Media and Polarization

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Abstract

This paper provides an economic framework to explain the impact of the media on political polarization. We start from a context where media environments, characterized by their levels of accessibility and ideological content variety, affect citizens’ ideological views and political motivation. From this we derive comparative statics in a model of electoral competition with endogenous turnout in which politicians react to those media-influenced attitudes. We identify two channels: the ideology effect, whereby a decrease in media ideological variety leads to convergence in citizens’ views and hence to lower polarization; and the composition effect, whereby a lowering of barriers to media accessibility increases turnout and hence affects the composition of the electorate, as the inflow of new citizens who turn out are relatively more moderate. We show that the composition effect affects the extensive and intensive margins for political parties chasing voters, so that its ultimate direction depends on the political system: lower polarization in majoritarian systems, but higher polarization under proportional representation. We test the model’s predictions in the US context of the introduction of broadcast TV, in the 1940s and 1950s, and radio, in the 1920s and 1930s. Consistent with our model, the evidence shows that TV decreased polarization, and exposure to radio was associated with lower polarization. The evidence suggests that the composition effect predominated in the case of radio, while the ideology effect was more important in the case of TV.

Keywords: Media; Political Polarization; Turnout; Ideology; TV; Radio; Majoritarian System; Proportional Representation.

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1 Introduction

In recent years, polarization has been one of the dominant themes in US politics. The contentious debate and vote on health care reform by the Congress in 2010 is a vivid illustration of the escalating partisan divide. This rise in partisan polarization, starting in the 1970s, has been widely discussed by commentators (Dionne 2004, Krugman 2004, \textit{inter alia}), and well-documented by scholars (Sinclair 2006, McCarty et al 2006), who have also noted that it followed a substantial drop in the preceding half-century. These movements matter because polarization has substantive policy consequences. There is strong evidence that it is associated with increased levels of political gridlock (Binder 1999, Jones 2001), implying low rates of policy innovation and a decreased ability to adapt to changes in economic, social, or demographic circumstances (McCarty 2007).\footnote{These concerns, of course, are not limited to the US or to developed democracies, as in developing countries polarization is often associated to social and political unrest (e.g. Huntington 1968, Ellner and Hellinger 2003, on Venezuela). Interestingly, for some, less polarization could have negative consequences. The drop in polarization in the US in the mid-century highlighted that a depolarized polity might lead to demobilization in the face of a lack of distinct choices (APSA, 1950).}

What explains these movements in polarization? The role of a changing media landscape is often mentioned as an important driver and propagator. There is a broad consensus among observers, and growing evidence to support it, that the media affect individuals’ views and political behavior – with whatever explicitly political content that they carry, but also with entertainment content (movies, soap operas, talk shows, even sports features) that often conveys subtle or less-than-subtle ideological cues. It is only natural that this would translate into an impact on political polarization.

The nature, extent, and direction of that impact is not clear, however. A longstanding view on “mainstreaming” has held that mass media have tended to induce conformity and lower polarization. As put by Gerbner et al (1980, p. 19-20) when analyzing the role of television, they can “contribute to the cultivation of common perspectives. In particular, heavy viewing may serve to cultivate beliefs of otherwise disparate and divergent groups toward a more homogeneous ‘mainstream’ view.” In the opposite direction, though, it has been argued that new media such as cable TV or the internet have increased polarization by enabling individuals to select outlets that conform to their prior ideologies as in an “echo chamber” (Bishop 2008, Sunstein 2009). This view has become widespread, and is well illustrated by Pres. Barack Obama’s (2010) remarks:

“Today’s 24/7 echo-chamber amplifies the most inflammatory soundbites louder and faster than ever before. And it’s also, however, given us unprecedented choice. Whereas most Americans used to get their news from the same three networks over dinner, or a few influential papers on Sunday morning, we now have the option to get our information from any number of blogs or websites or cable news shows. (...) If we choose only to expose ourselves to opinions and viewpoints that are in line with our own, studies suggest that we become more polarized (...) That will only reinforce and even deepen the political divides in this country.”
This paper proposes a theoretical framework to study the impact of the media on political polarization – one that can encompass those different possibilities. We start by identifying two dimensions of the media environment that seem central to the issue at hand: access barriers and ideological variety. **Barriers** refers to the fact that different media technologies impose different barriers to access by consumers. This can be driven by regulation (e.g. licenses), supply factors (e.g. prices, coverage), and/or demand-side factors such as cognitive barriers. For instance, newspapers or blogs require literacy and reading, whereas the consumption of TV or radio imposes much lower cognitive costs. **Variety** refers to the level of ideological choice available to media audiences. For example, for decades, broadcast TV in the US has had only a handful of highly homogeneous channels. In contrast, cable TV or the internet offer much higher content variety, with a wider spectrum of ideological content or “editorial lines”.

Our basic mechanism builds on the premise that changes in the media market will drive changes in the political attitudes of citizens, affecting who votes and which positions are more popular. Changes in access barriers affect exposure to political information, which in turn affects the levels of political motivation. Similarly, changes in media market variety affect the mix of ideological content available to consumers, which in turn can affect their support for different positions. In response to these changes, politicians and parties will adjust their platforms. Importantly, the impact of a new medium will depend on the characteristics of the pre-existing media environment, the media **substrate**. For example, the introduction of a “low-brow” medium such as TV in the US may have had a limited impact on media access given the widespread diffusion of radio at the time. In contrast, introducing TV in a society with a high-barriers substrate (e.g. low radio penetration) will have different implications on political behavior.

We put this basic intuition to work in a framework where individuals start with a given ideological position and level of intrinsic political motivation, and are influenced by what they see in the media. The distribution of ideological preferences thus becomes a function of media market variety – a decrease in variety leads to a compression of the distribution of ideological preferences – and the distribution of political motivation is a function of the extent of barriers to media access – greater access increases motivation. We use this to derive comparative statics in a model of electoral competition with endogenous turnout. In this model, two office- and ideology-motivated parties adopt (one-dimensional) platforms while taking into account individuals’ ideologies and turnout decisions. Voter turnout is driven by an idiosyncratic “civic” motivation and the relative positions of the platforms. Equilibrium platforms and turnout are a function of the media-influenced distribution of motivation and ideology.

Our main predictions concern the effect of changes in media environment on the political equilibrium. Our results distinguish between two separate channels: the **ideology effect** and the **composition effect**, as

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2On this see the references in Prior (2007, p. 72-73). While in the context of the US illiteracy (strictly speaking) would not be of much importance, functional illiteracy is: those who “eschew any serious reading that is not imperative” could be “estimated to be [as much] as 60 per cent” of the population. (Converse 1962, p. 592)

3For evidence on the extent of ideological segregation for the case of the internet and broadcast TV, see Gentzkow and Shapiro (2010). In particular, they find that the major TV networks (ABC, NBC, CBS) are very homogeneous in terms of the ideological profile of their audiences.
summarized in Figure 1. The ideology effect captures the impact of changes in media ideological variety: since a decrease in variety gives rise to a compression in the distribution of citizens’ ideological preferences, parties will naturally react by moving their platforms closer to each other. In other words, less variety induces lower polarization: the ideology effect expresses a complementarity between the ideological variety supplied by the media market and the degree of ideological polarization in the political equilibrium. This is what we would expect if broadcast TV is introduced into a substrate dominated by local newspapers or radio. The composition effect reflects the impact of changes in access barriers: with lower barriers – such as when mass TV or radio are introduced into a substrate where newspapers were dominant – a larger number of individuals will be motivated to vote. This will change the composition of the electorate, thereby affecting the incentives faced by parties.

We show that the parties’ response to this inflow of voters, and hence the direction of the composition effect on polarization, depends on the political system. There are two competing incentives. First, an endogenous feature of our model is that those initially not voting are disproportionately likely to be moderate – since, for a given level of political motivation, extremists care more about differences between candidates. Thus, reducing barriers changes the ideological composition of those who turn out, as most of the new voters will be relatively moderate. This provides parties with an incentive to moderate as well. The second effect is on the extensive margin. Roughly, with lower barriers the average voter has higher political motivation. Thus, parties will care less about dragging low-motivation voters to the polls, and will thus have more leeway to move towards their preferred platforms. This tends to increase polarization. In a winner-take-all majoritarian system (such as in the US), the first effect dominates: lower barriers reduce polarization, even if individual views are left unaffected by exposure to a new media environment. In a proportional representation system, the extensive margin prevails.4

The model also provides us with a strategy to distinguish between the ideology and the composition effect. The theory suggests an intimate connection between polarization and turnout. In the case of the composition effect, it is precisely the inflow of new voters that drives the decrease in polarization. At the same time, since voters care about how different the candidates are, lower polarization will tend to reduce turnout. In light of that, while the drop in polarization from the ideology effect is accompanied by a reduction in turnout, the one from the composition effect is associated with increased turnout.

We then take the framework’s predictions to the data. The theory in principle applies to any change in media technology, but an ideal context to test it is the introduction of radio, in the 1920s and 1930s, and broadcast TV, in the 1940s and 1950s, in the US. These were massive changes in media technology, and they coincided with a period over which there was a very substantial drop in measured polarization. For the case of TV, which we argue constituted a low-barrier, low-variety medium, we follow an empirical strategy inspired by Gentzkow (2006), and show evidence that counties that got TV relatively early

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4In this paper we restrict attention to the case of two parties, which is not typical in countries with proportional representation. The broader point remains, however, that the effects of new media on the political equilibrium are likely to depend on the details of the political system.
displayed a decrease in polarization as measured by their representatives’ ideological position, when compared to latecoming counties. This result is robust to a variety of specifications, and is consistent with the empirical prediction that TV would reduce polarization. We also show that the effect on turnout was substantially different depending on the media substrate. Specifically, in those counties where radio penetration had been small (and hence where TV represented a more important lowering of access barriers), turnout decreased less than in counties with a strong radio presence. Finally, we show that the drop in polarization is quantitatively less important in relatively poorer, less educated places – exactly where one would expect the lowering of barriers to have had a greater impact. This suggests that the drop in polarization engendered by the introduction of TV was driven mostly by the ideology effect.

We pursue a similar strategy for the case of radio, making use of exogenous variation in the dissemination of radio across different regions in the 1930s, introduced by the passage and later repeal of the so-called Davis Amendment demanding equal radio coverage for all the zones defined by the Radio Act of 1927. The data show a negative effect of radio exposure on polarization – consistent with both of our effects. We provide some correlational evidence to distinguish between them based on the fact that, while radio was certainly a low-barrier medium, there was substantial variation across localities in the degree to which radio stations were affiliated to a national network. To the extent that networks imposed relatively homogenous content, their expansion provides a contrast of a lower-variety environment encroaching the high-variety substrate of local radio and newspapers. We show that the negative correlation was present both for exposure to network-affiliated and unaffiliated stations, and does not seem to have been quantitatively stronger in the former case. This seems to suggest a predominance of the composition effect in the case of the introduction of radio, since variety would predict a stronger impact of affiliated stations.
Related Literature  Our paper relates directly to the growing literature in political science and economics that has examined the interaction between media and politics – one with a long history in the social sciences (e.g. Lazarsfeld et al. 1948). On the theory side, the focus in economics has been mostly on understanding the supply and demand of political bias in the media (e.g. Mullainathan and Shleifer 2005, Besley and Prat 2006). A central theme in this literature is to assess the extent to which consumer preferences, content suppliers (e.g. journalists, owners, politicians), and the degree of market competition affect the extent of media bias supplied by market competitors (see the surveys by Gentzkow and Shapiro (2008) and Della Vigna and Gentzkow (2009)). In contrast to this literature, we focus on analyzing the impact of the media on political outcomes. Specifically, our framework explains how changes in media technology have been an important determinant of changes in polarization, a theme emphasized by recent work in political science (e.g. Prior 2007).\(^5\)

We also depart from that literature by focusing on the ideological influence of the media, rather than the truthfulness of informational content. We view this as a complementary dimension that is also important to the study of the cultural and political impact of the media over time.\(^6\) In fact, the determinants of beliefs and attitudinal change have long been a central research topic in social psychology, sociology, and political science (e.g. Sarnoff and Katz (1954), Katz (1960), Abelson (1986), Nisbett and Ross (1980)). This research, in contrast to most economic modeling, has emphasized that beliefs and attitudes are not exclusively about information processing. Borrowing Abelson’s (1986) terminology, “beliefs of individuals are like possessions” that define and express an individual’s identity and have often an evaluative and an affective component. As such, it is hard to think of attitudes about communism, international affairs, religion, fertility, individual rights, redistribution, or many other key drivers of political behavior, as being mainly about processing information regarding some objectively “true” state of nature.

On the empirical side, the paper also relates to the growing literature substantiating the widespread perception that the introduction of different media technologies has had substantial impact on political outcomes (Strömberg 2004, Gentzkow 2006, Gentzkow et al. 2009), and on individual views and attitudes on and beyond politics (Della Vigna and Kaplan 2007, Gentzkow and Shapiro 2004, Gerber et al. 2009, Jensen and Oster 2009, La Ferrara et al. 2008). In particular, our results on turnout are consistent with, and also extend in new directions, the findings of Gentzkow (2006), who found a negative effect of TV on turnout, and Strömberg (2004), who found a positive effect of radio on turnout. Our results also

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\(^5\)Prior’s (2007) intuition is related to our composition effect: He focuses on the choice between news and entertainment content – as distinct from that between different ideological views – and argues for the assumption that individuals who prefer news content (who are, of course, more politically motivated) tend to be ideologically less moderate. Our formal model reveals that this intuition is incomplete without further assumptions on the institutional structure, and we also focus on the impact of media content and market structure on political beliefs, which he leaves aside. Our empirical evidence suggests that this channel – the ideology effect – was the more important in the case of TV, likely because the composition effect had already been put in motion by radio.

