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Information, Media and Elections: Incentives for Media Capture

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Information, Media and Elections: Incentives for Media Capture*

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Abstract

Media play an essential role in democracy by making available valuable information for electoral decisions. In a framework of political economy of mass media, I inquiry the possibility of capture by rent-seeking officers in a heterogeneous electoral environment. This allow me to discuss when relevant information is traded, when government captures media and what effect this has on political outcomes. I find media capture to be a pervasive phenomenon which implies minimum costs on politicians' side. However, incentives to corruption decrease if the possibility of being detected is introduced, leading to a more intermediate result with respect to the one obtained by Besley and Prat (2006). I show that information is a fundamental element for electoral choices and that any attempt to increase quality of news and to reduce information's costs can have positive effects on the selection of politicians.

JEL-Classification: L82, D72, D73, D81, H10.

Keywords: mass media, information acquisition, media capture, elections, incumbency advantage.

1 Introduction

The political race to public offices is not limited to electoral competition between candidates but it includes also issues on information acquisition by the electorate. How political information is collected and selected by sources of information and when news are acquired by voters, are essential elements to be considered. In situations of uncertainty about the quality of political candidates, media outlets play an essential role by making available valuable information for electoral decisions. By learning more about candidates, voters are more likely to replace bad types with good ones. However, this may arise a risk of attempts to media's freedom. If the media are meant to discipline politicians, we would

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expect politicians to view them as a threat. In particular, if they are office-motivated they will find ways to silence critics and to foster positive coverage.

Related literature on media capture Despite the essential role played by news media in modern democracies, the economic literature only recently has started analysing the market for news. However, this literature has grown rapidly over a large range of research questions. In particular there is a growing number of contributions discussing the role and the effects of news media on political and public outcomes and inquiring the existence of distortions in the market for news. For a complete overview of the literature on the political economy of news media, there are two extensive surveys: Prat and Strömberg [25] and Sobbrio [27].

Focusing on the theoretical literature on the interaction within the media industry and between the media and other agents, an issue of particular interest has been the possibility for media to provide distort information. Media outlets may compete for the audience by presenting information in a biased way (media bias as *news slanting*) or they can be prevented from performing their informational task (*media capture*). These phenomena may prevent the functioning of the market, skew electoral competition and produce negative political outcome [1].

Regarding media bias as *news slanting*, the literature has identified two different forces creating a bias in media reporting: a supply-driven bias and a demand-driven media bias. The first arises from idiosyncratic preferences of agents involved in the production of news (ideological bias of reporters Baron [2]) whereas the second bias occurs in equilibrium because of cognitive bias of audiences (Mullainathan and Shleifer [21], Suen and Chan [11], Sobbrio [26]) or because of reputational issues in presence of heterogeneous beliefs (Gentzkow and Shapiro [18]).

On the other hand, *media capture* is linked to interaction between media and agents outside the industry. Media capture may arises from different sources. On one side, in an electoral context where agents have common interests, it may come from Incumbent candidates trying to hide their true quality in order to be re-elected or it may come from the government trying to misreport the real value of public project in order to extract tangible rents. In this sense media capture can be considered as an incumbency advantage. Besley and Prat [6] present a model of incumbency advantage and endogenous media capture stating conditions under which capture is more likely and describing the effect non political outcome. They show that in a situation of asymmetric information about the quality of candidate competing for an office, an increase in the number of news media is likely to make capture more difficult and to increase turnover of politicians. Prat and Strömberg [25] build a model of retrospective voting and endogenous coverage showing that the political equilibrium depends on how informed different social groups are and that an increase in news coverage increases on average the Incumbent's vote share and the effort of politicians towards informed groups. On the other side,

[1] See Blasco and Sobbrio [7]

media capture may come from other sources when there are no common interest among agents. If the electorate is heterogeneous, news media can collude with interest groups or lobbies (Corneo [12]) or with the richest groups of voters (Petrova [23]).

Regarding the empirical literature, there is a strong evidence that media capture exists both within and cross-country [2]. However, the nature of the evidence does not allow for strong conclusions regarding causal effects. The most convincing evidence is provided by McMillan and Zoido [20], who reconstruct the system of bribes created during Alberto Fujimori's presidency of Peru [3] providing direct evidence of the existence of capture. In their analysis they find patterns that are consistent with those of Besley and Prat [6].

My contribution and plan of the paper I provide a simple theoretical framework composed by three stages: provision of news, acquisition of information and elections. The objective is to identify which incentives exist for individuals to get informed before elections and why politicians may spend resources to control information. The model is similar to Besley and Prat [6] in which choice-relevant information is traded in a market for news before elections. In this market media outlets are specialized in gathering and transferring news to an homogeneous audience. Incumbent candidates may interact with these media outlets in order to distort information and to maximize the probability of holding their office. Differently from their setting, I consider an heterogeneous environment where voters decide whether or not to access media's contents in order to get informed about the "quality" of candidates competing in the political arena, determining endogenously a demand for news. In particular, my work analyses the endogenous acquisition of information by voters with heterogeneous costs and it shows under which conditions media capture may arise.

The work is organized as follows. In section 2 I present the model and the timing of the game. In section 3 I look for equilibrium solutions in a simplified version without media capture and with a truthful reporting monopolist media. I consider all the stages involving voters, looking for conditions ensuring the existence of equilibrium strategies in order to determine endogenously the demand for news. Then I derive equilibrium solutions respectively for media outlets' stage and politicians' stage. Comparative statics is done by changing the relevant features (parameters, number of firms, quality of signal, etc.). Finally in section 4, since equilibrium strategies obtained show the existence of incentives to corruption, I introduce the possibility of media capture. Incumbent's choice about capturing media will be influenced by the conditions defined in previous stages, since victory is determined by priors, posteriors, price and demand for news. In section 5 and **??** I derive some preliminary conclusions and sketch some possible extensions of this simplified set up.

[2] Cross-country evidence of capture: Brunetti and Weder [8]; Djankov et al. [13]. Within-country evidence of capture: Di Tella and Franceschelli [28]; Petrova [24]; Dyck and Zingales [16]; Dyck, Volchkova and Zingales [15]; Gambaro and Puglisi [17].

[3] Fujimori had been president from 1990 to 2000.

2 The Model

2.1 Set up

In a framework of electoral competition, information about candidates may affect individual decisions concerning both private resource allocation and political choices. Indeed, political news are valuable during elections because they help individuals to choose the best candidate or to anticipate the possibility of a bad one. This relevant information can be traded in a market for news by outlets specialized in gathering and transferring news.

Getting informed is however a costly activity which involves, besides a price of accessing news, opportunity costs composed essentially by time and cognitive effort. These opportunity costs of processing information can be linked to individual characteristics (such as QI and education [4]), resulting in different individuals devoting more or less time to news consumption. Exploiting this intuition, I consider an audience composed by rational individuals, heterogeneous regarding their *costs of information*, who use information as support for electoral choices and private decisions. This heterogeneity allows me to identify a group of informed individuals and a group of uninformed individuals and to derive an endogenous demand for news depending on priors about candidates' types, access-price, information costs and quality of news.

When elections come, voters have to choose between re-electing the Incumbent and choosing an Opponent. Voters are uncertain about the quality of candidates and consistently with part of the literature on media bias, I model this uncertainty as a game of imperfect information. Two states of the world are possible, a "bad" politician ($x = 1$) and a "good" politician ($x = 0$). These states corresponds to two different types of politician running for elections. The Incumbent and the Opponent have the same distribution of types: Nature selects "good" with probability $1 - p$ and "bad" with probability p. Since Incumbent's type is realized before elections and media outlets receive some information about it, individuals can update their beliefs about Incumbent's quality by accessing media's content.

Viewers Each individual derives the following pay-off when a politician of type x is in office:

$$U(x) + T \times I(a_i, x) - C_i - P_A \tag{2.1}$$

Voters derive a direct utility $U(x)$ from the type of politician holding the public office. I assume $U(x)$ to be invariant across individuals and that $U(1) = 0$ and $U(0) = 1$. This direct utility is a common evaluation of the state: a bad politician is considered by everyone as a negative situation. Due to the shared nature of this evaluation, each candidate has the incentive to signal a good state in order to be elected.

[4] In a recent paper, Vaglio and Battaggion [3] considered issues of information acquisition in an heterogeneous environment, linking opportunity costs to individual levels of information.

In addition, voters may incur in a gain in consumption conditioned by the state and by the choice of a private action a_i. If individuals correctly anticipate the state, they can overwhelm it by matching it with "correct" private actions. This additional gain in utility varies across individuals and it is expressed as an indicator function which take value 1 if the action matches the state ($a_i = x$) and zero otherwise. Moreover, the impact of choosing the correct action is set in general terms as T, which can be greater, equal or lower than the direct impact of the state.

Since media receive some information about the type of Incumbent running for the office, individuals can improve their priors by accessing news. The costs of getting informed are composed by the price of news P_A and individual costs of information C_i. We can consider P_A as an access cost and C_i as individual opportunity costs of processing news in valuable information. Voters are heterogeneous in their costs of information C_i [5] which are assumed to be uniformly distributed on a positive support.

Media Outlets Media outlets receive information about the type of Incumbent competing in the political arena and they may report it to voters by supplying news. News are assumed not to be produced and they consist just in reporting strategies of signals received by media. In this sense, it is reasonable to assume no costs of production.

According to the media capture literature (Besley and Prat [6]), media outlets receive a signal just about the negative event [6]. If the Incumbent is of bad type media outlets receive a signal $s = b$ (*true signal*) with probability q and an "empty" signal $s = \varnothing$ (a *false signal* which is the same signal as in the case of a good politician) with probability $1 - q$. The empty signal $s = \varnothing$ can be considered as the absence of news about the politician being bad [7].

Media outlets have two sources of revenues: audience-related revenues and policy-related revenues. Each of them refers to the interaction of media outlets with their audience [8] and with the Incumbent.

$$\text{audience-related revenues } = P_A \times D(C_i, P_A, news) \tag{2.2}$$

$$\text{policy-related revenues } = y \tag{2.3}$$

Audience-related revenues are standard in the literature and they depend on the price of the service,

[5] These costs may depend on individual characteristics. Intuitively and consistently with the previous intuition, acquiring information on the political state is a costly activity in terms of time, effort and individual capabilities. A good proxy for these costs can be the inverse of individual education: education reduces the costs of acquiring information in terms of psychic costs, effort and time. See Vaglio and Battaggion [3].

[6] I considered also the possibility of a framework with a double-signal structure. However I do not present results on this alternative setting since they do not add any useful insight.

[7] In this framework q is treated as an exogenous variable. In a possible extension, it could be interesting to consider q as the result of a investment decision and let it be part of the media's maximization strategy.

[8] I do not consider a specific kind of audience. Media outlets considered can be of any kind (newspaper, television, radio, etc.). I usually refer to media's audience as *viewers*. However this term, doesn't imply any restriction to the kind of audience. Sometimes I use the terms *consumers, individuals* and *voters* to name audience.

the fixed price of accessing media content P_A, and the demand for news. By assuming that each individual can just "consume" one piece of information, the demand for news can be identified with the number of individuals willing to pay for accessing the media content given the price, their information costs and quality of news.

On the other side, *policy-related* revenues derive from the interaction between media outlets and politicians in office. These revenues are introduced when there is possibility for media to non-truthfully report signals and when politicians have means and incentives to capture outlets. They can offer a "bribe" y to each outlet: y is set in general terms and it may represent monetary bribes but also any other attempt to silence critics and to foster positive coverage. For each outlet, y has value 0 when the bribe is refused and it is positive otherwise.

