MEDIA SLANT AND OFFLINE POLARIZATION IN THE ONLINE ERA

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Abstract

I demonstrate that political polarization can intensify due to innovations in the information market even if a population's ideological distribution is fixed. Viewership-maximizing news firms cater to a diverse audience who assess source accuracy using noisy private signals that vary in precision and ideological bias. If better-informed consumers disproportionately migrate to newer platforms for news (e.g., the Internet), traditional media firms increase news slant to appeal more to less-informed partisans on both sides of the ideological spectrum. This leads to a greater divergence in beliefs about the state of the world among partisan traditional media audiences—increasing disagreements and potential hostility. The theory helps explain two empirical trends observed over recent decades: (i) rising slant in traditional news (e.g., cable television news) and (ii) increasing polarization among demographic groups least likely to use the Internet. I test the model's central mechanism using an algorithmic text analysis of Facebook posts from 600 U.S. local television news stations. Media markets with greater expansions in moderately high-speed Internet access between 2012 and 2016 exhibit significantly larger increases in news slant, controlling for economic, demographic, and voting characteristics.

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1 Introduction

Political polarization has rapidly intensified since the early 2000s, particularly among demographic groups least likely to use the Internet (Boxell et al., 2017). This trend, mainly characterized by rising negative feelings and disagreements across ideological and partisan boundaries, affects various political and apolitical interactions. Politically, it can undermine democratic processes as increased partisanship fuels distrust in government and diminishes the willingness to engage in bipartisan cooperation and dialogue (Hetherington and Rudolph, 2015). In non-political scenarios, it affects social interactions, economic decisions, and even personal relationships, as individuals increasingly distrust people with contrasting political beliefs (Iyengar et al., 2019; McConnell et al., 2018).

One potential catalyst for this growing divide is the increasing political slant in television news. Television remains a significant source of political information for Americans (Allen et al., 2020) and exhibits the highest levels of partisan audience segregation among all media platforms (Muise et al., 2022). Cable television news, for example, has become noticeably more partisan, with firms on both sides of the ideological spectrum adopting more partisan language (Martin and Yurukoglu, 2017), focusing on different political topics (Hosseinmardi et al., 2023) and giving greater visibility to partisan political figures (Kim and Kim, 2024). Such a shift towards increased partisanship in the news may lead consumers—who often prefer content that aligns with their views—to form increasingly divergent beliefs about the world (Benedictis-Kessner et al., 2019). This divergence in beliefs and distorted portrayals of the out-group, typical in slanted sources (Levendusky and Malhotra, 2016), can contribute to rising distrust and hostility across partisan lines (Stone, 2023) that manifests in everyday human interactions and influences political actions.

Although existing research provides insights on the persistence of political slant in news and the effects of competition on reporting slant in media markets, it does not focus on explaining the rising partisanship in traditional media and consequent rise in partisan disagreements among offline audiences. Supply-side models show that media slant may persist when actors within media organizations (e.g., journalists, editors) prioritize political objectives over financial gains (e.g., Baron, 2006). However, supply-side pressure alone might be insufficient to explain the consistent trend of increasing slant across the political spectrum—particularly at a time when the proliferation of online news increased competitive pressures, incentivizing firms to reduce supply-side slant and cater more to audience preferences (Gentzkow and Shapiro, 2006). Given a number of firms, demand-side models (e.g., Mullainathan and Shleifer, 2005) typically map media slant directly from consumers' ideological leanings or preferences—suggesting that a rise in slant could be linked to more extreme ideological positions within the general population. However, this recent rise in media bias occurred over a time when measurements of the ideological distribution of the U.S. population through both self-described ideology and party identification have shown remarkable stability. Moreover, although a growing body of literature show that reporting diversity can increase with more firms (e.g., Perego and Yuksel, 2022), it does not focus on explicitly characterizing the observed partisan divergence among media firms in incumbent markets and a resultant rise in disagreements across the partisan line among offline audiences.

In this paper, I address this gap by presenting a model in which strictly profit-maximizing news firms serving a population with a stable ideological distribution report with a higher political slant when more informed audiences disproportionately reduce viewership due to new technology. This analysis primarily aims to elucidate a potential consequence of the widespread adoption of the Internet and complementary technologies on the audience composition of traditional news markets and the reporting strategies of firms within it. Periodic surveys indicate that early internet adopters—who were also early consumers of online news—typically possessed higher educational attainment and income, were more likely to engage with diverse content, displayed a higher level of political knowledge, and often needed to stay updated with news for professional reasons (Olmstead et al., 2010; Pollard and Kavanagh, 2019). This trend also persisted among older adults who began using the Internet, showing higher adoption rates among those with greater educational attainment, better cognitive performance, and higher income levels (Macdonald and Hülür, 2021). Interestingly, most socioeconomic characteristics that predict early Internet adoption also correlate with a higher ability to assess truth in the news (Angelucci and Prat, 2024). As advancements in Internet bandwidth and the growth of complementary technologies have allowed for the proliferation of richer digital experiences over time, it is plausible to suspect that the composition of how informed a typical traditional media consumer is has changed. Therefore, in this paper, I investigate how a disproportionate departure of more informed audiences from traditional news markets affects the reporting choices of news firms and what the implication of this shift is on partisan disagreement.

I study equilibrium provision of political information by news firms catering to an audience population with diverse ideological biases and quality of private information. To describe consumer behavior, I employ a model of misspecified Bayesian learning from Gentzkow et al., 2024—where consumers assess the accuracy of news-firms' reports by comparing them with private signals from their environment over an extensive exploration period. These signals can be information consumers collect by interacting with friends and family or through direct observations, research or reasoning. The critical property of these environmental signals is that consumers entertain the possibility that the signals are noisy; however, they do not entertain the possibility that they are systematically biased towards a particular political ideology—at least after exogenous adjustments.[1]

[1] This lack of knowledge about the bias of environmental signals can be motivated by substantial evidence that individuals are either unaware of or significantly underestimate their own biases in reasoning or in signals they receive from people or organizations they inherently trust (e.g., Pronin et al. (2002); Pronin (2007); Thaler and Sunstein (2021).)

The accuracy (or quality) of the private signals that a consumer receives is their *informedness*, and the extent to which the bias of the signal is unaccounted for is their *ideological bias*. Using these private signals as a benchmark, consumers judge the accuracy of news reports and the liberal and conservative political positions. Following Gentzkow et al. (2024), I define a consumer's *trust* in a news source as their expected accuracy of the news signals and their *ideology* as their expected accuracy of the conservative political party's signals. Once trust is established, in the exploitation period, consumers choose to consume news from the firm they trust the most, and the extent of viewership is proportional to the level of trust.

In this model, news firms have no intrinsic preference for their news report slant, but they strategically adopt an ideological slant to maximize profits. Given that the audience population has imperfect private information quality, firms will report with a non-zero ideological slant. Viewers with slight ideological biases recognize the noisiness of their environmental signals, leading them to anticipate only weak correlations, even from perfectly accurate sources. Therefore, when news reports exhibit a slant that slightly increases correlation with these noisy signals, it disproportionately boosts perceived accuracy. This leads viewers with small biases to place greater trust in sources that are even more partisan than their environmental signals. This effect weakens among viewers with more extreme ideological biases, who become more overconfident in the accuracy of their environmental signals and perceive them as less noisy - consequently, expecting stronger correlations from accurate sources. From the perspective of news firms, increased viewership from the existing consumer base when reporting with a non-zero slant undermines the traditional Hotelling's location choice incentive (Hotelling, 1929) to decrease slant to attract new consumers. In equilibrium, firms on both sides of the political spectrum balance an intensive vs. extensive margin tradeoff by choosing a slant where the marginal loss of viewership from existing viewers equals the marginal gain of viewership from new consumers.

In equilibrium, news firms choose a slant that is higher than if they catered only to the most informed viewers, and lower than if they catered only to the least informed viewers. When firms cater to more informed partisans by increasing reporting slant, the gain in correlation from the unaccounted partisan portion of the environmental signal is countered more heavily by the loss of correlation with the accurate portion of those signals. Consequently, a better-informed consumer with the same ideological bias as a less informed one will trust overtly partisan sources less. To demonstrate the effect of this on news reporting, I partition the consumers by differing levels of informedness while keeping the diversity of ideological biases constant across partitions. I show that if firms were to cater only to the more informed subsets of consumers, they would report with a strictly lower slant in equilibrium. Thus, when firms aim to maximize viewership among consumers with varying levels of informedness, they effectively cater to a target group that is neither most informed nor least informed.

If a new technology disproportionately attracts the better-informed subsets of the population, firms increase reporting slant because the less informed partisans become a more prominent segment of the consumer population. To model the effect of the Internet, I introduce a substitutability parameter that captures the state of technology. This parameter could represent Internet speeds, depth of online content, efficiency of search engines, availability of online data, ease of use of computer technology etc. The core assumption of this model, motivated by the adoption patterns of the Internet as a news source, is that as the substitutability parameter increases, the better-informed consumers of traditional media are disproportionately drawn away from it. This leads to a drop in the average informedness levels in the consumer population served by traditional media firms, leading to a rise in slanted reporting.

I assess the impact of increased slant on disagreements among the consumer population by analyzing changes in the expected difference in the average liberal and conservative beliefs about the state of the world in periods after the viewership decision is made. I compute the mean posterior beliefs of consumers about states where direct signals from politicians and personal feedback are lacking. This scenario reflects many instances where consumers have limited firsthand knowledge and do not engage deeply with or receive official political communications. Consider, for example, the costly task of analyzing intricate policy proposals. These could range from comprehensive plans addressing climate change to initiatives reforming education or actions regarding evolving international disputes. News firms are crucial in distilling core concepts and presenting viewpoints in these scenarios. Another example is the coverage of topics where political figures might strategically maintain silence. Often observed in legal cases involving political scandals or when shedding light on nascent issues not yet mainstream in party discourse, news firms fill the information void. Their reporting on such topics, nonetheless, influences public opinion and contributes to the level of cohesion in the population. The focus here is on how consumers rely on the trust they have built with their preferred news outlets to navigate and comprehend topics with limited direct information.

As firms report with an increased slant, partisan disagreements strictly rise among consumers who rely most on traditional media. This is because, by increasing slant in reporting, the firms not only portray a more distorted impression of the state of the world but also enjoy higher viewership from the less informed partisan segments of the population. This increases the expected difference in beliefs about the state of the world among the less informed liberals and conservatives, who rely more heavily on traditional media. It is worth noting that this mechanism can still hold amidst declining trust in the traditional media overall, as the new choice of slant leads to a decrease in trust from the opposing partisan groups and the more informed consumer populations. Additionally, this rise in disagreements across partisan lines occurs amidst no changes in the ideological distribution of any subset of the consumer population. However, the average difference in beliefs between consumers on the two sides of the ideological spectrum diverges.

I test an empirical implication of the theory by investigating the effect of Internet penetration on the partisanship of local television news reporting. I leverage the local reach of the news stations and heterogenous changes in Internet connections across Designated Market Areas (DMAs) to see if higher Internet penetration is associated with higher local news media bias. I collect a novel data set of more than 15 million Facebook posts from all available U.S. local T.V. news channels from January 2012 to December 2016. To gauge shifts in partisanship, I examine the changes in the language of news headlines and sub-headlines from the Facebook posts, focusing on the use of bigrams that are indicative of partisanship in Congressional speeches from the corresponding time frames. To measure changes in Internet penetration, I collect county-level Internet connection data from the Federal Communications Commission (FCC) and calculate changes in Internet connections at the DMA level. Additionally, I collect other data that could affect news partisanship, such as changes in democratic vote share, education, income, poverty, ethnicity, and local GDP throughout the analysis period. Controlling for changes in vote share and economic and demographic characteristics of DMAs, I find that increase in Internet connections at moderate speeds is a significant predictor of increase in partisanship of local news. According to the point estimates of the empirical model, a roughly 1% increase in high-speed Internet connections in a DMA is associated with the same increase in partisanship of local liberal-leaning news as a 0.94% increase in the democratic vote share of the DMA.

