Confirmation Bias, Media Slant, and Electoral Accountability

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Abstract

This paper considers the implications, and the causes, of an important cognitive bias in information processing, confirmation bias, in a political agency setting. We make two main contributions. First, we show that when voters have this bias, it can in some cases increase voter welfare by altering the behavior of politicians. Second, we ask how this effect is mediated by the structure of the media market when confirmation bias is determined endogenously by selective exposure to media outlets. In doing so, we provides a link between the literature on media slant on the one hand, and the literature on the determinants of electoral accountability on the other. In more detail, treating confirmation bias as fixed, we show that confirmation bias reduces the electoral "reward" to pandering, and as a result, may increase voter welfare. We then allow confirmation bias to be created by selective exposure to the media. Competition (duopoly) generally creates more bias than monopoly, and supplies it more efficiently, and so welfare-dominates monopoly unless voters have a strong preference for political pandering.

KEYWORDS: confirmation bias, selective exposure, voting, pandering, elections

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1 Introduction

This paper contributes to the growing literature on the effect of voter and politician behavioral biases on the performance of electoral institutions. Our focus here is on a key bias in information-processing, confirmation bias. As Rabin and Schrag (1999) put it, "A person suffers from confirmatory bias if he tends to misinterpret ambiguous evidence as confirming his current hypotheses about the world". This is one of the most pervasive and well-documented forms of cognitive bias\(^1\); as Nickerson (1998) says, in a recent survey, "If one were to attempt to identify a single problematic aspect of human reasoning that deserves attention above all others, the confirmation bias would have to be among the candidates for consideration." Indeed, there is even some evidence of a genetic basis for confirmation bias (Doll, Hutchison, and Frank (2011)).

Nickerson (1998) emphasizes three mechanisms underlying confirmation bias; restriction of attention to a favored hypothesis, preferential treatment of evidence supporting existing beliefs, and looking only or primarily for positive cases that support initial beliefs. This third mechanism is sometimes called selective exposure.

There is considerable evidence for the first mechanism, biased processing of exogenously presented information, as discussed in for example, Rabin and Schrag (1999)\(^2\). Notable examples include experiments where subjects were initially questioned in a salient policy issue (Lord, Ross, and Lepper (1979), capital punishment, Plous (1991), safety of nuclear technology) to determine their views, and then presented with the same randomly sampled reading material for and against the issue. After exposure, those initially in favour (against) tended to be more in favour (against), despite having been exposed to the same reading material.

There is also a large body of experimental evidence that selective exposure occurs. In the classic experimental selective-exposure research paradigm, participants work on a binary decision problem and come to a preliminary conclusion (such as choosing one of two investment strategies). Participants are then given the opportunity to search for additional information, which is typically received in the form of short statements indicating the perspectives of newspaper articles, experts, or former participants. In the design, half of available statements will be positive, and half will be negative about each choice, and the participants are asked to indicate those pieces that they would like to read in more detail later on. In a meta-analysis of 91 such studies, Hart et.al. (2009) find significant evidence indicating that participants choose additional information that confirms their initial decisions.

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1 So salient is confirmation bias that is has been noted long before modern psychology came into being: "The human understanding when it has once adopted an opinion draws all things else to support and agree with it. And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or else by some distinction sets aside and rejects, in order that by this great and pernicious predetermination the authority of its former conclusion may remain inviolate." Francis Bacon, 1620.
2 Rabin and Schrag do not discuss, or model, selective exposure.
Experiments on selection of more structured information have also been conducted. Eliaz and Schotter (2006) find that who find that people are willing to pay for information to increase their confidence in a decision, even if the information would not be valuable to a rational decision-maker. Feiler, Goeree, and Yariv (2006) show that when given a choice between different information sources, more than half of all subjects choose a source that potentially confirms their prior inclinations but is an inferior information source for a rational decision-maker.

There is also non-experimental evidence, mainly in the context of political campaigns, examining choices of information about a preferred candidate (for example, Chaffee and Miyo (1983), Stroud (2010), Iyengar and Hahn (2009), Jerit and Barabas (2012)), or of friends who share one’s political views (Huckfeldt and Sprague (1988)).

In this paper, we first introduce confirmation bias into a variant of the standard political agency model of Maskin and Tirole (2004). To model confirmatory bias, we adopt the approach of Rabin and Schrag (1999), who assume that when the agent gets a signal that is counter to the hypothesis he currently believes is more likely, there is a positive probability that he misreads that signal as supporting his current hypothesis. The agent is unaware that he is misreading evidence in this way and engages in Bayesian updating that would be fully rational given his environment if he were not misreading evidence. In the Maskin and Tirole model, the signal of incumbent quality observed by the voter is the binary action taken by the incumbent. So, in our model, the relationship between incumbent quality and the signal is thus determined endogenously in political equilibrium, as opposed to Rabin and Schrag (1999), where the relationship is exogenously specified.

The key feature of the Maskin-Tirole model is that it can explain political pandering i.e. choice of policy to follow popular opinion even when this conflicts with what the benevolent politician knows is best. Our baseline finding is that voter confirmation bias reduces pandering, as it lowers the electoral "reward" for this behavior by reducing the increase in the probability of being elected from pandering. As pandering generally has an ambiguous effect on voter welfare, it is possible that an increase in confirmation bias (parametrized by the probability of misreading the signal) increases voter welfare.

We then consider the important case where confirmation bias is created or reinforced by selective exposure. We assume that at an initial stage of the model, the voter can obtain information about the incumbent politician’s action from one or several possibly biased media outlets (e.g. read one of two newspapers). We also assume that there is voter heterogeneity; some voters are initially optimistic about the incumbent, and some pessimistic, in that they place a high (low) probability on him being

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3This finding is similar to that of Levy and Razin (2014), who find that the cognitive bias of correlation neglect can improve outcomes for voters. However, both the institutions and the mechanism at work are completely different. They consider direct democracy i.e. a referendum on two alternatives, and correlation neglect causes individuals base their vote more on their information rather than on their preferences.

4Without reading a newspaper, the voter has no information and so does not vote.
benevolent.

In our setting, the demand for "slant" is determined by the assumption that the voter suffers cognitive dissonance if he gets a signal about the incumbent that conflicts with his prior belief. Then, in equilibrium, the voter will choose only the media outlet (if any) that is more biased in the same direction as his political belief. The supply of slant is determined as the outlets choose their slant to maximize sales and thus advertising revenue, as in Chan and Suen (2008), Duggan and Martinelli (2010).

We show that typically, the level of confirmation bias generated by competition in the media market (duopoly) is greater than monopoly; under some circumstances, a monopolist may provide unbiased information, but duopolists always slant the news. So, competition in the media market generally decreases pandering, and increases incumbent turnover; this is the same finding as in Besley and Prat (2006), but via a completely different mechanism.

Moreover, when numbers of optimists and pessimists are not too different, the duopolists "split the market", and thus provide slant in a more targeted and efficient way that the monopolist can. So, in the case that pandering reduces welfare, competition in the media market (duopoly) always welfare-dominates monopoly, although when pandering increases welfare, examples can be found where the opposite is true. However, generally, both monopoly and duopoly are inefficient, with a bias towards too much slant, relative to what a social planner would choose.

So, in general terms, the contribution of this paper is twofold. First, it shows that a behavioral bias, confirmation bias, can in some cases increase voter welfare by altering the behavior of politicians. Second, it asks how this effect is mediated by the structure of the media market when confirmation bias determined endogenously by selective exposure. In doing so, it provides a link between the literature on media slant on the one hand, and on the determinants of electoral accountability on the other. This link is explained in more detail in Section 2 below.

The remainder of the paper is structured as follows. Section 2 discusses related literature, Section 3 describes the model, and Section 4 derives baseline results. Section 5 shows how confirmation bias can be determined via selective exposure in the media market. Section 6 investigates how competition in the media market affects the political outcome, and welfare. [Finally, Section 7 considers the case where voters also have a demand for accurate information about the incumbent's action because they take a private action that is conditional on this action; this creates an interesting feedback where the demand for this information is lower, the more likely the incumbent is to pander, but pandering is increasing in the accuracy of information provided by the media.]

2 Related Literature

There are three broad related literatures to my paper.
Behavioral biases and voting /political agency. There is a small but growing literature studying the implications of introducing behavioral and cognitive biases into rational choice models of voting. One early contribution is Callander and Wilson (2006), (2008) who introduce a theory of context-dependent voting, where for example, for a left wing voter, the attractiveness of a left wing candidate is greater the more right wing is the opposing candidate, and apply it to the puzzle of why candidates are so frequently ambiguous in their policy. Another is Ghirardato and Katz (2006), who show that if voters are ambiguity-averse, they might strictly prefer abstaining to voting, even if voting is costless\textsuperscript{5}.

Other recent contributions include Ellis (2012) extends the arguments of Ghirardato and Katz (2006) to investigate information aggregation in large elections, and Levy and Razin(2014), who show that the cognitive bias of correlation neglect can lead to more efficient outcomes in elections where voters receive multiple signals about the state of the world. Another is Passarelli and Tabellini (2013), who introduce features based on loss-aversion into a model of redistribution with a benevolent government.