Politicians Several motivations can explain why politicians compete for holding public offices. They can be moved by policy outcomes and they desire to implement their preferred policies because of ideology or to favour special interest groups (*partisan politicians*); others may seek personal satisfaction from being in power or merely seek the benefits of holding the office (*opportunistic politicians*).

The issue of motivation has been prominent in the study of elections which has tried to understand whether candidates view public office as a mean or as a goal in itself. One stream of literature, following Hotelling [19] and Downs [14] considers opportunistic *office-motivated* and *rent-motivated* candidates, whereas an opposite stream proposed by Wittman [29] [30] Calvert [10] and Alesina [1] considers them as *policy-motivated* and partisan. Recently, this diarchy of opposite views has been criticized by Persson and Tabellini [22] as an imperfect understanding of ideology in politics. They argue that either *opportunism* or *partisanship* is always the best assumption and that the two are not necessarily mutually exclusive, rising new attention to the issue of motivations. A new stream of models tried to respond to the challenge posed by Persson and Tabellini, integrating both office motivations and policy motivations (see Besley and Ghatak [5] and Callander [9]) [9].

In this model I consider a situation of opportunistic *rent-seeking* politicians, who care about winning the election but also about extracting tangible rents for themselves [10]. By assuming politicians to be rent-seeking officers, it is possible introduce incentives to capture media in order to give a certain signal, since these officers just care on the probability of being re-elected and not on the policies they have to implement.

The possibility of media capture, is an exclusive feature of incumbency, one of the structural advantages of candidates in office over challengers during elections. Even if the Challenger [11] has the same prior probabilities on states, he has no means to influence media's reports and always acts as as a *passive agent* . In this framework, Incumbent's pay-offs are

[9] For a complete discussion of the literature on political motivation see Persson and Tabellini [22] and Besley [4].
[10] See chapter 4 in Persson and Tabellini [22]
[11] I refer to the candidate challenging the Incumbent both as Opponent and as Challenger.

$$R - \sum_{j=1}^{n} y_j \tag{2.4}$$

The Incumbent gets a positive rent R if elected and 0 otherwise; in both cases, he has to subtract the total cost of bribing if he decides to corrupt media outlets. The total cost of bribing is the sum of bribes y_j accepted by each outlet j. Since the bad state reduce utility of all voters, the Incumbent has the incentive to capture media in order to give a positive signal and to maximize the probability of being elected; however he will corrupt media only if the net rent from holding the office $R - \sum y_j$ is positive [12]. In addition to the costs of bribing, a politician can incurs in the possibility of being detected and punished while corrupting media.

2.2 Timing

The game can be summarized as follows. There are three stage, one for each kind of actor, namely politicians, media outlets and voters. Voters' stage is composed by three different sub-stages.

- Stage 1: Politicians Stage: Incumbent's Capture strategies
- Stage 2: Media Stage: Pricing and Reporting strategies
- Stage 3: Voters Stage: Information Decision, Action Choice and Election

The timing of the game is the following:
- Nature selects Incumbent's type (B or G); the Incumbent and media observe signals this type;
- the Incumbent decide whether or not to corrupt media by offering a bribe;
- media decide their reporting strategies: to accept the bribe or to truthfully report the signal;
- voters decide ether or not to get informed; informed voters observe the report and update beliefs;
- all individual chooses private actions;
- elections are held between the Incumbent and an Opponent; the elected politician implements policy according to his type (pay-offs realization);

I characterize perfect bayesian equilibria of this game, solving backward the stages for voters, media outlets and politicians.

3 Equilibrium under Truthful Reporting

I start with a simplified version of the model where I eliminate the possibility of capture by taking for granted that media have a strategy of truthful reporting of signals ($r = s$) and by assuming the

[12] Obviously, R has to be expressed in expected terms and has to be conditioned on the probability of being elected.

absence of revenues other than market profits (no policy-related revenues). Hence, in all stages, I just consider signals and I do not take into account the choice of Incumbent to bribe or not media outlets. Both the Incumbent and the Opponent act as passive agents. Moreover, media market is assumed to be non-competitive: I consider a monopolist media outlet that maximizes profits from the sale of news by choosing an optimal access price to its content (P_A). This simplified model is fundamental to check if it is possible to find the conditions needed to guarantee incentives for the Incumbent to corrupt media, once policy-related revenues are introduced, and it will be used as a benchmark.

3.1 Voters

I consider all the stages involving voters, looking for conditions ensuring the existence of equilibrium strategies. At first, each individuals have to decide whether or not to be informed, taking into account costs and benefits from accessing news; secondly, they have to decide which private action to choose, knowing that it will interact with the type of the politician elected; finally, they have to select which candidate they should vote for. It is important to point out that the electoral stage involves a simple model of retrospective voting with no pivotal considerations and no individual preferences for candidates or parties (*sincere voting*). Voters compare candidates just on the base of expected utilities from their types [13]. Moreover, I exclude the presence of costs of voting and the possibility of abstention [14].

3.1.1 Electoral stage

At the electoral stage voters have to choose between two competing candidates with a certain probability of being of bad type: the Incumbent and an Opponent. As already stressed, they vote sincerely for the candidate providing the highest expected utility. Expected utilities depend on priors and signals about the type of politicians competing. The distribution of types is the same for the two candidates; however, Incumbent's type is realized before the electoral stage and voters can access information about him through media reports. The main difference between the expected utility from the Incumbent (EU_I) and the expected utility from an Opponent (EU_O) is that the first must incorporate the information received from media, if voters are informed. Individual actions are taken before the electoral choice and are considered as given at this stage.

Since only a part of voters acquire information, I distinguish between uninformed individuals and informed ones: in the first case the expected utilities from Incumbent and Opponent are equal since there is no update, the two politicians have the same distribution of types and are no no ideological preferences. By assuming that individuals vote just considering expected utility without taking into

[13] The baseline of the election game is a pure adverse-selection model where the policy outcome is a function solely of the politician's type.

[14] Every individuals will be voters. Hence, I use the two terms has synonymous.

account the probability of victory of candidates (no pivotal voting strategy), the only reasonable behaviour for uninformed voters is the mixed strategy of voting with 50% of probability for each candidate [15]. On the other hand informed individuals condition their choice on the report received from media by updating their prior beliefs.

[Figures B.1 and B.2]

In the simplified version of the model I consider a situation of *truthful reporting* ($r = s$) where each media report the signal received about Incumbent's type. In this situation, I consider signals s instead of reports r also in voters' stages.

Equilibrium strategies in the electoral stage are obtained assuming standard values for the probability of negative event (p) and for quality of reports (q) and assuming $T \in (-1, 1)$. The latter condition implies that the impact of private action $I(a_i, x)$ is inferior (in percentage) with respect to the direct impact of the state on utility. I describe the equilibrium voting behaviour for informed individuals in the following proposition:

Proposition 1. *Given probability $p \in (0, 1)$ and probability $q \in (0, 1)$ and assuming $T \in (-1, 1)$, an informed individual prefers - and thus votes - the Opponent if he receives a report $r = b$; instead he prefers the Incumbent if he receives a report $r = \varnothing$.*

[see proof A.1 in the appendix]

Proposition 1 states that an informed individual does not vote for the Incumbent if he receive *bad news* about him. In case of absence of bad news, he is is willing to re-elect him. This kind of behaviour is essential to induce media capture by politicians: since voters prefers the Opponent if they receive a signal about the Incumbent being bad, the latter has an incentive to silence media in order to increase the probability of winning the election.

3.1.2 Action Choice stage

From the electoral stage, under the assumption of $p \in (0, 1)$ $q \in (0, 1)$ and $T \in (-1, 1)$ (see proposition 1), I know that individuals will vote for the Opponent if they receive news about the Incumbent being of bad type, whereas uninformed individuals will prefer the Incumbent with 50% probability.

[Figures B.3 and B.4]

[15] It is possible to relax this assumption by considering a more general mixed behaviour, but it will complicate the analysis without adding any insight.

At this stage individuals choose their private actions in order to compensate the possibility of a negative state. If the state is bad they should set $a_i = b = 1$ and $a_i = g = 0$ otherwise. In choosing their action informed individuals take into account their expected utility conditioned on the report received from media and their behaviour in the electoral stage; uninformed individuals condition their choice on priors. In the following proposition I derive equilibrium strategies with regards to action's choice. Assumptions on priors and signal's quality are identical to those in proposition 1, whereas I slightly modify the condition on the impact of private action (T), assuming it to be positive and inferior (in percentage) with respect to the direct impact of the state on utility.

Proposition 2. *Given probability $p \in (0,1)$ and probability $q \in (0,1)$ and assuming $T \in (0,1)$, an individual will choose his private action according to the information received, the probability of negative event and the quality of media's signal:*

1. *If $s = b$, informed chooses*
   - *(a) $a = b$ if $p > 1/2$*
   - *(b) $a = g$ if $p < 1/2$*
2. *If $s = \varnothing$, informed chooses*
   - *(a) $a = b$ if $p > 1/2$ and $(1-p) < p(1-q)$*
   - *(b) $a = g$ if $p < 1/2$ and $(1-p) > p(1-q)$*
   - *(c) $a = g$ if $p < 1/2$*
3. *Uninformed chooses*
   - *(a) $a = b$ if $p > 1/2$*
   - *(b) $a = g$ if $p < 1/2$*

[see proof A.2 in the Appendix]

To summarize, from the electoral stage imposing that $p \in (0,1)$ $q \in (0,1)$ and $T \in (-1,1)$ I know that individuals will vote for the Opponent if they receive news $r = b$ and they will re-elect the Incumbent if $r = \varnothing$. Moving to the action choice stage, I discovered that dominant strategies exist only if I consider separately a situation of highly probable negative events ($p > 1/2$) and a situation of unlikely negative events ($p < 1/2$) [16]. Hence from now on, I consider these two situation separately looking for equilibrium behaviours. If the negative state is very unlikely, informed individuals do not

[16] I overlook the threshold case of $p = 1/2$.

take into account the report received and they behave as uninformed by choosing always $a_i = g = 0$. Instead, in case of a high probability of realization of the negative state the kind of report becomes important: if they receive bad news about the type of the Incumbent ($r = b$), the report will very likely be correct and it will be better to act consistently ($a_i = b = 1$); if individuals don't receive news about the Incumbent being bad when is likely that the state is b , the quality of signal q[17] should be high to believe the report. Hence, in case of highly probable negative events, informed individuals act accordingly to the report only if the probability of receiving the wrong signal is sufficiently low ($p(1-q) < 1-p$); vice versa, they act as uninformed by choosing always $a_i = b = 1$.

3.1.3 Information stage

Information stage concerns individual choice about getting informed. Since information is a costly activity, some individuals may find profitable to remain uninformed. For voters with sufficiently high costs of information, these may overcome the gains of being informed. Costs are composed by two parts: in addition to a *fixed access price* P_A set by media, individuals have to sustain *individual information costs* C_i when they decide to get news. Information costs are a fundamental in this theoretical settings since they represent the element of heterogeneity. Information costs are heterogeneous across individuals and they can be thought as linked to personal characteristic (education, as example). At this point, I distinguish expected utility of an uninformed individual from that of informed one by introducing costs of information and compute them exploiting equilibrium strategies derived in the previous stage [18].