At a broader level, this paper highlights the role of technological change in reshaping the audience composition of existing media markets and the corresponding incentives for information provision by firms within them. I demonstrate that even innovations that augment access to information can lead to a deterioration in information quality for those slower or unable to adopt new technologies. A rise in political slant in this traditional media also leads to beliefs about the state of the world that are more aligned with partisan positions. This can lead to information inequalities and a rise in partisan disagreements, which could lead to long-term societal issues that last beyond the technological transition itself.

2 Model of a News Market

To demonstrate how innovations in substitute technologies impact political information provision, I directly build on a model from Gentzkow et al. (2024, Section 5). In this framework, consumers with ideological biases and noisy private information endogenously determine the accuracy of—or trust in—news sources based on misspecified models of signal-generating processes. This allows me to explore information dissemination strategies by news firms in a setting where consumers exhibit empirically consistent behaviors such as confirmation bias and increasing overconfidence with higher ideological biases.

Expanding on this framework, I explore the equilibrium reporting slants in a duopoly news market where firms produce news in order to cater to a diverse audience population heterogeneously distributed across continua of private information qualities and ideological biases who endogenously form trust in news sources. I introduce an exogenous technological parameter that disproportionately attracts a subset of consumers away from the traditional news market and analyze how changes in this parameter influence equilibrium reporting slant and the average disagreements between diverse liberal and conservative audience populations.

2.1 Set-up

Environment. There is a state of the world, ω_t in each time period $t \in \mathscr{T} = \{1,2,3,...,T\}$. The conservative position on the state of the world is r_t, which is composed of an *ideological valence* term $\tilde{r}_t$ such that $\tilde{r}_t \perp \omega_t$.[2] Conversely, the liberal position on the state of the world is $-r_t$. The parameter $\tau \in \mathbb{R}$ captures the state of substitute technology. Throughout the model, I assume ω_t, r_t and $\tilde{r}_t \sim \mathscr{N}(0,1)$ for any t.

News. News firm $j \in \{1,2\}$ reports on ω_t in each period by producing a news report signal, s_{jt}. A news report from firm j at time t is

$$s_{jt} = \alpha_{0j}\omega_t + \beta_{0j}\tilde{r}_t, \tag{1}$$

where α_{0j} is the *accuracy* and β_{0j} is the *slant*. I assume that $\alpha_{0j} = \sqrt{1-\beta_{0j}^2}$. This assumption centers the analysis on the inherent tradeoff between the accuracy and slant of news reports and ensures, through a specific functional form, that news signals s_{jt} are also normalized to follow a standard normal distribution. At $t = 1$, all firms commit to a choice of slant in order to maximize profits, denoted for firm j as $\mathscr{V}_j(\beta_{0j}, \beta_{0-j})$.

Audience. Consumers are partitioned into groups with a common *informedness* parameter $a_0(g)$ where group $g \in \mathscr{G} = [\underline{g}, \bar{g}] \subset \mathbb{R}$. Without loss of generality, groups are indexed in such a way that informedness is strictly increasing in g (i.e. $a_0'(g) > 0$). Within each group, consumers have diverse ideological biases. The ideological bias of a consumer in group g is denoted $b_0(g) \in \mathscr{B}(g) \in \{\mathscr{B}(g)\}_{g\in\mathscr{G}}$.

For clarity of exposition, I focus the analysis on a case where the set of possible ideological

[2]The conservative/liberal position could be a representative position of the conservative/liberal party or some extreme conservative/liberal position.

biases in every group is the same. More precisely, $\mathscr{B}(g) = \mathscr{B} = [-\bar{b}, \bar{b}] \forall g$ where $\bar{b} = \sqrt{1 - a_0(\bar{g})^2}$.[3]

A consumer *type* is characterized by a pair $c \equiv (a_0(g), b_0)$. Each group of consumers is assigned a "viewership weight" $w(g, \tau) \in \mathbb{R}_+^{\mathscr{G} \times \mathbb{R}}$. This weight can be interpreted in two ways. First, it could interpreted as a direct impact of τ on the viewership of group g. Second, it could represent the ad rate of the group g. Each group of consumers is also assigned a "population weight" $w_p(g)$ that represents the density of the audience population across $\mathscr{G}$. Within each group, consumers are symmetrically distributed over $\mathscr{B}$ according to a continuous $f(\cdot)$ where $f(\cdot) \in \left\{\mathbb{R}_+^{\mathscr{B}} : f(-b_0) = f(b_0) \forall b_0 \in \mathscr{B} \text{ and } f(b_0) = 0 \forall b_0 \notin \mathscr{B}\right\}$.[4]

Consumers seek to learn about the state of the world, but they never observe it directly. Instead, they try to learn about the quality of the news and political signals, which in turn inform them on ω_t. To do this, they go through an exploration period which consists of all $t \in \mathscr{E}_1 = \mathbb{N} \cap (0, \varepsilon T] \subset \mathscr{T}$, for some fixed $\varepsilon \in (0,1)$. I assume consumers single home, that is, they observe at most one firm at any given $t \in \mathscr{E}_1$. For two distinct subsets of the exploration period - $\delta_1, \delta_2 \subset \mathscr{E}_1$ - all consumers simultaneously observe a consumer type-specific feedback signal $x_t^c \sim \mathscr{N}(0,1)$, the conservative and liberal political positions (r_t and $-r_t$) and news report s_{jt} if $t \in \delta_j$. The feedback x_t^c serves as the key reference against which consumers judge other signals. These can be information about ω_t learned through lived experiences, direct observations, conversations with friends and family, etc. The defining property of this signal is that consumers entertain that x_t^c contain noisy information on ω_t, but they do not entertain that these signals are systematically biased towards a political party's ideological valence. After the exploration period, consumers make a viewership decision $v_{cj} \in \mathbb{R}$ on firm $j's$ news report for all t in the exploitation period, $\mathscr{E}_2 = \mathscr{T} \setminus \mathscr{E}_1$.

I focus the analysis of this model in the limiting case where $T \to \infty$ and $|\delta_1| = |\delta_2| = \aleph_0$. This implies a case where consumers have a long exploration period where they can simultaneously observe the political signals, the feedback signals and the news signal from each firm over a large number of instances—simulating a situation where consumers observe enough data to judge the accuracy/slant of the news reports from all firms.

Substitute Technology. In the model, τ acts as an exogenous parameter that alters the viewership composition of the audience population. In section 3.4, I explicitly characterize a condition on the effect of τ and examine the subsequent impact on the slant of the news firms.

In the following subsection, I describe the structure of the data-generating process, consumer learning and their viewership decision.

[3]The assignment of $\bar{b}$ allows for the maximum diversity of ideological biases in the most informed group. It can be relaxed to allow consumers in less informed groups to have more extreme ideological biases than $\bar{b}$. If we allow for more diverse ideological biases among the less informed groups, all results presented in the body of the paper hold.

[4]The common ideological bias distribution across all groups is used for notational clarity. If symmetric ideological distributions varied across groups, all results presented in the body of the paper hold.

2.2 Consumer Learning and Viewership Choice

Consumers construct models to understand the signal-generating process of x_t^c, r_t, s_{jt}, and s_{-jt}, assuming the correct functional forms and underlying distributions for ω_t and $\tilde{r}_t$. However, as consumers do not account for the possibility that their feedback signals are systematically biased toward a political position, their models are misspecified when $b_0 \neq 0$. Over the prolonged exploration period, all type c consumers learn the underlying distributions of x_t^c, r_t, s_{jt}, and s_{-jt}, as well as the coefficients of their own model of the data-generating process. Table 1 illustrates how a type c consumer's model differs from the true data-generating process, referred to as the 'True Model'.

Table 1: True Model vs Consumers' Models

	True Model	**Type c Consumers' Model**
Political Positions	$r_t = \tilde{r}_t$	$r_t = \gamma_c \omega_t + \sqrt{1-\gamma_c^2}\tilde{r}_t$
Firm j's News Report	$s_{jt} = \alpha_{0j}\omega_t + \beta_{0j}\tilde{r}_t$	$s_{jt} = \alpha_{cj}\omega_t + \beta_{cj}\tilde{r}_t$
Type c Feedback	$x_t^c = a_0(g)\omega_t + b_0\tilde{r}_t + \eta_{0t}$	$x_t^c = a_c\omega_t + \eta_{ct}$

In the true model of the world, the political position is independent of the state of the world ($r_t \perp \omega_t$ or $\gamma_0 = 0$) and is entirely comprised of the ideological valence term $\tilde{r}_t$. This implies that while the conservative (or liberal) position may occasionally align with or even represent the true state of the world, such alignment is not systematic. However, in the type c consumer's model of the world, they entertain the possibility that a political position is correlated with the true state of the world. This is characterized in their model by the term γ_c, which is type c consumers' *ideology*.

Any firm j's report in both true and the consumers' models are linear combinations of ω_t and $\tilde{r}_t$. In the consumers' model, the coefficients α_{cj} and β_{cj} are type c consumer's *perceived accuracy* (or *trust*) and *perceived slant* of firm j's reporting respectively. The primary misspecification in the consumer's model is that they do not entertain that their feedback signal is biased (i.e., they impose $b_c = 0$), although they do entertain that the feedback signal is noisy (i.e., η_{ct} is non-zero).

The true feedback signal observed by any consumer is the very thing that dictates consumer type. The informedness term, $a_0(g)$, is the true coefficient associated with ω_t - characterizing the accuracy of the feedback signal received by everyone in group g. The ideological bias term b_0 is the true coefficient associated with $\tilde{r}_t$ - characterizing the unaccounted partisan influence on the feedback signal. The perceived accuracy, a_c of a type c consumer's own feedback x_t^c is their *confidence*. A consumer is *overconfident* if their confidence is greater than their informedness ($a_c > a_0(g)$).

Over the exploration period, consumers observe an infinite number of simultaneous realizations of x_t^c, r_t and s_{jt} for any news firm $j \in \{1,2\}$ and hence learn the set of correlations between these variables $\rho = \{\rho_{xr}, \rho_{x1}, \rho_{x2}, \rho_{r1}, \rho_{r2}\}$. The parameter set of the consumers' model, $\theta^c = \{a_c, \gamma_c, \alpha_{c1}, \beta_{c1}, \alpha_{c2}, \beta_{c2}\}$, belongs to the set of all such parameter sets, Θ, and I denote the Lebesgue space on Θ as $(\Theta, \mathscr{L}_\Theta, \nu)$.

At the beginning of the first period, every agent has an absolutely continuous prior μ^c on Θ with a continuous density with respect to ν. I assume the support of μ^c, $\Theta^{prior} \subset \Theta$ is such that all $\theta^c \in \Theta^{prior}$ have $b_c = 0$ and $a_c \in (0, a^{max}]$, where $a^{max} = \sqrt{(a_0(g))^2 + b_0^2}$. μ^c has full support on Θ^{prior}. The restriction $b_c = 0$ in the support of the prior characterizes the misspecification in the consumers' model—they do not entertain the possibility that their feedback signal is biased. The restriction on a_c ensures that the consumers' priors on their confidence are concentrated around their true informedness. Specifically, the maximum value of a_c that any type c consumer a priori entertains (allows via the support of their prior) is the maximum that they can justify using their model and the data.

