Corruption, *Journal of Public Economics*, Vol. 87, pp. 1801-1824.

[5] Crawford, Vincent and Joel Sobel. Strategic Information Transmission, *Econometrica*, Vol. 50, No. 6 (Nov., 1982), 1431-1451

[6] Gehlbach, Scott and Sonin, Konstantin. Government Control of the Media, working paper, July 2009.

[7] Gentzkow, Matthew, Glaesar, Edward and Goldin, Claudia. The Rise of the Fourth Estate: How Newspapers Became Informative and Why it Mattered, NBER Working Paper March 2005.

[8] Gentzkow, Matthew and Shapiro, Jesse. Media Bias and Reputation, *Journal of Political Economy*, Vol. 114, No. 2 (Apr., 2006), pp. 280-316.

[9] Gentzkow, Matthew and Shapiro, Jesse. What Drives Media Slant? Evidence from US Newspapers NBER Working Paper 12707, November 2007

[10] Groseclose, Tim, and Mylio, Jeffrey. A Measure of Media Bias *Quarterly Journal of Economics*, Vol. 120, No. 4 (Nov., 2005), pp. 1191-1237.

[11] Knight, B.G., Chiang, C.-F., forthcoming. Media Bias and Influence: Evidence from Newspaper Endorsements. Review of Economic Studies.

[12] Larcinese, Valentino, Puglisi, Riccardo and Snyder James, Partisan bias in economic news: Evidence on the agenda-setting behavior of U.S. newspapers *Journal of Public Economics*, Vol. 95, (2011), pp. 11781189

[13] Macombs, Maxwell and Shaw, Donald. The Agenda-Setting Function of Mass Media *Public Opinion Quarterly* (1972) Vol. 36, Issue 2 (1972), pp. 176-187

[14] Morris, Stephen. Political Correctness, *Journal of Political Economy*, Vol.109, No. 2 (Apr., 2001), pp. 231-265.

[15] Mullainathan, Sendhil and Shleifer, Andrea. The Market for News, *The American Economic Review*, Vol. 95, No. 4 (Sep., 2005), pp. 1031-1053.

[16] Parry, Richard L. North Korea Clamps Down on Mobile Phones to Stop News of Food Crisis *The Sunday Times*, Friday, October 24, 2008.

[17] Ravallion, Martin. Famines and Economics, *Journal of Economics Literature*, Vol. 35 (Sept 1997), pp. 1205-1242

[18] Shanor, Donald R. *Behind the Lines: The Private War against Soviet Censorship*. New York: St. Martin's, 1985. Print.

[19] Snyder, James and Strömberg, David. Media Market's Impact on Politics working paper Sept. 2004.

[20] Strömberg, David. Mass media Political Competition and Public Policy, *Reviews of Economics Studies* Vol. 71, (2004), pp. 265-284.

[21] Suen, Wing. The Self Perpetuation of Biased Beliefs, *The Economic Journal* Vol. 114, (April 2004), pp. 377-396.