Expected utility of informed individuals Informed individuals vary in their information costs C_i. Their expected utility depends on the state, on private actions and on the signal received by media,[19] having assumed truthful reporting. If individuals are informed, they should have found convenient to sustain the costs of information in order to condition their choice on the news they have accessed and to update their beliefs about the Incumbent.

$$EU(s,\, a,\, x) - C_i - P_A \tag{3.1}$$

where $EU(s,\, a,\, x)$ is the expected utility from candidate of type x conditioned on the received signal/report s and given action a.

[figure B.5]

[17] Recall that in the simplified version $r = s$.

[18] When I compute these utilities I consider two different cases: a situation of high probability of the bad state ($p > 1/2$) and a situation of low probability of the bad state ($p < 1/2$). By considering these two situations separately, I am able to derive the expected utilities since I know voters equilibrium strategies for the other voters' stages (individual action and electoral choice).

[19] Since report and signal don't diverge $r = s$.

Informed individuals base their choice both on the distribution of Incumbent's types and on news' content. Differently from uninformed individuals, they take into account the kind of signal received (s) and its quality (q).

Lemma 1. *Given $p \in (0,1)$, $q \in (0,1)$ and $T \in (0,1)$, the expected utility of an informed individual is:*

- (CASE A) $EU = pq[(1-p) + T(1-p)] + (1-p)[1+T] - C_i - P_A$ if $p < 1/2$
- (CASE B) $EU = pq[(1-p) + Tp] + (1-p)[1+T] - C_i - P_A$ if $p > 1/2$ and $(1-p) > (1-q)p$
- (CASE C) $EU = pq[(1-p) + Tp] + p(1-q)[T] + (1-p) - C_i - P_A$ if $p > 1/2$ and $(1-p) < (1-q)p$

[see proof A.3 in the Appendix]

Expected utility of uninformed individuals There are no differences among uninformed individuals: by not reading, individuals have not to sustain information costs (heterogeneous element). In this case there is no possibility of update since no report is received.

$$EU(a,\, x) \tag{3.2}$$

where $EU(a,\, x)$ is the expected utility from candidate of type x given action a.

[figure B.6]

In the electoral stage, uninformed voters are assumed to vote 50% for the Incumbent and 50% for the Opponent since there are no preferences other than the utility derived from the type of politician elected and the expected pay-off of matching private actions. Without information, the expected utility from the two candidate is the same and it is realistic to assume that individuals choose this mixed strategy. Hence, the only "decision" is about private actions ($a = g$ or $a = b$).

Lemma 2. *Given $p \in (0,1)$, $q \in (0,1)$ and $T \in (0,1)$, the expected utility of an uninformed individual is*

- $EU = (1-p) + Tp$ *if* $p > \frac{1}{2}$
- $EU = (1-p) + T(1-p)$ *if* $p < \frac{1}{2}$

[see proof A.4 in the Appendix]

In each case, I know what individuals will do and which are their expected utilities. Voters are heterogeneous in their costs of processing news C_i and this determines that a share of them will find convenient to acquire information since their expected utility is greater than in case of no information. To be this the case, I need expected utility of informed, included all information's costs, to be grater than the expected utility of informed at least for some value of C_i. Essentially, I check that the difference between the two expected utilities is greater than zero, since both P_A and C_i are positive; after that I find the cost C_I (one for each case) making the individual indifferent. Indifference conditions obtained will determine the demand for news in the three situations and they will be used in the maximization problem of media.

Lemma 3. *Given $p \in (0,1)$, $q \in (0,1)$ and $T \in (0,1)$, the cost identifying the individual indifferent between acquiring news or remaining uninformed is*

- *(CASE A)* $C_I = p(1-p)q(1+T) - P_A$ *if* $p < \frac{1}{2}$
- *(CASE B)* $C_I = p[q(1-p) + T(p-2)] + T - P_A$ *if* $p > \frac{1}{2}$ *and if* $(1-p) > (1-q)p$
- *(CASE C)* $C_I = p(1-p)q(1-T) - P_A$ *if* $p > \frac{1}{2}$ *and if* $(1-p) < (1-q)p$

[see proof A.5 in the appendix]

3.2 Media Outlets

Media outlets process information in news that can be purchased by voters. Outlets receive a signal s about Incumbent's type before the electoral stage and they make a report r about this signal to informed voters. At this stage, media outlets should decide their report strategy (r) and their access price (P_A) in order to maximize both market-profits and revenues coming from the Incumbent. However, in the benchmark model, I focus just on the decision about prices, ruling out the possibility of capture by government. Media outlets follow a strategy of *truthful reporting* of signals ($s = r$) and they receive just market-profits (audience-related revenues). The demand of news is derived endogenously as the share of informed individuals [20].

The framework considered is a non-competitive market for news with one monopolist media outlet. I first derive the demand for news and the maximization strategy of the outlet. In the process of producing news the outlet does not incur in costs of production and its activity is just to report signals

[20] By assuming that each informed individual can "consume" just one piece of news, the number of individuals willing to acquire information (signal's report) can be a proxy for the demand for news, given price P_A, their information costs C_i and the quality of news q.

received about Incumbent's type: the monopolist media outlet maximizes profits by setting an optimal access price to its contents. Secondly, I consider the effects of changes in priors, quality of signals and heterogeneity of individuals on equilibrium quantities and prices. Finally I consider a more specific case with a distribution of costs on a unitary support.

3.2.1 Demand for news and Profit's maximization

In the previous section, I obtained the cost C_I identifying the individual indifferent between acquiring information or remaining uninformed . Given C_I , it is possible to identify voters willing to get informed as those individuals with a cost inferior to C_I . The share of informed individuals is therefore computed as the cumulative density function of C_I . I assume C_i to be uniformly distributed on a positive support, with a minimum cost of information a and a maximum cost b [21] . Each cost C_i has a density of $\frac{1}{b-a}$. The extent of the support $(b-a)$ can be seen as the degree of heterogeneity among individuals.

By assuming voters to consume just one piece of news, I can consider the share of informed individuals as the demand for news. If in all cases it exists a cost C_I associated to the individual indifferent between acquiring information or remaining uninformed, I can express the demand for news as the cumulative density function $CDF(C_I)$.

Lemma 4. *(Demand for news)*
Given $p \in (0,1)$, $q \in (0,1)$, $T \in (0,1)$ and positive heterogeneous costs of information distributed uniformly, the demand for news faced by the monopolistic media outlet is:

- *(CASE A)* $\quad demand = \frac{p(1-p)q(1+T)-P_A-a}{b-a}$ *if* $p < \frac{1}{2}$
- *(CASE B)* $\quad demand = \frac{p[q(1-p)+T(p-2)]+T-P_A-a}{b-a}$ *if* $p > \frac{1}{2}$ *and if* $(1-p) > (1-q)p$
- *(CASE C)* $\quad demand = \frac{p(1-p)q(1-T)-P_A-a}{b-a}$ *if* $p > \frac{1}{2}$ *and if* $(1-p) < (1-q)p$

In all cases demand for news is increasing in the quality of signal q and decreasing in access price P_A. Moreover, demand depends on the degree of heterogeneity $(b-a)$. [22]

In order to ensure that demand is positive - which means to have proper shares of informed and uninformed individuals - I have to impose conditions on the lower bound of information costs a and a limit on prices. [23]

By now I consider the maximization of audience-related revenues by the monopolist media, given the demand for news obtained in lemma 4.

[21] $C_i \sim U(a,b)$ with $a \geq 0$
[22] For a complete description of these effects an extra Appendix is available upon request.
[23] For a detailed analysis of these restrictions an extra Appendix is available upon request.

In order to maximize its market profits, the monopolist set an optimal access price P_A^* to its content which is a function of relevant parameters and degree of heterogeneity as stated in the following proposition.

Proposition 3. *(Optimal price and optimal quantity)*
Given $p \in (0,1)$, $q \in (0,1)$, $T \in (0,1)$ and positive heterogeneous costs of information $C_i \sim U(a,b)$, the monopolistic media outlet fixes the profit-maximizing price P_A^* to:

- (CASE A) $P_A^* = \frac{p(1-p)q(1+T)-a}{2}$ if $p < \frac{1}{2}$
- (CASE B) $P_A^* = \frac{p[q(1-p)+T(p-2)]+T-a}{2}$ if $p > \frac{1}{2}$ and if $(1-p) > (1-q)p$
- (CASE C) $P_A^* = \frac{p(1-p)q(1-T)-a}{2}$ if $p > \frac{1}{2}$ and if $(1-p) < (1-q)p$

[see proof A.6 in appendix]

In all cases prices are increasing in the quality of the signal q and they take into account the probability of states of nature and the minimum cost of information a . Profits and optimal quantities are affected in the same way with respect to the quality measure q and in addition they take into account the degree of heterogeneity - measured by $(b-a)$ - of individuals [24]. Prices, quantities and profits are positive if some requirements are met: in order to obtain an informed share included between 0 and 1, optimal prices must satisfy the conditions stated for news' demand [25]. In particular, restrictions are imposed on the support of information costs' distribution (a and b) by requiring a minimum degree of heterogeneity among voters.

3.2.2 Profits' maximization with $C_i \sim U(0,1)$.

So far I considered a general situation of a unit mass of individuals heterogeneous which are distributed uniformly over a generic positive support (a,b). As previously stated, this set-up requires further conditions on a and b in order to guarantee that the demand for news is positive and that a share of uninformed individuals exists [26]. These restrictions complicate the analysis by increasing the number of conditions required without adding any important insight. In order to simplify the analysis I consider a special case: a uniform distribution with a unitary support. In this setting it means to consider a uniform distribution of information costs $C_i \sim U(a,b)$ with $a = 0$ and $b = 1$.

Lemma 5. *(Modification of proposition 3)*
Given $p \in (0,1)$, $q \in (0,1)$, $T \in (0,1)$ and heterogeneous costs of information $C_i \sim U(0,1)$, the monopolistic media outlet obtains positive profits by fixing the profit-maximizing price P_A^* to:

[24] For a complete description of these effects an extra Appendix is available upon request.
[25] Extra appendix upon request.
[26] Extra appendix on request.

- (CASE A) $P_A^* = \frac{p(1-p)q(1+T)}{2}$ if $p < \frac{1}{2}$
- (CASE B) $P_A^* = \frac{p[q(1-p)+T(p-2)]+T}{2}$ if $p > \frac{1}{2}$ and if $(1-p) > (1-q)p$
- (CASE C) $P_A^* = \frac{p(1-p)q(1-T)}{2}$ if $p > \frac{1}{2}$ and if $(1-p) < (1-q)p$

This simplification does not change results of previous stages since it just affects the computation of optimal prices and profits in the media's stage. With this distribution, the level of heterogeneity is sufficient to obtain, after maximization, an informed share $S_I \in (0,1)$ and an uninformed share $S_U = 1 - S_I \in (0,1)$ in all cases and for every $p \in (0,1)$, $q \in (0,1)$ and $T(0,1)$ [27].

3.3 Politicians

Having defined equilibrium strategies for voters and media, it is possible to determine expected share of votes for the two candidate. In particular, I am able to obtain ex-ante expected shares of votes and ex-post share for the Incumbent after having observed the signal. In the simplified version of the model both the Incumbent and the Opponent can't modify their type and they can't interfere with the provision of news. Since they are unable to exert effort in order to improve their probability of victory, they act as *passive agents*. When the possibility of media capture will be introduce, Incumbent's objective will be re-election and to extract the maximum tangible rent for himself.