All of these contributions either study models of voting, where the alternatives or fixed, or, in the case of Callander and Wilson, models of electoral competition, where parties simultaneously choose policies. So, I believe this paper is the first to study the effect of cognitive biases when there is an agency problem between the politician and the voters.

Media slant. A number of papers provide various theoretical explanations why the media might distort information; a recent survey is Prat and Strömberg(2013)\textsuperscript{6}. Mullainathan and Shleifer (2005), is closely related to our work; they generate a demand for slant by assuming that readers dislike news reports that conflict with their priors\textsuperscript{7}. We also assume that voters suffer disutility (arising from cognitive dissonance) if they receive a signal about incumbent ability that conflicts with their prior. However, our detailed results on slant are somewhat different. Moreover, and more importantly, our focus is on the consequences of slant for electoral control of an incumbent politician; in their model, this is no government or policy choice.

Also quite closely related are Chan and Suen (2004) and Bernhardt et al. (2008), who consider the interaction between media slant and political outcomes. However, they consider Downsian competition between political parties, not a scenario with political agency. Of the two, Bernhardt et al. (2008) has a feature similar to this paper that citizens have a preference for news that is positive for their ideologically-closer candidate and negative about the opposing candidate\textsuperscript{8}. However, unlike in our paper, citizens in

\textsuperscript{5}The paper is motivated by the empirical observation that voters who arguably face no cost of voting might still abstain, as in the case of case of multiple elections on one ballot.

\textsuperscript{6}In contrast, Baron (2006) and Bovitz et al. (2002) focus on the supply side, analyzing the incentives of reporters and editors to manipulate the news.

\textsuperscript{7}It is worth noting that demand for slant can be explained within a fully rational choice framework; i.e. a cognitive dissonance argument is not required. For example, Gentzkow and Shapiro (2006) show that if the reader is uncertain about the quality of a news source, it will favour the source that has a bias in the same direction as the reader’s ex ante beliefs about the state of the world.

\textsuperscript{8}There is a difference; the payoff in Bernhardt et.al. (2008) is based on proximity of preferences to the candidate, whereas
their model are completely rational and understand the nature of the biases. Moreover, in their paper, candidate positions are exogenous, unlike in this paper, where the incumbent takes into account slant when determining policy.

*Government capture of the media.* In an influential paper, Besley and Prat (2004) consider the possibility of government capture of the media in a political agency setting\(^9\). Unlike our paper, however, there are no behavioral features, and unlike the media slant literature, there is no demand from consumers of the news for "slant". Rather, the media outlets prefer to reveal unbiased information unless they are bribed by government not to do so i.e. slant is determined by incumbent government behavior. They find that reduced government control of the media (generated, for example, by greater transactions costs of bribery) leads to better selection of politicians, and therefore greater turnover in office. We also predict that greater media competition reduces political turnover- however, the mechanism is completely different to Besley-Prat.

### 3 Set-Up

A single voter lives for periods \(t = 1, 2\). In each of the two periods, an incumbent politician chooses a binary policy \(x_t \in \{A, B\}\). The first-period incumbent faces an election at the end of his first term of office, where the voter can either re-elect the incumbent or elect a challenger. The payoff to the action depends on a state of the world \(s_t \in \{A, B\}\). Prior to choosing \(x_t\), the incumbent observes the state.

The voters get utility 1 if the incumbent's action in period \(t\) matches the state, and 0 otherwise. Politicians get zero payoff when out of office, and enjoy an exogenous ego-rent \(E\) when in office; they also care about policy choices when in office, as described below. Both voter and the incumbent discount payoffs by \(\delta\).

Politicians are of two types, "good", denoted \(H\), and "bad", denoted \(L\). Good politicians, when in office, get utility \(u_t\) if \(s_t = x_t\), and 0 if \(s_t \neq x_t\). Here, \(u_1, u_2\) are i.i.d. random variables with a continuous distribution \(F\) on support \([0, \pi]\). So, they share the same basic preferences as voters, but can vary in the extent to which they value an action that matches the state. They also have an ego-rent \(E\) from office. Bad politicians when in office, get \(u_t\) if \(s_t \neq x_t\), 0 if \(s_t = x_t\), and they also have an ego-rent \(E\) from office. So, they have the reverse preferences to voters; thus, "\(H\)" and "\(L\)" refer to the congruence between voter and incumbent preferences. Finally, we assume without loss of generality that \(E[u_t] = 1\), and we assume \(\pi > \delta(1 + E)\). Finally, the reason why we assume that politicians' payoff from their most preferred outcome are determined by random draw from a continuous distribution (rather than being

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\(\text{9More recent theoretical models of government and special interest group capture of the media include Corneo (2006), Gehlbach and Sonin (2014), and Petrova (2008).}\)
fixed at 1, as in Maskin and Tirole) is to ensure that in all cases, $x_t$ is an informative, but not perfect signal of politician type, so that the Rabin-Schrag definition of confirmation bias can be applied\textsuperscript{10}.

### 3.1 Order of Events and Information Structure

All agents i.e. incumbent, voter, and challenger have a prior $p > 0.5$ that state $A$ will occur. The incumbent is good with probability $\pi$, and faces a randomly drawn challenger at the end of period 1, who is good with the same probability $\pi$. We assume, following Maskin and Tirole(2004), that the voter observes the action $x_1$ before election, but not the payoff generated by $x_1$: so in equilibrium, $x_1$ is a signal for the voter - in fact, the only signal - about the politician type.

### 3.2 Modelling Confirmation Bias

We follow Rabin and Schrag in modelling confirmation bias. They take the following approach: "To model confirmatory bias, we assume that when the agent gets a signal that is counter to the hypothesis he currently believes is more likely, there is a positive probability that he misreads that signal as supporting his current hypothesis. The agent is unaware that he is misreading evidence in this way and engages in Bayesian updating that would be fully rational given his environment if he were not misreading evidence" (Rabin and Schrag (1999), p 48)

The voter cares about the incumbent type, so voter confirmation bias can be modelled as follows. Say that the voter is optimistic (resp. pessimistic) about the quality of the incumbent if $\pi > 0.5$ (resp. $\pi < 0.5$). In our simple setting, if the agent is optimistic, the agent misreads $x_1 = B$ as $x_1 = A$ with probability $q$. If the agent is pessimistic, the agent misreads $x_1 = A$ as $x_1 = B$ with probability $q$. Note that a key difference between Rabin and Schrag (1999)’s set-up and this one is that in theirs, the signal is exogenously generated, whereas in our set-up, voter signals are actions generated by equilibrium -play of the game between incumbent and voter\textsuperscript{11}.

Moreover, when it comes to politician behavior, we will assume that the politician understands that the voter has confirmation bias, and takes this into account when making his policy choices. This seems a reasonable assumption; in modern politics, political parties conduct extensive research into voter attitudes and behavior (Gibson and Römmele (2009)).

\textsuperscript{10}A problem arises with $u_t \equiv 1$ because then in the pandering equilibrium, $x_t$ is not an informative signal of type, as both $H$ and $L$ types choose $x = A$ with probability 1.

\textsuperscript{11}The formal definition of Rabin and Schrag (1999) is the following. Assume a binary state of the world, $s = \{A, B\}$, and sequence $t = 1, \ldots, T$ of informative signals $\sigma_t \in \{A, B\}$ about the state, where $\Pr(\sigma_t = K|s = K) = \theta > 0.5$. If $\pi_t$ is the decision-maker’s prior at $t$, then: (i) if $\pi_t > 0.5$, the agent misreads $\sigma_t = B$ as $\sigma_t = A$ with probability $q$, and (ii) if $\pi_t < 0.5$, the agent misreads $\sigma_t = A$ as $\sigma_t = B$ with probability $q$. 

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3.3 Equilibrium Selection

We focus on pure-strategy perfect Bayesian equilibrium in what follows. As we show below, any equilibrium in pure strategies must have the cutoff property that the incumbent panders in the first period (i.e. chooses an action that is not short-run optimal) if and only if the return to the short-run action, $u_1$, is below some cutoff $\hat{u}$. However, as remarked by Maskin and Tirole (2004), without any further restrictions on beliefs, there are two types of pandering equilibrium. The first is characterized in Proposition 1 below, where the voter re-elects the incumbent only if he thinks he observes action $A$. The second is a "perverse" pandering equilibrium, where the voter re-elects the incumbent only if he thinks he observes action $B$. Maskin and Tirole argue that this equilibrium is implausible, and show that in their set-up, where $u_t = 1$ with probability 1, it is not robust to the introduction of a small probability that the incumbent is a "mechanical" type who always matches.

We follow them by focussing on the first type of pandering equilibrium. It is convenient to do so by imposing the monotonicity assumption on beliefs; that the probability that the incumbent is good, conditional on $x_1 = A$ is at least as great as the probability that the incumbent is good, conditional on $x_1 = B$. To avoid repeated statement of these qualifications, we just refer to any pure-strategy equilibrium that is consistent with the monotonicity assumption on voter beliefs just as a political equilibrium.

4 The Baseline Case

4.1 Political Equilibrium

In the second period, good (bad) politicians match the action to the state according to their preferences i.e. good politicians choose $x_2 = s_2$, and bad politicians choose $x_2 \neq s_2$. So, the voter prefers to re-elect the incumbent if and only if he is good. So, in what follows, we focus on the first period, and so we can drop time subscripts without ambiguity.