\(^6\)In this sense, our paper is in the spirit of Murphy and Shleifer (2004), who provide a model in which individual views are partly shaped by the drive to conform to the “average views” of the people they interact with.
underscore the importance of the structure of the media environment, as emphasized by the impact of different media substrates and content variety. This is consistent with concurrent work by Gentzkow et al. (2009), in the context of local newspaper markets in the US.

Finally, the electoral model we study is in turn related to Glaeser et al. (2005), where office-motivated candidates may strategically choose to polarize, especially if they can target more extreme voters, who are more likely to turn out. In our model, in contrast, polarization is the result of a party ideological motive, as in Alesina and Rosenthal (1995), but we focus on how ideologies and political motivation are affected by changes in the media environment, thus changing the incentives to polarize faced by candidates. We view the two approaches as complementary.

The remainder of the paper is as follows: Section 2 describes how media environments interact with individual views and attitudes. Section 3 embeds this into a model of electoral competition, showing how changes in media technology affect polarization in the political equilibrium. (The main results are in subsection 3.3.) Section 4 tests the theory’s predictions in the context of the introduction of broadcast TV and radio in the US. Section 5 concludes and points at future research directions.

2 Media Environment and Citizens’ Attitudes

2.1 Citizens’ Heterogeneity: Ideology and Political Motivation

We are ultimately interested in how the media affect the political behavior of individuals (citizens), so we start by describing the sources of heterogeneity across those citizens. We focus on two sets of characteristics that we posit can be influenced by the media: their propensity to engage in political activities (political motivation) and their ideological views and attitudes (ideology).

We think of a citizen’s ideology as her preferred position in a unidimensional (liberal-conservative) scale. The space of ideologies is denoted by $X \in \mathbb{R}$. With regard to political motivation, our definition is operational: we identify motivation with a composite of individual characteristics that are independent of ideology and affect his/her willingness to vote. In practice, we can think of variation in political motivation as differences in the cost or benefit of voting that may arise from cognitive skills (e.g. processing political information) or tastes (e.g. interest in politics, civic duty, opportunity cost of voting). For simplicity, we consider this to be a binary variable, it can be either $\pi$ (low) or $\bar{\pi}$ (high) with $\pi < \bar{\pi}$.

We thus assume that each voter $v$ is characterized by a pair $(x_v, \pi_v)$ where $x_v \in X$ is a preferred ideology and $\pi_v \in \{\pi, \bar{\pi}\}$ is political motivation. Ideology and political motivation are assumed to be independently distributed – although we will show later that this does not imply that they will be uncorrelated in equilibrium. The fraction of citizens with high motivation ($\pi$) is denoted by $p$, and the distribution of citizens’ ideologies is denoted by $g$, with an associated c.d.f. $G$. 

\[ g(x) = \begin{cases} 
  g_{\pi}(x) & \text{if } x \leq \pi \\
  g_{\bar{\pi}}(x) & \text{if } x > \pi
\end{cases} \]
2.2 Media Environment

A media environment refers to the complex array of technological, cultural, legal, market, and socio-economic variables that determine the type of media and the content that are available and consumed by individuals in a particular time and location. For the sake of simplicity, we will summarize them in terms of two specific dimensions that will allow us to distill some of the main empirical facts on the impact of media on political behavior: the barriers to media access faced by citizens/consumers, and the ideological variety of content available in the media market.

These two dimensions capture two conceptually independent channels through which the media can influence voters’ behavior. First, to the extent that the media carry politically relevant content, increased exposure to the media increases an individual’s political learning, which can trigger or increase political participation. Access to the media is in turn affected by regulatory and technological features, which we call “barriers” to access. We assume that each media environment is associated with an access barrier \( b \). We think of this as a number, and the set of access barriers is denoted by \( B \).

The second type of media influence we are interested in is the potential effect on citizens’ political and ideological views and attitudes. We assume that each media outlet offers content with a certain ideological “slant” or “editorial line”. Our focus is not so much on the informational content and how the “truth” viewers are presumably seeking may or may not be distorted by a particular outlet. Instead, we focus on the ideological content that may be explicit or implicit in media content. This is not to say that direct informational content is not a crucial dimension of the market for news, for example. However, the media provide consumers with volumes of content that is hardly ideologically neutral and that often times conveys little or no direct information.

We assume that each media outlet can be identified with an ideological position \( m \in X \). The set of ideological positions supplied in the market, which we refer to as the market ideological variety, is denoted by \( M \), \( M \subseteq X \). Note that, unless providers are completely differentiated in the ideological dimension, the number of positions supplied in the market is less than the number of content providers.

We summarize this in the following:

**Definition 1** A local media environment is pair \( E = (b, M) \in B \times 2^X \) where \( b \in B \) is an access barrier.

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7There is considerable evidence consistent the idea that higher levels of political learning are associated with greater participation. Potential reasons include a reduction in the uncertainty about the platforms and individual qualities of politicians, a reduction in the cognitive costs associated to the choice of a political option, and/or increased awareness about politics leading to a heightened sense of duty.

8See Gentzkow and Shapiro (2008) for interesting discussion on the role of market competition, regulation and truthful reporting in the market for news.

9As an illustration, in recent years, echoing the political debate, a number of primetime TV dramas have provided us with positive or negative portrayals of topics such as the rights of homosexuals to raise a family, the issues surrounding civil liberties and the “war on terror”, to mention a few examples. The same is true for a wide variety of entertainment (as opposed to news) content, from movies and soap operas to sports features.

10Importantly, as shown by Groseclose and Milyo (2005) and Gentzkow and Shapiro (2010a), the ideological variety of a market can be measured with considerable precision, at least for some types of media. In any event, even in the absence of a precise measurement, one can still make qualitative inferences about changes in variety associated to the introduction of a new media.
and $M \subseteq X$ is the market’s ideological variety.

2.3 Media Environment and Citizens’ Heterogeneity

We postulate that the distributions of voter characteristics, as captured by the share of voters with high political motivation $p$ and the distribution of ideologies $G$, are affected by the media environment as follows.

2.3.1 Access Barriers and Political Motivation

Consider a change in media technology, in which an existing media environment, which we call a media substrate and denote with a subscript $s$, is being replaced by a new environment, denoted with a subscript $n$. Let $f_s$ and $f_n$ denote the distribution of political motivation for environments $s$ and $n$. We assume that, if barriers to access are lowered from $b_s$ to $b_n < b_s$, then $f_s$ first-order stochastically dominates $f_n$. In particular, for $\pi, \pi$ fixed, this translates simply into $p_n > p_s$: lower barriers to access entails a greater share of citizens with high levels of political motivation. This is consistent with a large body of research in political science on media access and turnout.

2.3.2 Market Variety and the Distribution of Ideologies

We posit that the distribution of ideology $G$ is affected by media variety $M$. In principle, consumers choose their media exposure to different outlets and these choices are at least partially based on the political content supplied and their own political preferences. In the appendix we provide a simple model in which each consumer allocates a budget of time or money to the consumption of one or more outlets. We assume that, given an initial ideology, a consumer’s “posterior” ideology is affected by the ideology of the outlets she is exposed to, from the choices described by $M$. If consumers want to minimize the dissonance that exposure generates with respect to her original ideology (Mullainathan and Shleifer 2005), the model delivers a demand for ideology as a function of $M$ and each voter initial ideology.

This provides a microfoundation for very intuitive properties. As suggested by the “mainstreaming” effect that we have alluded to, we might expect that decreases in variety may lead to a “compression” of ideological preferences. Conversely, the “echo chamber” effect suggests that greater variety in the media environment induces greater “dispersion” in preferences.11 In other words, if a new media environment is introduced that comprises a narrower set of varieties available to consumers in comparison to the media substrate, then one will observe a compression of citizens’ ideological views in response to that introduction. Less variety induces convergence to the “mainstream”, and more variety induces a dispersion of views.

11The pattern is also consistent with observed patterns of ideological sorting in media consumption, whereby strong partisans tend to segregate into different news sources (Pfau et al 2007) and (conditional on the level of political interest) moderates are more likely to consume disparate sources. The working paper version of the paper contains further discussion of the evidence.
To make this precise we introduce a few definitions, the first of which is reminiscent of a mean-preserving spread:\footnote{A mean-preserving spread is equivalent to a single-crossing property of the distributions such as the one in this definition, plus a mean preservation condition.}

**Definition 2** (Compression) Let $G$ and $\tilde{G}$ be two unimodal distributions on $X$ with the same median $\hat{x}$. We say $\tilde{G}$ is a compression of $G$ if $\tilde{G}(x) \leq G(x)$ for all $x < \hat{x}$ and $\tilde{G}(x) \geq G(x)$ for all $x > \hat{x}$. If the opposite inequalities hold, $\tilde{G}$ is a dispersion of $G$.

The next definitions first require some terminology. The ideology span $\Sigma(M) \subseteq X$ of a market with variety $M$ is the subset of ideologies that are covered by the ideological variety of the market, i.e., $\Sigma(M) = \{z \in X| m \leq z \leq m' \text{ for some } m, m' \in M\}$. The two extremes of the ideology span of $M$ are denoted by $\sigma_-(M)$ and $\sigma_+(M)$ so that $\Sigma(M) = [\sigma_-(M), \sigma_+(M)]$. We can now define changes in variety in terms of that ideology span:

**Definition 3** (Decrease in Variety) A market with variety $M'$ is said to be a decrease in variety with respect to $M$ if $\Sigma(M') \subset \Sigma(M')$. Conversely, $M$ is an increase in variety with respect to $M'$.

We restrict ourselves to symmetric \((balanced)\) cases, by which we mean that the set of ideologies that is covered by media environments is symmetric around the median ideology. More precisely:

**Definition 4** (Balanced Media Environment) A media environment with variety $M$ is said to be balanced with respect to the unimodal distribution $G_0$ if $\sigma_-(M)$ and $\sigma_+(M)$ are symmetrically positioned relative to the median ideology $\hat{x}$ of $G_0$ or $|\sigma_-(M) - \hat{x}| = |\sigma_+(M) - \hat{x}|$.

From these definitions we can state the following property, which synthesizes our main intuition (See Proposition 2 in the Appendix):

**Property 1** (Variety-Ideology Complementarity) If $M$ and $M'$ are two markets balanced with respect to the distribution $G_0$, and $M'$ is a decrease in variety with respect to $M$ then $G_{M'}$ is a compression of $G_M$.

### 3 Media and Polarization in a Model of Electoral Competition

How do changes in the media environment such as those induced by the introduction of radio or TV affect the political equilibrium? We can answer this question in the context of a relatively standard model of electoral competition with endogenous turnout. For simplicity, let us consider two parties, Left \((L)\) and Right \((R)\). The candidates of each party choose platforms before the elections, $x_L$ and $x_R$, along our unidimensional ideology space $X$. In line with our empirical application, we think of candidates as the Democrat and Republican contenders for a seat in the House of Representatives. Their ideologies are interpreted as a position in the liberal-conservative dimension, in the spirit of the ideology scores
that can be calculated for representatives (i.e. winning candidates), based on their roll-call votes in the legislature. (This is what we will use in our empirical implementation, as we will discuss in detail later.)

We start by describing each citizen’s electoral behavior as a function of the profile $x = (x_L, x_R)$ of candidates’ ideologies and their own individual characteristics – ideology and political motivation. Next, we describe the electoral game between the two candidates. Our main results characterize the effects of introducing a new media environment on the equilibrium levels of polarization $|x_R - x_L|$ and turnout.

### 3.1 Voters

There is a continuum of citizens and a typical citizen is indexed by $v$. As previously argued, each citizen $v$ is characterized by a pair $(\pi_v, x_v)$ where $\pi_v \in \Pi$ represents $v$’s level of political motivation and $x_v \in X$ is her preferred ideology. Citizens make two decisions: whether or not to turn out and, conditional on turning out, whether to vote for $L$ or $R$.

As is standard in the literature, we assume that the voter’s utility when it comes to ideology $y \in X$ decreases with the distance to her own preferred ideology. For simplicity, we assume that utility is quadratic, i.e., $u_v(y) = -(y - x_v)^2$. In particular, this means that, conditional on voting, $v$ chooses the candidate with the ideology closest to $x_v$. For ease of notation, let $x_{1/2} = \frac{x_L + x_R}{2}$, so that voter $v$ chooses $L$ over $R$ if $x_v < x_{1/2}$ and $R$ over $L$ if the opposite strict inequality holds. A voter who is indifferent between both ($x_v = x_{1/2}$) is assumed to randomize between both choices with equal probability.

We consider two standard motives behind the turnout decision: the *consumption benefit of voting*, and *intrinsic political motivation*.\(^{13}\)

The consumption benefit of voting is the difference between the utilities associated to each of the candidates’ ideologies. It captures the idea that individuals are more likely to turn out if they perceive the stakes of the election to be high. For voter $v$, this is measured by $D_v(x) = |u_v(x_L) - u_v(x_R)|$. Using the fact that $u_v(\cdot)$ is quadratic, we can write down:

$$D_v(x) = 2|x_R - x_L||x_{1/2} - x_v|.$$  

Hence, for any $x_v$, changes in the candidates' ideological positions that increase polarization $|x_R - x_L|$, while keeping the average ideology $x_{1/2}$ constant, will increase the consumption motive $D_v(x)$. On the other hand, for any fixed level of polarization $|x_R - x_L|$, $D_v(x)$ is larger for voters with more extreme bliss points as we pull away from median ideology. Clearly, the consumption motive depends on the profile of candidates platforms.

The second motive, an individual’s political motivation, is – by assumption – independent of platforms and captured by a “vertical” parameter $\pi_v$. As discussed earlier, there are a number of vertical factors

\(^{13}\)Note that we assume that voters are infinitesimal, with a negligible probability of being pivotal, so that their motivation is not instrumental. As discussed later, our main results are qualitatively unchanged if we consider a third motive, *alienation*. A nice survey on the determinants of turnout is in Aldrich (1993). Our approach follows Glaeser et al. (2005).
that can influence a voter’s willingness to vote including the extent to which the individual cares about politics, his sense of civic duty, and the opportunity cost of voting.