3.3.1 Expected shares of votes from informed group and uninformed group

In a deterministic retrospective voting model it is possible to determine the probability of victory of one candidate by "counting" how many voters prefer him to his challengers. In this model, I determine the number of votes for each politician by considering equilibrium strategies identified in the electoral stage. I keep the distinction between uninformed individuals and informed ones and I derive for each candidate his share of expected votes ex-ante and ex-post.

Lemma 6. *(Expected votes from uninformed share [28]) From the uninformed group, the Incumbent and the Opponent expect the same number of votes, namely half of the uninformed share:*

$$\frac{S_U}{2} = \frac{1-S_I}{2} \tag{3.3}$$

[27] Extra appendix on request.

[28] In this case ex-ante and ex-post expected shares of votes coincide. These votes are expected due to the fact that the composition (in terms of dimension of the groups) depends on priors.

Uninformed individuals obtain the same expected utility from the Incumbent and from the Opponent [29]. In absence of elements different from expected utility (I don't consider the possibility of ideological preferences or party affiliation), uninformed individuals vote using a mixed strategy, choosing the Incumbent in the 50% of cases and the Opponent in the remaining 50%. On the basis of this behaviour, each candidate will obtain half of the votes of the uninformed group.

Differently, informed individuals receive from media additional information on the realization of Incumbent's type and they condition their electoral choice on news. If the they receive bad news ($r = b$) they vote for the Opponent; if instead they don't receive bad news ($r = \varnothing$) they vote for the Incumbent [30].

Lemma 7. *(Ex-ante Expected votes from informed share [31]) The Incumbent and the Opponent have an expected share of votes from the informed group that depends on news :*

$$\textit{Opponent's share} = S_I \times pq \tag{3.4}$$

$$\textit{Incumbent's share} = S_I \times [p(1-q) + (1-p)] \tag{3.5}$$

[See proof A.7 in the Appendix]

3.3.2 Expected shares of votes

By considering both votes coming from the uninformed share and those from the informed one, it is possible to assess the expected number of votes for each candidate. These ex-ante expected shares of votes are obviously functions of the composition of the electorate (S_I and S_U), the probability of negative event and the quality of news. In a framework of truthful reporting media and passive politicians, there is possibility for both candidates to win the office. In Lemma 8 and Propositions 4 and 5, I assess under which conditions the expected share of one candidate exceeds the 50%+1 of votes - namely when it is greater than $\frac{1}{2}$ - making him the winner (probability of victory equals 1). I also compute ex-post shares of votes, which will be used in the next section.

[29] The two candidates have the same prior probabilities on types and uninformed individuals condition they private actions just on the probability of negative event.

[30] This electoral behaviour has been derived as equilibrium strategy in section 3.1.1.

[31] Ex-post expected votes will differ in this case, since Incumbents know the realization of signals. If media receive a signal $s = \varnothing$, in case of truthful reporting, he expect to be voted by the whole informed group; instead, if $s = b$ he expect to obtain no votes from the informed group.

Lemma 8. *(Ex-ante Expected Votes)*
Each candidate competing in the electoral arena has an expected share of votes which depend on the probability of negative event (p), on the quality of signals (q) and on the composition of the electorate (S_I and S_U). These expected shares of votes are, respectively:

$$V_O = \frac{1-S_I}{2} + S_I \times pq \tag{3.6}$$

$$V_I = \frac{1-S_I}{2} + S_I \times [p(1-q) + (1-p)] \tag{3.7}$$

The difference between votes received by the Incumbent (V_I) and those obtained by the Opponent (V_O) lays in the share coming from informed individuals. Informed individuals are those conditioning the electoral choice on news and their votes are influenced by changes in types' distribution and quality of signals.

If the probability p of bad type increases (ceteris paribus) it affects both the share of votes going to the Incumbent and those received by the Opponent: pq and $p(1-q)$ increases but $(1-p)$ decreases, making the overall effect on Incumbent's votes depending on which effect prevails.

If the reduction in $(1-p)$ is stronger than the increment of pq , an increase of negative state's probability implies an increase of votes received by the Opponent and reduction of those received by the Incumbent. A rise in signal's quality (ceteris paribus) benefits the Opponent since since pq increases and $p(1-q)$ decreases.

Looking at each different cases, it is possible to disentangle this ambiguity and to assess which effect prevails. In particular, I consider separately a situation of low probability and a situation of high probability of the negative event.

Proposition 4. *(Low Probability of Bad Type $p < \frac{1}{2}$).*
The Incumbent wins elections if the negative event has a low probability of realization, i.e. if $p < \frac{1}{2}$.

[see proof A.8 in the Appendix]

Proposition 5. *(High Probability of Bad Type $p > \frac{1}{2}$).*
In case of highly prob. negative event ($p > \frac{1}{2}$), the Opponent wins elections if the quality of signals is sufficiently high, i.e. if $q > \frac{1}{2}$.

[see proof A.9 in the Appendix]

It is fundamental to notice that the quality of signals has a "double" effect: an increase in q increments Opponent's votes (see Proposition 5) and situations in which individuals condition their private actions to news (Case B), as stated in the following corollary.

Corollary 1. *(Effect of quality on actions) The higher is the quality of signals the more "often" individuals condition their private actions on news received (Case B).*

[see proof A.10 in the Appendix]

Propositions 4 and 5 and Corollary 1 state, respectively, under which conditions the Incumbent and the Opponent wins with certainty and which are the effect of better signals in case of highly likely negative events. Quality intervenes both on winner's selection and on voters' behaviour. A "high" q ($q > \frac{1}{2}$) increases Opponent's probability of victory if $p > \frac{1}{2}$ since it makes more likely to receive a negative news. Moreover, a "high" q reduces the range of p (it is required a higher p) supporting the case of no-influence of signals on actions (case C). With high-quality news, individuals choose an indiscriminate behaviour $a = b$ only if the negative event is very likely.

Notice that the ex-post share of votes are deterministic: if $s = b$ the Opponent receives votes from the informed group and half from the uninformed group, winning with certainty; the opposite hold in case of $s = \varnothing$.

4 Media Capture: Incentives

[very preliminary]

What happens when the possibility of media capture is introduced? Does the Incumbent have any incentive to spend resources in corrupting media? When a media should accept bribing and when refuse it? There exist a trade-off between audience-related revenues and policy-related revenues? All this question are fundamental in order to assess under which conditions media capture may arise. I allow the Incumbent to offer media a compensation for silencing negative signals. I first analyse what happens to expected shares of votes when the monopolist outlet is captured, in order assess whether or not this may change chances of victory for the Incumbent. Then, I check if the Incumbent has the incentives to invest part of the rent in corruption even in presence of a possibility of and for which level of bribing media silences negative signals.

4.1 Expected Shares of Votes

What happens to expected shares of votes when the monopolist media is captured? Having the only existing media outlet corrupted means that the only report is $r = \varnothing$. This implies that all informed individuals vote for the Incumbent:

$$V_I = \frac{1}{2} + \frac{1}{2} S_I \tag{4.1}$$

In this case, the Incumbent wins elections with certainty if at least on voters is informed. Instead, the Opponent looses for sure, since he receives just half of the votes of uninformed individuals:

$$V_O = \frac{1}{2} - \frac{1}{2} S_I \tag{4.2}$$

4.2 Incentive to Capture

Obviously, the Incumbent has the incentive to corrupt media if there are some informed voters and if media receive a negative signal. However, when it is profitable for him? Benefits from corruption have to overcome costs, that is the rent from holding the office R has to be greater than the necessary amount of bribes:

$$\begin{aligned} R &> bribes \\ R &> \sum_{j=1}^{n} y_j \end{aligned} \tag{4.3}$$

In addition to the amount of bribes paid the Incumbent may run into other costs of corruption, namely the possibility of being detected. If a politician is caught corrupting and silencing media, it is reasonable to assume that he will incur in some forms of punishment. Here the punishment is the removal from the office and the loss of all benefits. The more politicians corrupt media, the more evidence is possible to collected against them. I call γ the probability of detection and I assume it to be an increasing function of the number of media captured n_c: $\gamma = 0$ if $n_c = 0$ and $\gamma \to 1$ as $n_c \to \infty$. This implies that costs of corruption are increasing in the number of media outlets.

Hence, the Incumbent faces a trade-off between increasing his probability of victory by corrupting media and decreasing the probability of being detected.

$$\begin{aligned} R * prob(V_I > \frac{1}{2}) - \sum_{j=1}^{n} y_j \quad -R\gamma &> \quad 0 \\ R * (p_{victory} - \gamma) \qquad &> \qquad \sum_{j=1}^{n} y_j \end{aligned} \tag{4.4}$$

where $prob(V_I > \frac{1}{2}) = probability\, of\, victory = p_{victory}(n_c,\, s)$.

In case of monopoly

$$\begin{aligned} R * prob(V_I > \frac{1}{2}) - y \quad & -R\gamma > \quad 0 \\ R\left(p_{victory} - \gamma\right) \quad & > \quad y \end{aligned} \tag{4.5}$$

When media outlets accept bribes? In this framework, individuals don't make any distinction between news and the demand for information is not affected by the kind of report. Outlets accept to be captured for any value greater than zero since there is no real trade-off between market profits and policy-related revenues (bribes).

$$y_j > 0 \tag{4.6}$$

If the only condition on bribes is non negativity, the equilibrium strategy for the Incumbent is to set a bribe enough close to zero in order to preserve his rent. Hence the Incumbent should corrupt an optimal number of media n_c^*, sufficient to have

$$R * (p(n_c^*) - \gamma(n_c^*)) \quad \gtrapprox \quad 0 \tag{4.7}$$

$$p(n_c^*) \quad > \quad \gamma(n_c^*) \tag{4.8}$$

In case of monopoly it is always the case that $p_{victory} > \gamma$ in case of media capture. This pessimistic result predicts media capture under monopoly in any situation different from the case of low probability of negative event ($p < \frac{1}{2}$).

When the number of media outlet increases it is possible to obtain an intermediate result where the Incumbent corrupts a sufficient number of media in order to be re-elected and not detected. For the time being I can only assess that there is always room for media capture and that as the number of outlets increases there is no incentive to corrupt the whole market. A further analysis on the shape of $p_{victory}$ and of γ should tell us if there exist situations under which it does not exists a n_c^* such that $p(n_c^*) > \gamma(n_c^*)$. .

5 Preliminary Results and Conclusions

[very preliminary and incomplete]

The model developed so far produces a number of predictions on the relationship between the media industry, the electorate and political candidates.

The main conclusion is that information is a fundamental element for electoral choices and that any attempt to increase quality of news and to reduce information's costs can have positive effects on the selection of politicians. Quality intervenes both on winner's selection and on voters' behaviour. A "high" quality ($q > \frac{1}{2}$) increases Opponent's probability of victory in case of high probability of a bad Incumbent, since it makes more likely to receive a negative news. Moreover, with high-quality news, individuals condition more their actions on information and they choose an indiscriminate behaviour only if the negative event is very likely.

Regarding the possibility of media capture, my result both confirms and contradicts the one obtained by Beasley and Prat [6]. They found that "*media pluralism provides effective protection against capture*" since incentives to capture the media market decrease as the number of outlets increases. Indeed they assume individuals to prefer and buy only informative news ($r = b$) [32] and that once reported, news become public. The conclusion is that to make capture effective an Incumbent has to bribe the whole market. Hence, as number of outlets increases also costs of corruption increase, making capture less likely. In this way they obtain a dichotomous result: the media industry is independent or it is capture.