Given the observed correlations between the signals and the restrictions on their prior, any type c consumer can point identify all the elements of θ^c over the exploration period (See Proposition 6, Gentzkow et al. 2024). A type c consumer's identified trust on firm j's news reports is

$$\alpha_{cj} = \frac{a_0(g)\alpha_{0j} + b_0\beta_{0j}}{\sqrt{(a_0(g)^2 + b_0^2)}}, \tag{2}$$

and their identified ideology, or perceived accuracy of conservative positions is

$$\gamma_c = \frac{b_0}{\sqrt{(a_0(g)^2 + b_0^2)}}. \tag{3}$$

It is worth noting that γ_c is not a function of β_{0j}. Since consumers simultaneously observe r_t and x_t^c over a large period, they can directly infer the accuracy of the political positions using their model and the data.

After learning θ^c, at the beginning of the exploitation period, consumers choose only to observe news reports from the firm they trust the most.[5] The magnitude of their viewership is proportional to the trust they place in their most trusted firm's reporting. Formally, a type c consumer's viewership choice of firm j's news report in any $t \in \mathscr{E}_2$ is

$$v_{cj} = \begin{cases} \alpha_{cj} & \text{if } \alpha_{cj} = \max\{\alpha_{c1}, \alpha_{c2}\}, \\ 0 & \text{otherwise.} \end{cases} \tag{4}$$

In the following subsection, I describe firms' viewership maximizing choice of slant.

[5] this choice can be micro-founded as consumers minimizing their cumulative expected loss over all periods with an ε-first strategy in a multi-armed bandit problem with optimal decision rules linear in trust (See Gentzkow et al., (2024, Proposition 3))

2.3 Firms' Actions and Payoffs

Firms observe the true state of the world along with the politicians' signals and know the viewership choice of any consumer c given any choice of slant from both firms. They utilize this information to simultaneously commit to the slant of their news signals, β_{0j}, at $t=1$ to maximize profit, $\mathscr{V}_j$. Formally, firm j's optimization problem is

$$\max_{\beta_{0j}} \mathscr{V}_j = \int_{\mathscr{G}} w_p(g) w(g,\tau) \int_{\mathscr{B}} f(b_0) v_{cj}(\beta_{0j}, \beta_{0-j})\, db_0\, dg. \tag{5}$$

This profit function could represent revenue streams that are directly proportional to viewership levels (e.g., affiliate fees) or when $w(g,\tau)$ is interpreted as advertising rate—the function can represent advertising revenue.

The solution concept is a Nash equilibrium, which I characterize in the next section.

3 Analysis

I define the equilibrium concept in this section and prove existence and uniqueness. I then outline the model's implications, focusing on an audience population that is ideologically diverse and, on average, cannot consistently access very high-quality information from non-media sources. I begin by defining the "more informed" and "less informed" audience groups within this context. Next, I examine the role of τ in the viewership of these groups and discuss the implications of changing τ on the equilibrium reporting slant of news firms. I define partisan disagreement as the expected difference in the posterior mean of the state of the world between an average conservative and an average liberal at any $t \in \mathscr{E}_2$ when the audience only receives the news signals—isolating the effect of news reporting on consumer beliefs. Finally, I explore the impact of increasing equilibrium slant on disagreements across partisan boundaries among the less informed audience groups.

3.1 Equilibrium

It is easy to see that if $\beta_{01}, \beta_{02} > 0$ or $\beta_{01}, \beta_{02} < 0$, the strategy profile (β_{01}, β_{02}) can not be a Nash equilibrium since any firm j can choose $-\beta_{0j}$ and be strictly better off. Therefore, without loss of generality, I will restrict the strategy space of Firm 1 to $\beta_{01} \geq 0$ and the strategy space of Firm 2 to $\beta_{02} \leq 0$. I focus specifically on a natural subclass of Nash equilibria in this game, defined as follows.

Definition 1. *A strategy profile (β_{01}, β_{02}) is a mirror-symmetric equilibrium if (β_{01}, β_{02}) is a pure strategy Nash equilibrium and $\beta_{01} = -\beta_{02}$.*

The next result establishes the existence and uniqueness of this equilibrium.

Theorem 1. (Existence and Uniqueness) *A mirror-symmetric equilibrium exists and is unique.*
Proof. *See Appendix A.*

For the subsequent portion of the paper, I will refer to this unique mirror symmetric equilibrium as simply the "equilibrium" and define β_{0j}^{E} as the equilibrium slant of firm j.

3.2 Imperfect Private Information Quality Criterion

Theorem 1 establishes the general existence and uniqueness of the mirror-symmetric equilibrium, but I will focus on information provision in an audience population that enables some interesting dynamics. If the population has minimal ideological biases and very high informedness across all groups, firms will never be incentivized to produce news with a political slant. Alternatively, media firms will report with extreme partisan slants if the audience population is highly polarized and exhibits very low informedness.

Although I do not explicitly model consumers' decision to consume news or not in the main analysis, I characterize a criterion that ensures that the audience population has some ideological biases and does not have extremely high or low informedness across all groups. This allows us to consider a realistic scenario where audience members have diverse ideological biases and have incentives to rely on news for information but are not completely clueless about the state of the world. I formally define the criterion as follows.

Definition 2. *An audience population satisfies the Imperfect Private Information Quality Criterion (IPIQC) if the tuple (f, w_p, w, a_0), jointly satisfies*

$$\int_{\mathscr{G}} w_p(g)w(g,\tau)\left[\int_0^{\bar{b}} \frac{f(b_0)}{\sqrt{(a_0(g))^2+b_0^2}}\left[b_0-\frac{a_0(g)}{a_0(\bar{g})}\bar{b}\right]db_0-\frac{f(0)a_0(g)}{2}\right]dg<0, \tag{6}$$

$$\int_{\mathscr{G}} w_p(g)w(g,\tau)\left[\int_0^{\bar{b}} \frac{b_0 f(b_0)}{\sqrt{a_0(g)^2+b_0^2}}db_0-\frac{f(0)a_0(g)}{2}\right]dg>0. \tag{7}$$

The first condition, (6), is satisfied if the integral with respect to b_0 is negative or sufficiently small when positive. For individuals with with higher biases, $b_0 > \frac{a_0(g)}{a_0(\bar{g})}\bar{b}$, the term inside the integral is negative. For groups with lower informedness, smaller b_0 satisfies this condition since $\frac{a_0(g)}{a_0(\bar{g})}$ will be smaller, relaxing the condition. Therefore, if the distribution of ideological biases within groups and the viewership and population weights across groups is such that the audience population, on average, has very high ideological biases and very low informedness, condition (6) will not be satisfied.

The second condition, (7), is satisfied if the first term inside the squared brackets is sufficiently positive. If the ideological distribution within groups is highly concentrated on very low ideological biases, this condition will be satisfied for all g. For any ideological distribution, this term is strictly decreasing for groups with higher informedness. Therefore, even if the distribution of ideological biases is such that groups with higher informedness do not have sufficient mass on higher ideological biases to make the term positive, as long as the viewership and population weights are such that there are enough groups with lower informedness for whom the squared term is sufficiently positive, this assumption will hold.

Satisfying the IPIQC ensures that the audience population is neither extremely well-informed nor entirely uninformed and that their ideological biases are diverse but not extreme. From the perspective of modeling information provision, this criterion helps rule out trivial cases where firms have no incentive to slant their reports or where audience characteristics drive maximally partisan reporting. Instead, it allows for the exploration of a market for information provision where media firms adjust their slant based on varying audience compositions, offering insights into the interaction between media behavior and technological changes with greater clarity.

In the next section, I present two propositions that explore how firms choose equilibrium slant when catering to an audience with diverse informedness and formally partition $\mathscr{G}$ into more informed and less informed groups for a given equilibrium slant.

3.3 More Informed Groups and Less Informed Groups

Let $(\beta_1(g), \beta_2(g))$ be the equilibrium when firms only cater to group g. Since $\beta_2(g) = -\beta_1(g)$ due to the symmetry of f and α_{cj}, for clarity, I will discuss the propositions in this section only in terms of $\beta_1(g)$. First, I note that the equilibrium slant is higher when group informedness is lower.

Proposition 1. *For $g', g'' \in \mathscr{G}$, if $g' > g''$ then $\beta_1(g'') \geq \beta_1(g')$.*

Then I claim the existence of a *target group*, $\tilde{g} \in \mathscr{G}$ such that the equilibrium slant when serving only this target group is equal to the equilibrium slant when serving all groups in $\mathscr{G}$.

Proposition 2. *There exists a target group $\tilde{g} \in (\underline{g}, \bar{g})$, such that $\beta_{01}^E = \beta_1(\tilde{g})$.*

Taken together, Proposition 1 and Proposition 2 imply that in equilibrium firms, cater with a slant that is too high for all $g > \tilde{g}$ and too low for all $g < \tilde{g}$. For any given equilibrium, $(\beta_{01}^E, \beta_{02}^E)$, I define two sets of groups as follows.

Definition 3. *The more informed groups, $\bar{G}$ is a set of groups that have weakly higher informedness than the target group. Formally, $\bar{G} = [\tilde{g}, \bar{g}]$. The less informed groups, $\underline{G}$, is a set of groups that have lower informedness than the target group. Formally, $\underline{G} = [\underline{g}, \tilde{g})$.*

In the following subsection, I analyze the impact of an increase in τ on the equilibrium slant of news firms.

3.4 The Effect of τ on Equilibrium Slant

When firm 1 chooses $\beta_{01} = \beta_{01}^E$, the marginal loss of viewership from the more informed groups due to increasing bias is equal to the marginal gain of viewership from the less informed groups. If τ changes the composition of the audience population by changing the viewership weighting function $w(g,\tau)$, the equilibrium slant can change.

If τ reduces the viewership/population of more informed groups such that the marginal loss of viewership from the more informed groups by increasing slant is lower than the marginal gain of viewership from the less informed groups, the equilibrium slant will increase for both firms. The condition can be formally stated as follows.

Condition 1. Let $\frac{\partial w(g,\tau)}{\partial \tau}$ be such that

$$\int_{\bar{G}} w_p(g) \frac{\partial w(g,\tau)}{\partial \tau} \left[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta_{01}^E, g)}{\partial \beta_{01}} db_0 - \frac{f(0)a(g)}{2} \right] dg$$
$$> - \int_{\underline{G}} w_p(g) \frac{\partial w(g,\tau)}{\partial \tau} \left[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta_{01}^E, g)}{\partial \beta_{01}} db_0 - \frac{f(0)a(g)}{2} \right] dg. \quad (8)$$

The next result specifies the impact of τ on equilibrium partisan slant of news reports.