For simplicity, we assume that the utility of turnout is additively separable. That is, given $x$, the utility of voting for citizen $v$ is given by

$$U(x, \pi_v, x_v) = \beta D_v(x) + \pi_v.$$ 

Without loss of generality, the utility of abstention is normalized to zero. It follows that a citizen votes if

$$U(x, \pi_v, x_v) \geq 0.$$ 

For ease of exposition, we make a simplifying assumption and consider low motivation citizens with $\pi = -c$, where $c > 0$ is interpreted as a net cost of voting for those with low political motivation. For high motivation citizens, $\pi = d$ is represents the net benefit of voting (e.g. civic duty).

For a fixed profile of ideologies $x$, the above inequality defines a turnout region in the $(\pi, x)$-space of voter characteristics. The latter implies that high motivation citizens vote regardless of candidate platforms. Further, as shown in Figure 2, there exist thresholds $y_L(x) < x_{1/2}$ and $y_R(x) > x_{1/2}$ such that all the low motivation citizens with ideologies between $y_L(x)$ and $y_R(x)$ abstain from voting. Thus, moderate low-motivation citizens do not turn out. Voters to the left of $y_L(x)$ vote for $L$ while those to the right of $y_R(x)$ vote for $R$. If the support of the ideology distribution $G$ is $[\underline{x}, \overline{x}]$, these thresholds are given by

$$y_L(x) = \max \left\{ \underline{x}, x_{1/2} - \frac{c}{2(x_R - x_L)} \right\} \quad \text{and} \quad y_R(x) = \min \left\{ \overline{x}, x_{1/2} + \frac{c}{2(x_R - x_L)} \right\}.$$ 

Note that the set of (relatively) moderate voters who abstain increases as the platforms get closer and the consumption benefit of voting drops. The following lemma derives the turnout for each party $V_L$ and $V_R$ as a function of the profile of strategies $x$ and the distribution of citizens characteristics.

**Lemma 1** The levels of turnout for each parties and total turnout are given by

$$V_L(x) = pG(x_{1/2}) + (1 - p)G(y_L(x)), \quad V_R(x) = p(1 - G(x_{1/2})) + (1 - p)[1 - G(y_R(x))], \quad \text{and} \quad V(x) = 1 - (1 - p)\Delta G(x),$$

where $\Delta G(x) \equiv G(y_R(x)) - G(y_L(x))$ is the share of low motivation citizens that do not vote.

### 3.2 Political Competition

Having characterized the behavior of voters, we can now turn our attention to the politicians. We assume that candidates are both office- and policy-motivated. Candidate $j$’s policy motivation is represented by a decreasing function $u_j(x_j)$ of the distance between her proposed ideology $x_j$ and her preferred ideology,
which we denote by $x_{0j} \in X$, where $x_{0L} < x_{0R}$. This preferred ideology, in our context, could represent the average ideological preference of a group of local constituencies, the national party’s ideology, the candidate’s intrinsic ideological preferences, or a combination of those. For simplicity, just as with voters, we assume that $u_j(x_j) = -(x_j - x_{0j})^2$.\(^\text{14}\)

We use $W_j(x)$ to denote candidate $j$’s office motivation, $j \in \{L, R\}$, when candidates choose the profile $x = (x_j, x_{-j})$, where as usual $-j$ stands for candidate $j$’s opponent. As it turns out, the qualitative nature of some of our results, as anticipated, will depend on the finer details of this motivation term. For our benchmark, we consider the case that is most descriptive of our empirical application, which focuses on legislative elections in the United States. For each congressional district, these are majoritarian, “winner-take-all” contests, so we assume as our benchmark that candidates care about winning the election. For simplicity, we operationalize this assumption as $W_j(x) = V_j(x) - V_{-j}(x)$, namely the margin of victory for candidate $j \in \{L, R\}$.\(^\text{15}\) In contrast, in a proportional system it might be more natural to assume

\(^{14}\text{Most models of electoral competition with a policy motivation consider candidates who care about the distance between their preferred ideology and the policy implemented in equilibrium rather than the policy they promote (See, for example, Austen-Smith and Banks (2005).) This seems plausible in the context of a presidential election, but less so in the context of our empirical application. Indeed, if we think of candidates as contestants for a seat in the legislature, the policies implemented will normally result from the interaction between representatives of possibly hundreds of districts. In this context, it seems more plausible to identify the policy motive with the policies the candidates commit to support in the legislature if elected. More broadly, as emphasized by Alesina and Rosenthal (1995), the model is consistent with the idea that it may not be credible for political agents to depart from their preferred ideology even if they care mostly about electoral incentives.}\)

\(^{15}\text{The direct alternative would be to assume that each candidate receives a payoff of 1 if he/she wins and 0 otherwise. However, in a model in which candidates are perfectly informed about the distribution of voter preferences, as is our case, it is well-known that this implies discontinuous payoffs as a function of the strategies, and consequent equilibrium existence problems. (See, for example, Austen-Smith and Banks (2005, ch. 7).) In contrast, in a probabilistic voting model in which}\)
that maximizing the share of votes, so that \( W_j(x) = V_j(x)/V(x) \), reflects more accurately the incentives of political competitors.

In sum, we are interested in the Nash equilibria of the game in which candidates choose ideologies to maximize the additive objective

\[
O_j(x_j, x_{-j}) = W_j(x_j, x_{-j}) + \rho u_j(x_j),
\]

where \( \rho > 0 \) measures the importance of the policy motivation relative to the office motivation. Our benchmark assumption on the nature of the latter can be stated for future reference as:

**Assumption (P1)** (Winner-take-all) Each candidate’s office motivation is captured by the margin of victory \( W_j(x) = V_j(x) - V_{-j}(x) \).

We will also focus our attention in a symmetric case, in the sense that candidates are positioned symmetrically relative to the median individual. This ensures the existence of a symmetric equilibrium in which candidates choose equilibrium ideologies that are equidistant from the median ideology \( \hat{x} \). We state this assumption as:

**Assumption (P2)** \( |x_{0L} - \hat{x}| = |x_{0R} - \hat{x}| \), where \( \hat{x} \) is the median of the distribution of ideologies \( G \).

Let us discuss the intuition behind the electoral incentives captured by the model. Note that if \( p = 1 \), all citizens are highly motivated and vote. In this case, if \( \rho \) is sufficiently small so that candidates care mostly about the electoral outcome, the unique equilibrium of the game involves both parties choosing converging ideologies, namely the median voter’s preferred ideology \( \hat{x} \). If \( p \) is small, on the other hand, in order to attract low-motivation voters to the polls, parties may face an incentive to choose policies that are more extreme. Still, the parties also face the convergence force driven by the incentive to steal voters from their competitor. It can be shown that for most reasonable distributions the convergence incentives prevail if \( \rho \) is small. Hence, in our model, ideological polarization exists in equilibrium only if \( \rho \) is high enough, which is what we state precisely in:

**Assumption (P3)** \( g(\hat{x}) < \frac{1}{2}\rho |x_{0R} - x_{0L}| \).

If \( p = 1 \) the marginal electoral benefit associated with a small move towards moderation when both candidates choose the median voter’s preferred ideology \( \hat{x} \) is \( g(\hat{x}) \), while the marginal disutility of moving candidates are imperfectly informed about this distribution (e.g. the ideology distribution \( G \) is a symmetric unimodal distribution, but its median is imperfectly known and distributed uniformly on a subinterval of \( X \)), the candidates’ expected payoff from winning the election is simply the probability of winning the election. This is typically a continuous function of the strategies. Furthermore, under reasonable conditions on the voters’ preferences over platforms, maximizing this probability is equivalent to maximizing the margin of victory computed for an “average distribution”. Thus, an expression analogous to \( W_j(x) \) can be derived if candidates care exclusively about winning rather than maximizing the margin of victory in a model with probabilistic voting. (For equivalence results of this type in elections with abstention see Leydard [1984], Coughlin [1992], and Duggan [2000].) Our specification can be interpreted as a reduced-form of this assumption.
away from the candidate’s preferred policy is $\frac{1}{2}\rho|x_{0R} - x_{0L}|$. The assumption ensures that each candidate has an incentive to move towards their own preferred platform whenever both of them choose the median voter’s preferred ideology $\bar{x}$.

We are now ready to characterize the political equilibrium:

**Lemma 2** If (P1)-(P3) hold then any symmetric equilibrium $x^* = (x^*_L, x^*_R)$ of the electoral game is such that $x_{L0} < x^*_L < x^*_R < x_{0R}$.

This lemma shows that our assumptions guarantee the existence of a symmetric equilibrium with a positive level of polarization, i.e. $x^*_R - x^*_L > 0$. At the same time, the equilibrium level of polarization is bounded by the candidates’ preferred ideologies.

### 3.3 Main Results: New Media and Political Outcomes

We can now establish our main results, which describe how changes in the media environment will affect the political equilibrium of the electoral model we have just described. An equilibrium of the electoral game $x^*$ is a function of the citizens’ distribution of characteristics, i.e., the distribution of political motivation, characterized by $p$, and the distribution of ideologies, $G$. We thus write $x^* = x^*(p, G)$.

As discussed in the previous section, a media environment $E = (b, M)$ affects the distribution of citizens’ characteristics. In particular, $p$ is affected by accessibility barriers $b$, and $G$ is affected by the market’s ideological variety $M$ as described by Property 1, so that $p = p_b$ and $G = G_M$. With some abuse of notation, we write $x^*(E) = x^*(p_b, G_M)$, so as to make explicit the connection between political outcomes and the media environment. Let $\Delta x^*(E) \equiv x^*_R(E) - x^*_L(E)$ and $V^* \equiv V(x^*(E))$ designate the corresponding levels of equilibrium polarization and turnout. We are interested in how these quantities will change with changes in $E$.

Before we move on to the results, it is worth mentioning that while Lemma 2 guarantees the existence of equilibria, uniqueness is not guaranteed. The comparative statics summarized by our results are robust in the sense that they apply to the largest and smallest selection – where the smallest (resp. largest) selection refers to the symmetric equilibrium having the smallest (resp. largest) level of polarization.

#### 3.3.1 The Composition Effect

Our first prediction concerns the effect of a reduction in access barriers. A canonical example, as we will argue, is the introduction of radio or television in a society in which the new medium replaces newspapers as the primary source of news and entertainment. As argued in the previous section, an increase in access will be typically associated with an increase in political learning and, more generally, what we have referred as political motivation. In our model, this is captured by a first-order stochastic dominance

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\[\text{For a uniform distribution of citizens’ ideologies on any interval the equilibrium is unique under assumptions (P1)-(P3). However, this is not necessarily true for other distributions – for instance, multiple equilibria are possible for a triangle distribution.}\]
transformation in the distribution of political motivation. This can happen either by an increase in the fraction of citizens \( p \) with high motivation \( \pi \), or by increasing one or both of the motivation levels – e.g. a reduction of the cost of voting for the low motivation \( c \). For this case, we can state the following:

**Proposition 1** Let \( E_s = (b_s, M_s) \) and \( E_n = (b_n, M_n) \) be respectively the substrate and the new media environments. Suppose that \( b_n < b_s \) and \( M_n = M_s \), i.e., the new environment lowers barriers to access. Then, if the the p.d.f. of ex-ante ideological preferences \( g_0 \) is log-concave, the political equilibrium is affected as follows:

(i) Polarization falls: \( \Delta x^*(E_n) \leq \Delta x^*(E_s) \)

(ii) Turnout increases: \( V^*(E_n) \geq V^*(E_s) \).

The inequalities are strict if either \( p_n > p_s \) or \( c_n < c_s \).

The result is very intuitive, although further probing will reveal some subtleties that we will discuss later on. To fix ideas, suppose that the reduction in barriers leads to an increase in the fraction of highly motivated citizens from \( p_s \) to \( p_n \). In our model, individuals vote either because they are sufficiently motivated or because their preferences are relatively extreme. Indeed, the turnout decision of citizens with low political motivation depends on the consumption benefit of voting. In particular, for a fixed profile of candidate ideologies, this benefit is larger for voters with extreme ideological preferences than moderates. Since all high-motivation citizens vote, the distribution of preferences of high-motivation voters is relatively more moderate than the one corresponding to low-motivation voters. Thus, ceteris paribus, an increase in the fraction of high motivation citizens is associated with a change in the composition of the preferences of those who turn out, increasing the share of moderates. As a result, each candidate has an incentive to moderate their ideology to compete for the vote of the “new moderates” who join the electorate. This leads to a drop in polarization. Because it is driven by a change in the composition of the electorate in equilibrium, we refer to this drop in polarization associated to a reduction in access barriers as the composition effect.\(^{17}\)

Part (ii) seems quite natural: an increase in the share of high-motivation citizens should naturally lead to higher turnout. However, the model reveals a subtler intuition, which is apparent from Lemma 1. Let \( \Delta g = g(y_R) - g(y_L) \) and observe that \( y_j, j \in \{L, R\} \), depends on \( p \). A small increase in \( p \) yields

\[
\frac{dV}{dp} = (\Delta G) dp + (1 - p) \left[ g(y_L) dy_L - g(y_R) dy_R \right] = (\Delta G) dp + (1 - p) \left[ -\Delta g dx_{1/2} + (g(y_R) + g(y_L)) \frac{c}{2(\Delta x)^2} d(\Delta x) \right].
\]

The first term is the direct effect, which is always positive: since high-motivation citizens vote, increasing their share increases turnout. This is precisely the intuition we have just mentioned. However, there is

\(^{17}\)The logic for a decrease in the cost \( c \) of voting for low motivation citizens is similar. Note that an increase of the duty benefit of voting \( d \) for high motivation citizens is insubstantial, as all citizens in this group vote to begin with.
an indirect effect which is due to the fact that candidates’ platforms will react, and that this will affect the turnout of the $1 - p$ low-motivation citizens. This indirect effect is captured by the terms in brackets. For a symmetric equilibrium, $\Delta g = 0$ so the first term in brackets drops out. The second term in brackets is negative, though, as equilibrium polarization drops ($d(\Delta x^*) < 0$) decreasing the consumption benefit of voting. We can show that the direct effect dominates if $g_0$ is log-concave, as we assume.\footnote{Most of the familiar distributions are log-concave, including the uniform and the normal. (See Bagnoli and Bergstrom (2005).) Intuitively, log-concavity means that there is sufficient weight in the middle of the distribution, which is not too “polarized”. As moderates are the ones driving the increase in turnout, this ensures that the overall effect will be positive.}

### 3.3.2 The Ideology Effect

We now turn our attention to the effect of changes in media ideological variety on polarization. From Property 1 a balanced increase in variety is associated with a compression while a balanced decrease in variety leads to a compression of the distribution of preferences. We can thus state the following:

**Proposition 2** Let $E_s = (b_s, M_s)$ and $E_n = (b_n, M_n)$ be respectively the substrate and the new media environments. Suppose that $b_s = b_n$ and $M_n$ is a balanced decrease in variety with respect to $M_s$. Then, there exists $\overline{p} \in [0, 1]$ such that if $p \geq \overline{p}$ and the p.d.f. of prior ideological preferences $g_0$ is log-concave, the political equilibrium is affected as follows:

(i) Polarization falls: $\Delta x^*(E_n) \leq \Delta x^*(E_s)$

(ii) Turnout decreases: $V^*(E_n) \leq V^*(E_s)$

Property 1 implies that a balanced decrease in variety is associated with a compression of the distribution of citizens’ ideologies. This means that the marginal electoral benefit of a policy movement towards moderation is higher for the new distribution, resulting in lower polarization. We refer to this as the ideology effect, as it stems from a shift in the distribution of ideologies.