Instead, I obtain an intermediate result: as the number of outlets increases, it exists an optimal level of corruption which does not coincide with the whole market. If the possibility of detection is included, the Incumbent faces a trade-off between increasing the probability of winning the office and being punished. Further analysis on the effect of capture on these two probabilities and on the effects of competition is needed.

Differently from what Besley and Prat [6] state, there is always incentive to corruption and media market is never completely independent. This pessimistic result predicts complete media capture under monopoly in any situation different from the case of low probability of negative event ($p < \frac{1}{2}$).

Hence, the possibility of media capture is an important issue we should worry about. Since it is robust to increases in competition, it is fundamental to induce media outlets to privilege accuracy over remunerations from news's distortion in order to reduce incentives to corruption.

The analysis developed here is simple, and much remains to be done to obtain a complete picture of the issues involved.

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Appendix

A Proofs of lemmas and propositions

A.1 Proof of proposition 1

The proof is twofold. First I compute expected utilities for informed voters given individual actions. Secondly I look for equilibrium strategies. Information received about the Incumbent is incorporated in the update of types probability: in case of informed individuals I use posteriors for computing the expected utility from Incumbent. In the expected utilities from the Opponent I use priors.

1. *If the signal is $s = b$ posteriors are:*

$$pr(b|s=b) = \frac{pr(s=b|b) \times pr(b)}{pr(s=b)} = 1 \tag{A.1}$$

$$pr(g|s=b) = \frac{pr(s=b|g) \times pr(g)}{pr(s=b)} = 0 \tag{A.2}$$

2. *If the signal is $s = \varnothing$posteriors are:*

$$\begin{aligned} pr(b|s=\varnothing) &= \frac{pr(s=\varnothing|b) \times pr(b)}{pr(s=\varnothing)} \\ &= \frac{(1-q)p}{(1-p)+(1-q)p} \end{aligned} \tag{A.3}$$

$$\begin{aligned} pr(g|s=\varnothing) &= \frac{pr(s=\varnothing|g) \times pr(g)}{pr(s=\varnothing)} \\ &= \frac{1-p}{(1-p)+(1-q)p} \end{aligned} \tag{A.4}$$

Expected utilities are computed for four different combinations :

1. *In case of signal $s = b$ and action $a_i = b$, the expected utilities (I use posteriors A.1 and A.2) from the two candidates are respectively:*

$$\begin{aligned} EU_I(a_i = b\,,\, s = b) &= U(b) \times pr(b|s=b) + U(g) \times pr(g|s=b) + E[T \times I(a=b)] \\ &= T \end{aligned} \tag{A.5}$$

where $E[T \times I(a=b)] = T \times pr(b|s=b)$

$$\begin{aligned} EU_O(a_i = b\,,\, s = b) = EU_O(a_i = b) &= U(b) \times pr(b) + U(g) \times pr(g) + E[T \times I(a=b)] \\ &= (1-p) + Tp \end{aligned} \tag{A.6}$$

where $E[T \times I(a = b)] = T \times pr(b)$

2. *In case of signal* $s = b$ *and action* $a_i = g$*, the expected utilities (I use posteriors A.1 and A.2) from the two candidates are respectively:*

$$\begin{aligned} EU_I(a_i = g\,,\, s = b) &= U(b) \times pr(b|s = b) + U(g) \times pr(g|s = b) + E[T \times I(a = g)] \\ &= 0 \end{aligned} \tag{A.7}$$

where $E[T \times I(a = g)] = T \times pr(g|s = b)$

$$\begin{aligned} EU_O(a_i = g\,,\, s = b) = EU_O(a_i = g) &= U(b) \times pr(b) + U(g) \times pr(g) + E[T \times I(a = g)] \\ &= (1 - p) + T(1 - p) \end{aligned} \tag{A.8}$$

where $E[T \times I(a = g)] = T \times pr(g)$

3. *In case of signal* $s = \varnothing$ *and action* $a_i = b$*, the expected utilities (I use posteriors A.3 and A.4) from the two candidates are respectively:*

$$\begin{aligned} EU_I(a_i = b\,,\, s = \varnothing) &= U(b) \times pr(b|s = \varnothing) + U(g) \times pr(g|s = \varnothing) + E[T \times I(a = b)] \\ &= \frac{1 - p}{(1 - p) + (1 - q)p} + T \times \frac{(1 - q)p}{(1 - p) + (1 - q)p} \end{aligned} \tag{A.9}$$

where $E[T \times I(a = b)] = T \times pr(b|s = \varnothing)$

$$\begin{aligned} EU_O(a_i = b\,,\, s = \varnothing) = EU_O(a_i = b) &= U(b) \times pr(b) + U(g) \times pr(g) + E[T \times I(a = b)] \\ &= (1 - p) + Tp \end{aligned} \tag{A.10}$$

where $E[T \times I(a = b)] = T \times pr(b)$

4. *In case of signal* $s = \varnothing$ *and action* $a_i = g$*, the expected utilities from the two candidates are respectively:*

$$\begin{aligned} EU_I(a_i = g\,,\, s = \varnothing) &= U(b) \times pr(b|s = \varnothing) + U(g) \times pr(g|s = \varnothing) + E[T \times I(a = g)] \\ &= \frac{1 - p}{(1 - p) + (1 - q)p} + T \times \frac{1 - p}{(1 - p) + (1 - q)p} \end{aligned} \tag{A.11}$$

where $E[T \times I(a = g)] = T \times pr(g|s = \varnothing)$

$$\begin{aligned} EU_O(a_i = g\,,\, s = \varnothing) = EU_O(a_i = g) &= U(b) \times pr(b) + U(g) \times pr(g) + E[T \times I(a = g)] \\ &= (1-p) + T(1-p) \end{aligned} \tag{A.12}$$

where $E[T \times I(a = g)] = T \times pr(g)$

Having computed the expected utilities in the different cases, I can now look for the equilibrium behaviour. Since there is no dominant strategies, I check under which conditions the following behaviour is an equilibrium strategy: if $s = \varnothing$*, independently from the action chosen, it is optimal (the expected utility is greater) to choose the Incumbent; if* $s = b$*, independently from the action chosen, it is optimal (the expected utility is greater) to choose the Opponent.*

To have this result it must be that, given the different parameters p*,* q *and* T *:*

$$\begin{aligned} EU_O(a_i = b) &> EU_I(a_i = b\,,\, s = b) \\ (1-p) + Tp &> T \\ T &< 1 \end{aligned}$$

$$\begin{aligned} EU_O(a_i = g) &> EU_I(a_i = g\,,\, s = b) \\ (1-p) + T(1-p) &> 0 \end{aligned}$$

which is satisfied if $T > -1$

$$\begin{aligned} EU_I(a_i = b\,,\, s = \varnothing) &> EU_O(a_i = b) \\ \frac{1-p}{(1-p)+(1-q)p} + T \times \frac{(1-q)p}{(1-p)+(1-q)p} &> (1-p) + Tp \\ \frac{(1-p) + T(p-pq) - (1-pq)[(1-p)+Tp]}{1-pq} &> 0 \end{aligned}$$

if I exclude $p = 0$*,* $p = 1$*,* $q = 0$ *and* $q = 1$ *, I impose that the denominator is* > 0*. The numerator is positive if* $T < 0$ *or if* $T > 0$ *and* $T < 1$*. Hence the conditions ensuring* $EU_O(a_i = b) > EU_I(a_i = b\,,\, s = b)$ *are* $T < 1$*,* $p \in (0,1)$ *and* $q \in (0,1)$*.*

$$\begin{aligned} EU_I(a_i = g\,,\, s = \varnothing) &> EU_O(a_i = g) \\ \frac{1-p}{(1-p)+(1-q)p} + T \times \frac{1-p}{(1-p)+(1-q)p} &> (1-p) + T(1-p) \\ \frac{1}{(1-p)+(1-q)p}[(1-p) + T(1-p)] &> (1-p) + T(1-p) \end{aligned}$$

if I exclude $q = 0$ *and* $p = 0$*, then* $\frac{1}{(1-p)+(1-q)p} > 1$ *and the condition is satisfied.*

To recap, the conditions required are:

$$p \in (0,1) \tag{A.13}$$
$$q \in (0,1) \tag{A.14}$$
$$T \in (-1,1) \tag{A.15}$$

A.2 Proof of proposition 2

*Moving to the action stage, I look for equilibrium strategies with regards to the choice of private action a_i. It is important to recall that actions are chosen given equilibrium strategies derived in the electoral stage (*Proposition *1). Hence, in the evaluation of expected utilities for an informed individual, I have to use posteriors just when $s = \varnothing$ since voters are choosing the Incumbent. Instead, when $s = b$ I know that individuals choose the Opponent and I have to use priors in computing the expected utility. To identify equilibrium strategies, I compare expected utilities from each candidate, given signals and electoral strategies.*

In the first situation, given $s = b$ in the electoral stage individuals will choose to vote for the Opponent. The expected utilities deriving from choosing $a = g$ and$a = b$ are respectively:

$$EU_O(a = g) \quad = \quad (1 - p) + T(1 - p) \tag{A.16}$$

$$EU_O(a = b) \quad = \quad (1 - p) + Tp \tag{A.17}$$

Unfortunately, it doesn't exist a choice giving an expected utilities that is always greater. It doesn't exist a strategy which is dominant independently from p, T and q. However under some conditions, a private action is preferable to the other. If $T > 0$ [together with the conditions obtained in the previous section we have that $T \in (0, 1)$] all depends on p

if $p > 1/2$ then

$$\begin{array}{rcl} (1 - p) + Tp & > & (1 - p) + T(1 - p) \\ EU_O(a = b) & > & EU_O(a = g) \end{array}$$

if $p < 1/2$ then

$$\begin{array}{rcl} (1 - p) + Tp & < & (1 - p) + T(1 - p) \\ EU_O(a = b) & < & EU_O(a = g) \end{array}$$

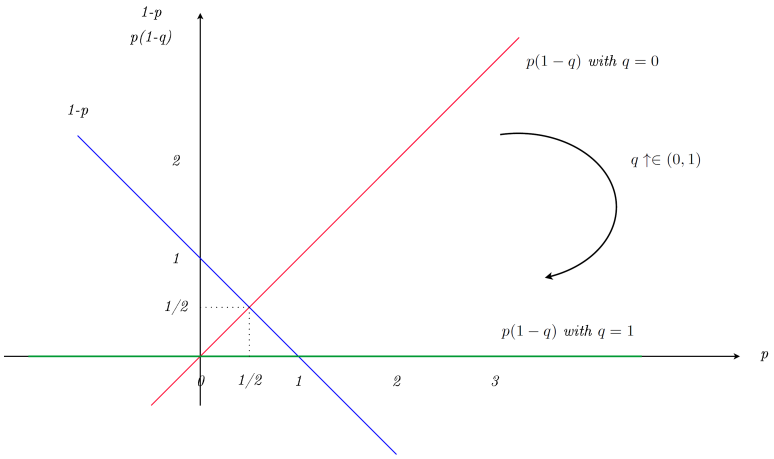
If $T < 0$ [therefore $T \in (-1, 0)$] the opposite result holds. The existence and the kind of dominant strategy depends strictly on the sign of T and on the size of p. I restrict the analysis on the more realistic case of a positive impact of private action, $T > 0$: if $p > 1/2$ it is dominant to choose $a = b$ if $s = b$; if $p < 1/2$ it is dominant to choose $a = g$ if $s = b$.