Result 1. (Equilibrium Impact of τ) *If the audience population satisfies the IPIQC and* $\frac{\partial w(g,\tau)}{\partial \tau}$ *satisfies* **Condition 1**, *an increase in τ leads to a strict rise in equilibrium partisan slant for both firms.*

Proof. *See Appendix A.*

From Proposition 1, we know that the optimal slant for firm 1 when serving only one group, g, such that $g > \tilde{g}$ is lower than the equilibrium slant when serving all groups, β_{01}^E. Therefore, there will be a marginal loss of viewership from any $g > \tilde{g}$ if $\beta_{01} > \beta_{01}^E$. Since $w_p(g) > 0$ and $w(g,\tau) > 0$,

$$\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta_{01}^E, g)}{\partial \beta_{01}} db_0 - \frac{f(0)a(g)}{2} < 0 \quad \forall g \in \bar{G} \setminus \tilde{g}. \quad (9)$$

Similarly, since the optimal slant when serving only a less informed group is higher than β_{01}^E, there will be a marginal gain of viewership from less informed groups if $\beta_{01} > \beta_{01}^E$. Since $w_p(g) > 0$ and $w(g,\tau) > 0$,

$$\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta_{01}^E, g)}{\partial \beta_{01}} db_0 - \frac{f(0)a(g)}{2} > 0 \quad \forall g \in \underline{G}. \quad (10)$$

Consider a restrictive case where we assume that τ does not change viewership weights for any group other than a non-empty subset of $\bar{G}$ with non-zero measure. In this case, the term on the right side of the inequality in condition (8) is 0, and the term on the left-hand side is strictly positive—satisfying the condition. This implies that if some more informed groups decrease viewership due to τ, ceteris paribus, an increase in τ will lead to an increase in equilibrium slant for firm 1. If we relax this restriction and allow some less informed groups to also decrease viewership due to τ, the right side of the inequality in (8) becomes strictly positive, imposing an upper-bound on the decrease of viewership from the less informed groups due to τ. As long as there is a sufficiently large viewership decrease from the more informed groups due to τ, Condition 1 would be satisfied, and firms will produce news reports with an increased partisan slant on both sides of the aisle.

The core intuition here is that since more informed groups are more discerning of partisan news, a relatively larger loss of viewership from them leads firms to cater more to the less informed group by increasing news slant. Since condition 1 does not restrict the sign of $\frac{\partial w(g,\tau)}{\partial \tau}$, a relatively larger increase in viewership from less informed groups will also have the same effect on equilibrium slant.

In the following subsection, I analyze the implications of increasing equilibrium slant on the disagreements between the liberal and conservative audiences of the news market.

3.5 The Effect of Increased Equilibrium Slant on Partisan Disagreement

I focus on $t \in \mathscr{E}_2$ such that audiences do not observe x_t^c and r_t. Considering a time when consumers learn about the state of the world solely from the news report they trust allows us to see the effect of increasing slant on partisan disagreement. The mean of an agent's posterior on the state of the world, ω_t after observing only the equilibrium s_{jt} from their preferred source j is

$$\bar{\omega}_t^c = \alpha_{cj}[\alpha_{0j}\omega_t + \beta_{0j}^E \tilde{r}_t]. \tag{11}$$

Since $\beta_{01} \geq 0$ and $\beta_{02} \leq 0$, in equilibrium, firm 1 will capture all the consumers who have a positive (conservative) ideological bias and firm 2 will capture all the consumers with negative (liberal) ideological bias. To understand the average beliefs about the state of the world held by the conservative consumers belonging to a set of groups $G \subseteq \mathscr{G}$, at any $t \in \mathscr{E}_2$, I calculate the mean of their posterior beliefs,

$$\bar{\omega}_t^{RG} = \int_G w_p(g) \int_0^{\bar{b}} f(b_0)\bar{\omega}_t^c \, db_0 \, dg. \tag{12}$$

Similarly, the mean of consumers' posterior beliefs in the liberal population is

$$\bar{\omega}_t^{LG} = \int_G w_p(g) \int_{-\bar{b}}^0 f(b_0)\bar{\omega}_t^c \, db_0 \, dg. \tag{13}$$

Definition 4. *Partisan disagreement among groups in G is the expected difference between $\bar{\omega}_t^{RG}$ and $\bar{\omega}_t^{LG}$,*

$$\Delta_G = \mathbb{E}(\left|\bar{\omega}_t^{RG} - \bar{\omega}_t^{LG}\right|). \tag{14}$$

The following result states the effect of increasing equilibrium slant on the partisan disagreement among the less informed population.

Result 2. (Disagreement due to Rising Slant) *Partisan disagreement strictly increases for the less informed groups as equilibrium slant increases.*

Proof: *See Appendix A.*

When equilibrium slant increases, viewership from the less informed groups increases. This implies that partisan individuals in the less informed groups trust the news reports more and have a more partisan impression of the state of the world. This leads to increased average disagreements between the conservative and liberal audience populations among the less informed groups. Taken together, Results 1 and 2 show that if changes in substitute technology lead to a relatively large loss of viewership from more informed audiences, the equilibrium slant will rise in traditional news, and the audiences who rely on traditional news most will have more disagreements across the partisan line.

In the next section, I discuss an empirical test for the mechanism described in this section.

4 Discussion for an Empirical Analysis

The theory presented in this paper proposes a mechanism by which news partisanship increases due to developments in substitute technology. Therefore, I empirically examine whether the rise of moderately high-speed Internet connections in local media markets from 2012 to 2016 is associated with the rise in partisanship of local television news within them. If increase in moderately high-speed Internet connections satisfies Condition 1—that is, if it disproportionately draws more informed audiences away from traditional media—then, ceteris paribus, the model predicts an increase in partisan slant from local television news.

Local news covers a wide range of topics and is considered an important source of information for Americans. According to a 2024 Pew study, 85% of Americans considered local news outlets at least somewhat important for their community, with 66% reporting that they follow local news closely—figures comparable to those for national news outlets. Beyond popular topics such as weather, crime, and traffic, most local news consumers also engage with content related to government, politics, and the economy (Pew).

Television has been a dominant medium through which Americans consume local news, but it has gradually declined in popularity. In 2013, for instance, local T.V. news reached 71% of U.S. adults, surpassing both network and cable T.V. news in audience span. In 2018, television was still the most preferred medium for consuming local news—significantly more popular than other traditional media such as print newspapers or radio, and slightly more popular than online media. However, by 2024, online sources had overtaken it in popularity—though a significant portion (32%) of U.S. adults still preferred television as their primary medium for local news.

Therefore, throughout the analysis period, we observe a large number of news markets that cumulatively cater to a substantial segment of the national population and cover topics susceptible to partisan slant. These markets experience varying levels of pressure from online substitutes due to differing rates of adoption of moderately high-speed Internet connections across local markets. Furthermore, over this period, people from all age groups, especially older individuals, reported increased Internet use (Pew). Since typical local T.V. news viewers are older, focusing on this period allows us to observe changes in reporting slant as local television markets experience increasing pressure to react, with subsets of their audience substituting away to alternative online media for information.

In the following subsection, I discuss why high-speed Internet is a good empirical proxy for τ and present a simple micro-foundation model that explicitly characterizes consumers' choice of news medium.

4.1 Internet Penetration as τ

To capture the extent of the broader technological shift brought about by the Internet and complementary technologies, I measure changes in access to broadband Internet with speeds greater than 10 Mbps across all DMAs throughout the study period. Designated Market Areas (DMAs) are geographic regions defined by Nielsen based on local television viewership patterns; they are used by media and advertising companies to target broadcasts and understand consumer behavior in local markets. Internet speeds of 10 Mbps and above allow for a comfortable browsing experience where users can multitask, experience high-quality content, and use multiple devices simultaneously on Wi-Fi networks. Focusing on this speed threshold allows us to observe changes in the portion of the local population that actively engages with the Internet and complementary technologies.

Furthermore, this measure is an appropriate empirical analog for τ because it likely satisfies Condition 1. Periodic surveys (Pew, 2010; RAND, 2019) consistently reveal that early adopters of online news and the Internet generally exhibited higher political knowledge, earned higher incomes, were more educated, were younger, and were disproportionately white compared to the general population and consumers of other news sources. Similar characteristics that predict Internet adoption among the general population are also observed among older populations adapting to the Internet earlier. In a study concerning Internet adoption among an older population (aged 50 and above), Macdonald (2021) found that older adults are more likely to adopt the Internet if they have higher education and income, whereas they are less likely to adopt if they are part of a minority population. Additionally, the study examined cognitive and personality factors. Older individuals with better cognitive performance and who self-identified as having the personality trait of "openness" were more likely to adopt the Internet earlier.

In a different context, Angelucci and Pratt (2024) uncover the role of socioeconomic characteristics in individuals' ability to discern truth among a mix of real and fake news stories. Interestingly, the same socioeconomic traits that predict earlier Internet adoption among the older population also predict a higher capability to discern truth in the news. This alignment directly links to a measure of informedness similar to the informedness parameter in the theoretical model - where better feedback information allows for better discernment of truth. Therefore, traditional media audiences who are likely to be earlier Internet adopters also tend to possess characteristics linked to higher informedness. Consequently, I argue that an increase in connections to moderately high-speed Internet serves as a good empirical candidate for increasing τ, fulfilling Condition 1's requirement that τ should disproportionately attract more informed consumers away from traditional media, in addition to serving as a substitute technology to local television news.

In the following subsection, I use a simple micro-foundation model to explicitly formalize consumer choice of watching news on T.V. as Internet technology access and/or quality improve.

4.1.1 Viewership Impact of τ: A Simple Microfoundation with Consumer Choice

Consider a special case of the general model where the audience consists of only two groups, g^m and g^l, with $a_0(g^m) > a_0(g^l)$. I assume that the audience population satisfies IPIQC. Firm j's optimization problem is

$$\max_{\beta_{0j}} \sum_{i \in \{m,l\}} w_p(g^i) \int_{\mathscr{B}} t^*_{TV}(g^i) f(b_0) v_{cj}(b_0, \beta_{0j}, g^i)\, db_0, \tag{15}$$

where $t^*_{T.V.}(g^i, \tau)$ serves as the viewership weight function and represents time spent watching television by any individual in group g^i. To determine news viewership of a consumer with ideological bias b_0 in group g, the TV-watching time is scaled by the trust that they place on their preferred news source. Therefore, each consumer in a given group will watch the same amount of television, but they will watch more television news if they trust their preferred news source more.[6]

Let the audience of television news be part of a broader population where $\tau < 1$ is the fraction of the broader population that has high-speed Internet connections. So, for instance, if we consider the local news audience for a DMA, the broader population could be the population of the state or

[6] Although consumers make a viewership decision based on outside options and news media slant, there is still an implicit behavioral assumption that carries over from the general model—consumers do not reason about the origins of news slant (they are still non-strategic actors).

country. I define the probability of any individual in g^i having access to high-speed Internet as

$$l_\tau(g^i) = p(g^i)\tau. \tag{16}$$

This formulation captures a simple adoption behavior where individuals in the broader population randomly interact. If an individual in group g^i comes into contact with someone in the population who has high-speed Internet, the probability that they also adopt the Internet connection is $p(g^i)$. As τ increases, representing a higher fraction of the population with Internet access, the probability of such contact occurring increases, thereby raising the probability $l_\tau(g^i)$ that the individual adopts high-speed Internet.

I assume $p(g^m) \in (0,1)$ and $p(g^l) = 0$, implying that as τ increases, the more informed audiences are more likely to adopt the new technology, while the less informed audiences remain unaffected.