In contrast with the composition effect, this reduction in polarization is accompanied by a decrease in turnout. Indeed, since all high-motivation citizens always vote, the decrease in variety only affects the turnout decision of low-motivation citizens. Formally, we can see from Lemma 1 that:

\[
dV = (1 - p) \left[ -d(\Delta G) + g(y_L)dy_L - g(y_R)dy_R \right] = (1 - p) \left[ -d(\Delta G) - \Delta gdx_{1/2} + (g(y_R) + g(y_L)) \frac{c}{2(\Delta x)^2} d(\Delta x) \right].
\]

For a compression, the mass of low-motivation citizens who abstain grows as the mass of moderates grows, and only those with sufficiently extreme preferences care enough about voting. Specifically, $d(\Delta G) > 0$ as the set of citizens with views on the symmetric interval $[y_L, y_R]$ that contains $\hat{x}$ is larger following the compression. Hence, the direct effect is negative: an increase in the share of moderates among those with
lower motivation decreases turnout. The second term is zero for a symmetric equilibrium as \( \Delta g = 0 \) and \( dx_1^{*}/2 = 0 \). The third term is negative as polarization falls, so \( d(\Delta x^{*}) < 0 \).

In sum, we have uncovered two channels through which changes in the media environment affect equilibrium polarization: a decrease in barriers to access reduces polarization, because new voters brought into the electorate are relatively moderate, and so does a decrease in variety, because the resulting compression in citizens’ ideological views increases politicians’ incentives for moderation. In addition, we have derived different predictions stemming from each channel when it come to the effects on turnout, which decreases with the former and increases with the latter.

### 3.3.3 Discussion and Extensions

It is illuminating to consider what happens to our results when we modify two of our assumptions.

**Proportional Representation.** The “winner-take-all” assumption (Assumption (P1)) is crucial for some of the results. Specifically, the qualitative nature of the composition effect summarized by Proposition 1 changes if we consider a different office motivation for the politicians. Let us make this precise by considering a model with proportional representation, where the politicians’ office motivation is described as:

**Assumption (P1’)** (Proportional Representation) Each candidate’s office motivation is captured by the share of votes, i.e., \( W_j(x) = V_j(x)/V(x) \).

Under this assumption, the composition effect on polarization is reversed.

**Proposition 3** Let \( E_s = (b_s, M_s) \) and \( E_n = (b_n, M_n) \) be respectively the substrate and the new media environments. Suppose that \( b_n < b_s \) and \( M_n = M_s \), i.e., the new environment lowers barriers to access. Then, if the cumulative distribution prior ideological preferences \( G_0 \) is log-concave, the political equilibrium is affected as follows:

(i) Polarization increases: \( \Delta x^{*}(E_n) \geq \Delta x^{*}(E_s) \)

(ii) Turnout increases: \( V^{*}(E_n) \geq V^{*}(E_s) \).

The inequalities are strict if either \( p_n > p_s \) or \( c_n < c_s \).

Why does proportional representation lead to an increase in polarization, reversing the conclusion obtained for the “winner-take-all” case? As it turns out, the intuition behind the composition effect, which seemed very natural, is in fact a little more subtle than meets the eye. The fact that the electorate becomes more moderate as a result of the entry of previously low-motivation citizens into the voter pool is evidently present, but there is a second effect related to the extensive margin of those citizens who
remain low-motivation. Becoming more extreme entails a cost of losing moderate low-motivation voters, who decide to abstain instead; if there are fewer low-motivation voters, this cost is correspondingly lower. This means that the parties will face a lower cost to moving towards their preferred ideologies (and away from the median). In sum, a reduction in barriers to access stimulates moderation in order to chase the intensive margin of those who decide to turn out, but it facilitates extremism because of the reduced importance of the extensive margin.

Both of these effects were already present in the “winner-take-all” case – our previous discussion of the intuition was deliberately simplified – but there it turns out that the moderating incentive prevails. Proposition 3 shows that this is no longer the case under Assumption (P1’). Why is that the case, intuitively? Under a majoritarian system, the intensive margin is always more important than the extensive margin, by a factor of two, because it represents an additional vote for j and one fewer vote for −j. Under proportional representation, in contrast, the two margins have essentially the same weight. Because of this greater relative weight, the effect driven by the extensive margin is more important in the latter case, and will dominate as long as the distribution of preferences is log-concave.

The broader lesson is that the effect of changes in the media environment, when it comes to the composition effect, will depend on institutional features. Under majoritarian systems, as we will see, we would expect the introduction of a relatively low-barrier environment (say, radio entering a media substrate dominated by newspapers) to lead to lower polarization. The same change in media technology would be expected to lead to greater polarization under a proportional representation system, because the incentives faced by politicians would differ. An empirical investigation of this prediction remains for future research, but the prediction itself illustrates quite starkly the importance of a formal theory in elucidating the nature of these effects and the fact the impact of media in the political equilibrium could depend on institutional details.

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19To see this from a formal perspective, note first that \( V_j(x)/V(x) = \frac{1}{2} (V_j(x) - V_{-j}(x))/V(x) \), that is, the office-motivation component is proportional to the one under Assumption (P1) (margin of victory), but normalized by total votes. The latter will increase as a result of the reduced barriers, thus working in the opposite direction of Proposition 1. To look at the overall effect, it is useful to contrast the two extreme cases of \( p = 1 \) and \( p = 0 \). If \( p = 1 \) then all citizens turnout (\( V(x) = 1 \) for all \( x \)) and the first-order condition in a symmetric equilibrium is

\[
g(\hat{x}) = \rho(x^*_L - x_{L0}).
\]

Instead if \( p = 0 \),

\[
\frac{\partial W_L}{\partial x_L} = \frac{1}{V} \left( W_R \frac{\partial V_L}{\partial x_L} - W_L \frac{\partial V_R}{\partial x_L} \right) = \frac{1}{2V} \left( \frac{\partial V_L}{\partial x_L} - \frac{\partial V_R}{\partial x_L} \right),
\]

which yields

\[
\frac{g(y^*_L)}{2G(y^*_L)} = \rho(x^*_L - x_{L0}).
\]

where \( y^*_L = \hat{x} - \frac{\rho}{2V} < \hat{x} \). By log-concavity, the left-hand-side of the latter equation (\( p = 0 \)) is greater than the one corresponding to \( p = 1 \). In short, the equilibrium platform will be farther to the left under the former than under the latter.

20To see this schematically, consider the effect of one additional vote for candidate j in each of the margins, under the different systems, in a model with a discrete set of voters. Under Assumption (P1), an extra vote in the intensive margin yields \( V(x_j) + 1 - (V(x_{-j}) - 1) \), while the extensive margin yields \( V(x_j) + 1 - V(x_{-j}) \) – the difference is 2 for 1. Under Assumption (P4’), the contrast is between \( \frac{V(x_j)+1}{V(x)} \) and \( \frac{V(x_{-j})+1}{V(x)} \) – for a difference of \( \frac{1}{V(x)} \) versus \( \frac{1}{V(x)+1} \). The factor here is always smaller than 2, for any \( V(x) > 1 \), and approaches 1 for a large \( V(x) \).
Alienation. Another standard motive to turnout is alienation, i.e., citizens are more likely to turn out the closer is their preferred ideology to the one supported by their preferred candidate. Conversely, a voter is alienated and abstains if this distance is too large. Formally, the likelihood that $v$ votes increases with $A_v(x) = \max_{j \in \{L,R\}} u_v(x_j)$. Specifically, if we consider that the utility of voting is given by

$$U(x, \pi_v, x_v) = -\alpha A_v(x) + \beta D_v(x) + \pi_v,$$

it can be shown that the results presented above continue to hold. The only difference is that, with alienation, both moderate and extreme voters with low political motivation can abstain in equilibrium depending on the platforms chosen by the candidates. In particular, a decrease in market ideological variety that leads to a decrease in polarization and turnout, as described by Proposition 2, can be associated with a drop in the vote by both moderates and extremists. In contrast, without alienation, it is only the former who drop out.

4 Changes in Media Environment and Polarization: Empirical Evidence

We can now turn to the data to assess whether our framework’s predictions can illuminate the effects of the introduction of new media technologies on political polarization. To motivate the context, let us recall the well-established fact that the US experienced a remarkable decrease in polarization from the 1920s and into the 1960s (McCarty et al. 2006). While many societal changes beyond the introduction of media technologies lie behind this trajectory, the variation that it entails gives us hope that, in this context, we may be able to identify effects that are quantitatively important.

This variation in polarization is roughly contemporaneous with two instances in which new media technologies were adopted very fast and very broadly, which also gives us hope that any potential effects are more easily detectable. Specifically, between the early 1920s and late 1930s, the share of US households with radio sets went from around zero to 80 percent in roughly 15 years. That same share for TV sets went a similar distance over an even shorter span of time, between the late 1940s and late 1950s (Prior 2007, p. 13). Both media carried substantial amounts of explicitly political content (Prior 2007, Benjamin 2001), and their effect on general attitudes and beliefs, with natural ideological and political implications, certainly went beyond that.

In sum, rapid and important change in media environments, plus substantial variation in polarization, create an ideal context in which to test the predictions of our framework.

4.1 The Introduction of TV and Radio in the United States

We provide some context to link our theory to specific empirical predictions for radio and broadcast TV. The impact of television was immense in terms of popularity.\(^{21}\) Of particular interest, the early days of

\(^{21}\)The discussion in the following two paragraphs largely relies on information gathered from Sterling and Kittross (2002) and Prior (2007).
television were marked by low variety: “the most popular mass medium ever offered the lowest degree of content choice of any mass medium.” (Prior, 2007, p. 68) First of all, few channels were available – an average of three stations per market in 1965. Second, even if the average viewer had access to a few additional channels from signals traveling from other markets, these were essentially retransmitting network programming, exposing different markets to very similar content. Last but not least, both because of FCC regulation and market-driven choices, the content provided by each network was quite similar to what was offered by the others: as put by Webster (1986, p. 79), “there is no significant difference in what a viewer can see on ABC, CBS, and NBC”, the three major networks at the time. This narrow set of options, not surprisingly, tended to be restricted to middle-of-the-road, “mainstream” content. In sum, in the terms of our theory, TV was a low-variety medium, both within and especially across localities.

Just as important, TV was unquestionably a highly accessible medium. It required considerably less attention and cognitive ability than newspapers or magazines. As such, it was also much more amenable to the kind of incidental learning that would particularly affect individuals who are not that motivated for politics to begin with (Downs 1957). In addition, while it might be the case that the price of buying a TV set would represent a significant barrier in many contexts, the very rapid pace at which Americans bought them upon the introduction of TV broadcasting belies this concern in our context. In short, we can also characterize TV as a low-barrier medium.

How about radio? Similarly to the case of TV, as we have noted, the diffusion of radio was also very fast and its influence widespread, starting in the 1920s and through the 1940s. It is rather clear that radio also constituted a relatively high-accessibility alternative to the print media, the dominant media technology of the day: it did not require literacy, nor reading skills or habit. In other words, radio was a low-barrier medium.

The story is somewhat more complicated when it comes to variety, which will in fact turn out to be useful for our empirical exercise. Initially, in the 1920s, radio was a local phenomenon, with lots of variety in terms of content – for instance, stations would often cater to specific ethnic groups (Cohen 1990). Nevertheless, an interesting and somewhat unexplored aspect of the rise of radio was the “networkization” phenomenon that occurred in the 1930s and 1940s. Starting in the late 1920s – after the creation of the first two major networks (NBC and CBS) in 1926-27 and the Radio Act of 1928, which favored consolidation as a way of organizing the allocation of the radio spectrum – and picking up speed in the 1930s and 1940s, the dominant trend was the spectacular rise of the networks that underpinned the so-called “golden age” of radio. By the late 1940s, almost all stations were affiliated to one of the four major networks, as ABC (which was spun off by NBC due to regulatory pressure) and Mutual had

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22There is little doubt that radio was a mass medium with a much broader reach than newspapers: by 1938, even at the lowest level of income (below $1,000 a year) 57% of households had at least one radio set (Sterling and Kittross 2002, p. 204). Considering how radio was often a communally shared experience (Cohen 1990), this understates the true reach of the medium.
joined the first two. (The pattern is depicted in Figure 3.) While a full history of that process is beyond the scope of the paper (Sterling and Kittross 2002), the fact is that these networks introduced a much more homogenous content to their affiliates across the country.\textsuperscript{23} This means that, while radio started as a high-variety medium, it gradually moved towards lower levels of variety.