In the second situation, given $s = \varnothing$ in the electoral stage individuals will choose to vote for the Incumbent. The expected utilities deriving from choosing $a = g$ and $a = b$ are respectively:

$$EU_I(a = g) \quad = \quad \frac{1 - p}{(1 - q)p + (1 - p)} + T\frac{1 - p}{(1 - q)p + (1 - p)} \tag{A.18}$$

$$EU_O(a = b) \quad = \quad \frac{1 - p}{(1 - q)p + (1 - p)} + T\frac{1 - p}{(1 - q)p + (1 - p)} \tag{A.19}$$

To state which expected utility is greater, I compare the second element of the right side of these two equation. If $T > 0$ [$T \in (0, 1)$], the sign of the inequality depends on p and q. Again, the threshold value is $p = 1/2$.



As drawn in the picture, if $p < 1/2$ *then* $\forall q \in (0,1)$ *we have* $(1-p) > p(1-q)$*, implying*

$$EU_I(a=g) \quad > \quad EU_I(a=b)$$

whereas if $p > 1/2$*, also* q *matters*

$$\begin{array}{rcl} & \textit{if} & \\ (1-p) & > & p(1-q) \\ \Rightarrow EU_I(a=g) & > & EU_I(a=b) \end{array}$$

$$\begin{array}{rcl} & \textit{if} & \\ (1-p) & < & p(1-q) \\ \Rightarrow EU_I(a=g) & < & EU_I(a=b) \end{array}$$

If $T < 0$ *[hence* $T \in (-1,0)$*] the opposite result holds.*

The existence and the kind of dominant strategy depends therefore of the sign of T *and on the size of* p *and, in some cases, on the level of* q*. I focus on the more realistic condition that* $T > 0$*, obtaining the following results:*

- *if* $p > 1/2$ *(HIGH PROB. OF NEGATIVE STATE) and* $(1-p) < p(1-q)$ *it is dominant to choose* $a = b$ *if* $s = \varnothing$ *(and individual chooses Incumbent)*
- *if* $p > 1/2$ *(HIGH PROB. OF NEGATIVE STATE) and* $(1-p) > p(1-q)$ *it is dominant to choose* $a = g$ *if* $s = \varnothing$ *(and individual chooses Incumbent)*
- *if* $p < 1/2$ *(LOW PROB. OF NEGATIVE STATE) it is dominant to choose* $a = g$ *(for each value of* $q \in (0,1)$*) if* $s = \varnothing$ *(and individual chooses Incumbent)*

A.3 Proof of lemma 1

Given the results of proposition 1 and proposition 2 in previous stages, in case of informed individuals, I obtain three situations instead of two, as in the case of no information

- *if* $p < 1/2$ *individuals choose* $a = g$ *whatever is the signal (CASE A)*
- *if* $p > 1/2$ *and* $(1-p) > (1-q)p$ *individuals choose* $a = b$ *if* $s = b$ *and* $a = g$ *if* $s = \varnothing$ *(CASE B)*
- *if* $p > 1/2$ *and* $(1-p) < (1-q)p$ *individuals choose* $a = b$ *whatever is the signal (CASE C)*

There reason for this additional case is that now the quality (q) of the signal matters if we have a high probability of negative state.

CASE A *(*$p < 1/2$*)*[33]

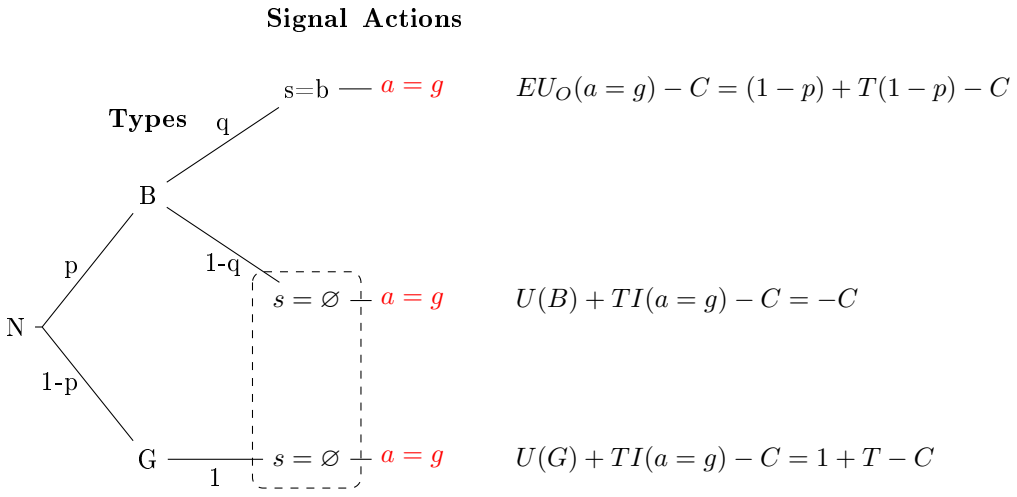


Figure A.1: Case $p < 1/2$

[33] C summarizes both information cost C_i and access price P_A.

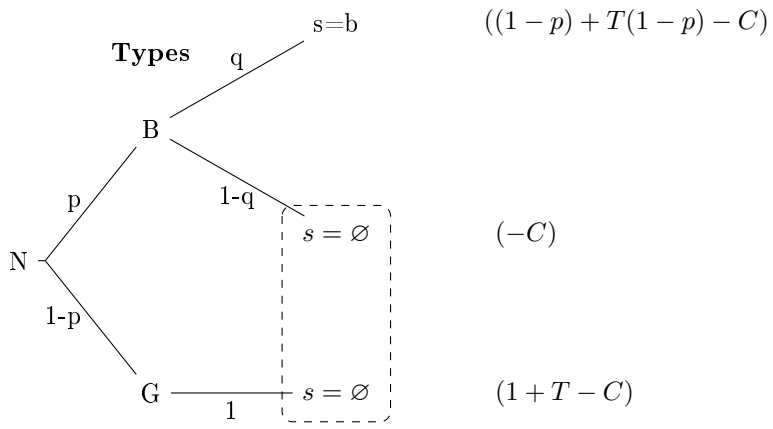


Figure A.2: Case $p < 1/2$: pay-offs

Notice that in the branch $s = b$, the individual know that he will vote for the Opponent: his utility in that node will be the expected utility of voting the Incumbent, choosing $a = g$ and sustaining the costs of information.

$$\begin{aligned} EU(a=g) &= pq[(1-p) + T(1-p) - C] + p(1-q)[-C] + (1-p)[1+T-C] \\ &= pq[(1-p) + T(1-p)] + (1-p)[1+T] - C \end{aligned} \tag{A.20}$$

CASE B *($p > 1/2$ **e** $(1-p) > (1-q)p$)*

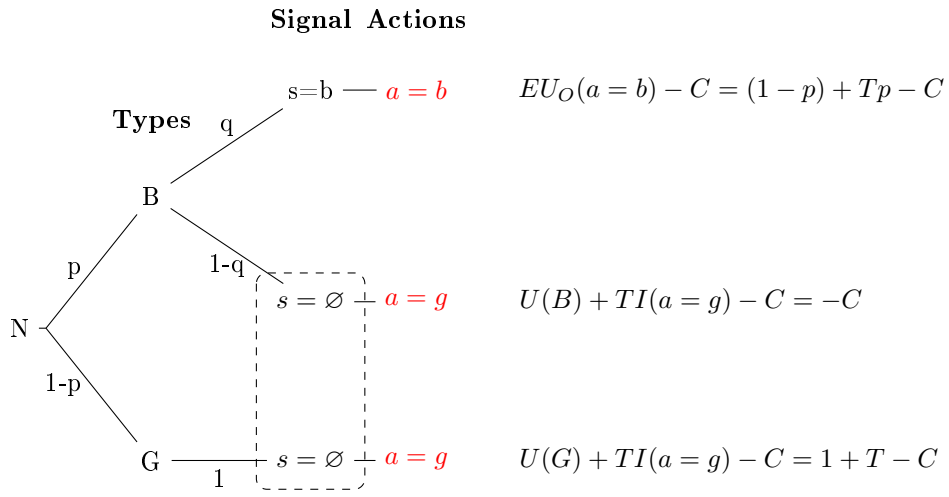


Figure A.3: Case $p < 1/2$ e $(1-p) > (1-q)p$

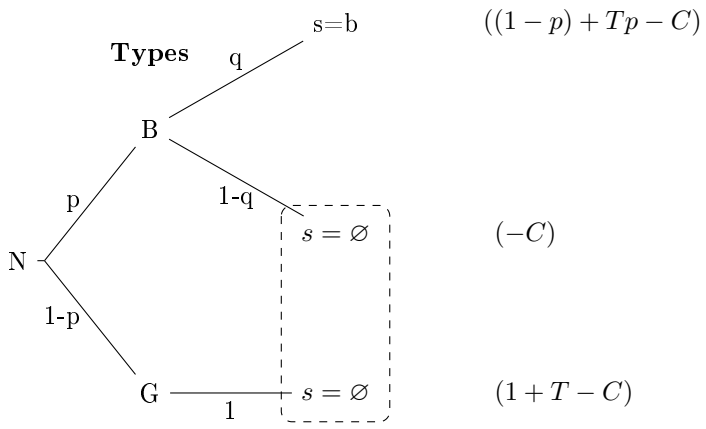


Figure A.4: Case $p < 1/2$ e $(1-p) >)1-q)p$: pay-offs

Notice that in the branch $s = b$, the individual know that he will vote for the Opponent: his utility in that node will be the expected utility of voting the Incumbent, choosing $a = b$ and sustaining the costs of information.

$$\begin{aligned} EU(a=b,\, a=g) &= pq[(1-p)+Tp-C]+p(1-q)[-C]+(1-p)[1+T-C] \\ &= pq[(1-p)+Tp]+(1-p)[1+T]-C \end{aligned} \tag{A.21}$$