Individuals in the audience allocate time between browsing the Internet, t_τ, and watching T.V., $t_{T.V.}$, to maximize

$$u(t_\tau, t_{TV}, l_\tau(g^i)). \tag{17}$$

I assume $u'(t_.) > 0$ (positive marginal utility assumption), $u''(t_.) < 0$ (diminishing marginal utility assumption), and $\frac{\partial u}{\partial l_\tau(g^i)\partial t_\tau} > 0$ (assumption that marginal utility of time spent on the Internet rises as probability of adopting high-speed Internet increases). Assume that consumers allot a fixed total time to spend watching T.V. and browsing the Internet, $t_\tau + t_{T.V.} = T$. Given this assumption, one can think of t_τ as the time spent browsing the Internet doing activities that are substitute to spending time watching T.V. The first order conditions of the maximization problem imply

$$L = u'(t_\tau) - u'(t_{TV}) = 0. \tag{18}$$

The marginal change in optimal time watching T.V. due to a marginal change in the probability of Internet access is

$$\frac{\partial t^*_{TV}}{\partial l_\tau(g^i)} = -\frac{\frac{\partial L}{\partial l_\tau(g^i)}}{\frac{\partial L}{\partial t_{TV}}} = -\frac{\frac{\partial u'(t_\tau)}{\partial l_\tau(g^i)} - \frac{\partial u'(t_{TV})}{\partial l_\tau(g^i)}}{\frac{\partial u'(t_\tau)}{\partial t_{TV}} - u''(t_{TV})}. \tag{19}$$

The second term in the numerator is the change in the marginal utility of spending time watching T.V. as $l_\tau(g^i)$ increases. It is reasonable to assume that better access to Internet technology does not increase the marginal utility of spending extra time watching T.V., so I assume that $\frac{\partial u'(t_{T.V.})}{\partial l_\tau(g^i)} \leq 0$. This implies that the numerator is positive.

The first term in the denominator is $\frac{\partial u'(t_I)}{\partial t_{TV}} = u''(t_\tau)\frac{\partial t_\tau}{\partial t_{TV}} = -u''(t_\tau)$. It is positive - more time watching T.V. leads to less time for Internet, which increases the marginal utility of extra time spent using the Internet by the diminishing marginal utility assumption. The second term is negative, also by the diminishing marginal utility assumption. Taken together, the positive denominator and the positive numerator implies

$$\frac{\partial t^*_{TV}}{\partial l_\tau(g^i)} < 0. \tag{20}$$

If the fraction of high-speed Internet connections increases in the broader population, the expected effect of an individual's optimal T.V. watching time is

$$\frac{\partial t^*_{TV}}{\partial \tau} = \frac{\partial t^*_{TV}}{\partial l_\tau(g^i)} \frac{\partial l_\tau(g^i)}{\partial \tau} = \frac{\partial t^*_{TV}}{\partial l_\tau(g^i)} p(g^i) \leq 0. \tag{21}$$

Since $p(g^m) > 0$, the inequality above implies that an increase in τ leads to a decrease in the optimal T.V. watching time among the more informed audiences and since $p(g^l) = 0$ there are no changes in the optimal T.V. watching time among the less informed audiences.

Now, we can analyze how that affects the choice of slant for firm 1. Note that in equilibrium, the slant chosen by firm 1 satisfies

$$L_f = \sum_{i \in \{m,l\}} w_p(g^i) t^*_{TV}(g^i) \left[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}}{\partial \beta_{01}} db - \frac{f(0)a(g^i)}{2} \right] = 0. \tag{22}$$

Let β^*_{01} be the equilibrium slant that satisfies this equation. Recall from section 3.3, that $\beta_{01}(g^m)$ and $\beta_{01}(g^l)$ are the equilibrium slants chosen by firm 1 if they only cater to g^m and g^l respectively. From Proposition 1 and 2, we know $\beta^*_{01} \in (\beta_{01}(g^m), \beta_{01}(g^l))$ and

$$\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta^*_{01}, g^l)}{\partial \beta_{01}} db - \frac{f(0)a(g^l)}{2} > 0, \tag{23}$$

$$\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta^*_{01}, g^m)}{\partial \beta_{01}} db - \frac{f(0)a(g^m)}{2} < 0. \tag{24}$$

To understand the impact of increasing τ on the equilibrium reporting slant for firm 1, we need to sign

$$\frac{\partial \beta^*_{01}}{\partial \tau} = -\frac{\frac{\partial L_f}{\partial \tau}}{\frac{\partial L_f}{\partial \beta_{01}}}. \tag{25}$$

Since viewership is strictly concave in slant, we need to focus on

$$\frac{\partial L_f}{\partial \tau} = w_p(g^m) \frac{\partial t^*_{TV}(g^m)}{\partial \tau} \left[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}}{\partial \beta_{01}} db - \frac{f(0)a(g^m)}{2} \right]. \tag{26}$$

From (21), we know that $\frac{\partial t^*_{T.V.}(g^m)}{\partial \tau} < 0$ and using the inequality in (24), it is easy to see that $\frac{\partial L_f}{\partial \tau} > 0$. Therefore, we can claim

$$\frac{\partial \beta^*_{01}}{\partial \tau} > 0, \tag{27}$$

and since $\beta^*_{01} = -\beta^*_{02}$, we can also claim

$$\frac{\partial \beta^*_{02}}{\partial \tau} < 0. \tag{28}$$

Thus, an increase in τ leads to an increase in partisan reporting in local news. This simple model encapsulates the key dynamics presented in the general model and includes consumer choice. My goal is for this model to serve as a bridge between the empirical analysis where I investigate whether increases in high-speed Internet connections are associated with increases in partisanship in local media markets.

In the following section, I describe the data I use and how I construct the variables for the empirical analysis.

5 Data Sources and Variables

5.1 Sources

For local television news content, I collected a set of more than 15 million Facebook posts representing all posts from 600 US Local T.V. news channels across 209 DMAs from January 2012 to December 2016. The data source is CrowdTangle, a public insights tool from Meta that allows access to Facebook data for large public pages. Local television news channels usually use their Facebook pages to share website articles. By 2012, all local news pages in the data shared their news articles daily. Each Facebook post in this dataset contains three components: "Message", "Link Text" and "Description". The "Message" usually contains a sentence summarizing the shared article. The "Link Text" is generally the headline of the news article, and "Description" is the lead for that story. The implicit assumption behind using this data is that articles that local television news channels share from their online sites are a good representation of the offline news content that television news consumers get to watch.

To assess the change in the technological landscape, I collect county-level broadband connection data from the Federal Communications Commission, which provides a coarse measure of the proportion of the county housing units that had access to broadband connections over 10Mbps at the end of 2011 and 2016 (FCC Form 477 Data Program). The measure is described in Table 2.

I get voting data from the "MIT Election Data + Science Lab (MEDSL)" to account for ideological composition changes. The collected data includes county-level counts of votes for each candidate for the 2012 and 2016 presidential elections.

To track changes in the demographic characteristics of local populations, I use data from the U.S. Census, which provides access to yearly county-level estimates of ethnicity data. Additionally, I use a data set constructed by the USDA Economic Research Service with data from the Department of Commerce, Bureau of Census and American Community Survey to determine the percentage of college-educated people at the county level for the two years of interest.

To track shifts in the economic environment, I collect the county-level poverty rate and median income estimates from the U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program for 2012 and 2016. Additionally, I collect county-level GDP estimates for the two years from the Bureau of Economic Analysis.

5.2 Variable Construction

In this subsection, I define and describe the construction of the variables used in the empirical model

Change in Partisanship. To determine the partisanship of each Facebook post from a local television news channel, I searched for 'partisan phrases' in the post from lists of bigrams indicative of partisan leaning for each congressional session between 2012 and 2016. These lists of phrases are created by (Gentzkow et al., 2019) as outputs from the application of their proposed methodology that tackles the problem of measuring group differences in choices when the dimensionality of choice sets is large. To demonstrate their methodology, they measure differences in phrase choices between Democrats and Republicans in Congress. This is a natural example of choice data where the number of possible choices is large relative to the number of actual choices observed. The preferred penalized estimator of their speech choice model used to create these lists of bigrams is particularly robust to issues plaguing traditional partisan bigram generation methods.

Gentzkow et al. (2019) effectively addresses the issue of sparsity in speech data by employing a regularization technique that reduces the influence of rare, unrepresentative phrases. Since the number of possible phrases is much larger than those observed in Congress, less commonly used phrases might appear partisan if disproportionately used by Republicans or Democrats by chance. By imposing a penalty on the coefficients in their model, their preferred estimator promotes sparsity—allowing only phrases with sufficient statistical support across multiple data points to influence the model. This focuses on robust patterns of partisanship supported by frequent and consistent phrase usage, eliminating the need to exclude less frequent phrases preemptively. Additionally, their approach accounts for characteristics related to both party and speech that are not necessarily manifestations of political differences. For example, speakers from different regions may have distinct linguistic preferences that correlate with political alignments but are fundamentally driven by geographic or cultural factors rather than explicit partisan intent.

Applying their model to observed phrase choices, Gentzkow et al. (2019) calculate, for an observer with a neutral prior, the expected posterior probability that a speaker with specific characteristics is Republican. They define the partisanship of a phrase as the average change in this expected posterior for all speakers of a party in a given Congress when the phrase is removed from the vocabulary. Essentially, this measure captures a phrase's ability to convey information about partisanship and has both direction and magnitude: a positive value indicates the phrase is informative of Republican-leaning, a negative value indicates Democratic-leaning and the absolute value represents the magnitude of partisanship.

Using these lists of bigrams for each Congressional session is particularly useful for assigning partisanship in local news reports. Since the phrases are considered partisan only if they are consistently representative of partisan speech across all speakers, this ensures that the identified phrases genuinely reflect partisan tendencies rather than individual or anomalous usage. Additionally, because the model accounts for non-partisan variations in language—such as regional dialects and cultural expressions—the lists are robust to regional differences. This means they effectively capture partisan language while being insensitive to geographic linguistic variations, making them reliable tools for analyzing partisanship in diverse local contexts.

The primary assumption behind the assignment of partisanship to the Facebook posts data is that phrases or bigrams that are indicative of partisanship when used in Congress within the same time frame are also indicative of partisanship when used in local television news articles. To determine partisanship at a post level, I start by extracting the sets of bigrams from all the components ("Message", "Link Text" and "Description") of each Facebook post.

Given the text of one of these components, an example bigram generation process is ‘‘The President of the country announced plans to reduce taxes for the middle class." $\rightarrow$ ‘‘president country announced plans reduce taxes middle class" $\rightarrow$ {president country, country announced, announced plans, plans reduce, reduce taxes, taxes middle, middle class}. Next, I take a union of the sets of bigrams from each component for a given post. This captures the diversity of bigrams across the components without unnecessary repetitions.

For each Congressional session, Gentzkow et al. (2019) provide a list of approximately 1,000 bigrams along with their associated partisanship scores. I use these scores directly to assign a partisanship score to each post in my dataset. Given a post (and its corresponding date), I first identify the list of partisan phrases from the relevant Congressional session. Next, I perform a fuzzy matching procedure between each bigram in the post and the partisan bigram list. The overall partisanship score for the post is obtained by aggregating the partisanship scores of all matched bigrams. The post is assigned a partisanship score of zero if no matches are found. Let the post score for the k-th post of the day t be defined as p_{kt}.

Two types of bigrams can cause issues in this kind of naive matching with a list of partisan phrases. The first type includes bigrams that have different meanings in the context of television news compared to Congressional speeches, such as `‘‘join us"` or `‘‘take look"`. I eliminate these bigrams from consideration before the matching step. The second type includes bigrams, whose meaning may vary depending on the locality of the news channel. For instance, the bigram `‘‘san diego"` may be associated with partisanship in Congressional speeches due to a particular event of interest to a specific party. However, for a news channel based near San Diego, CA, the context of using this bigram may differ significantly, leading to potential mischaracterizations of partisanship. To mitigate such issues, I limit the influence of excessively frequent bigrams. For each quarter, if a bigram's occurrence exceeds a certain heuristic "unnatural" threshold, I down-weight it exponentially.