4.2 Empirical Predictions

Figure 4 helps us interpret the transitions in media technologies in terms of the theory. Given a certain media substrate, it lets us map out whether the introduction of the new technology represents a decrease or increase in access barriers, and/or a balanced decrease or increase in variety with respect to that substrate. Note that, in our context, the substrate could well vary across different locations: for instance, TV could be introduced into a market with a strong radio presence (network or not), or into a market where radio was sparse and newspapers still dominant. Note also that we are considering a context of majoritarian elections, in line with Assumption (P4).

Based on that, we summarize the empirical predictions we should expect to see in the data:

**Empirical Prediction 1: TV reduces polarization.** The introduction of TV can be interpreted as a decrease in variety, regardless of the substrate. Note that this is the case even if the previous media outlets (newspapers or radio stations) had remained unaltered (which of course was not the case). As people substituted away from those outlets and into the new medium – to a large extent due to non-

\textsuperscript{23} As Sterling and Kittross (2002, p. 284) describe, “the national networks exercised great power over individual affiliates. In several cases, when local radio stations wanted to substitute a local program for a network program, network officials threatened to reconsider the station’s affiliation contract. (...) Such threats had great effect, for network affiliation was the key to success.”
ideological reasons such as the fact that TV was seen as more entertaining (Prior 2007) – the media environment to which the typical individual was actually exposed had less variety. TV also represents a lowering of access barriers – or a non-increase, at the very least. In that case, both the ideology and composition effects work in the same direction, unambiguously reducing polarization.

**Empirical Prediction 2: The effect of TV on turnout is ambiguous (depends on substrate).** While our main focus is polarization, our theory also has predictions on the effects of media on turnout. Here, for the case of TV, the prediction is more subtle. If the dominant substrate medium before TV happened to be radio, we would expect to see the ideology effect in action – but not so much the composition effect. This would predict lower turnout, as lower polarization demobilized voters. On the other hand, in places where newspapers were dominant or there was low media consumption, one would expect to see added strength on the composition effect: newly mobilized voters turning out would counteract the former movement.

**Empirical Prediction 3: Radio reduces polarization.** The introduction of radio into a substrate dominated by newspapers would represent a lowering of access barriers, and the composition effect would thus induce lower polarization. Networkization would push in the same direction, via the ideology effect.

**Empirical Prediction 4: The effect of radio on turnout is ambiguous (depends on network).** As far as turnout is concerned, radio would initially increase turnout, because of the composition effect. Network radio, on the other hand, might have a negative effect as it implies a balanced decrease in
variety.

4.3 Measuring Polarization

Before taking these predictions to the data, we introduce measures of our main variable of interest, polarization. Our model ultimately refers to the behavior of politicians, which we assume to react to the preferences of constituents. One set of measures of polarization of (incumbent) politicians is the one used by McCarty et al. (2006), as exemplified above. However, these are defined at the national level, while we want variation at the county level, which is where our data on media technologies are defined – as will be later described in greater depth. We construct such a county-level measure by resorting again to the DW Nominate scores for US House members, from Poole and Rosenthal. While this is a well-established measure for ideological positions that is comparable across individuals and over time, it is available at the congressional district level, which we then need to match with the county-level information. We do so by using the classification provided by ICPSR (study #8611). If one district comprises more than one county (which is typically the case) we attribute the Nominate score of the district’s representative to all of the counties. Due to their geographic proximity, those counties will typically be part of the same TV market (and will thus share the same date of TV introduction), but not always. In any event, we will cluster the standard errors at the level of the congressional district – by decade, since districts are redrawn based on every new Census. We leave aside counties that are split over more than one district. In the end, we are left with a panel with one measure of ideological position per county per congress, i.e. two-year period.

Once we have the scores converted onto the county level, we need to turn them into measures of polarization. Our model is framed in terms of polarization within a congressional district, but since we only have the measure of ideological position for the incumbent, it is not possible to observe that type of polarization. Nevertheless, we can look at polarization across counties. As a matter of fact, the most notable impact of TV and network radio, when it comes to changes in variety relative to the previous media environment, was across different localities, as a fragmented newspaper and local radio market gave way to a situation where different places now had access to the exact same content. We can reinterpret the model in terms of that level of variation, and to motivate this connection consider our measure of polarization $\Delta x^*$. (In a symmetric setting we can focus on $\Delta x^* = x_R^* - \hat{x}$.) Letting $\omega$ denote the median of the distribution of ideology over all counties, we can decompose this into $(x_R^* - \omega) + (\omega - \hat{x})$.

---

24 We look at the first coordinate of DW Nominate, which is usually interpreted as a conventional left-right ideological spectrum, as distinct from the second dimension that in the US case used to capture positions with respect to racial issues. This might be relevant for the period we are looking at, which mostly precedes the Southern realignment. We will discuss how the presence or absence of the South in the sample affects our results and their interpretation.

25 We have also checked our results including those counties, for which case we take the relatively coarse approach of taking the Nominate score of a given county to be the simple average of all the representatives associated with it. (Ideally, we would like to weigh that average by the share of the county’s population that belongs to each district, but we do not have that information.) The results are robust, and available upon request.

26 Some districts do not have Nominate scores for all years in the original DW Nominate data set, so the panel is not fully balanced.
The first term captures polarization of platforms relative to the national median, which is the variable we can observe. The second term (polarization of median county preferences relative to the national median) is constant for balanced changes in the media environment. As a result, the model implies that polarization across localities and within each locality are essentially two sides of the same coin.

We look at two relative measures of polarization: the (absolute value of the) difference between a county’s score and the average score of all counties in that year, and the (absolute value of the) difference with respect to the median score of all counties. These measures of “average polarization” and “median polarization” capture the extent to which a county’s preferences depart from the national center, and will be the main outcome variables of interest in our analysis. In addition, we also consider a non-relative measure, which compares the ideological score to a time-invariant “center”, namely the standard DW Nominate benchmark of zero. We will refer to this, the absolute value of the county’s score, as “absolute polarization”.

In addition to these two main variables, we are also interested in predictions on turnout, to disentangle the relative impact of the composition and ideology effects that underlie Predictions 2 and 4. We thus look at voter turnout (in congressional elections), from the county-level data compiled by ICPSR (again from study #8611).

4.4 Evidence from the Introduction of Broadcast TV

As we have noted, the fast adoption of the broadcast TV means that there was substantial variation over a short period of time. It was also the case that there was substantial variation across different places in terms of the timing of introduction of and the exposure to the new medium. Importantly, this variation had an additional exogenous component to this timing was generated by events that delayed introduction in markets that would have otherwise gotten TV earlier than they did – namely World War II and an FCC-imposed freeze in new operation licenses, between 1948 and 1953, due to spectrum allocation issues. Given these features, we can implement an empirical strategy along the lines of the one proposed by Gentzkow (2006) in his analysis of the effect of the introduction of TV on voter turnout.\textsuperscript{27} In other words, we combine the use of a panel structure that controls for constant unobservable factors and controls for the level and evolution of key variables that might be related to the timing of adoption of the new technology.

For a first look at the raw data, we split the sample between counties that got access to TV relatively early (before 1951) and those that got it late. We then run a regression of the average polarization variable on year-region dummies, and then calculate the mean of the residuals for each group of counties.

The comparison for relative polarization is depicted in Figure 5, drawn for a three-year moving average around each data point in order to smooth out the noise in the measure. The key dates for the

\textsuperscript{27}Our empirical strategy for the introduction of TV closely follows Gentzkow (2006). While there is little reason to stray from his convincing and well-established strategy, our main focus is on a different variable, polarization, and a different set of predictions. As such, we will depart accordingly.
introduction of TV, 1946 (marking the end of the wartime ban on television station construction) and 1952 (the end of the FCC freeze on new television licenses), are marked as vertical lines in the plot. We see a remarkably clear decline after those periods, showing that relative polarization in those counties that got TV early dropped dramatically in comparison with the relative polarization in the latecomer counties. The downward trend starts as TV spreads in the groundbreaking counties, and picks up speed as the second group joins the fold.

This picture suggests an effect of TV on polarization, but it is essentially about correlations. A regression analysis enables us to implement the empirical strategy we have described. This strategy translates into the following specification:

\[ Y_{it} = \alpha_i + \delta_{rt} + \gamma TV_{it} + \beta X_{it} + \epsilon_{it} \]  

where \( i \) refers to county, \( t \) to years and \( r \) to census region. Note that we include county fixed effects and also region-year fixed effects, which let us control for unobservable time trends that we allow to vary by region. \( Y_{it} \) is the outcome variable, and \( X_{it} \) stands for a set of control variables. We then estimate this equation with the standard errors are all clustered at the level of congressional district.

In order to model the effect of TV, \( TV_{it} \), we again follow Gentzkow (2006) in looking at the number of years since the introduction of TV in the county (“years of TV”) – with 1946 being year zero for all counties where TV was introduced before the end of World War II, since the penetration of TV was essentially negligible until then. After all, this is the measure that encapsulates the idiosyncratic variation introduced by the exogenous freezes, and it does so less crudely than a simple dummy variable.
since we should expect any effect to be felt over time. Finally, we restrict our attention to the sample between 1940 and 1966, to focus on the period over which TV was being introduced.\footnote{We leave out of the sample those counties where TV was introduced after 1960, as suggested by Gentzkow (2006). The results are robust to their inclusion.}

The results in Table 1 show a negative and significant effect of TV on relative polarization, both measured with respect to average and median. The measure is quantitatively significant: our coefficients would suggest that within the space of two decades exposure to TV would induce a decrease in relative (average) polarization that is around one standard deviation of that polarization sample. The results for absolute polarization go in the same direction, although attenuated. Note that the even-numbered columns add a broader set of demographic controls (interpolated from Census data), which include (the log of) population, population density, percent urban, percent non-White, and percent with high-school education.\footnote{We have also measures of income and median age, but we do not include them because they are only available starting in the 1950s. The regressions including those yield similar results for both measures of relative polarization, with coefficients that are slightly larger and still significant. The results are available upon request.} The results are robust to the inclusion of those controls.\footnote{The results for polarization are also robust to excluding from the sample the period during World War II, which may be thought of as exceptional – one might argue that the war itself would have had a very strong impact on political behavior and preferences. The coefficients are actually slightly larger, for all measures of polarization.} This is entirely consistent with our Prediction 1.

When talking about ideology and polarization in the mid-20th century, it is important to keep in mind that the US South is in a peculiar position. Because of the importance of racial issues in Southern politics, and the transformations brought about by the emergence of the civil rights movement, it is quite likely that our measure of ideological position should be considerably more precise outside of the South, as previously mentioned. By the same token, even leaving aside issues of measurement, we would expect the dynamics of polarization to have been very different in that region. We thus repeat in Table 2 the exercise from Table 1, while excluding the Southern states from the sample. The results are striking in that the message from the previous table is now even stronger. The effect is strongly significant for all measures of polarization, relative or absolute, and the size of the coefficients is at least twice as large. In other words, our preferred estimate of the quantitative effect of TV corresponds to a decrease of one standard deviation in the relative (average) polarization sample over the span of one decade.

We can gain further insight on the nature of the results by looking at the data in a slightly less parametric way. If we consider only counties that are “reliably” left- or right-wing, in the sense that they are always to the left or always to the right of the national average, we can have a better idea of whether the driving force behind the reduced polarization are movements towards the center or ideological “switches” from left to right or vice-versa. This is what we do in Table 3, still focusing on the sample excluding the South. The dependent variable is the DW Nominate score, along the left-right spectrum. As we can see from Columns (1)-(2), the right-wing counties are becoming less right-wing; Columns (3)-(4) show that the left-wing counties, which are much less numerous, are also moving to the center. This provides additional evidence in support of the idea that exposure to TV fostered ideological convergence.
### Table 1. Effects of Years of TV on Political Outcomes, 1940-66 (Single-district counties)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rel. avg</td>
<td>rel. avg</td>
<td>rel. median</td>
<td>rel. median</td>
<td>absolute</td>
<td>absolute</td>
<td>turnout</td>
<td>turnout</td>
</tr>
<tr>
<td>Years of TV</td>
<td>-0.0041***</td>
<td>-0.0041***</td>
<td>-0.0038**</td>
<td>-0.0037**</td>
<td>-0.0018</td>
<td>-0.0019</td>
<td>-0.4220***</td>
<td>-0.2740***</td>
</tr>
<tr>
<td>Controls</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
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<td>38518</td>
<td>38574</td>
<td>38518</td>
<td>38574</td>
<td>38518</td>
<td>39506</td>
<td>39450</td>
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<td># of counties</td>
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<td>2900</td>
<td>2908</td>
<td>2900</td>
<td>2908</td>
<td>2900</td>
<td>2997</td>
<td>2989</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.048</td>
<td>0.050</td>
<td>0.063</td>
<td>0.064</td>
<td>0.065</td>
<td>0.065</td>
<td>0.643</td>
<td>0.650</td>
</tr>
</tbody>
</table>

Robust standard errors in brackets, clustered by congressional district (per decade). All regressions include county fixed effects and region-year dummies. Controls are: log population, density, percent urban, percent nonwhite, and % high school. *** p<.01, ** p<.05, * p<.1

### Table 2. Effects of Years of TV on Political Outcomes Outside the South, 1940-66 (Single-district counties)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rel. avg</td>
<td>rel. avg</td>
<td>rel. median</td>
<td>rel. median</td>
<td>absolute</td>
<td>absolute</td>
<td>turnout</td>
<td>turnout</td>
</tr>
<tr>
<td>Years of TV</td>
<td>-0.0091***</td>
<td>-0.0102***</td>
<td>-0.0086***</td>
<td>-0.0098***</td>
<td>-0.0058***</td>
<td>-0.0071***</td>
<td>-0.6022***</td>
<td>-0.3988***</td>
</tr>
<tr>
<td>Controls</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>20589</td>
<td>20580</td>
<td>20589</td>
<td>20580</td>
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<td>20580</td>
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<td>21410</td>
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<tr>
<td># of counties</td>
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<td>1538</td>
<td>1538</td>
<td>1538</td>
<td>1538</td>
<td>1538</td>
<td>1624</td>
<td>1624</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.06</td>
<td>0.06</td>
<td>0.07</td>
<td>0.07</td>
<td>0.06</td>
<td>0.06</td>
<td>0.68</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Robust standard errors in brackets, clustered by congressional district (per decade). All regressions include county fixed effects and region-year dummies. Controls are: log population, density, percent urban, percent nonwhite, and % high school. *** p<.01, ** p<.05, * p<.1
and hence reduced polarization.