CASE C *($p > 1/2$ **e** $(1-p) < (1-q)p$)*

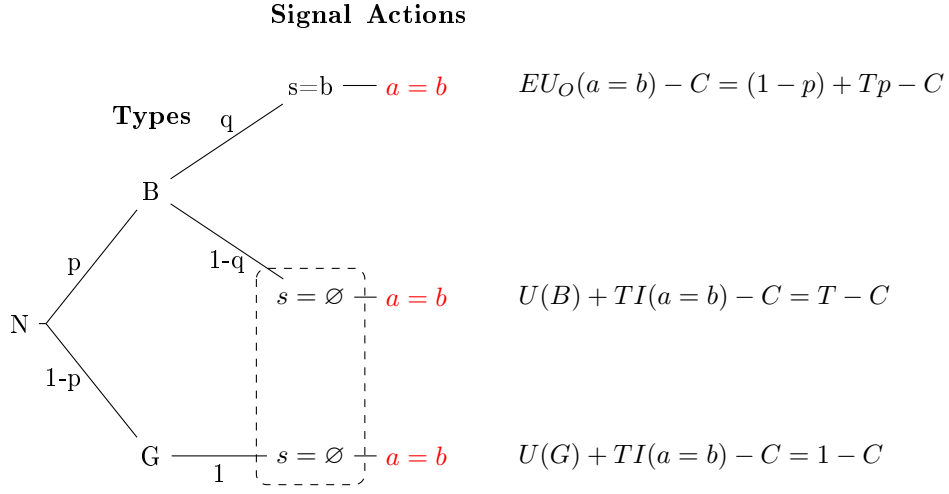


Figure A.5: Case $p < 1/2$ e $(1-p) >)1-q)p$

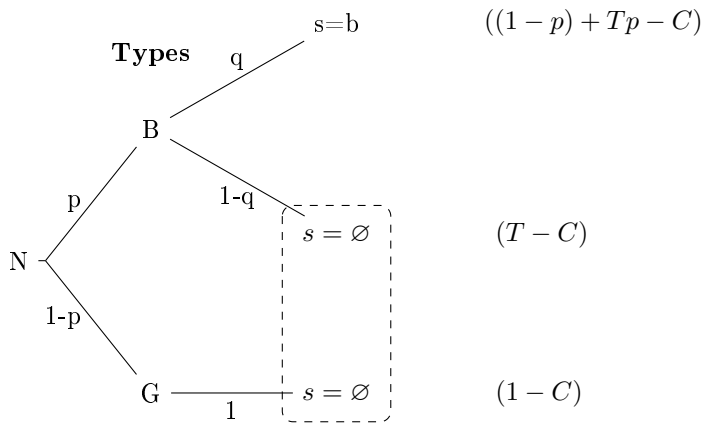


Figure A.6: Case $p < 1/2$ e $(1-p) > (1-q)p$: pay-offs

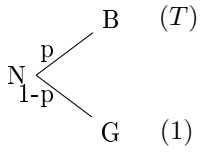
Notice that in the branch $s = b$, the individual know that he will vote for the Opponent: his utility in that node will be the expected utility of voting the Incumbent, choosing $a = b$ and sustaining the costs of information.

$$\begin{aligned} EU(a=b) &= pq[(1-p)+Tp-C]+p(1-q)[T-C]+(1-p)[1-C] \\ &= pq[(1-p)+Tp]+p(1-q)[T]+(1-p)-C \end{aligned} \tag{A.22}$$

A.4 Proof of lemma 2

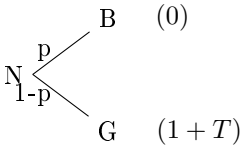
As stated in the previous section, given results from proposition 1 and proposition 2:

if $a = b$



$EU_I(a=b) = EU_O(a=b) = (1-p)+Tp$

if $a = g$



$$EU_I(a=g) = EU_O(a=g) = (1-p) + T(1-p)$$

obtaining the following equilibrium strategies:

- *if* $p > 1/2$ *then* $a = b$ $\rightarrow$ $EU = (1-p) + Tp$
- *if* $p < 1/2$ *then* $a = g$ $\rightarrow$ $EU = (1-p) + T(1-p)$

A.5 Proof of lemma 3

In lemma 2 and lemma 1, we derived the following expected utilities for informed and uninformed individuals[34]:

	Uninformed	*Informed*
$p < 1/2$	$(1-p) + T(1-p)$	$pq[(1-p) + T(1-p)] + (1-p)[1+T] - C$
$p > 1/2$ *e* $(1-p) > (1-q)p$	$(1-p) + Tp$	$pq[(1-p) + Tp] + (1-p)[1+T] - C$
$p > 1/2$ *e* $(1-p) < (1-q)p$	$(1-p) + Tp$	$pq[(1-p) + Tp] + p(1-q)[T] + (1-p) - C$

CASE A

Expected utility informed	*Expected utility uninformed*
$pq[(1-p) + T(1-p)] + (1-p)[1+T] - C_i - P_A$	$(1-p) + T(1-p)$

The difference in expected pay-offs (gain from information) has to be bigger than costs (C_i and P_A), so that an individual finds profitable to acquire information

$$\begin{aligned} pq[(1-p) + T(1-p)] + (1-p)[1+T] - (1-p) - T(1-p) &\geq C_i + P_A \\ \underbrace{pq[(1-p) + T(1-p)]}_{>0} &\geq C_i + P_A \end{aligned}$$

Since the left-hand side of the inequality is greater than zero, I am sure that exists at least one C_i which make convenient to get informed. Therefore, I can derive an indifference condition or a profitability condition:

$$p(1-p) \geq \frac{C_i + P_A}{q(1+T)}$$

The cost C_I corresponding to the indifferent voter is then

$$C_I = p(1-p)q(1+T) - P_A \tag{A.23}$$

[34] C summarizes both access cost P_A and information cost C_i

CASE B

Expected utility informed	*Expected utility uninformed*
$pq[(1-p)+Tp]+(1-p)[1+T]-C_i-P_A$	$(1-p)+Tp$

In order to have information acquisition I need the difference in expected utilities (gain from information) to be grater than costs (C_i and P_A)

$$\begin{aligned} pq[(1-p)+Tp]+(1-p)[1+T]-(1-p)-Tp &\geq C_i+P_A \\ pq+T+(T-1)p^2q-2pT &\geq C_i+P_A \end{aligned}$$

since $T<1$, it is that $(T-1)p^2q<0$ and $-2pT<0$ whereas $pq>0$ and $T>0$. The negative part is compensated by the positive one giving that

$$\underbrace{pq+T+(T-1)p^2q-2pT}_{>0} \quad \geq \quad C_i+P_A$$

From this inequality I know that exists at least one cost making profitable to get informed and I can compute the indifference condition and the cost of the indifferent individual

$$C_I \quad = \quad p[q(1-p)+T(p-2)]+T-P_A \tag{A.24}$$

CASE C

Expected utility informed	*Expected utility uninformed*
$pq[(1-p)+Tp]+p(1-q)[T]+(1-p)-C_i-P_A$	$(1-p)+Tp$

The difference in expected utilities (gain from information) has to be greater than costs (C_i and P_A)

$$\begin{aligned} pq[(1-p)+Tp]+p(1-q)[T]+(1-p)-(1-p)-Tp &\geq C_i+P_A \\ \underbrace{pq[(1-p)-\underbrace{T}_{<1}(1-p)]}_{>0} &\geq C_i+P_A \end{aligned}$$

since the left-hand side is bigger than zero, it is possible to find at least one cost C_i making the individual to acquire news. The indifferent voter is identified by the cost

$$C_I \quad = \quad p(1-p)q(1-T)-P_A \tag{A.25}$$

A.6 Proof of proposition 3

Profit maximization requires the setting of an optimal price P_A^*, which is the only control variable for the media outlet. I show computations just for the first case.

In Case A ($p>\frac{1}{2}$), from lemma 4, the demand for news is given by

$$\begin{aligned} CDF(C_I) &= \frac{C_I-a}{b-a} \\ &= \frac{p(1-p)q(1+T)-P_A-a}{b-a} \end{aligned} \tag{A.26}$$

Audience related revenues are set as:

$$\begin{aligned} P_A \times CDF(C_I) &= P_A \times [\frac{C_I - a}{b-a}] \\ &= P_A \times \frac{p(1-p)q(1+T) - P_A - a}{b-a} \end{aligned} \tag{A.27}$$

Profit maximization problem gives the following results:

$$\max_{P_A}\{P_A \times \frac{p(1-p)q(1+T) - P_A - a}{b-a}\}$$

$$\begin{aligned} \frac{\partial\{P_A \times CDF(C_I)\}}{\partial P_A} &= 0 \\ \frac{1}{b-a}\{[p(1-p)q(1+T) - P_A - a] + P_A[-1]\} &= 0 \end{aligned}$$

$$P_A^* = \frac{p(1-p)q(1+T) - a}{2} \tag{A.28}$$

The optimal quantity of news is obtained by substituting back P_A^* in the demand :

$$\begin{aligned} demand\,(P_A^*) &= CDF(C_I(P_A^*)) \\ &= \frac{p(1-p)q(1+T) - a}{2(b-a)} \end{aligned} \tag{A.29}$$

Maximization profits are:

$$\begin{aligned} \Pi^* &= P_A^* \times CDF(C_I(P_A^*)) \\ &= \frac{[p(1-p)q(1+T) - a]^2}{4(b-a)} \end{aligned} \tag{A.30}$$

Optimal prices, quantities and profits for Case B and Case C are derived in the same way.

Case	P_A^*	$demand(P_A^*)$	Π^*
Case A	$\frac{p(1-p)q(1+T)-a}{2}$	$\frac{p(1-p)q(1+T)-a}{2(b-a)}$	$\frac{[p(1-p)q(1+T)-a]^2}{4(b-a)}$
Case B	$\frac{p[q(1-p)+T(p-2)]+T-a}{2}$	$\frac{p[q(1-p)+T(p-2)]+T-a}{2(b-a)}$	$\frac{\{p[q(1-p)+T(p-2)]+T-a\}^2}{4(b-a)}$
Case C	$\frac{p(1-p)q(1-T)-a}{2}$	$\frac{p(1-p)q(1-T)-a}{2(b-a)}$	$\frac{[p(1-p)q(1-T)-a]^2}{4(b-a)}$

Table A.1: Results from maximization

A.7 Proof of lemma 7

I compute the probability that an informed individual receives a certain kind of news and I use it to derive the shares of votes obtained by the two candidates as

Incumbent's share: $S_I \times pr(s = \varnothing)$

Opponent's share: $S_I \times pr(s = b)$

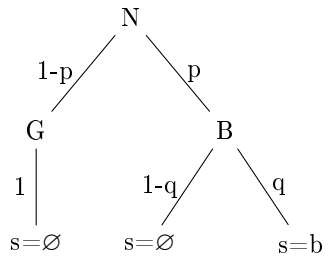


Figure A.7: Signal's structure

Probabilities of each kind of news are

$$\begin{aligned} Pr(s = b) &= pq \\ Pr(s = \varnothing) &= p(1-q) + (1-p) \end{aligned}$$

Votes received by each candidate are:

$$\begin{aligned} Opponent &= S_I \times Pr(s = b) \\ &= S_I \times pq \end{aligned}$$

$$\begin{aligned} Incumbent &= S_I \times Pr(s = \varnothing) \\ &= S_I \times [p(1-q) + (1-p)] \end{aligned}$$

A.8 Proof of proposition 4

A candidate wins if he obtains the 50%+1 of votes or more - that is if $V > \frac{1}{2}$.

In this case (CASE A), the informed share is:

$$S_I = \frac{p(1-p)q(1+T) - a}{2(b-a)}$$

$S_I \in (0,1)$ *if conditions set in part 3.2 hold.*

From equation 3.6, the ***Opponent*** *gets:*

$$\begin{aligned} V_O &= \frac{1}{2} \times (1 - S_I) + S_I \times pq \\ &= \frac{1}{2} + S_I \times (pq - \frac{1}{2}) \end{aligned} \tag{A.31}$$

$V_O > \frac{1}{2}$ *only if* $pq - \frac{1}{2}$ *is positive, that is* $pq > \frac{1}{2}$*: in case of low probability of negative event this* ***is not possible*** *(even if* $q = 1$*) since* $p < \frac{1}{2}$*. The Opponent cannot win.*

From equation 3.7, the ***Incumbent*** *gets:*

$$\begin{aligned} V_I &= \frac{1}{2} \times (1 - S_I) + S_I \times [p(1-q) + (1-p)] \\ &= \frac{1}{2} + S_I \times [p(1-q) + (1-p) - \frac{1}{2}] \end{aligned} \tag{A.32}$$

$V_I > \frac{1}{2}$ only if $p(1-q) + (1-p) - \frac{1}{2} > 0$ that is if $p(1-q) + (1-p) > \frac{1}{2}$: when $p < \frac{1}{2}$ the Incumbent wins election.