After the pre-match and post-match contextual adjustments, I aggregate the post scores for each day to obtain a "daily partisanship score" for the t-th day,

$$d_t = \sum_k p_{kt}. \tag{29}$$

To understand the temporal dynamics of partisanship, I employ a Locally Estimated Scatterplot Smoothing (LOESS) of these scores. This non-parametric approach is flexible and accommodates non-linear trends with an implicit assumption that a news channel's "latent partisanship" is smooth over the temporal space. The method works by fitting local polynomial regressions to the data within a neighborhood around each target time point t_0. The smoothed value y_{t_0} for each day t_0 is estimated using a weighted least squares regression, with neighboring day weights determined by a tricube kernel,

$$w_i = \left(1 - \left(\frac{|t_i - t_0|}{h}\right)^3\right)^3 \quad \text{for } |t_i - t_0| < h. \tag{30}$$

I set the bandwidth, h, so that the smoothed value for each day is influenced by the nearest 50% of all daily scores for a news channel. The kernel function assigns higher weights to data points closer to t_0 in time, while points farther away receive lower weights. The local regression coefficients β_0 and β_1 are obtained by minimizing the weighted sum of squared errors,

$$\sum_i w_i \left(d_i - \beta_0 - \beta_1 (t_i - t_0)\right)^2. \tag{31}$$

The smoothed value for a day t_0, denoted y_{t_0}, is given by the intercept of this locally fitted polynomial, $y_{t_0} = \hat{\beta}_0$.

Unlike simple averaging or summing over a set interval like a quarter or a year, LOESS smoothing of daily scores accounts for the density of partisan rhetoric. This method values the consistency of partisanship by weighting daily scores based on their proximity to each other, thus giving more importance to a series of moderate but consistently partisan days over isolated instances of extreme partisanship. This approach not only ensures sensitivity to the regularity and persistence of partisan expression over time but also offers a layer of robustness, as consistently observed partisan language is less likely to be an artifact of out-of-context usage—reducing the potential for misinterpretation due to isolated anomalies.

To assess the change in partisanship over the observed period, I looked at the final and initial smoothed values of the daily scores for each channel. According to this partisanship measure, 520 out of the 600 local television news channels in the data have negative final and initial smoothed values. This implies that the overall language used by these channels at both the beginning and end of the observation period is more indicative of Democrats in Congress than Republicans.[7]Among these channels, some became less "liberal" throughout analysis, and some became more "liberal". Given this constraint and for clarity of exposition, I narrow the scope of the empirical analysis to understanding partisanship changes on only one side of the political spectrum, focusing on these 520 channels. If a channel becomes less liberal, I assume they are becoming less partisan—since the channel sounds less like the democratic politicians in Congress (but still sounds liberal-leaning overall). If a channel is becoming more liberal, I assume they are becoming more partisan—since the channel sounds more like the democratic politicians in Congress. [8]

Finally, the change in partisanship measure, Δy_{it} for any news channel i is the difference between the smoothed score of December 31st 2016 (t) and January 1st 2012 $(t-1)$ multiplied by -1.

The choice of bandwidth h ensures that the first half of the data influences the initial smoothed score, while the last half influences the final smoothed score. This allows us to capture how the overall partisanship of the news channel has changed over the entire analysis period.

Change in Internet Connections. Since local television news channels serve DMAs, I aggregate the proportion of broadband Internet use data at the DMA level, weighting by housing units in each county within the DMA. Then, I take the difference between the DMA level Internet connections measure between the end of 2016 and 2011. I define this change variable as $\Delta\tau_{it}$ representing

[7] According to a survey by Pew, in 2016, nationally, democrats trust local news more than Republicans—which is consistent with the finding

[8] In the Appendix, I present a more thorough analysis and justification for these assumptions.

the change in high-speed Internet connections in the area that is served by the i-th firm. Roughly, a positive unit change of this measure represents that on average, an extra 20% of the population of the DMA has access to Internet speeds 10Mbps or higher. Figure 1 (a) and (b) show the DMA level measure of Internet connections at the beginning of 2012 and the end of 2016 respectively.

Change in Democratic Vote Share. I only retain the county-level vote counts for the Republican and Democratic candidates. I aggregate the counts at the DMA level and calculate the proportion of votes for the Democratic candidate for the 2012 and 2016 elections. The change in Democratic vote share, Δv_{it}^D is the difference between the percentage of votes cast towards the Democratic candidate in the 2016 and 2012 presidential elections.

Change in Demographic and Economic Characteristics. I aggregate the county-level percentages of people with white ethnicity and people with college education or higher to the DMA level for both 2012 and 2016 to track changes in the ethnic composition and education levels of the population in the DMA. I take the difference of each variable and define the changes in the demographic characteristics of the population as $\Delta \mathbf{x}_{it}^d$.

Similarly, I aggregate the county-level measures of economic characteristics (poverty rate, median income and local GDP) to the DMA level. The change in poverty rate measure is the difference between the DMA level poverty rate between 2016 and 2012. The change in median income is the difference between the population-weighted county median incomes in the DMA between 2016 and 2012. The change in GPD is measured as the percentage growth in GDP of the DMA over the five years of the analysis period. Collectively, I define the change variables in economic characteristics as $\Delta \mathbf{x}_{it}^e$.

Table 3 presents the summary statistics for the variables discussed in this section.

6 Empirical Analysis

To quantify the role of changes in connections to moderately high-speed Internet, changes in vote share, and changes in demographic and economic characteristics of the DMA on the partisanship changes of local television news channels, I estimate the linear model

$$\Delta y_{it} = \beta_1 \Delta \tau_{it} + \beta_2 \Delta v_{it}^D + \beta_3 \Delta \mathbf{x}_{it}^d + \beta_4 \Delta \mathbf{x}_{it}^e + \varepsilon_{it}. \tag{32}$$

As defined in the previous section, Δy_{it} represents the change in partisanship of local news channel i from 2012 to 2016 and $\Delta \tau_{it}$, Δv_{it}^D, $\Delta \mathbf{x}_{it}^d$, and $\Delta \mathbf{x}_{it}^e$ represent the changes in 10Mbps Internet connections, Democratic vote share, and the demographic and economic characteristics of the DMA where channel i operates, respectively.

6.1 Results

Table 4 presents the results of several OLS regressions based on the specified linear model (32), where the dependent variable is the change in partisanship score for local television channels. Each column in the table reports estimates from different model specifications, where I systematically vary the included control variables. This allows for a robustness check of the relationship between changes in Internet penetration and partisanship shifts by including or excluding variables such as Democratic vote share, demographic characteristics, and economic factors.

Figure 2 presents a bin scatter plot that illustrates the relationship between changes in Internet penetration and changes in local news partisanship. The data for changes in Internet penetration are divided into deciles. Within each decile, the plot shows the average change in Internet penetration against the corresponding average change in partisanship. Error bars represent bootstrap standard errors, which are calculated from 10,000 resamples within each bin, quantifying the variability of the mean changes in partisanship. For a visual aid, I add a best-fit line through the binned data. The slope of the line is 1.953.

6.2 Discussion of Findings

In the simplest model, where only changes in Internet connections are considered, a one-unit increase in Internet connections is associated with a 3.499-unit increase in partisanship—this change is 51.2% of the observed standard deviation of the change in partisanship over the analysis period. The inclusion of changes in Democratic vote share only slightly decreases this magnitude, indicating that fluctuations in Democratic vote share over the analysis period are not strongly correlated with changes in the partisanship of local liberal news channels. In the model that includes economic characteristics, each unit increase in Internet connections corresponds to a 1.883-unit increase in partisanship. Adding demographic characteristics alone results in a lower coefficient of 1.283. In the full specification controlling for changes in vote share, economic and demographic characteristics, a one-unit increase in the Internet connections measure is associated with a 1.354 unit increase in partisanship—this change is 19.8% of the observed standard deviation of changes in partisanship.

The results in Table 4, alongside the bin scatter plot (Figure 2), indicate a clear and statistically significant relationship between changes in Internet connections and the shifts in partisanship among local television news channels. Across all models, the coefficient for $\Delta\tau_{it}$ remains positive and significant, supporting the hypothesis that increasing Internet penetration correlates with rising partisanship. According to the point estimates of the full linear model (33), a roughly 1%

increase in households with Internet access at speeds of 10Mbps or higher within a DMA is linked to an increase in partisanship of liberal local news channels within it comparable to a 0.94% rise in Democratic vote share.

In contrast, changes in Democratic vote share (Δv_{it}^{D}) show a positive but statistically insignificant relationship with partisanship across both specifications that include it. Theoretically, we might expect the partisanship of liberal news channels to increase with a growing Democratic vote share, as this could indicate a stronger partisan base. However, the data includes only two presidential elections, with an average change in Democratic vote share of -2.59% and a standard deviation of 4.27%. These modest fluctuations in vote share are likely insufficient to drive observable shifts in news content, especially if they do not significantly impact the core audience base.

During the same period, Internet penetration rose by an average of 27.9%, representing a substantial shift in the information environments of the DMAs. This broad structural change likely affects how most people in the DMA interact with news media, prompting local television channels to adjust their content in response to shifts in the viewership habits of their audience.

The specific mechanism proposed in the theory—that more informed partisans are increasingly substituting away to online news—cannot be directly tested here. However, the consistent association between changes in Internet penetration and changes in partisanship in local news suggests that news channels may respond to the shifting information environment by increasing partisanship.

In the "Internet & Economic Characteristics" model, the coefficient on median income is positive and statistically significant, suggesting that an increase in median income is associated with an increase in partisanship of liberal local news channels. However, this effect becomes statistically insignificant when controls for changes in vote share and demographic characteristics are included.

Both the change in poverty rate and the percentage change in GDP have statistically insignificant effects on partisanship across all models. The data shows an average increase in median income of $5,674, a reduction in poverty rate of -1.73%, and a 5-year GDP growth of 7.32% across DMAs during the study period. These relatively modest changes in economic characteristics may not have been substantial enough to noticeably affect the audience composition of local news firms and significantly influence the partisanship of the news content when all the controls are present.

Both the change in the percentage of the White population and the change in the percentage of the population with a college education are statistically significant in the "Internet & Demographic Characteristics" model. An increase in the percentage of the White population is associated with a decrease in the partisanship of liberal local news channels, while an increase in the percentage of the college-educated population is associated with an increase in partisanship. However, when controls for vote share and economic variables are included, these effects remain in the same direction but become statistically insignificant.

On average, the percentage of the White population decreased by -0.78%, while the percentage of the college-educated population increased by +4.46% across DMAs during the study period. News channels are expected to adjust their content in response to demographic changes in the DMA if they alter the composition of the audience. However, the relatively modest shifts in these variables over this short time frame may not induce significant changes in the news viewing habits of the core audience base of the news channels.

These findings lend empirical support to the hypothesis that increasing Internet penetration is associated with more partisan content in local news. Across all model specifications, Internet penetration is a consistently significant predictor of rising partisanship, suggesting that structural changes in the information environment—rather than short-term political or economic fluctuations—may be contributing to the observed shifts in local news partisanship over the analysis period. The bin scatter plot further supports this conclusion, showing a clear upward trend between the rise of high-speed Internet connections and the increase in partisanship of local news channels.

7 Conclusion

I present a model that can explain the rising partisanship in traditional media and rising disagreements among demographic groups that are least likely to use the Internet. I show that innovations in the information environment can alter the incentives of news firms in the incumbent market as viewership composition changes. If more informed audiences disproportionately migrate to new platforms for news, traditional news firms respond by catering to the more engaged, less informed audiences. This adjustment results in distorted beliefs and heightened partisan disagreements, even without changes in the overall ideological distribution of the population.