Having established the basic result, the next step in the strategy considers direct comparisons between counties that look alike in some observable dimension that is likely to influence the timing of introduction of TV. Similar to a matching strategy, the idea is to check whether, say, two rural counties that just happened to differ in the timing of introduction – presumably due to exogenous reasons, for the most part – displayed different trajectories in terms of polarization. We can do so for a number of observable dimensions, splitting the sample according to terciles of those distributions; this is what Table 4 shows. In this table, each entry corresponds to the coefficient on “years of TV” that is obtained from running a regression such as the one in Table 2. We can see that the signs are negative in all but one case, where the effect is essentially zero, and the coefficients are generally significant. In other words, this underscores the evidence of a negative effect of TV on polarization, providing further evidence in favor
Table 4. Effect of Years of TV on Average Polarization Outside the South, by Terciles

<table>
<thead>
<tr>
<th>Counties partitioned by:</th>
<th>Lowest</th>
<th>Middle</th>
<th>Highest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>-.0182***</td>
<td>-.0080***</td>
<td>-.0028</td>
</tr>
<tr>
<td></td>
<td>[.0049]</td>
<td>[.0030]</td>
<td>[.0025]</td>
</tr>
<tr>
<td>Population density</td>
<td>-.0194***</td>
<td>-.0065**</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>[.0053]</td>
<td>[.0028]</td>
<td>[.0026]</td>
</tr>
<tr>
<td>Percent urban</td>
<td>-.0150***</td>
<td>-.0064**</td>
<td>-.0056**</td>
</tr>
<tr>
<td></td>
<td>[.0040]</td>
<td>[.0027]</td>
<td>[.0025]</td>
</tr>
<tr>
<td>Family income</td>
<td>-.0092**</td>
<td>-.0095***</td>
<td>-.0119***</td>
</tr>
<tr>
<td></td>
<td>[.0041]</td>
<td>[.0028]</td>
<td>[.0028]</td>
</tr>
<tr>
<td>% high school</td>
<td>-.0014</td>
<td>-.0020</td>
<td>-.0182***</td>
</tr>
<tr>
<td></td>
<td>[.0043]</td>
<td>[.0024]</td>
<td>[.0036]</td>
</tr>
</tbody>
</table>

Table 5. Effect of Years of TV on Turnout, by Terciles

<table>
<thead>
<tr>
<th>Counties partitioned by:</th>
<th>Lowest</th>
<th>Middle</th>
<th>Highest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>-.5155***</td>
<td>-.2555***</td>
<td>-.3292***</td>
</tr>
<tr>
<td></td>
<td>[.1065]</td>
<td>[.0847]</td>
<td>[.0769]</td>
</tr>
<tr>
<td>Population density</td>
<td>-.5209***</td>
<td>-.2424***</td>
<td>-.2131***</td>
</tr>
<tr>
<td></td>
<td>[.1207]</td>
<td>[.0812]</td>
<td>[.0870]</td>
</tr>
<tr>
<td>Percent urban</td>
<td>-.5437***</td>
<td>-.1441</td>
<td>-.3765***</td>
</tr>
<tr>
<td></td>
<td>[.0986]</td>
<td>[.0901]</td>
<td>[.0587]</td>
</tr>
<tr>
<td>Family income</td>
<td>-.1415</td>
<td>-.4233***</td>
<td>-.5833***</td>
</tr>
<tr>
<td></td>
<td>[.1054]</td>
<td>[.0925]</td>
<td>[.0737]</td>
</tr>
<tr>
<td>% high school</td>
<td>-.1847*</td>
<td>-.3853***</td>
<td>-.6896***</td>
</tr>
<tr>
<td></td>
<td>[.1084]</td>
<td>[.0841]</td>
<td>[.0813]</td>
</tr>
</tbody>
</table>

Table 4 also lets us go a little bit further in exploring the mechanisms predicted by the theory. In particular, the differences between terciles are illuminating: the drop in polarization is quantitatively smaller in the less educated counties than in their most educated counterparts. This is important because it goes against what one would have expected from the composition effect, when it comes to polarization. It thus seems to indicate that the drop in polarization might have been mostly due to the ideology effect.

We can also look at the auxiliary prediction on turnout, as summarized by Prediction 2. We start by looking at Columns (7)-(8) of Tables 1 and 2 to see that there is evidence of a negative effect, essentially of or Prediction 1.  

Another strategy, also following Gentzkow (2006), is to control for the interaction between key demographic variables (income, the log of population) in a base year and a fourth-order polynomial in time. This lets us control flexibly for the evolution over time of variables that might have been important in determining the timing of introduction of TV. Our regression results also go through if we include these interactions, with the base year chosen to be 1960; these are available upon request.
reproducing for both samples what was found by Gentzkow (2006). Our Prediction 2, however, suggests that there is something more to the effect of TV on turnout, depending on the pre-existing media substrate. Some of this subtlety can be seen in Table 5, which repeats for turnout the exercise that was run in Table 4 for polarization.\textsuperscript{32} Most interesting here is the variation across terciles. In the poorest, least educated terciles, the effect of introducing TV is much less negative than in their wealthier, more educated counterparts. This is consistent with the logic of the composition effect: the drop in turnout is much smaller (and insignificant) precisely where the impact of TV on political learning should be stronger.

However, we can test the mechanism underlying Prediction 2 more directly, by taking on the importance of the media substrate that our theory highlights. The “quasi-matching” strategy that we have used above can be directly adapted to disentangle that issue. As we have mentioned, our theory suggests that, in places where radio did not have a large presence, the effect of TV as a low-barrier medium in increasing political knowledge would have been stronger. This would actually lead to a positive effect on turnout, as more people are exposed to at least some political knowledge, or at least less negative, as these “new” participants compensate for the “old” ones whom our theory suggests might tune off because of a decrease in stakes driven by lower polarization within county.\textsuperscript{33}

With that in mind, we run the regressions separately by quintiles of the distribution of radio penetration (measured by the share of dwellings with radio in 1940, from the Census).\textsuperscript{34} The results for turnout (with 95% confidence intervals) are depicted in Figure 6. We see a pattern in which the effect is more pronouncedly negative for those counties that had been more exposed to radio; in fact, the point estimate is positive for those counties that had been least exposed. This is in line with what our theory would predict, as per Prediction 2, with the composition effect balancing out the negative impact on turnout in the counties least exposed to radio.\textsuperscript{35}

We can use the same procedure for relative polarization, which is depicted in Figure 7. We do not see the same clearly monotonic profile – there is some evidence that the effect might be more pronounced in counties with low levels of radio penetration, although the confidence intervals are too wide there to give us much confidence.\textsuperscript{36} Since the level of variety afforded by TV is even smaller than for radio, in any event, we would expect it to trigger the ideology effect everywhere.

In sum, the evidence from the introduction of TV in the US points, quite robustly, at a causal effect

\textsuperscript{32}Note that we choose to include the Southern states as our preferred sample, because turnout is not subject to the same type of measurement error. The results are essentially the same if we drop those states.

\textsuperscript{33}These old participants might also drop out due to lower consumption of local news, as suggested by Gentzkow (2006). Our interpretation is certainly complementary to that.

\textsuperscript{34}The quintiles are: 0-47, 47-68, 68-81, 81-88, 88-98.

\textsuperscript{35}To make sure that the result is due to differences in the substrate, and not in the penetration of TV, we can run the same exercise in the sample of counties that had low penetration of radio, but happened to have high penetration of TV – as measured by the share of households with TV sets in 1952. The results (available upon request) are essentially the same for that relatively small subsample.

\textsuperscript{36}Interestingly, the same exercise, when performed for the full sample, does not suggest a stronger effect for low-radio-penetration counties. This is available upon request.
Figure 6: Effect of TV on Turnout, by Radio Penetration Quintile

Figure 7: Effect of TV on Relative Polarization Outside the South, by Radio Penetration Quintile
leading to lower polarization, which is statistically significant and quantitatively important. In other words, we find support for Prediction 1. The evidence also seems to suggest that the ideology effect was prominent in driving that reduction in polarization – the reduction in polarization seems weaker in the poorer, less educated counties where the composition effect would presumably be at its strongest. At the same time, there is evidence that the logic behind the composition effect is also present, as the poorer, less educated counties seem to have experienced an increase in turnout, in contrast with their richer, more educated counterparts. Finally, we also find evidence in favor of Prediction 2, as turnout decreased much less – and may have actually increased – in those places where TV represented a lowering of barriers, when compared to those where it would have been mostly a decrease in variety.

4.5 Evidence from the Rise of Network Radio

To test our predictions on the introduction of radio, we collected information on the location and network affiliation of all radio stations in the US, from primary sources – namely, multiple editions of White’s Radio Log, a publication listing radio stations by name, frequency and call letters. This enables us to know the number of radio stations in each county as well as the subset of those that were indeed affiliated. Data limitations restrict us to the period after 1932, since our sources did not include network affiliation before then. We also limit our attention to the period before the entry of the US into World War II in late 1941, which greatly affected the radio industry across the country, to an extent that makes comparisons over time difficult. We also collect data on the transmission power of every radio station, since their reach would vary a lot depending on that power. We then weigh each station by the square root of its power – because distance reached varies with that square root. We end up with the power-weighted number of radio stations that are located in each county, which we term “radio exposure”, and its network component, (“network exposure”). This will give us an idea of the degree of exposure to radio, and of the variety embedded in that exposure, that each county would have – albeit an imperfect one, since radio signals evidently do not stop at county lines.

Similarly to what happened in the case of TV, we can use regulatory episodes that introduce poten-

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Digitized copies of those editions are available at http://www.davidgleason.com/Whites_Master_Page.htm. Those were monthly or quarterly issues, and we use the first quarter of each year as our reference point. Whenever the corresponding issue is not available, we use the closest available one.

We could not obtain sources for 1937, 1939 and 1941, but because our Nominate data is biannual we have every two-year period represented. For those periods for which we have both years, we use the average as our measure. Each year label in the data corresponds to the year of inauguration of the specific Congress, and the number of radio stations corresponds to the two previous years – under the assumption that this is what would have influenced the election of that Congress.

In February 1942 the FCC imposed a freeze on new stations due to the wartime rationing, which lasted until August 1945. In 1941 a freeze in the production of radio sets also set in. Most importantly from our perspective, the war also substantially affected content, by unleashing “programming patriotism” (Sterling and Kittross 2002), which substantially blurred the distinction between network and non-network stations in terms of uniformity. Consistent with this point, including the war period does confound the empirical results.

The importance of this weighting is evident from the fact that network stations were typically much more powerful, by an order of magnitude, than their unaffiliated counterparts. For instance, in 1935 the average American city would have just over 3,000 watts of power coming from its average network station, and a mere 500 watts coming from its average unaffiliated station.
tially exogenous variation in the dissemination of radio during the 1930s in order to identify the effect of radio exposure. Specifically, there was substantial variation introduced by the so-called Davis Amendment to the Radio Act of 1927, the major piece of legislation that set the regulatory framework under which the “Golden Age” of radio was to take place.\footnote{The following description is largely based on McMahon (1979) and Craig (2000).} The Radio Act had split the country into five zones, which are depicted in Figure 8. These zones were meant to cover roughly equal populations, although in practice Zone 5 (West), while the largest in territory, was much less populated than the other four. Soon after enactment, congressmen from Southern and Western states started criticizing the Federal Radio Commission (FRC, the regulator created by the Radio Act) for, in their view, shortchanging their regions in the allocation of broadcast licenses. Rep. Ewin Davis from Tennessee then proposed the eponymous amendment, requiring that the FRC “make and maintain an equal allocation of broadcasting licenses, of bands of frequency or wave lengths (...), and of station power, to each of said zones.” (McMahon, 1979, p. 45) This Amendment was passed by Congress in March 1928, largely on a sectional vote pitching South and West (in favor) against East (opposed), with the Midwest split.

While there is controversy as to whether there was indeed an unequal allocation prior to the Amendment – different measures could support different views on the subject – the fact is that the FRC spent most of its energy during its short-lived existence trying to implement it. As it turns out, it soon became clear that the Western states were not really benefitting from it: because it was much bigger geographically, Zone 5 could have accommodated many more stations than the smaller Zone 1, but the law required that the larger zone be restricted by what could be crowded into the smaller (McMahon, 1979, p. 119).
In other words, the system arbitrarily restricted the reach of radio in regions that could have otherwise had a much faster dissemination. In a curious reversal, as put by Sen. Wheeler of Montana in 1936 (quoted in McMahon, 1979, p. 120), “the big cities of the country, such as those in New York, have found that the law works all right; but in the case of the larger zones in the West and Midwest it has hampered us in securing the facilities we ought to have.” Finally, in June 1936, the Davis Amendment was repealed, lifting those arbitrary constraints. The effect of this change can be clearly seen in Figure 9, with a massive increase in our measure of radio exposure in the arbitrarily constrained regions, while Zone 1 stays much flatter.