We look for an equilibrium with the following structure. Let the policy that the voter thinks he observes be denoted $x_R$. First, voters re-elect the incumbent if and only if $x_R = A$. Second, both types follow a cutoff rule i.e. a politician of type $i = H, L$ "panders" if and only if his payoff $u$ in period 1 from his short-run optimal action is less than some critical value. Here, pandering means choosing action $A$ even when the short-run optimal action is $B$.

Assume first that $\pi > 0.5$, so that the voter is an optimist. We consider first the good type. A conflict between short-run and long-run payoffs arises when $s = B$. Here, the payoffs are as follows. If the

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12 To see this, note that in this equilibrium, pandering is defined as choosing $B$ when it is short-run optimal to choose $A$. Then an argument as in Section 4.1 shows that it is optimal to pander whenever $u \leq \delta(1 + E)(1 - q)$. But, for this to be an equilibrium, it must be that $Pr(i = H | x = B) \geq \pi > Pr(i = H | x = A)$. Now, in this equilibrium, the re-election probabilities for $H, L$ types are are $r_H = \lambda + (1 - \lambda)(1 - p)$, $r_L = \lambda + (1 - \lambda)p$, and formulae (4) still hold. Then, as $r_H < r_L$, $Pr(i = H | x = B) \geq \pi > Pr(i = H | x = A)$ is verified.
incumbent chooses $A$, he gets a short-run payoff of zero, but will be re-elected with probability 1. If he chooses $B$, he gets a short-run payoff of $u$, but will be re-elected with probability $q$, as the voter mis-reads $x = B$ as $x = A$ with probability $q$. (Recall that we are assuming that the politician understands that the voter has confirmation bias). Finally, the payoff to being re-elected is $E[u] + E = 1 + E$. Then, the good incumbent prefers to pander i.e. take action $x = A$ even when $s = B$ if

$$\frac{\delta(1 + E)(1 - q)}{1 - q} \geq \frac{u}{1 - q}$$

So, the cutoff for the good type is

$$\hat{u} = \delta(1 + E)(1 - q)$$

Now consider the bad type. A conflict between short-run and long-run payoffs now arises when $s = A$. Here, the payoffs are as follows. If the incumbent chooses $A$, he gets a short-run payoff of zero, but will be re-elected with probability 1. If he chooses $B$, he gets a short-run payoff of $u$, but will be re-elected with probability $q$. Finally, his payoff to being re-elected is $E[u] + E = 1 + E$. So, the model is symmetric, in the sense that the bad type has the same cutoff $\hat{u}$.

The model also has another important symmetry: the equilibrium cutoff, $\hat{u}$, is the same for both incumbent types also if the voter is a pessimist. To see this, note that in this case, if the good incumbent chooses $A$, he gets a short-run payoff of zero, but will be re-elected with probability $1 - q$, as the voter mis-reads $x = A$ as $x = B$ with probability $q$. If he chooses $B$, he gets a short-run payoff of $u$, but will be re-elected with probability $0$. So, the good incumbent again prefers to pander when (1) holds.

So, for all values of $\pi$, we can define the probability that either type of incumbent panders as

$$\lambda = F(\delta(1 + E)(1 - q))$$

Note also that by the assumption $\pi > \delta(1 + E)$, $\lambda$ is always strictly less than 1. Note for future reference that the probability that the good and bad type choose $x = A$ are

$$r_H = \lambda + (1 - \lambda)p, \quad r_L = \lambda + (1 - \lambda)(1 - p)$$

respectively.

Now consider the behavior of the voters. Recall that Rabin and Schrag (1999) assume that an agent with confirmation bias engages in Bayesian updating that would be fully rational given his environment if he were not misreading evidence. In this context, this means that the voter is willing to re-elect the incumbent if and only if $x_R = A$ whenever the following holds:

$$\Pr(i = H | x = A) \geq \pi > \Pr(i = H | x = B)$$
From Bayes’ rule, we know

\[
\Pr(i = H | x = A) = \frac{r_H \pi}{r_H \pi + r_L (1 - \pi)} \tag{4}
\]

\[
\Pr(i = H | x = B) = \frac{(1 - r_H) \pi}{(1 - r_H) \pi + (1 - r_L) (1 - \pi)}
\]

But from (2) and (4), we see that \( r_H > r_L \) as long as \( \lambda < 1 \), and so (3) holds. But, by assumption that \( \pi > \delta(1 + E) \), \( \lambda \) is always strictly less than 1. This establishes that voters will in fact behave as claimed in equilibrium. We can summarize as follows;

**Proposition 1.** Whether voters are optimists or pessimists, there is a unique political equilibrium where both types pander with probability \( \lambda = F(\delta(1 + E)(1 - q)) \). So, pandering \( \lambda \) is decreasing in voter confirmation bias.

The proof that this equilibrium is unique is in the Appendix.

**4.2 Welfare**

We now turn to consider the effect of changes in confirmation bias \( q \) on welfare. The definition of welfare is not straightforward in this case; should it be calculated taking into account the confirmation bias?\(^{13}\) Rabin and Schrag (1999) argue that the voter is, by definition, unaware of confirmation bias. This certainly must be true in the ex post sense; if the voter knows that he has mis-classified the signal, after the signal is received, an otherwise rational voter would correct the mis-classification. However, the voter may or may not be aware, before getting the signal \( x \), that he will mis-classify it with probability \( q \). If he is not aware of this possibility, we call the voter naive. However, the voter is aware ex ante that he will mis-classify the signal, we could call the voter sophisticated\(^{14}\).

As our main focus in this paper is on the endogenous determination of confirmation bias via selective exposure, we only focus on the simpler and more plausible naive case. A discussion of the sophisticated case is in Lockwood (2015). In the naive case, it is easily calculated that voter welfare is

\[
W = \lambda(p + \delta \pi) + (1 - \lambda)(\pi + \delta(r \pi_A + (1 - r) \pi)) \tag{5}
\]

where

\[
r = p \pi + (1 - \pi)(1 - p) \tag{6}
\]

is the unconditional probability that incumbent is re-elected if he does not pander, and \( \pi_A = p \pi / r \) is the probability that the incumbent is good, conditional on him not pandering and being re-elected.

\(^{13}\)See Bernheim and Rangel (2007) for a more general discussion of welfare evaluations when agents have behavioral biases.

\(^{14}\)This terminology is based on O’Donoghue and Rabin (1999)’s study of the decision-makers with time-inconsistent preferences.
This is explained as follows. With probability \( \lambda \), the incumbent panders, and thus generates expected payoff \( p \) for the voter in the first period, as he takes the right action for the voter only if the state is \( A \). Following this, he is re-elected with probability 1, and then in the second period, will take the short-run optimal action and thus generate a payoff for the voter only if he is good, which is with probability \( \pi \).

With probability \( 1 - \lambda \), the incumbent takes the short-run optimal action and generate \( \pi \) for the voter in the first period. Following this, he is re-elected with probability \( r \). If he is not re-elected, a challenger sets policy in the second period, and he is good with probability \( \pi \). If he is re-elected, he retains office, and, ignoring his own confirmation bias, the voter calculates that he is good with probability \( \pi_A \) via application of Bayes’ rule.

Now consider the effect of an increase in confirmation bias \( q \) on (5). This works through \( \lambda \), so we have:

\[
\frac{\partial W_N}{\partial q} = -\frac{\partial W_N}{\partial \lambda} f(\hat{u}) = f(\hat{u}) \times \begin{cases} \delta(\pi(1-\pi)(2p-1) - (p-\pi)) & \text{selection gain (+)} \\ \text{discipline loss (?)} & \end{cases}
\]

That is, increased confirmation bias reduces pandering, and this always increases the quality of selection of politicians, as the bad incumbent is more likely to be fired. The effect on discipline is ambiguous; if \( p < \pi \), increased confirmation bias can actually improve discipline. In fact, it is clear from (7) that \( \frac{\partial W}{\partial \delta} \geq 0 \) when

\[
\delta \geq \frac{(p-\pi)}{\pi(1-\pi)(2p-1)}
\]

We can summarize:

**Proposition 2.** An increase in confirmation bias \( q \) always makes the voter weakly better off if \( \delta \geq \frac{(p-\pi)}{\pi(1-\pi)(2p-1)} \), and worse off otherwise. In particular, if pandering worsens discipline, i.e. \( p \leq \pi \), an increase in confirmation bias \( q \) always makes the voter strictly better off.

5 Selective Exposure and the Market For Media Slant

5.1 The Set-Up

Here, we extend the baseline model of Section 4 to endogenize the degree of confirmation bias. In particular, motivated by the extensive experimental literature on selective exposure, we model the idea that bias is determined by selective exposure, i.e. the voter’s choice of which media outlet to access. In turn, the degree of confirmation bias offered by the outlets ("slant") is determined in equilibrium. To be specific, following Mullainathan and Shleifer (2005), we refer to the outlets as newspapers, although
now, most consumers of political information get their news from TV and online\textsuperscript{15}. If the citizen does not read the newspaper, he is assumed completely uninformed about the first-period policy choice, and is assumed not to vote.