The empirical analysis supports the hypothesis that growth in substitute information platforms is related to changes in partisanship. By examining the effect of high-speed Internet penetration on the partisanship of local television news reporting, I find that larger increases in high-speed Internet connections in a DMA are significantly associated with larger increases in the partisanship of local news. This suggests that technological changes can influence the information provision strategies of traditional media toward greater partisanship.

While worthwhile attention has been given to issues that arise in the online information environment as technology and Internet access improve, I highlight that these innovations can affect not only those who adopt them but also those who do not. The mechanism explored extends beyond the Internet and traditional news sources to other contexts where societal, technological, or algorithmic changes disproportionately impact segments of the population with varying levels of informedness.

If new platforms provide easy access to trustworthy fact-checking for diverse ideological groups, a rapid transition to these platforms could mitigate the increasing slant in traditional news and the resulting rise in partisan disagreements. Alternatively, if these platforms primarily enable high-quality information provision to better-informed audiences to maximize engagement, an influx of less-informed users could improve information quality for them but diminish it for better-informed users. This could drive better-informed audiences to seek alternative sources—leading to segmentation in online spaces—perpetuating the mechanism.

Future work could explore how interactions between better-informed early adopters and less-informed late adopters, who may hold distorted beliefs due to rising media bias, affect social network structures and information dissemination within them. Detailed audience characteristics data could enable direct tests of the mechanism presented in the model and cross-country analyses with diverse supply-side conditions and regulatory frameworks could further illuminate the impact of technological change on media bias and polarization.

Appendix A Proofs

Proof of Theorem 1. Let $x \in X$ be such that, when $\beta_{0-j} = -x$,

$$\beta^*_{0j}(-x) = x,$$

where $\beta^*_{0j}(.)$ is the best response function for firm j. The first order condition for firm j's optimization problem is

$$L_1(\beta_{0j}) = \int_{\mathscr{G}} w_p(g)w(g,\tau)\Big[\int_{b_i(a(g),\beta_{0j},\beta_{0-j})}^{\bar{b}} f(b_0)\frac{\partial \alpha_{cj}(\beta_{0j},b_0)}{\partial \beta_{0j}}\,db_0 - f(b_i)\alpha_{cj}(\beta_{0j},b_i)\frac{\partial b_i}{\partial \beta_{0j}}\Big]\,dg = 0,$$

where,

$$b_i = \frac{a(g)\left(\sqrt{1-\beta^2_{0-j}} - \sqrt{1-\beta^2_{0j}}\right)}{\beta_{0j}-\beta_{0-j}},$$

is the ideological bias of the indifferent consumers. Let, $\beta_{0j} = -\beta_{0-j}$ then the first order condition is satisfied when

$$L_1(\beta_{0j})\Big|_{\beta_{0j}=-\beta_{0-j}} = \int_{\mathscr{G}} w_p(g)w(g,\tau)\Big[\int_0^{\bar{b}} f(b_0)\frac{\partial \alpha_{cj}(\beta_{0j},b_0)}{\partial \beta_{0j}}\,db_0 - \frac{f(0)a(g)}{2}\Big]\,dg = 0.$$

Since $a_0(g) > 0\ \forall g$ and $\beta_{0j} < 1$,

$$\begin{aligned}
\frac{\partial L_1}{\partial \beta_{0j}}\Bigg|_{\beta_{0j}=-\beta_{0-j}} &= \int_{\mathscr{G}} w_p(g)w(g,\tau)\int_0^{\bar{b}} f(b_0)\frac{\partial^2 \alpha_{cj}(\beta_{0j},b_0)}{\partial \beta^2_{0j}}\,db_0\,dg \\
&= -\int_{\mathscr{G}} w_p(g)w(g,\tau)\int_0^{\bar{b}} \frac{f(b_0)a(g)}{(1-\beta^2_{0j})^{3/2}\sqrt{(a(g))^2+b_0^2}}\,db_0\,dg < 0.
\end{aligned}$$

Case 1: $L_1(0)\big|_{\beta_{0j}=-\beta_{0-j}} < 0$ **:** If $L_1(0)\big|_{\beta_{0j}=-\beta_{0-j}} < 0$, since $\frac{\partial L_1}{\partial \beta_{0j}}\Big|_{\beta_{0j}=-\beta_{0-j}} < 0$ firm j has no incentive to increase slant from $\beta_{0j} = 0$ if firm $-j$ chooses slant $\beta_{0-j} = 0$. This implies that $\beta^*_{0j}(0) = 0$. By symmetry of $f(.)$ and $\alpha_{cj}(.)$ around $b_0 = 0$, we can also claim $\beta^*_{0-j}(0) = 0$. Thus in this case, the strategy profile $(0,0)$ is a Nash Equilibrium. And since X is a singleton, there exists a unique mirror symmetric equilibrium.

Case 2: $L_1(\bar{b})\big|_{\beta_{0j}=-\beta_{0-j}} > 0$ **:** If $L_1(\bar{b})\big|_{\beta_{0j}=-\beta_{0-j}} > 0$, since $\frac{\partial L_1}{\partial \beta_{0j}}\Big|_{\beta_{0j}=-\beta_{0-j}} < 0$ firm j has no incentive to decrease slant from $\beta_{0j} = \bar{b}$ if firm $-j$ chooses slant $\beta_{0-j} = -\bar{b}$. This implies that $\beta^*_{0j}(-\bar{b}) = \bar{b}$. By symmetry of $f(.)$ and $\alpha_{cj}(.)$ around $b_0 = 0$, we can also claim $\beta^*_{0-j}(\bar{b}) = -\bar{b}$. Thus in this case, the strategy profile $(\bar{b}, -\bar{b})$ is a Nash Equilibrium. And since X is a singleton, there exists a unique mirror symmetric equilibrium.

Case 3: $L_1(0)\big|_{\beta_{0j}=-\beta_{0-j}} > 0$ **and** $L_1(\bar{b})\big|_{\beta_{0j}=-\beta_{0-j}} < 0$**:** Note that if $L_1(0)\big|_{\beta_{0j}=-\beta_{0-j}} < 0$ then $L_1(\bar{b})\big|_{\beta_{0j}=-\beta_{0-j}} < 0$ and if $L_1(\bar{b})\big|_{\beta_{0j}=-\beta_{0-j}} > 0$ then $L_1(0)\big|_{\beta_{0j}=-\beta_{0-j}} > 0$. The only case remaining to check is when $L_1(0)\big|_{\beta_{0j}=-\beta_{0-j}} > 0$ and $L_1(\bar{b})\big|_{\beta_{0j}=-\beta_{0-j}} < 0$. Continuity of L_1 and the Intermediate Value Theorem implies that there exists a unique $x \in (0, \bar{b})$, such that $\beta^*_{0j}(-x) = x$. By symmetry of $f(.)$ and $\alpha_{cj}(.)$ around $b_0 = 0$, $\beta^*_{0-j}(x) = -x$. Thus the strategy profile $(x, -x)$ is a Nash Equilibrium. And since X is a singleton, there exists a unique mirror symmetric equilibrium.
■

Proof of Result 1. From proof of Theorem 1, we know that β^E_{01} can be found by solving the following equation

$$L_1(\beta_{0j}) = \int_{\mathscr{G}} w_p(g) w(g,\tau) \Big[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{cj}(\beta_{0j}, b_0)}{\partial \beta_{0j}} \, db_0 - \frac{f(0)a(g)}{2} \Big] \, dg = 0.$$

The impact of increasing τ on the equilibrium slant of firm 1 can then be expressed as follows

$$\frac{\partial \beta^E_{01}}{\partial \tau} = -\frac{\frac{\partial L_1(\beta^E_{01})}{\partial \tau}}{\frac{\partial L_1(\beta^E_{01})}{\partial \beta_{01}}}$$

The numerator can be expressed as follows

$$\begin{aligned}\frac{\partial L_1(\beta^E_{01})}{\partial \tau} &= \int_{\bar{G}} w_p(g) \frac{\partial w(g,\tau)}{\partial \tau} \left[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta^E_{01}, g)}{\partial \beta_{01}} \, db_0 - \frac{f(0)a(g)}{2} \right] dg \\ &\quad + \int_{\underline{G}} w_p(g) \frac{\partial w(g,\tau)}{\partial \tau} \left[\int_0^{\bar{b}} f(b_0) \frac{\partial \alpha_{c1}(\beta^E_{01}, g)}{\partial \beta_{01}} \, db_0 - \frac{f(0)a(g)}{2} \right] dg\end{aligned}$$

It is easy to see that if CONDITION 1 is satisfied then

$$\frac{\partial L_1(\beta^E_{01})}{\partial \tau} > 0$$

From proof of Theorem 1, we know that $\frac{\partial L_1(\beta^E_{01})}{\partial \beta_{01}} < 0$. Therefore we can conclude that

$$\frac{\partial \beta_{01}^E}{\partial \tau} > 0$$

By the nature of the mirror symmetric equilibrium we can also similarly demonstrate that

$$\frac{\partial \beta_{02}^E}{\partial \tau} < 0$$

Therefore in equilibrium both firms become more partisan with increasing τ. ■

Proof of Result 2. For any time t, the mean of the consumers' posterior beliefs in the conservative less informed population is

$$\bar{\omega}_t^{R\underline{G}} = \int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c1}[\alpha_{01}\omega_t + \beta_{01}^E \tilde{r}_t]\, db_0\, dg$$

The mean of the consumers' posterior beliefs in the liberal less informed population is

$$\bar{\omega}_t^{R\underline{G}} = \int_{\underline{G}} w_p(g) \int_{\underline{b}}^0 f(b_0)\alpha_{c2}[\alpha_{01}\omega_t + \beta_{02}^E \tilde{r}_t]\, db_0\, dg$$

By symmetry of α_{cj}, f and equilibrium slant ($\beta_{0j}^E = -\beta_{0-j}^E$) we can claim the following relations

$$\int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c1}\alpha_{01}\omega_t\, db_0\, dg = \int_{\underline{G}} w_p(g) \int_{\underline{b}}^0 f(b_0)\alpha_{c2}\alpha_{01}\omega_t\, db_0\, dg$$

$$\int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c1}\beta_{01}^E \tilde{r}_t\, db_0\, dg = -\int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c2}\beta_{01}^E \tilde{r}_t\, db_0\, dg$$

Then the difference in beliefs at any time t can be expressed as follows

$$|\bar{\omega}_t^{R\underline{G}} - \bar{\omega}_t^{L\underline{G}}| = 2\int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c1}\beta_{01}^E \tilde{r}_t\, db_0\, dg$$

and

$$\begin{aligned}\mathbb{E}(|\bar{\omega}_t^{R\underline{G}} - \bar{\omega}_t^{L\underline{G}}|) &= 2\int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c1}\beta_{01}^E \mathbb{E}(|\tilde{r}_t|)\, db_0\, dg \\ &= \sqrt{\frac{8}{\pi}} \int_{\underline{G}} w_p(g) \int_0^{\bar{b}} f(b_0)\alpha_{c1}\beta_{01}^E\, db_0\, dg\end{aligned}$$

To understand the impact of increasing equilibrium bias on partisan disagreement consider the following expression

$$\frac{\partial \Delta_{\underline{G}}}{\partial \beta_{01}^{E}} = \beta_{01}^{E}\sqrt{\frac{8}{\pi}}\int_{\underline{G}} w_p(g)\int_0^{\bar{b}} f(b_0)\frac{\partial \alpha_{c1}}{\partial \beta_{01}}\,db_0\,dg + \sqrt{\frac{8}{\pi}}\int_{\underline{G}} w_p(g)\int_0^{\bar{b}} f(b_0)\alpha_{c1}\,db_0\,dg$$