The unforeseen consequences of the Davis Amendment and its eventual repeal thus introduce a random component that disturbed what would have otherwise been the pattern of radio expansion in the 1930s. This opens up the possibility of a similar empirical strategy to the one that we implemented in the case of TV, where regulatory moves also provided exogenous variation. To see if the strategy is plausible, we can once again take a look at the crude data on polarization, asking whether the variation in our variable of interest follows the pattern to be expected from the regulatory shift. This can be seen in Figure 10, which plots yearly averages for the measure of relative polarization for Zones 4 and 5 – corresponding to the Midwest and West – relative to the average polarization for the country as a whole.\footnote{As in Figure 5, we use three-year averages to smooth out the noise in the measure. We use the raw measure of polarization, without expunging the region-year fixed effects, because the latter contain the variation we are interested in looking at.} The Congress year labeled as 1939, which is marked in the Figure, corresponds to the first year after the repeal of the Amendment, aggregating the radio stations as of 1937 and 1938. There is a clear

![Figure 9: Radio Exposure across Different FRC Zones](image-url)
reversion of the previous upward trend: the explosion in the number of radio stations coincided with a relative decrease in polarization in the previously constrained regions. (Note that no change is evident at that break for the “placebo” exercise with polarization in the unconstrained Zone 1, as shown in Figure 11.) This preliminary look is thus consistent with Prediction 3.

We can look at the results in a more systematic manner by using a similar regression specification to the one we used for TV. They are shown in Table 6. Column (1) shows a negative and significant impact of radio exposure on relative polarization. This is entirely consistent with Prediction 3: the introduction of a low-barrier medium such as radio would be expected to be associated with lower polarization. For a sense of magnitudes, the coefficient implies that the impact of a one standard deviation increase in radio exposure among the counties with radio stations (as of 1939) would correspond to a reduction of just under 0.3 s.d. in the measure of polarization.

Column (2) lets us go in greater depth into the prediction, as it differentiates between network and non-network stations. We should note that the exogenous variation from the Davis Amendment does not have a differentiated impact on the two types of stations – in fact, it is clear from Figure 3 that by the mid-1930s the expansion of radio was mostly about the dissemination of the networks. Nevertheless, the correlations can be illuminating in terms of suggesting the mechanism behind the effect detected in Table 6. What we see is that, while the correlation is significant for network and not for non-network stations, as opposed to those with a single congressional district. This is because a lot of the interesting variation, when it comes to differences in network penetration, comes from large cities, which are disproportionately left out when focusing on single-district counties. On the other hand, this underscores the caveat that the variation in network exposure is far from exogenous.
stations, the size of the coefficients does not suggest a meaningful difference across the two types. (The non-network coefficients are less precisely estimated – not surprisingly in light of the explosion of network radio at the time.) It thus seems that, unlike in the case of TV, any drop in polarization seems to be mostly driven by the composition effect, rather than the ideology effect. After all, the latter would be associated with a stronger effect of network radio.

The same pattern is very much true when it comes to our other measures of polarization, as shown in Columns (3)-(6). It is interesting that the results do not come from contrasting counties that are measured to have zero radio exposure – which we have noted to be imperfectly measured, as radio signals do not stop at county lines. In fact, they are remarkably similar, both in terms of coefficient size and their statistical significance, when obtained from the sample restricted to counties with positive exposure (available upon request).

When it comes to Prediction 4, on turnout, the results are very much similar. Column (7) shows some evidence of an impact of exposure to radio on turnout, in line with the results that Strömberg (2004) obtains with a different strategy. Column (8) in turn suggests that there is not that much of a distinction between affiliated and unaffiliated stations. The information/motivation impact of the introduction of the new medium seems to have dominated any possible negative impact on turnout that lower polarization might have induced. That said, these results do seem to be coming mostly from the contrast with zero-exposure counties, as the coefficients are substantially smaller when the sample is restricted (available upon request).

In sum, the results are consistent with the idea that radio had a similar depolarizing effect to that
Table 6. Effects of Radio Exposure on Political Outcomes, 1932-41 (All counties)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
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<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
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<tr>
<td></td>
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<td>rel. avg</td>
<td>rel. med</td>
<td>rel. med</td>
<td>absolute</td>
<td>absolute</td>
<td>turnout</td>
<td>turnout</td>
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<td>Radio Exposure</td>
<td>-0.00017***</td>
<td>-0.00017***</td>
<td>-0.00010**</td>
<td>0.0070**</td>
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<tr>
<td></td>
<td>[0.00006]</td>
<td>[0.00005]</td>
<td>[0.00005]</td>
<td>[0.00005]</td>
<td>[0.0028]</td>
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<tr>
<td>Network</td>
<td>-0.00016***</td>
<td>-0.00015***</td>
<td>-0.00011**</td>
<td>0.0067**</td>
<td></td>
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<tr>
<td></td>
<td>[0.00005]</td>
<td>[0.00005]</td>
<td>[0.00005]</td>
<td>[0.0032]</td>
<td></td>
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<tr>
<td>Non-Network</td>
<td>-0.00019</td>
<td>-0.00021</td>
<td>-0.00007</td>
<td>0.0106**</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>[0.00022]</td>
<td>[0.00023]</td>
<td>[0.00021]</td>
<td>[0.0046]</td>
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<tr>
<td># of counties</td>
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<td>2951</td>
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<td>2951</td>
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<td>2951</td>
<td>3088</td>
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<tr>
<td>R-squared</td>
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<td>0.195</td>
<td>0.180</td>
<td>0.179</td>
<td>0.222</td>
<td>0.222</td>
<td>0.491</td>
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</table>

Robust standard errors in brackets, clustered by county. All regressions include county fixed effects and region-year dummies. Controls are: log population, density, percent urban, percent nonwhite.

*** p<0.01, ** p<0.05, * p<0.1
which TV would also have later on. Unlike TV, however, there is evidence that such depolarizing effect would have been attributable, to a substantial extent, to the composition effect predicted by the theory. Broadly speaking, we have good reason to believe that the evolution of media technologies between the 1930s and 1950s had a significant role in the drop in polarization observed over that period. The most natural interpretation is that the radio worked in favor of depolarization by bringing new, more moderate voters to the polls. When TV arrived, that effect was somewhat exhausted, but depolarization was further enhanced by the new medium’s direct impact on citizens’ ideological preferences.

5 Concluding Remarks

This paper has developed a framework that allows us to understand the impact of changes in media technology on the distribution of political attitudes, and thus on equilibrium levels of polarization. Building on a simple framework of how media exposure affects individual ideological positions, our electoral competition model identifies two different channels through which the media impacts polarization: the composition effect, stemming from the impact of media exposure on political motivation and turnout, and the ideology effect, arising from its impact on individuals’ ideological views.

We provide empirical evidence, gauged from the introduction of TV and radio in the US, that supports the prediction that these new technologies – since they implied substantial decreases in variety and increases in accessibility – would engender reductions in polarization. This suggests that the substantial reduction in polarization that occurred in the US around the mid-20th century was helped by the changes in media environment, as had been suggested for instance by Prior (2007). The evidence also enables us to go further, by disentangling the two effects predicted by the theory: it seems that the composition effect predominated in the case of radio, while the ideology effect was the key to the role played by TV.

An important advantage of our theoretical framework is that it can be broadly applied, presumably to any changes in media technology, which we codify simply according to accessibility and variety. For instance, one could use it to think about the effects of recent changes – cable TV, the internet, talk radio – that have all been accused of increasing polarization (Prior 2007, Bishop 2008, Sunstein 2009). In particular, the relative importance of the ideology and composition effects should vary with the context.

Our theory also suggests, and the data support, that the same technology could have very different effects depending on the media substrate into which it is introduced. This could be especially interesting in the context of comparing different countries: the introduction of the internet could have a very different impact when it takes place in a context dominated by a high-variety medium (say, cable TV), as is probably a good description for the US, than when the backdrop is state-owned broadcast TV. Our theory suggests that differences in political institutions will affect the effects of media – it would be worthwhile to empirically check for the predictions under a proportional representation system. These are all exciting topics for future research.

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6 References


Appendix: Demand For Ideological Content

We provide a microfoundation for Property 1. Specifically, we introduce a simple model in which individuals choose the mix of media they consume. In principle, each media outlet in a given media market can be conceived as a bundle that offers entertainment, information, and ideological content, but a complete theory of media consumption is beyond the scope of this paper. Instead, we focus on a theory of demand for ideological content.

The consumption of media content requires deploying time and financial resources. We capture this in a simplified manner by assuming that an individual has a fixed budget to be spent on media consumption. To fix ideas, we can think of this budget as an amount of time to be allocated to different providers – “channels”, “stations”, “newspapers”, “blogs”. Each citizen-consumer has a fixed budget of 1, and decides the time of exposure to each media outlet.

We assume that each outlet differs exclusively on the ideological content it provides. We can thus think of the citizen’s allocation problem as defined over each of the ideological positions offered in the market, the set of which we have defined as $M$. Let $\Delta(M)$ be the set of probability distributions on $M$. We denote by $\tau_v \in \Delta(M)$ the vector describing the exposure times chosen by consumer $v$. If $M = \{m_1, ..., m_N\}$ has $N$ points then $\tau_v = (\tau_{v1}, ..., \tau_{vN})$ such that $\tau_{vj} \geq 0$ and $\sum_{j=1}^{N} \tau_{vj} = 1$. We refer to $\tau_v$ as consumer $v$’s demand for ideological content.

We assume that exposure to a particular ideological content affects a citizen’s preferred ideology. If the citizen has an initial ideology $z_v$, her “ex-post” ideology following media exposure is denoted by $x_v$. We assume that $x_v$ is a function of $z_v$ and the demand for ideological varieties $\tau_v$, i.e., $x_v = H(z_v, \tau_v)$. The map $H : X \times \Delta(X) \rightarrow X$ is referred to as an influence function, which we define formally as follows. (Note that for any $m \in X$ we use $\delta_m \in \Delta(X)$ to denote a mass point on $m$.)

\[44\]

In a more general case, each station would be characterized by a multidimensional bundle of characteristics that include potentially differentiated entertainment varieties, ideological slant, information values, etc.
Assumption (A1) There exists a continuous influence function $H : X \times \Delta(X) \rightarrow X$ such that the ex-post ideology $x$ for a citizen with (ex-ante) ideology $z \in X$ and exposure to content $\tau \in \Delta(X)$ is given by $x = H(z, \tau)$. The function $H$ satisfies the following properties:

(H1) $H(z, \tau)$ is increasing in $z$;

(H2) $H(z, \delta_m) - m$ has the same sign as $z - m$ (In particular, $H(z, \delta_z) = z$);

(H3) For any $m \in X$, $\tau \in \Delta(X)$, $\epsilon \in [0, 1]$, if $\tau_\epsilon = \epsilon \delta_m + (1 - \epsilon)\tau$, $|H(z, \tau_\epsilon) - m|$ is decreasing in $\epsilon$.

This function captures the idea that more exposure to a particular view pushes a citizen toward that view, but also that the citizen's initial view "anchors" the view she ends up holding after exposed to the media. Intuitively, the ex-post position can be thought of as a weighted average between a prior (or "natural") ideology and media influence.

In the spirit of Mullainathan and Shleifer (2005), we assume that the consumer chooses the demand for varieties $\tau$ "as if" she minimizes the dissonance between her prior ideology $z$ and her posterior ideology $x = H(z, \tau)$, measured as any increasing continuous function $\lambda$ of $|z - H(z, \tau)|$. Thus, $\tau^*(z, M)$ solves $\max_{\tau} \{ z - \lambda(|z - H(z, \tau)|) \}$ where $\tau \in \Delta(M)$. 46

Before characterizing the demand for content, we introduce some terminology. The ideology span $\Sigma(M) \subseteq X$ of a market with variety $M$ is the subset of ideologies that are covered by the ideological variety of the market. Formally, $\Sigma(M) = \{ z \in X \mid m \leq z \leq m' \}$ for some $m, m' \in M$. In particular, if $M = \{ m \}$ then $\Sigma(M) = \{ m \}$; if $M$ contains extreme ideologies then $\Sigma(M) = X$. We use $m^*(z) \in M$ to denote the ideological position closest to ideology $z$, i.e., $m^*(z) = \arg \min_{m \in M} |m - z|$.

Proposition A 1 Let $\tau^*(z, M)$ be the demand for ideological content for a citizen of ideology $z$ in a market with variety $M$. Then: $\mathbb{R} \ni (i)$ if $z \in \Sigma(M)$ then $\tau^*(z, M)$ is such that $H(z, \tau^*(z, M)) = z$; (ii) otherwise, if $z \notin \Gamma(M)$ then $\tau^*(z, M) = \delta_{m^*(z)}$. Finally, (iii) the ex-post ideology $H(z, \tau^*(z, M))$ is strictly increasing in the ex-ante ideology $z$.

Proof. The demand $\tau^*(z, M)$ for varieties of a consumer with ex-ante ideology $z \in X$ in a market with variety $M$ solves

$$\max_{\tau \in \Delta(M)} \quad C(z, \tau) \equiv \lambda(|z - H(z, \tau)|).$$

The result is established by characterizing the solution to this problem.

If $z \notin \Sigma(M)$ then optimal choice is $\tau^*(z, M) = \delta_{m^*(z)}$. Indeed, this choice achieves the smallest possible dissonance.

If $z \in \Sigma(M)$ then assumption (A1) ensures that $\tau^*(z, M)$ can be chosen so that $H(z, \tau^*(z, M)) = z$, i.e., zero dissonance.