We suppose that there are newspaper(s) $i = 1, \ldots, n$, and each of them can choose a "slant", which is a pair $(q^i_{BA}, q^i_{AB}) \in [0, \frac{1}{2}]^2$, where $q^i_{BA}$ is the probability of reporting $x^i_R = A$ when $x = B$, and a probability $q^i_{AB}$ of reporting $x^i_R = B$ when $x = A$. Note that $(q_{AB}, q_{BA}) = (0, 0)$ is the polar case where $x^i_R$ is perfectly informative about $x$, and $(q_{AB}, q_{BA}) = (0.5, 0.5)$ is the other polar case where $x^i_R$ is random noise\textsuperscript{16}.

We now assume a continuum $[0, 1]$ of voters, rather than just one voter as before. Further, assume that a fraction $\gamma \in (0, 1)$ of voters are "optimistic" about the incumbent in the sense that they have a prior $\pi^+ > 0.5$, and the other fraction $1 - \gamma$ are pessimistic about the incumbent in the sense that they have a prior $\pi^- < 0.5$. This has a party-political interpretation. Assume that there are two parties, $L$ and $R$, and w.l.o.g., that the incumbent is from party $L$, and the challenger from party $R$. Then, the optimistic voters can be interpreted as supporters of the $L$ party, and the pessimistic voters can be interpreted as supporters of the $R$ party. Note that a homogeneous electorate is the special case where either $\gamma = 1$ or $\gamma = 0$.

Voter preferences for newspapers are as follows. First, following Mullainathan and Shleifer (2005), we assume that every citizen has some utility from the consumption of news for reasons other than slant e.g. entertainment, given by a random variable $\theta$. We assume that $\theta$ is uniformly distributed on $[-\sigma, \sigma]$. Note that $\theta$ can be negative, because this taste parameter includes any fixed price of subscribing to the media outlet\textsuperscript{17}.

Moreover, if the voter is optimistic (pessimistic) he has a cognitive dissonance loss of $d > 0$ if he gets "bad news" (resp. "good news") about the incumbent. This motivated by the psychology literature on cognitive dissonance, which is seen as a negative state which individuals try to avoid\textsuperscript{18}.

This is formalized as follows. To make the model analytically tractable, we impose the weak assumption that the voter suffers cognitive dissonance from the signals $x^i_R$ only when they are informative; that is, only if the incumbent is not pandering\textsuperscript{19}. This seems plausible; if voters are fully rational (other than suffering cognitive dissonance), they will understand that with probability $\lambda$, the information $x^i_R$ does

---

\textsuperscript{15}In a 2012 PEW survey, in response to the question: "where did you get the news yesterday?", 55% said from TV, 39% said online, 33% said radio, and only 29% said from traditional newspapers. Of course, much online news is also in "newspaper" form. (http://www.people-press.org/2012/09/27/in-changing-news-landscape-even-television-is-vulnerable/)

\textsuperscript{16}We could allow $q_{AB}, q_{BA}$ be as high as 1 because voters prefer confirmation bias as high as possible; this does not affect the qualitative results in any way.

\textsuperscript{17}We also assume that the distribution of $\theta$ is the same for both optimistic and pessimistic voters.

\textsuperscript{18}For example, Smith, Fabrigar and Norris (2008) state that "When people are exposed to information that is incongruent with their attitudes or decisions, a negative arousal state of cognitive dissonance is produced which people are then motivated to reduce."

\textsuperscript{19}Without this assumption, the demand for newspapers also depends on $\lambda$ and the analysis quickly becomes too complex.
With this assumption, the disutility of the optimistic voter who reads newspaper \( i \) is \( d^+ \), where \( \beta^+ \) is, from the perspective of the optimistic voter, the probability that the newspaper reports a "bad" signal i.e. \( x = B \), conditional on the incumbent not pandering:

\[
\beta^+ (q^i_{AB}, q^i_{BA}) = r^+ q^i_{AB} + (1 - r^+)(1 - q^i_{BA}), \quad r^+ = \pi^+ p + (1 - \pi^+)(1 - p)
\]

where \( r^+ \) is defined as in (6); that is, it is the probability, from the point of view of the optimistic voter, that the incumbent chooses \( x = A \), given that he does not pander.

In the same way, the disutility of the pessimistic voter who reads newspaper \( i \) is \( d^- \), where \( \beta^- \) is, from the perspective of the pessimistic voter, the probability that the newspaper reports a "bad" signal i.e. \( x = A \) conditional on the incumbent not pandering:

\[
\beta^- (q^i_{AB}, q^i_{BA}) = r^- (1 - q^i_{AB}) + (1 - r^-)q^i_{BA}, \quad r^- = \pi^- p + (1 - \pi^-)(1 - p)
\]

where again, \( r^- \) is defined as in (6); that is, it is the probability, from the point of view of the pessimistic voter, that the incumbent chooses \( x = A \), given that he does not pander. Note \( r^+ > r^- \), \( r^+ > 0.5 \).

So, overall, the utilities of optimistic and pessimistic voters from reading newspaper \( i \) are

\[
\theta - d^+ (q^i_{AB}, q^i_{BA}), \quad \theta - d^- (q^i_{AB}, q^i_{BA})
\]

5.2 The Order of Events and Information Structure

For simplicity, we assume that voters only buy and read newspapers in the first period, and then carry over the cognitive bias (if any) generated by this over to the second period. So, we can ignore the second period and concentrate on the first. The order of events in the first period is as follows.

1. The newspaper(s) \( i = 1, \ldots n \) choose their "slants" \((q^i_{BA}, q^i_{AB})\).
2. Each voter chooses whether to read a newspaper or not.
3. The state \( s \in \{A, B\} \) is realized, and the incumbent politician chooses \( x \in \{A, B\} \).
4. Newspaper \( i \) reports \( x^i_R \), \( i = 1, \ldots n \).
5. The election takes place.
5.3 Discussion

While our modelling of the market for slant broadly follows Mullainathan and Shleifer (2005), there are some differences, which are really simplifications. First, following much of the media slant literature, we assume that the newspaper(s) do not charge a price to the citizens, but attempt to maximize sales via their choice of characteristics. This assumption is motivated by the stylized facts that (a) broadcast television and radio derive virtually no revenue from viewers or listeners; (b) newspapers and magazines obtain some revenue from their readers, but it is still relatively minor compared to advertising revenue.

Second, unlike nearly all of the literature except for Chan and Suen (2008), we do not need to assume that the citizens take a "private action" such as choice of labour supply, which depends on government policy in order to generate interesting or meaningful results about media slant. [We introduce such a private action in Section 7 below, where we show that it introduces an interesting "feedback effect" from equilibrium in the political agency subgame (stages 3-5 above) to stage 1, the choice of slant.]

5.4 Political Equilibrium

As is standard, we solve the model backwards, beginning with stages 3-5. Much of the work required has already been done. Specifically, suppose (without loss of generality) that some fraction \( f^+ \) optimistic citizens have chosen to read a newspaper with slant \( q^+_{AB}, q^+_{BA} \), and some fraction \( f^- \) of pessimistic citizens have chosen to read a newspaper with slant \( q^-_{AB}, q^-_{BA} \). We are interested in the equilibrium in the policy and voting subgame conditional on these choices, which we have already called the political equilibrium, and so we retain this terminology.

Assume first that the informed optimistic citizens are in the majority i.e. \( \gamma f^+ > (1 - \gamma) f^- \) and are thus decisive if there is any disagreement between voters. Then, if the incumbent panders, he will be re-elected with probability \( 1 - q^+_{AB} \), and if he does not, he will be re-elected with probability \( q^-_{BA} \). The difference in re-election probabilities is \( 1 - q^+_{AB} - q^-_{BA} \), and so \( q^+_{AB} + q^-_{BA} \) plays the role of \( q \) in Proposition 1. We will call \( q^+_{AB} + q^-_{BA} \) the effective confirmation bias faced by the incumbent.

Assume next that the pessimistic voters are in the majority i.e. \( \gamma f^+ < (1 - \gamma) f^- \) and are thus decisive if there is any disagreement between voters. Then, by the same argument, the effective confirmation bias faced by the incumbent is \( q^+_{AB} + q^-_{BA} \).

Finally, in the knife-edge case \( \gamma f^+ = (1 - \gamma) f^- \), assume, as is usual, that each group is decisive with probability 0.5. Thus, the increase in the expected re-election probability from choosing \( x = A \) over \( x = B \) can be computed as follows. If \( x = B \) is chosen, with probability 0.5, the optimists will be decisive, and thus the re-election probability is \( 0.5 \left( q^+_{AB} + q^+_{BA} \right) \). If \( x = A \) is chosen, with probability
0.5, the pessimists will be decisive, and thus the re-election probability is \(1 - 0.5(q_{AB}^- + q_{BA}^-)\). So, the increase in re-election probability from pandering is \(\frac{1}{2}(q_{AB}^+ + q_{BA}^+ + q_{AB}^- + q_{BA}^-)\).

So, collecting these results, we have shown the following.