The second term in the expression above is strictly greater than zero. From inequality (10), we also know that for any $g \in \underline{G}$ the following condition holds

$$\int_0^{\bar{b}} f(b_0)\frac{\partial \alpha_{c1}}{\partial \beta_{01}}\,db_0 - \frac{f(0)a(g)}{2} > 0$$

$$\implies \int_0^{\bar{b}} f(b_0)\frac{\partial \alpha_{c1}}{\partial \beta_{01}}\,db_0 > 0$$

Since $\beta_{01}^{E} > 0$ due to satisfaction of IPIQC, we can then claim $\frac{\partial \Delta_{\underline{G}}}{\partial \beta_{01}^{E}} > 0$. ■

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Table 2: Measure for 10Mbps Internet Connections

Measure	**Connections (X) per 1,000 Housing Units**
0	0
1	$0 < X \leq 200$
2	$200 < X \leq 400$
3	$400 < X \leq 600$
4	$600 < X \leq 800$
5	$800 < X$

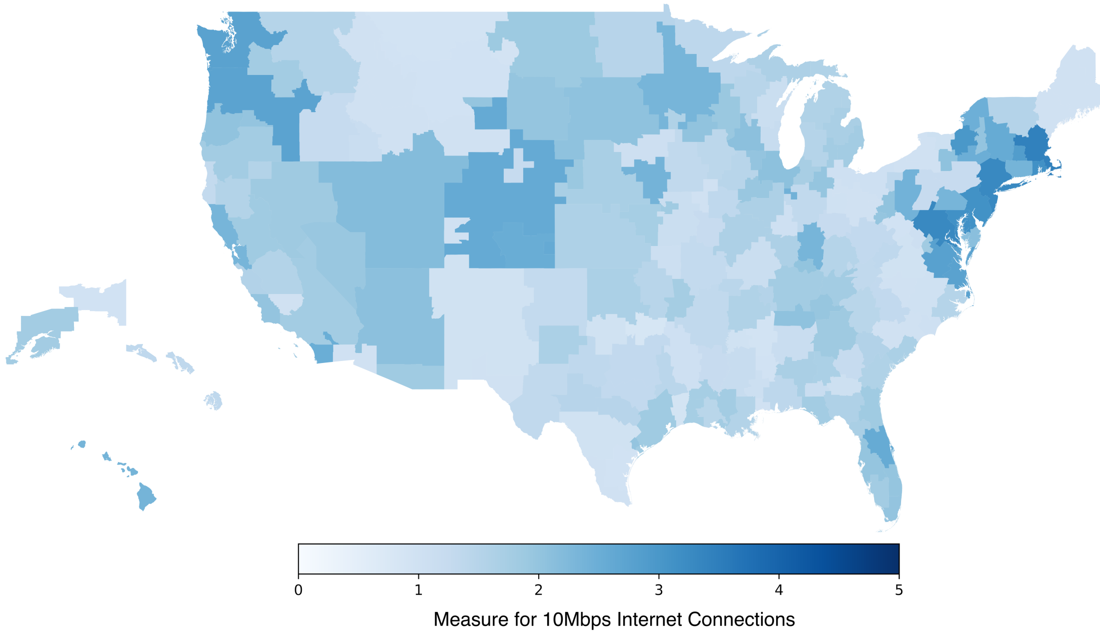
Table 3: Summary Statistics

	Mean	**Median**	**Std Dev**	**Min**	**25%**	**75%**	**Max**
Change in Partisanship	5.05	3.62	6.83	-14.91	0.77	7.60	47.84
Change Internet Connections	1.39	1.34	0.48	0.23	1.00	1.70	2.65
Change Vote Share	-2.59	-2.47	4.27	-14.46	-4.55	-0.77	25.09
Change Median Income	5.67	5.64	2.17	0.74	4.27	6.75	19.35
Change Poverty Rate	-1.73	-1.64	1.14	-5.20	-2.43	-1.01	1.82
Percentage Change in GDP	7.32	6.57	8.41	-19.75	2.50	11.07	69.40
Change Percentage White Pop	-0.78	-0.74	0.48	-2.14	-1.01	-0.48	0.93
Change Percentage College	4.46	4.42	1.21	1.75	3.54	5.30	8.13

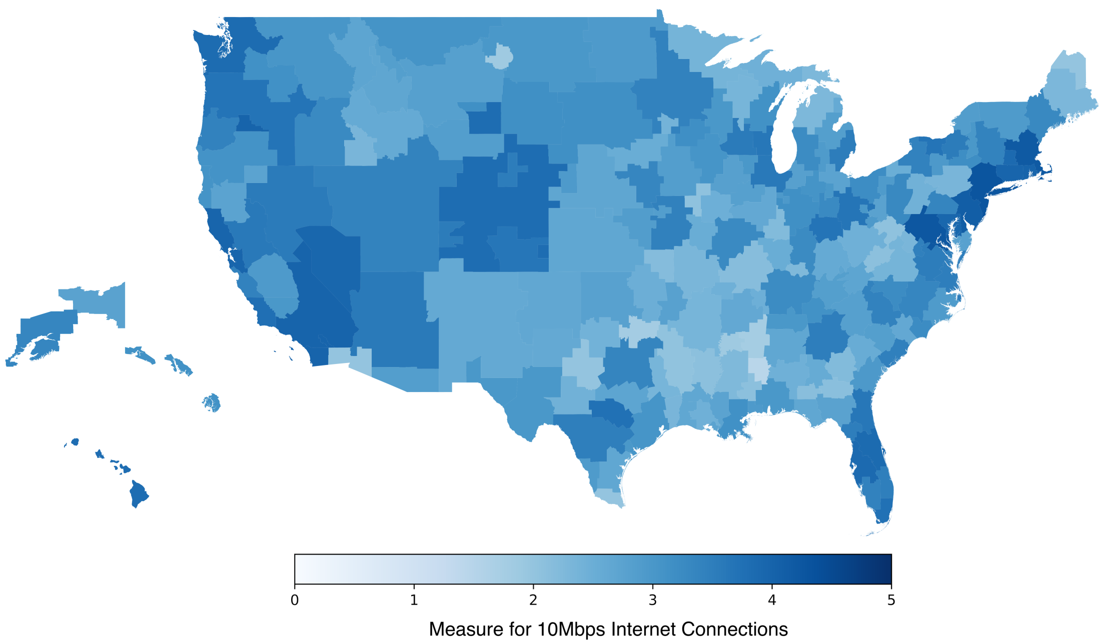
Table 4: OLS Regressions with Bootstrapped Standard Errors

	Dependent variable: Change in Partisanship				
	Internet	Internet & Vote Share	Internet & Economic Characteristics	Internet & Demographic Characteristics	Full Specification
Change Internet Connections	3.420***	3.499***	1.883***	1.283**	1.354**
	(0.217)	(0.241)	(0.559)	(0.611)	(0.650)
Change Vote Share	—	0.053	—	—	0.0722
	—	(0.055)	—	—	(0.061)
Change Median Income	—	—	0.477***	—	0.097
	—	—	(0.139)	—	(0.212)
Change Poverty Rate	—	—	0.366	—	0.266
	—	—	(0.316)	—	(0.320)
Percentage Change in GDP	—	—	0.039	—	0.043
	—	—	(0.052)	—	(0.052)
Change Percentage White Pop	—	—	—	-1.360*	-1.197
	—	—	—	(0.713)	(0.728)
Change Percentage College	—	—	—	0.500**	0.449
	—	—	—	(0.220)	(0.309)
Observations	520	520	520	520	520
R^2	0.353	0.354	0.375	0.378	0.382
Adjusted R^2	0.352	0.351	0.370	0.375	0.374
Residual Std. Error	6.734	6.732	6.704	6.698	6.689
F Statistic	247.9***	123.7***	68.43***	97.39***	42.02***

Note: CI Excludes 0 at: *90%; **95%; ***99%



(a) DMA Level Internet (2012)



(b) DMA Level Internet (2016)

Figure 1: DMA Level Internet Connections, 2012 and 2016

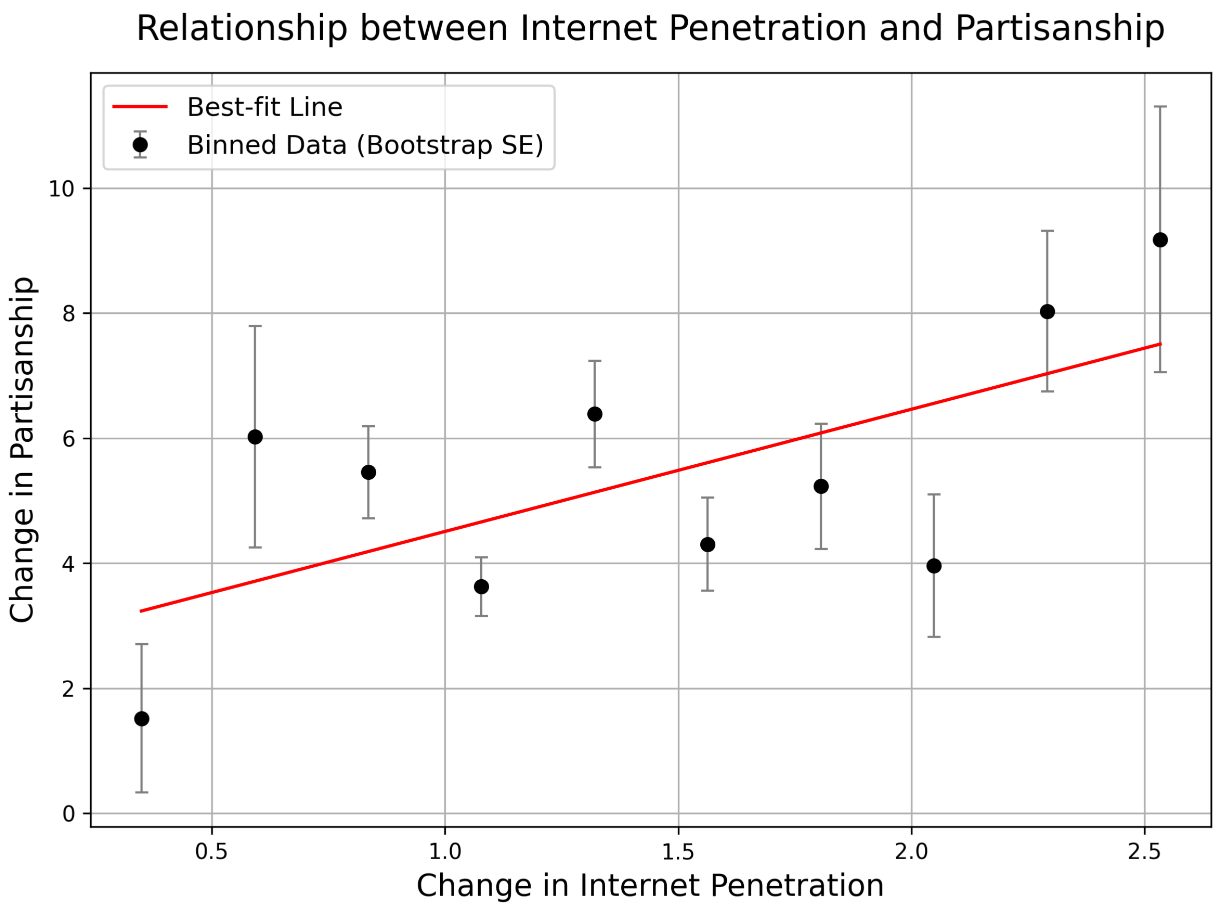


Figure 2: *Bin Scatter Plot: Change in Internet Penetration vs. Change in Partisanship.*