A.9 Proof of proposition 5

If $p > \frac{1}{2}$ there are two possible situations determining two different choices of private actions and consequently two informed shares

- *(Case B) if $p > \frac{1}{2}$ and $(1-p) > p(1-q) \Longrightarrow S_I = \frac{p[q(1-p)+T(p-2)]+T-a}{2(b-a)}$*
- *(Case C) if $p > \frac{1}{2}$ and $(1-p) < p(1-q) \Longrightarrow S_I = \frac{p(1-p)q(1-T)-a}{2(b-a)}$*

$S_I \in (0,1)$ if conditions set in section 3.2 hold.

For the sake of simplicity, I consider Case B and Case C together and I omit to give an explicit dimension of S_I. This simplifies the computation of votes' shares for the two candidates.

From equation 3.6, the ***Opponent*** *obtains:*

$$\begin{aligned} V_O &= \frac{1}{2} \times (1 - S_I) + S_I \times pq \\ &= \frac{1}{2} + S_I \times (pq - \frac{1}{2}) \end{aligned} \tag{A.33}$$

Now the sign of $pq - \frac{1}{2}$ depends also on q, since $p > \frac{1}{2}$. If p and q are high enough (in particular q has to be greater than $\frac{1}{2}$) and such that $pq > \frac{1}{2}$, the Opponent wins.

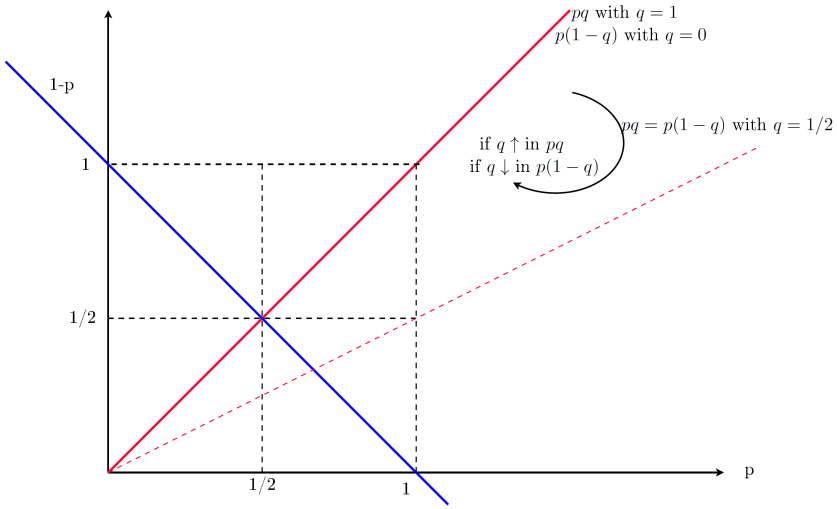


Figure A.8:

From equation 3.7, the ***Incumbent*** *obtains:*

$$\begin{aligned} V_I &= \frac{1}{2} \times (1 - S_I) + S_I \times [p(1-q) + (1-p)] \\ &= \frac{1}{2} + S_I \times [p(1-q) + (1-p) - \frac{1}{2}] \end{aligned} \tag{A.34}$$

Victory depends on p and q. The reasoning is exactly the same as in the Opponent's case but results are reverse.

A.10 Proof of corollary 1

Recall how cases have been defined in Proposition 2. Looking at fig. A.8 from the proof of proposition 5, it is possible to notice how a higher q increases the range of $p > \frac{1}{2}$ supporting case B (and reduces those supporting case C) where individuals set $a_i = b$ if $r = b$ and $a_i = g$ if $r = \varnothing$.

B Figures

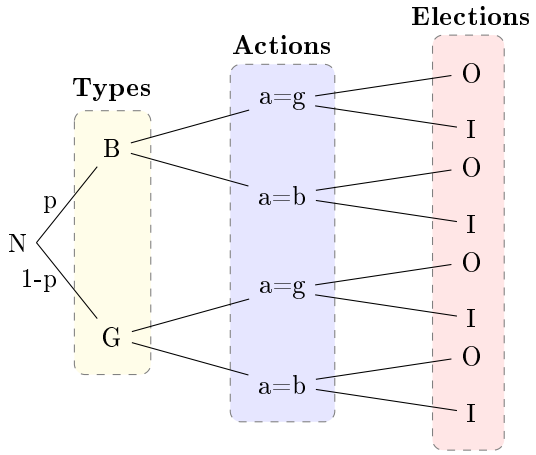


Figure B.1: Game form for uninformed individuals

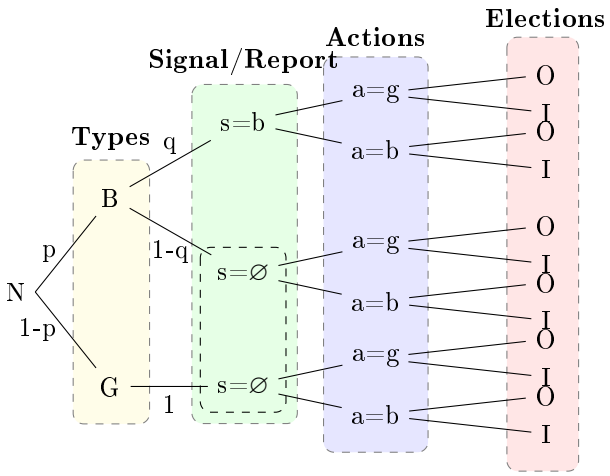


Figure B.2: Game form for informed individuals

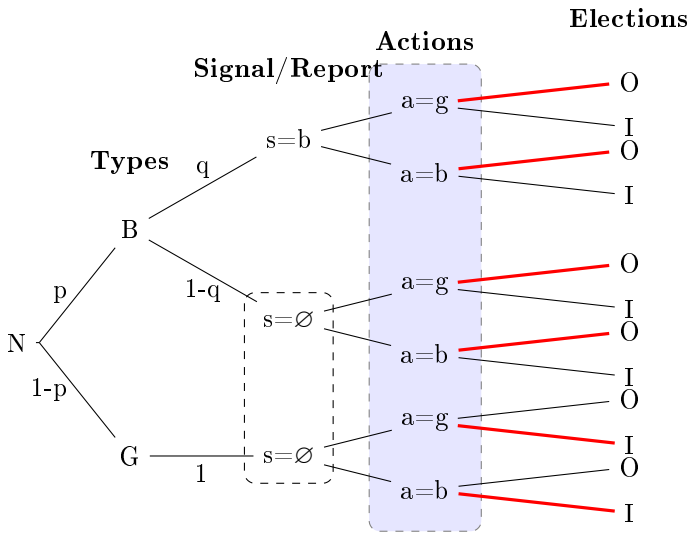


Figura B.3: From electoral stage: backward solution

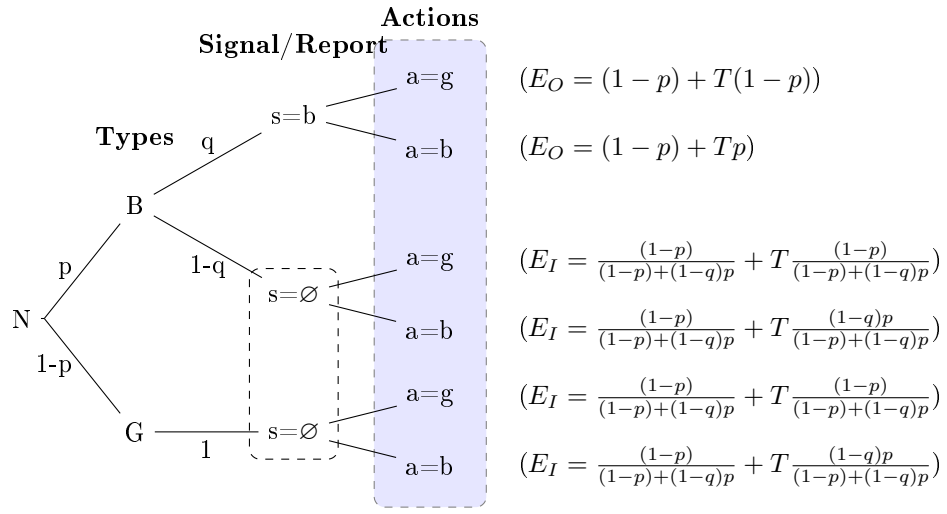


Figura B.4: From electoral stage: expected pay-offs

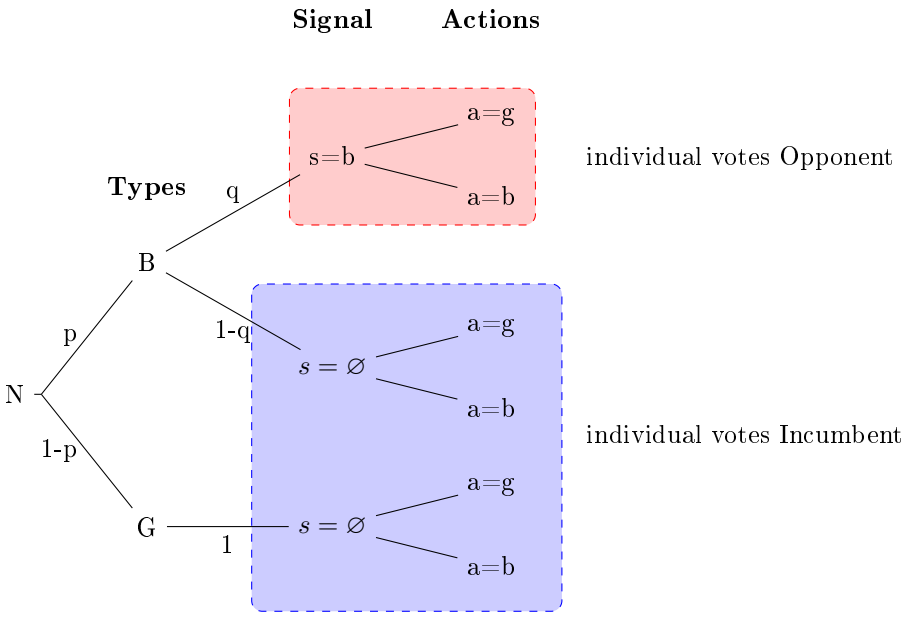


Figure B.5: Equilibrium strategies in electoral stage for informed individuals

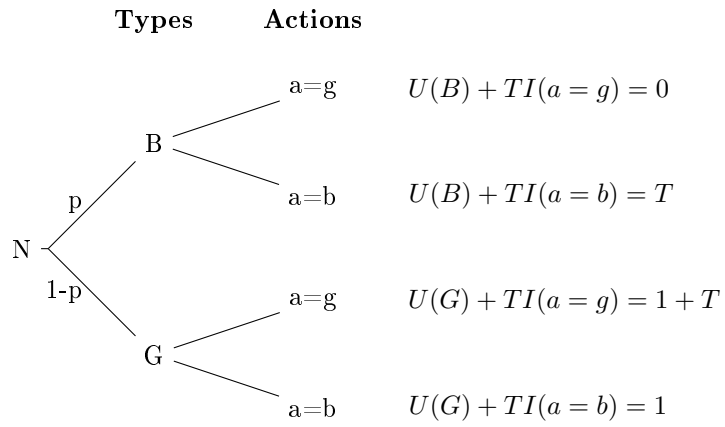


Figure B.6: Pay-off in the action stage for uninformed individual