**Proposition 3.** Assume that some fraction \(f^+\) of optimistic citizens have chosen to read a newspaper with slant \(q_{AB}^+, q_{BA}^+\), and some fraction \(f^-\) of pessimistic citizens have chosen to read a newspaper with slant \(q_{AB}^-, q_{BA}^-\). Then, there is a unique political equilibrium where both incumbent types pandering with probability \(\hat{f} = F(\delta(1 + E)(1 - \hat{q}))\), where \(\hat{q}\) is the effective confirmation bias, and is:

\[
\hat{q} = \begin{cases} 
q^+ = q_{AB}^+ + q_{BA}^+, & \gamma f^+ > (1 - \gamma)f^- \\
q^- = q_{AB}^- + q_{BA}^+, & \gamma f^+ < (1 - \gamma)f^- \\
\frac{1}{2}(q_{AB}^+ + q_{BA}^+ + q_{AB}^- + q_{BA}^-), & \gamma f^+ = (1 - \gamma)f^- 
\end{cases} \tag{11}
\]

This Proposition makes clear the link between media slant and the political outcome, via the mechanism of confirmation bias. We now turn to stages 1 and 2, where media slant is determined. For clarity and tractability, we consider only the cases of monopoly \((n = 1)\) and duopoly \((n = 2)\).

### 5.5 Monopoly

A monopolist can choose to report \(q_{AB}, q_{BA} \in [0, 0.5]\). Note now from (10) that any optimistic citizen with \(\theta \geq -d\beta^+(q_{AB}, q_{BA})\) will buy the newspaper, as will any pessimistic citizen with \(\theta \geq -d\beta^-(q_{AB}, q_{BA})\). Then, assuming that \(\sigma\) is large enough so that we can ignore corner cases where everybody or nobody buys the newspaper, sales by the monopolist to optimistic and pessimistic voters separately are

\[
S^+ = \frac{1}{2} - \frac{1}{2\sigma}d\beta^+, \quad S^- = \frac{1}{2} - \frac{1}{2\sigma}d\beta^-
\tag{12}
\]

So, using (8),(9) in (12), we see that overall sales are:

\[
S = \gamma S^+ + (1 - \gamma)S^- = \frac{1}{2} - \frac{d}{2\sigma}\gamma (r^+q_{AB} + (1 - r^+)(1 - q_{BA})) - \frac{d}{2\sigma}(1 - \gamma)(r^-(1-q_{AB})+(1-r^-)q_{BA}) \tag{13}
\]

Then the monopolist chooses \(q_{AB}, q_{BA} \in [0, 0.5]\) to maximize (13). It is easily verified that the solution to this problem has the following properties\(^{21}\):

**Proposition 4.** If the fraction of optimists is large, \(\frac{\gamma}{1 - \gamma} > \frac{1 - r^-}{1 - r^+}\), then the monopolist slants to the optimists i.e. \(q_{BA} = 0.5, q_{AB} = 0\). If the fraction of optimists is small , \(\frac{\gamma}{1 - \gamma} < \frac{r^-}{1 - r^+}\), then the monopolist slants to the pessimists; \(q_{BA} = 0, q_{AB} = 0.5\). If the fraction of optimists is intermediate, \(\frac{r^-}{1 - r^+} < \frac{\gamma}{1 - \gamma} < \frac{1 - r^-}{1 - r^+}\), then there is no slant i.e. \(q_{BA} = q_{AB} = 0\).

\(^{21}\)Proofs of this and all subsequent Propositions are in the Appendix.
Note that for clarity, we do not specify monopoly choice when \( \frac{q}{I} = \frac{1}{r} \) or \( \frac{q}{I} = \frac{r}{2} \); in these borderline cases, it is clear that \( q_{BA}, q_{AB} \) are not uniquely determined.

This result can be compared to Proposition 4 of Mullainathan and Shleifer (2005). Their setting is where the state of the world is a continuous variable, and the newspaper observes a noisy signal of it. The newspaper can report on its signal of the state of the world, possibly with some slant. Voters vary in the level of bias, \( b \in \mathbb{R} \), that they most prefer in the report, and \( b \) is assumed to have a mean of zero. They find that when the monopolist sells to all readers, it slants the news by scaling its signal towards zero. Our result is rather different. We find conditions under which the monopolist reports unbiased information about its signal, \( x \in \{ A, B \} \).

5.6 Duopoly

Now there are two newspapers, 1, 2 choose \( q_{AB}^i, q_{BA}^i \in [0, \frac{1}{2}]^2 \), and so from (10), conditional on buying any newspaper, the optimistic citizen will buy from newspaper \( i \) if \( \beta^+(q_{AB}^i, q_{BA}^i) < \beta^+(q_{AB}^j, q_{BA}^j) \), and similarly for the pessimistic citizen. We thus define two indicator functions recording the fraction of voters of either type that buy from newspaper 1 as:

\[
I^+ = \begin{cases} 
1, & \beta^+(q_{AB}^1, q_{BA}^1) < \beta^+(q_{AB}^2, q_{BA}^2) \\
0, & \beta^+(q_{AB}^1, q_{BA}^1) > \beta^+(q_{AB}^2, q_{BA}^2) \\
0.5, & \beta^+(q_{AB}^1, q_{BA}^1) = \beta^+(q_{AB}^2, q_{BA}^2)
\end{cases}
\]

\[
I^- = \begin{cases} 
1, & \beta^-(q_{AB}^1, q_{BA}^1) < \beta^-(q_{AB}^2, q_{BA}^2) \\
0, & \beta^-(q_{AB}^1, q_{BA}^1) > \beta^-(q_{AB}^2, q_{BA}^2) \\
0.5, & \beta^-(q_{AB}^1, q_{BA}^1) = \beta^-(q_{AB}^2, q_{BA}^2)
\end{cases}
\]

As in the monopoly case, assume that \( \sigma \) is large enough so that we can ignore corner cases where everybody or nobody buys the newspaper. Then we can write the aggregate sales of newspapers 1 and 2 as:

\[
S_1 = \gamma I^+ \left( \frac{1}{2} - \frac{d}{2\sigma} (r^+ q_{AB} + (1-r^+)(1-q_{BA})) \right) + (1-\gamma) I^- \left( \frac{1}{2} - \frac{d}{2\sigma} (r^-(1-q_{AB}) + (1-r^-)q_{BA}) \right)
\]

\[
S_2 = \gamma (1-I^+) \left( \frac{1}{2} - \frac{d}{2\sigma} (r^+ q_{AB} + (1-r^+)(1-q_{BA})) \right) + (1-\gamma)(1-I^-) \left( \frac{1}{2} - \frac{d}{2\sigma} (r^-(1-q_{AB}) + (1-r^-)q_{BA}) \right)
\]

Then, we look for a Nash equilibrium in slants, defined in the usual way i.e. as a pair \( (q_{AB}^1, q_{BA}^1), (q_{AB}^2, q_{BA}^2) \) such that \( (q_{AB}^1, q_{BA}^1) \) maximizes \( S_1 \) taking \( (q_{AB}^2, q_{BA}^2) \) as given, and vice-versa. We have the following result\(^{22}\):

**Proposition 5.** If \( \frac{\gamma}{1-\gamma} > \frac{1+\frac{dr}{1-\gamma}}{1-\frac{dr}{1-\gamma}} \) the unique equilibrium is where both newspapers slant only to the optimists i.e. \( q_{AB}^i = 0, q_{BA}^i = 0.5 \), \( i = 1, 2 \). (ii) If \( \frac{1+\frac{dr}{1-\gamma}}{1-\frac{dr}{1-\gamma}} < \frac{\gamma}{1-\gamma} \), the unique equilibrium is where

\(^{22}\)Note as in the monopoly case, that for clarity, we do not specify the outcome in borderline cases; there, it is clear that \( q_{BA}, q_{AB} \) are not uniquely determined.
both slant only to the pessimists i.e. $q_{AB}^i = 0, q_{BA}^i = 0$, $i = 1, 2$. If $\frac{1 - d}{1 + d} r^- < \frac{\gamma}{1 - \gamma} < \frac{1 + d}{1 - d} (1 - r^-)$ there are two Nash equilibria, one where firm 1 slants to the optimists and firm 2 to the pessimists ($q_{AB}^1 = 0, q_{BA}^1 = 0.5, q_{AB}^2 = 0.5, q_{BA}^2 = 0$), and one where the reverse happens.

Note that the interval $\left(\frac{1 - d}{1 + d} r^-, \frac{1 + d}{1 - d} (1 - r^-)\right)$ is always non-empty, so that "splitting the market" is always an equilibrium outcome for some parameter values. Note also that generally, there is no ranking of the monopoly and duopoly cutoffs; however, if $\sigma/d$ is large enough, i.e. if tastes for the newspaper are very diffuse, or cognitive dissonance is small, then it is possible to show that

\[
\frac{r^-}{r^+} < \frac{1 - \frac{d}{\sigma}}{1 + \frac{d}{\sigma}}; \quad \frac{1 + \frac{d}{\sigma} (1 - r^-)}{1 - \frac{d}{\sigma} (1 - r^+)} < \frac{1 - r^-}{1 - r^+}
\]

i.e. with duopoly, is more likely that there is slant just to the majority group in the population\textsuperscript{23}. Figure 1 below shows this case.

Figure 1 in here

This result can be compared to Proposition 5 of Mullainathan and Shleifer (2005). They find that the duopolists always "split the market", with one duopolist reporting a weighted average of its true signal and a point to the left of it, and the other duopolist reporting a weighted average of its true signal and a point to the right of it. This is similar to the outcome we find when $\gamma$ is not too far from 0.5; however, when $\gamma$ is close to 0 or 1 we find that both duopolists compete for the same readers.

We can also now compare monopoly and duopoly when there is only one type of citizen. Assume w.l.o.g. that $\gamma = 1$, so all citizens are optimistic. Then, in this case, monopoly and duopoly slant are exactly the same i.e. $q_{AB} = 0, q_{BA} = 0.5$, which is exactly the finding of Mullainathan and Shleifer (2005), p1037.

6 Market Structure, Pandering and Voter Welfare

We have now characterized equilibrium in our extended set-up, where confirmation bias is determined endogenously via selective exposure. This generates a link between the number of firms in the media market (market structure) and the political equilibrium outcome (degree of pandering). It is also interesting, following Chan and Suen (2008) and Duggan and Martinelli (2009), to ask how these effects feed through to voter welfare, and whether there is any role for government in regulating either entry to the media market, or the amount of slant provided by a given number of firms.

\textsuperscript{23}Specifically, it is easily verified that these inequalities reduce to

\[
\frac{r^- - r^+ d}{\sigma}, \frac{d}{\sigma} (1 - r^-)(1 - r^+) \frac{d}{\sigma} < r^+ - r^-.
\]
6.1 Market Structure and Pandering

We first ask how the market structure (monopoly, duopoly) links to the political outcome via (11). To do this, we have to compute the fractions of citizens of each type that actually vote i.e. $f^+, f^-$. Once this is done, the following result can be straightforwardly established.

**Proposition 6.** (i) In the case of monopoly, equilibrium aggregate confirmation bias is $\hat{q} = 0.5$ unless $\frac{\gamma}{1+\gamma} < \frac{1 - \gamma}{1+\gamma}$, in which case it is zero. (ii) In the case of duopoly, equilibrium aggregate confirmation bias is always $\hat{q} = 0.5$. So, equilibrium confirmation bias is always greater with duopoly, implying that the level of pandering is always lower with duopoly.

So, we have shown that greater competition in the media market leads to less pandering, and a greater probability of incumbent turnover. This result is illustrated in Figure 2, where the degree of pandering, $\lambda = F(\delta(1 + E)\hat{q})$ is graphed against the relative fraction of optimists, $\frac{\gamma}{1+\gamma}$, for both monopoly and duopoly.

Figure 2 in here

The intuition for this result is the following. From Proposition 5, with duopoly, in all equilibrium configurations, we see that both voter groups purchase slant of 0.5. So, in this case, the equilibrium confirmation bias must be 0.5. In the case of monopoly, it can be proved that the group which is supplied its preferred slant is always larger than the one that is not, whenever slant is supplied. But of course, when $\frac{\gamma}{1+\gamma} < \frac{1 - \gamma}{1+\gamma}$, no slant is supplied, and so voter confirmation bias is zero. So, in this sense, we see that media competition gives rise to greater selective exposure and confirmation bias.

6.2 Market Structure and Welfare

We now can ask what the effect of the media is on voter welfare, and in particular, whether more competition in the media market leads to higher welfare or not. Asking this question is in part motivated by media regulation that typically place limits on the ownership of media outlets by single entities. For example, in the US, the Federal Communications Commission (FCC) sets limits on the number of broadcast stations (radio and TV) an entity can own, as well as limits on the common ownership of broadcast stations and newspapers (http://www.fcc.gov/guides/review-broadcast-ownership-rules). A less common form of regulation is that of content, or slant. For example in the UK, the publically funded BBC us required by charter to show balance in its coverage of the news.24

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24 The Agreement accompanying the BBC Charter specifies that we should do all we can *to ensure that controversial subjects are treated with due accuracy and impartiality* in our news and other output dealing with matters of public policy or political or industrial controversy. http://www.bbc.co.uk/editorialguidelines/page/guidelines-editorial-values-charter/
Given this, we can ask two kinds of normative question. First, we can ask whether the government should regulate entry, which in practice is the more common form of regulation. Should it restrict or encourage entry? Second, we can ask whether the market outcome is efficient, holding the number of firms fixed, relative to the bias that can be feasibly supplied by those firm(s). That is, in the monopoly case, is the choice of \( q_{BA}, q_{AB} \) welfare-maximising, given the implicit restriction that both types of reader must be exposed to the same slant, and in the duopoly case, are \( q'_{BA}, q'_{AB}, i = 1, 2 \) welfare maximizing, given that readers will choose between newspapers as described in (14)(15)? This is effectively asking whether, given the number of newspapers in the market, the government should regulate in some way their slant.

To proceed, we can write aggregate welfare for all citizens from both the consumption of newspapers, and from policy choices as

\[
\Pi = \gamma \left( \frac{1}{2\sigma} \int_{-\beta^+}^{\beta^+} (\theta - d\beta^+) d\theta + W(\pi^+) \right) + (1 - \gamma) \left( \frac{1}{2\sigma} \int_{-\beta^-}^{\beta^-} (\theta - d\beta^-) d\theta + W(\pi^-) \right)
\]

The integral terms are the surplus enjoyed by the readers of newspapers. The terms \( W(\pi^+), W(\pi^-) \) are the welfares from policy choice for optimists and pessimists, defined as in (5) above, but where we now make the dependence of \( W \) on \( \pi, \pi_A \). So, we see that there are potentially two sources of inefficiency in the "market" for confirmation bias. First, voters and newspapers do not internalize the effect of the choice of \( q_{BA}, q_{AB} \) respectively on the political equilibrium via (11) and thus on the welfare from policy choice. Second, even ignoring this effect, newspapers might not "supply" the efficient amount of slant because they maximize revenues, not reader surplus.

To develop ideas, it is best first to look at the special case where voters are homogenous i.e. where \( \gamma = 1 \). Here, both monopoly and duopoly will provide maximum slant to the voter of the type that he likes i.e. \( q_{BA} = 0.5, q_{AB} = 0 \). So, entry has no effect on the outcome, or on voter welfare and so should not be regulated. Now, suppose that the social planner can choose \( q_{BA}, q_{AB} \). Clearly, he will set \( q_{AB} = 0 \). Also, from (11), effective slant is \( \bar{q} = q_{BA} \). So, from (16), using (8), the marginal effect of \( q_{BA} \) on welfare is

\[
\frac{\partial \Pi}{\partial q_{AB}} = \frac{\sigma + d\beta^+}{2\sigma}(1 - \sigma^+) + \frac{\partial W}{\partial \bar{q}} = \frac{\sigma + d(1 - \sigma^+)(1 - q_{BA})}{2\sigma}(1 - \sigma^+) + \frac{\partial W}{\partial \bar{q}}
\]

where by a slight abuse of notation, \( W = \gamma W(\pi^+) + (1 - \gamma)W(\pi^-) \). So, as long as \( \frac{\partial W}{\partial \bar{q}} \geq 0 \), this is positive for all \( q_{BA} \), and thus the market outcome \( q_{BA} = 0.5 \) is efficient. In fact, this is the case as long as

\[
\frac{\partial \Pi}{\partial q_{AB}} \bigg|_{q_{BA}=0.5} = \frac{\sigma + d(1 - \sigma^+)}{4\sigma}(1 - \sigma^+) + \frac{\partial W}{\partial \bar{q}} \geq 0
\]

i.e. as long as \( \frac{\partial W}{\partial \bar{q}} \) is not too negative. But, when \( \frac{\partial W}{\partial \bar{q}} < -\frac{\sigma + d(1 - \sigma^+)}{4\sigma}(1 - \sigma^+) \), a lower value of \( q_{BA} \) that
solves \( \frac{\partial H}{\partial q_{1AB}} = 0 \) is socially desirable, with eventually \( q_{BA} = 0 \) being best when \( \frac{\partial W}{\partial q} = \frac{\sigma + d(1-r^+)}{2\sigma} (1 - r^+) \). The intuition for this is clear. In the homogenous case, the only source of efficiency is that firms do not internalize the effect of confirmation bias on political behavior of the incumbent. So, we can summarize:

**Proposition 7.** Assume voters are homogenous. Then, media slant and political outcomes are unaffected by entry. Moreover, equilibrium media slant is efficient as long as (17) above holds; otherwise, it is too high.

Now we turn to the heterogenous case. We first discuss the welfare effects of entry. The first observation is that we can note that if \( \frac{\partial W}{\partial q} \geq 0 \) i.e. confirmation bias is weakly welfare-improving at the policy stage, then duopoly always leads to a more efficient outcome. First, when monopoly outcomes and duopoly outcomes are different, by Proposition , this is because either (i) duopoly offers maximum slant to both types of voters when the monopolist offers no slant, or (ii) the duopoly offers maximum slant to one type of voter when the monopolist offers no slant. In both cases, equilibrium confirmation bias is higher with duopoly, and this is efficient both because \( \frac{\partial W}{\partial q} \geq 0 \), and because each type of voter purchases slant closer to.

So, we conclude that as long as pandering is undesirable, promoting entry in the media market is welfare-improving.

Now consider the other welfare question. The easiest case is duopoly. Suppose that the social planner can choose \((q_{1AB}^i, q_{2AB}^i)_{i=1,2}\). First, if newspaper \( i \) is bought only by the optimists, it is optimal to have \( q_{1AB}^i = 0 \), and if newspaper \( j \) is bought by pessimists, it is optimal to have only \( q_{2AB}^j = 0 \). So, as the optimistic (pessimists) dislike negative (positive slant), the efficient arrangement is for the duopolists to share the market; in this way, any given effective confirmation bias can be supplied at least "cost" in terms of cognitive dissonance.

So, duopoly is only potentially efficient when the market is shared i.e. when \( \gamma/(1-\gamma) \) is in the intermediate range in Proposition 5. Assume w.l.o.g. that paper 1 slants to the optimists, so \( q_{1AB}^1 = 0 \) and paper 2 to the pessimists, so \( q_{2AB}^2 = 0 \). So, the question now is: are \( q_{1AB}^1, q_{2AB}^2 \) chosen efficiently?

Differentiating (16), we get

\[
\frac{\partial \Pi}{\partial q_{1AB}} = \frac{\sigma + d\beta^+}{2\sigma} \gamma (1 - r^+) + \frac{\partial W}{\partial q} \frac{\partial q_{1AB}}{\partial \beta^+} \frac{\partial q_{1AB}}{\partial q_{1AB}} \quad \frac{\partial \Pi}{\partial q_{2AB}} = \frac{\sigma + d\beta^-}{2\sigma} (1 - \gamma) r^- + \frac{\partial W}{\partial q} \frac{\partial q_{2AB}}{\partial \beta^-} \frac{\partial q_{2AB}}{\partial q_{2AB}} \tag{18}
\]

and where \( \frac{\partial q_{1AB}}{\partial \beta^+}, \frac{\partial q_{2AB}}{\partial \beta^-} \) measure the effect of \( q_{1AB}^1, q_{2AB}^2 \) on effective confirmation bias. Moreover, from (11), \( \frac{\partial q_{1AB}}{\partial \beta^+}, \frac{\partial q_{2AB}}{\partial \beta^-} \geq 0 \), whatever \( f^+, f^-, \gamma \).

So, if \( \frac{\partial W}{\partial q} \geq 0 \), from (18), we see that both terms in each derivative in (18) are positive, and so the social planner always chooses \( q_{1AB}^1 = q_{2AB}^2 = 0.5 \), which is also what occurs in duopoly. If \( \frac{\partial W}{\partial q} < 0 \) on the other hand, it is possible that the optimal \( q_{1AB}^1, q_{2AB}^2 \) or both less than 0.5, or even zero, as in the
homogenous case. To conclude, it is worth noting that there are two ways in which duopoly can be inefficient; it can supply "too much" confirmation bias or supply it inefficiently.

Finally, turning to monopoly, we ask whether \( q_{BA}, q_{AB} \) are chosen efficiently. Recalling that \( \hat{q} = q_{BA} + q_{AB} \) in this case, the derivatives of welfare with respect to \( q_{BA}, q_{AB} \) are:

\[
\frac{\partial W}{\partial q_{BA}} = \frac{\sigma + d^+}{2\sigma} \gamma (1 - \gamma) - \frac{\sigma + d^-}{2\sigma} (1 - \gamma) + \frac{\partial W}{\partial \hat{q}} , \\
\frac{\partial W}{\partial q_{AB}} = -\frac{\sigma + d^+}{2\sigma} \gamma (1 - \gamma) + \frac{\partial W}{\partial \hat{q}} .
\]

Comparing these two the derivatives of monopoly sales (20),(21) in the proof of Proposition 4 in the Appendix, we see two differences. First, there is an additional term \( \frac{\partial W}{\partial \hat{q}} \) capturing the external effect of the firm’s choice on the political outcome. Second, the terms in \( \gamma, 1 - \gamma \) are not longer weighted by \( \frac{d^+}{2\sigma} \), but by \( \frac{\sigma + d^+}{2\sigma}, \frac{\sigma + d^-}{2\sigma} \) respectively. This is because the monopolist cares about revenues, but the social planner cares about reader surplus. Generally, unless \( \frac{\partial W}{\partial \hat{q}} \) is strongly negative (in which case optimal slant is zero), there will be cutoffs for \( \gamma/(1 - \gamma) \) i.e. \( \xi < \bar{\tau} \) such that when \( \gamma/(1 - \gamma) \) is below \( \xi \), negative slant is optimal i.e. \( q_{AB} > 0, q_{BA} = 0 \), and when \( \gamma/(1 - \gamma) \) is above \( \bar{\tau} \), positive slant is optimal i.e. \( q_{AB} > 0, q_{BA} = 0 \). However, even when \( \frac{\partial W}{\partial \hat{q}} = 0 \), these cutoffs will be different to the ones specified in Proposition 4. So, there are no simple conditions under which the monopoly makes efficient choices.

We can summarize the discussion so far as follows:

**Proposition 8.** Assume that voters are heterogenous. (i) If reducing pandering is weakly welfare improving i.e. \( \frac{\partial W}{\partial \hat{q}} \geq 0 \), duopoly always leads to a higher value of welfare than monopoly i.e. entry is always desirable. (ii) The duopoly outcome is efficient if (a) the duopolists split the market, and (b) reducing pandering is weakly welfare improving i.e. \( \frac{\partial W}{\partial \hat{q}} \geq 0 \). (iii) The monopolist generally does not choose \( q_{AB}, q_{BA} \) efficiently.

These results contrast with Chan and Suen (2008), which is the only paper so far, to our knowledge, to give a systematic account of how media competition effects voter welfare. They establish that a new entrant to the media market always raises the probability that both parties choose the policy favoured by the median voter (their Proposition 5). This is somewhat in contrast to our results, which say that when pandering is not optimal, entry (moving from monopoly to doupoly) may not be welfare-improving, because of the induced effects on behavior of the incumbent politician, and effect that is not present in

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25Mullainathan and Shleifer (2005) do not have any results on welfare. Duggan and Martinelli (2010) do consider voter welfare, but with some limitations. First, they assume throughout just one media outlet, so the issue of media competition on welfare cannot be examined. Second, they compare the effect of a pro-challenger, pro-incumbent, and neutral outlet on voter welfare, but they do not provide an explicit theory of how the outlet might adopt any of these positions as a result of maximizing sales or some other objective.
Chan and Suen (2008).

In their Proposition 6, they also have some results on optimal media positions in the case of two newspapers; some bias is always optimal, and it is also optimal that the papers should take different editorial positions. This second result is similar to our result that it is optimal for two newspapers to split the market and not compete head to head for readers.

7 Equilibrium with Private Actions

TO BE COMPLETED.

8 Conclusions

This paper considers the implications, and the causes, of confirmation bias in a political economy setting. Initially, treating confirmation bias as fixed, we show that confirmation bias reduces pandering, as it lowers the electoral "reward" for this behavior by reducing the increase in the probability of being elected from pandering. As pandering generally has an ambiguous effect on voter welfare, it is possible that an increase in confirmation bias (parametrized by the probability of misreading policy choice, the signal about the benevolence of the politician) increases voter welfare.

We then consider the important case where confirmation bias is created or reinforced by selective exposure. We assume that at an initial stage of the model, the voter can obtain information about the incumbent politician’s action from one or several possibly biased or slanted media outlets. In our setting, the demand for "slant" is determined by the fact that the voter suffers cognitive dissonance if he gets a signal about the incumbent that contrasts with his prior belief, and belief. The supply of slant is determined as the outlets choose their slant to maximize sales and thus advertising revenue.

We show that typically, the level of confirmation bias generated by competition in the media market (duopoly) is greater than monopoly; under some circumstances, a monopolist may provide unbiased information, but duopolists always slant the news. So, competition in the media market generally decreases pandering, and increases incumbent turnover. Moreover, in the case that pandering reduces welfare, competition in the media market (duopoly) welfare-dominates monopoly, although when pandering increases welfare, examples can be found where the opposite is true.

9 References


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A Appendix

Proof of Proposition 1. (i) Assume that voters only re-elect if they observe \( x_R = A \). Then, the only other possible equilibrium is where one (or both) types does not follow a cutoff rule. But then (say) the \( H \)–type will pander when \( u = u' \), but not when \( u = u'' \), for some \( u' > u'' \). But then the gain to to pandering when \( u = u'' \) is \( \delta(1 + E)(1 - q) - u'' \), which is greater than \( \delta(1 + E)(1 - q) - u' \), which is the gain to pandering when \( u = u' \), a contradiction.

(ii) The second possibility is that voters re-elect if they observe \( x_R = B \). But this is ruled out by the monotonicity assumption.

(iii) The third and fourth possibilities are that voters always or never re-elect the incumbent, whatever \( x \). But in this case, both types will choose their short-run optimal actions, whatever \( u \); so that \( \Pr(i = H | x = B) < \pi < \Pr(i = H | x = A) \). So, neither voting strategy can be sequentially rational. □

Proof of Proposition 4. Differentiating (13), we get:

\[
\frac{\partial S}{\partial q_{BA}} = \frac{d}{2\sigma} \gamma(1 - r^+) - \frac{d}{2\sigma} (1 - \gamma)(1 - r^-) \\
\frac{\partial S}{\partial q_{AB}} = - \frac{d}{2\sigma} \gamma r^+ + \frac{d}{2\sigma} (1 - \gamma)r^-
\]

But then \( \frac{\partial S}{\partial q_{BA}} > 0 \) iff \( \frac{\gamma}{1 - \gamma} > \frac{1 - r^-}{1 - r^+} \), so \( q_{BA} = 0.5 \) iff \( \frac{\gamma}{1 - \gamma} > \frac{1 - r^-}{1 - r^+} \). Similarly, \( \frac{\partial S}{\partial q_{AB}} > 0 \) iff \( \frac{\gamma}{1 - \gamma} < \frac{r^-}{r^+} \), so \( q_{AB} = 0.5 \) iff \( \frac{\gamma}{1 - \gamma} < \frac{r^-}{r^+} \).

Of these inequalities are reversed, then \( q_{BA} = 0, q_{AB} = 0 \) respectively. □

Proof of Proposition 5. (i) We look first for a Nash equilibrium where newspapers 1 and 2 split the market. Assume w.l.o.g that 1 sells only to optimists, and 2 to pessimists. In this case, because sales are linear in slant, to maximize sales, 1,2 will set

\[ q_{1AB} = 0, q_{1BA} = 0.5, q_{2AB} = 0.5, q_{2BA} = 0 \]

Equilibrium sales are

\[ S_1 = \frac{1}{2} \gamma \left( 1 - \frac{d}{2\sigma} (1 - r^+) \right), \quad S_2 = \frac{1}{2} (1 - \gamma) \left( 1 - \frac{d}{2\sigma} (1 - r^-) \right) \]

Now suppose that 1 deviates. To attract any pessimistic customers, it would have to imitate 2. Then, each would get half of total market evaluated at \( q_{AB} = 0.5, q_{BA} = 0 \), so sales for both firms would be would be

\[ S' = \frac{1}{2} \left[ \gamma \left( \frac{1}{2} - \frac{d}{2\sigma} (1 - 0.5 r^+) \right) + \frac{1}{2} (1 - \gamma) \left( 1 - \frac{d}{2\sigma} (1 - r^-) \right) \right] \]

So, 1 prefers not to deviate if \( S_1 \geq S' \), or

\[
\frac{\gamma}{1 - \gamma} > \frac{1 - \frac{d}{2\sigma} r^-}{1 + \frac{d}{2\sigma} r^+}
\]
Next, suppose that 2 deviates from the equilibrium. To attract any optimistic customers, it would have to imitate 1. Then, each would get half of total market evaluated at \( q_{AB} = 0, q_{BA} = 0.5 \), so sales would be

\[
S'' = \frac{1}{2}\left[ \frac{1}{2}\gamma \left( 1 - \frac{d}{2\delta} (1 - r^+) \right) + (1 - \gamma) \left( \frac{1}{2} - \frac{d}{2\delta} (r^- + (1 - r^-)0.5) \right) \right]
\]

So, 2 prefers not to deviate if \( S_2 \geq S'' \) or

\[
\frac{1 - \gamma}{\gamma} > \frac{1 - \frac{d}{2\delta} (1 - r^+)}{1 + \frac{d}{2\delta} (1 - r^-)}
\]

So, if both (22), (23) hold, i.e. \( \frac{1 - \frac{d}{2\delta} r^-}{1 + \frac{d}{2\delta} r^+} < \frac{\gamma}{1 - \gamma} < \frac{1 + \frac{d}{2\delta} (1 - r^-)}{1 - \frac{d}{2\delta} (1 - r^+)} \), splitting the market is an equilibrium, as claimed.

(ii) Now, suppose that \( \frac{\gamma}{1 - \gamma} < \frac{1 - \frac{d}{2\delta} r^-}{1 + \frac{d}{2\delta} r^+} \). Then, we show that there is an equilibrium where both compete for pessimistic voters i.e. \( q_{iAB} = 0.5, q_{iBA} = 0 \), \( i = 1, 2 \). Then, in equilibrium, each gets \( S' \). Now consider a deviation by either 1 or 2 to serving the optimistic voters. The deviator would get all the optimistic voters and thus have sales \( S_{1} \). But, for \( \frac{\gamma}{1 - \gamma} < \frac{1 - \frac{d}{2\delta} r^-}{1 + \frac{d}{2\delta} r^+} \), \( S_{1} < S' \). So, this deviation does not pay. So, \( q_{iAB} = 0.5, q_{iBA} = 0 \) must be an equilibrium.

(iii) By the same argument, suppose that \( \frac{\gamma}{1 - \gamma} > \frac{1 + \frac{d}{2\delta} (1 - r^-)}{1 - \frac{d}{2\delta} (1 - r^+)} \). Then, we show that there is an equilibrium where both compete for optimistic voters i.e. \( q_{iAB} = 0, q_{iBA} = 0.5 \), \( i = 1, 2 \). Then, in equilibrium each gets \( S'' \). Now consider a deviation by either 1 or 2 to serving the pessimistic voters. The deviator would get all the pessimistic voters and thus have sales \( S_{2} \). But, for \( \frac{\gamma}{1 - \gamma} < \frac{1 - \frac{d}{2\delta} r^-}{1 + \frac{d}{2\delta} r^+} \), \( S_{2} < S'' \). So, this deviation does not pay. □

**Proof of Proposition 6.** We only need consider the case of monopoly. It is obvious that equilibrium aggregate confirmation bias is zero if \( \frac{\gamma}{1 - \gamma} < \frac{\gamma}{1 - \gamma} < \frac{\gamma}{1 - \gamma} \), as no slant is supplied by the monopolist.

Consider next the case \( \frac{\gamma}{1 - \gamma} > \frac{\gamma}{1 - \gamma} \). Here, the size of these groups of optimists and pessimists who buy the newspaper and therefore vote are are simply equal to the sales of the newspaper to each group (12).

Evaluating the size of these groups in equilibrium i.e. where \( q_{AB} = 0, q_{BA} = 0.5 \), we get

\[
f^+ = \frac{1}{2} - \frac{d}{4\sigma} (1 - r^+), \quad f^- = \frac{1}{2} - \frac{d}{4\sigma} (1 + r^-)
\]

Then, we see that when slant is provided to the optimists, they are the largest group, because

\[
\gamma f^+ - (1 - \gamma)f^- = \gamma \left( \frac{1}{2} - \frac{d}{4\sigma} (1 - r^+) \right) - (1 - \gamma) \left( \frac{1}{2} - \frac{d}{4\sigma} (1 + r^-) \right) > (2\gamma - 1) \left( \frac{1}{2} - \frac{d}{4\sigma} (1 + r^-) \right)
\]

and also \( \frac{\gamma}{1 - \gamma} > \frac{\gamma}{1 - \gamma} > 1 \) implies \( 2\gamma > 1 \). So, in this case, equilibrium slant must be 0.5.

Consider finally the case \( \frac{\gamma}{1 - \gamma} < \frac{\gamma}{1 - \gamma} \). Again, the size of these groups of optimists and pessimists who buy the newspaper and therefore vote are are simply equal to the sales of the newspaper to each group.
(12). Evaluating the size of these groups in equilibrium i.e. where \( q_{AB} = 0.5, q_{BA} = 0 \), we get

\[
f^+ = \frac{1}{2} - \frac{d}{2\sigma} (1 - 0.5r^+), \quad f^- = \frac{1}{2} - \frac{d}{2\sigma} 0.5r^-
\]

For the voting pessimists to be the larger group, we need

\[
\frac{\gamma}{1 - \gamma} < \frac{f^-}{f^+} = \frac{\frac{1}{2} - \frac{d}{2\sigma} 0.5r^-}{\frac{1}{2} - \frac{d}{2\sigma} (1 - 0.5r^+)}
\]

But as \( \frac{\gamma}{1 - \gamma} < \frac{r^-}{r^+} \), we need simply

\[
\frac{r^-}{r^+} \leq \frac{\frac{1}{2} - \frac{d}{2\sigma} 0.5r^-}{\frac{1}{2} - \frac{d}{2\sigma} (1 - 0.5r^+)}
\]

But after some rearrangement, this last inequality reduces to \( \frac{d}{2} (r^+ - 1)r^- < r^+ - r^- \), which certainly holds, as \( r^- < r^+ < 1 \). \( \square \)
Figure 1: Equilibrium Slant with Monopoly and Duopoly

Monopolist slants to pessimists: $q_{AB}=0.5, q_{BA}=0$

No slant: $q_{AB}=q_{BA}=0$

Monopolist slants to optimists: $q_{AB}=0, q_{BA}=0.5$

Duopolists slant to pessimists

Duopolists split market

Duopolists slant to optimists

$r-/r+$

$1/2$

$(1-r-)/(1-r+)$

relative fraction of optimists, $\gamma/(1-\gamma)$
Figure 2: Media Market Competition and Political Pandering

Probability of pandering, $\lambda$

$F(0.5\delta(1 + E))$

$F(\delta(1 + E))$

0

r-/$r^+$

1/2

$(1-\gamma)/(1+r+)$

monopoly

duopoly

relative fraction of optimists, $\gamma/(1-\gamma)$