To show (iii), let $\Sigma(M) = [\sigma_-, \sigma_+]$. Suppose that $z \leq \sigma_- \leq \delta_{m_i} = \sigma_-$. From (ii), the ex-post ideology is given by $x(z) = H(z, \delta_{m_i})$ and, by assumption (A1), $H(\cdot, \cdot)$ is increasing in its first argument from which $x(z)$ is increasing for all $z \leq \sigma_-$. The case $z \geq \sigma_+$ is analogous. If $M = \Sigma(M) = \{ m \}$ then $\sigma_- = \sigma_+$ and we are done. Suppose instead that $\sigma_- < \sigma_+$ and consider $z \in \Sigma(M)$. Recall that $M = \{ m_1, ..., m_n \}$ with $\sigma_- = m_1$ and $\sigma_+ = m_n$, and $\Sigma(M)$ can be partitioned into subintervals of the form $\Sigma_i = [m_i, m_{i+1}]$, where each of the extremes correspond to adjacent varieties offered in the market. Note that if $z = m_i$ then $\tau^*(z, M) = m_i$ and $H(z, \tau^*(z, M)) = z$. To conclude the proof it suffices to show that $H(z, \tau^*(z, M))$ is increasing in $z$ within each $\Sigma_i$. Observe that from (i) and (ii), we conclude that there exist $m_i^- < m_i^- < m_i^+ < m_i^+$ such that if $z \in [m_i^-, m_i^+]$ then $\tau^*(z, M)$ is such that $H(z, \tau^*(z, M)) = z$. Clearly, $H(z, \tau^*(z, M))$ is strictly increasing in each of the intervals $[m_i, m_i^-]$, $[m_i^-, m_i^+]$, and $(m_i, m_i^+)$. Furthermore, $H(m_i^- \delta_{m_i}) < m_i^-$ and $H(m_i^+, \delta_{m_i+1}) < m_i^+$. It follows that $H(z, \tau^*(z, M))$ is increasing on $\Sigma_i$, and thus, on $\Sigma$ as desired.

45The influence function has a strong parallel with the properties of Bayesian updating. Specifically, the mean of a posterior distribution is monotonic in the value of the mean of the prior, it coincides with the mean of the prior if all the signals observed have that particular value, and it is closer to a given value of a signal the larger the number of signals of that particular value. This seems like a reasonable benchmark, but it is not obvious that the update in ideological views parallels information processing. For example, confirmatory bias and motivated reasoning may lead an individual to drift further apart from views that are dissonant with her prior view.

46In the working paper version we consider a generalization that allows for the the possibility of costs associated to “switching” between different media.
Part (i) implies that a consumer with an ideology in the ideology span of the market demands a content mix that counteracts any ideological influence. Part (ii) says that citizens with relatively “extreme” views (in the sense that they are not in the ideology span of the market) do not diversify their ideological consumption and pick the one outlet that is closest to their original view. Part (iii), which comes directly from Condition (H1), is instrumental in deriving the properties of the distribution of citizens’ views as a function of $M$ and the distribution of prior views.

A basic message of the proposition is that, if the costs of switching are small, consumers can significantly neutralize the media’s ideological influence by suitably choosing exposure. Because of that, only those with relatively extreme views, as defined above, will be significantly affected. Indeed, if and $\Sigma(M) = X$ then $H(z, \tau^*(z, M)) = z$ for all $z$. This can be interpreted as a generalized “echo chamber” effect: after exposure consumers’ views remain unchanged either because they consume a single variety that matches their pre-existing view, or else, because they can combine exposure to ideological messages that balance each other out.

Using the previous result we can now derive Property 1. Specifically, for a fixed $H$, let $R_M : X \to X$ denote this inverse function. Let $G_0$ be the c.d.f. of citizens’ prior ideologies (i.e. in the absence of exposure to the media) and $g_0$ for the corresponding density. Note that the c.d.f. of ex-post ideologies for market with variety $M$ is

$$G_M(x) = G_0(R_M(x)). \quad (2)$$

Proposition A 2 Suppose assumption (A1) holds. If $M$ and $M'$ are two markets balanced with respect to the distribution $G_0$, and $M'$ is a decrease in variety with respect to $M$ then $G_{M'}$ is a compression of $G_M$.

Proof.

For each balanced market variety $M \subset X$ and $\Sigma(M) = [\sigma_-, \sigma_+]$ is the variety span. If $M$ is balanced then $\sigma_- + k = \sigma_+ - k = \hat{x}$. Given $z \in X$ let $R_M(z) \equiv H(z, \tau^*(z, M))$ be the corresponding ex-post ideology and recall that $G_M(x) = G_0(R_M(x))$. Invoking Proposition 1(i),

$$R_M(x) = \begin{cases} 
H(x, \delta_{\sigma_-}) & \text{if } x < \sigma_- \\
\hat{x} & \text{if } x \in [\sigma_-, \sigma_+] \\
H(x, \delta_{\sigma_+}) & \text{if } x > \sigma_+.
\end{cases}$$

To establish the result we consider an infinitesimal increase in $\sigma_-$ and a decrease in $\sigma_+$. (Recall that a balanced decrease in variety amount to increasing $\sigma_-$ and decreasing $\sigma_+$ by the same amount.) We need to show that this change is associated with an increase of the mass $G_M(x)$ for $x < \hat{x}$ and an increase for $x > \hat{x}$. Assumption (A1)(H3) implies that $H(x, \delta_{\sigma}) < H(x, \delta_{\sigma'})$ if $\sigma' > \sigma$. It follows that $\frac{\partial H(x, \delta_{\sigma})}{\partial \sigma} > 0$, from which $\frac{\partial G_M(x)}{\partial \sigma} = g_0(R_M(x))\frac{\partial H(x, \delta_{\sigma})}{\partial \sigma} > 0$.

B Appendix: Political Equilibrium – Analysis and Proofs

The following lemma is used in the proof of Proposition 1.

Lemma 3 Fix a market with variety $M$. If $M'$ is a balanced decrease in variety with respect to $M$ then $g_{M'}(\hat{x}) \geq g_M(\hat{x})$ with strict inequality if $M' = \{\hat{x}\}$.

Proof. From Proposition A1, $G_{M'}$ is a compression of $G_M(x)$. Fix any $x \geq \hat{x}$. Since $G_{M'}(x) \geq G_M(x)$ and $G_{M'}(\hat{x}) = G_M(\hat{x}) = 1/2$, then $\frac{G_{M'}(x) - G_M(\hat{x})}{x - \hat{x}} \geq \frac{G_M(x) - G_M(\hat{x})}{x - \hat{x}}$. Taking the limit $x \to \hat{x}$ yields the conclusion.

In words, since a reduction in variety leads to a compression of the distribution, it cannot reduce the mass of voters with the median ideology.

We introduce some notation and terminology used in the proofs. Write $\epsilon$ for the set of parameters of the model. Let

$$y(z, \epsilon) = \hat{x} - \frac{c}{2z}$$
and
\[ Q(z, \epsilon) = pg(\hat{x}) + (1 - p)g(y(z, \epsilon)) - \frac{1}{2}\rho(x_0R - x_0L - z) \]

We say \( x^* \) is an interior equilibrium of the electoral game if \( x_{L0} < x^*_L < x^*_R < x_0R \).

**Lemma 4** If \( x^* \) is an interior equilibrium of the electoral game then \( \Delta x^* = x^*_R - x^*_L \) solves \( Q(\Delta x^*, \epsilon) = 0 \).

**Proof.** Each candidate’s policy must satisfy a first order condition (FOC). For \( L \) the FOC is

\[ \frac{\partial W_L}{\partial x_L}(x^*_L, x^*_R) = \rho(x^*_L - x_{L0}) = 0. \]

Observe that under assumption (A4), \( \frac{\partial W_L}{\partial x_L} = \frac{\partial V_L}{\partial x_L} - \frac{\partial V_R}{\partial x_L} \), where

\[ \frac{\partial V_L}{\partial x_L} = \frac{1}{2}pg(x_{1/2}) + (1 - p)g(y_L) \frac{\partial y_L}{\partial x_L} \quad \text{and} \quad \frac{\partial V_R}{\partial x_L} = -\frac{1}{2}\left[ pg(x_{1/2}) + (1 - p)g(y_R) \frac{\partial y_R}{\partial x_L} \right]. \]

If \( G \) has unbounded support, \( y_L(x) = x_{1/2} - \frac{c}{2(x_R - x_L)} \) and \( y_R(x) = x_{1/2} + \frac{c}{2(x_R - x_L)} \), from which \( \frac{\partial y_L}{\partial x_L} = \frac{1}{2} \left( 1 - \frac{c}{2(x_R - x_L)} \right) \) and \( \frac{\partial y_R}{\partial x_L} = \frac{1}{2} \left( 1 + \frac{c}{2(x_R - x_L)} \right) \). Now, for a symmetric equilibrium, we have that \( x_{1/2} = \hat{x} \), \( x_L^* - x_{L0} = \frac{1}{2}(x_0R - x_0L - \Delta x^*) \) and, since \( g \) is symmetric with respect to \( \hat{x} \), \( g(y_R(x^*)) = g(y_R(x^*)) \).

Combining the previous, the FOC at an equilibrium point is

\[ pg(\hat{x}) + (1 - p)g(y(\Delta x^*, \epsilon)) - \frac{1}{2}\rho(x_0R - x_0L - \Delta x^*) = 0, \]

or \( Q(\Delta x^*, \epsilon) = 0 \).

**Lemma 5** \( Q(\Delta x^*, \epsilon) = 0 \) has a solution \( 0 < \Delta x^* < x_{R0} - x_{L0} \). Furthermore, the largest and smallest solutions of \( Q(\Delta x^*; \epsilon) = 0 \) in \([0, x_{R0} - x_{L0}]\) satisfy \( \frac{\partial Q}{\partial z}(\Delta x^*, \epsilon) > 0 \). These two solutions are equilibria of the electoral competition game.

**Proof.** Observe that \( Q(x_{R0} - x_{L0}, \epsilon) = pg(\hat{x}) + (1 - p)g(y(\Delta x^*, \epsilon)) \geq pg(\hat{x}) > 0 \) for all \( \epsilon \). On the other hand, \( y(0, \epsilon) = -\infty \), so that \( g(y(\Delta x^*, \epsilon)) \geq pg(\hat{x}) > 0 \) for all \( \epsilon \). It follows that \( Q(0, \epsilon) = pg(\hat{x}) - \frac{1}{2}\rho(x_0R - x_0L - \Delta x^*) \).

From assumption (P6), \( Q(0, \epsilon) < 0 \). Since \( Q(0, \epsilon) < 0 \), \( Q(x_{R0} - x_{L0}, \epsilon) > 0 \), and \( Q \) is continuous in its first argument, we conclude by the intermediate value theorem that \( Q(z^*, \epsilon) = 0 \) for some \( z^* \in (0, x_{R0} - x_{L0}) \). Since \( Q(0, \epsilon) < 0 \), for the smallest solution \( Q(z^*, \epsilon) \) crosses the zero from below. Similarly, since \( Q(x_{R0} - x_{L0}, \epsilon) > 0 \), the same is true for the largest solution. It follows that \( \frac{\partial Q}{\partial z}(\Delta x^*, \epsilon) > 0 \) where \( \Delta x^* \) is either the largest or smallest solution of \( Q(\Delta x^*, \epsilon) = 0 \).

Finally, observe that \( Q(\Delta x^*, \epsilon) = 0 \) follows from the candidates’ necessary FOC. For the case of the smallest and largest solution it can be shown that this FOC is associated with the unique best response for each candidate.

**Lemma 6** Given the c.d.f. \( G \) and the corresponding p.d.f. \( g \) let \( r_G(x, y) = \frac{g(x) - g(y)}{G(x) - G(y)} \). If \( g \) is log-concave then \( r_G(x, y) \leq \frac{g'(y)}{g(y)} \) for all \( y \leq x \).

**Proof.** \( r_G(x, y) \leq \frac{g'(y)}{g(y)} \) for all \( y \leq x \iff S(x, y) \equiv (G(x) - G(y))g'(y) - g(y)(g(x) - g(y)) \geq 0 \) for all \( y \leq x \). Note that \( S(y, y) = 0 \). Differentiating \( S(x, y) \) with respect to \( x \) we get \( S_x(x, y) = g(x)g'(y) - g(y)g'(x) \). This is strictly positive for \( x \geq y \) as long as \( g \) is log-concave.

**Proof of Proposition 1**

(i) From Lemma 4, an interior equilibrium satisfies \( Q(\Delta x^*, \epsilon) = 0 \). It follows that \( \frac{\partial \Delta x^*}{\partial p} = -\frac{\partial Q}{\partial \rho} \). For the highest and lowest equilibrium \( \frac{\partial Q}{\partial \rho} > 0 \) (Lemma 5). Hence, if \( \frac{\partial Q}{\partial \rho} < 0 \), then \( \frac{\partial \Delta x^*}{\partial p} > 0 \). Now,

\[ \frac{\partial Q}{\partial p} = g(\hat{x}) - g(y(\Delta x^*, \epsilon)) > 0. \]
Similarly,
\[
\frac{\partial Q}{\partial c} = -(1 - p)g'(y(\Delta x^*, \epsilon)) - \frac{1}{\Delta x^{*2}},
\]
which is less than zero if \(g\) is increasing at \(y(\Delta x^*, \epsilon)\).

(ii) As argued in the main text, letting \(\Delta G = G(y_R(x^*)) - G(y_L(x^*))\) and \(y' = \frac{\partial y(\Delta x^*, \epsilon)}{\partial z} = \frac{c}{2\Delta x^{*2}} > 0\) for short,
\[
\frac{\partial V^*}{\partial p} = \Delta G + 2(1 - p)g(y(\Delta x^*, \epsilon))y' \frac{\partial \Delta x^*}{\partial p}
\]
and, from (i), letting \(\Delta g = g(\hat{x}) - g(y(\Delta x^*, \epsilon))\),
\[
\frac{\partial \Delta x^*}{\partial p} = -\frac{\partial Q}{\partial p} \frac{\partial Q}{\partial z} = -\frac{\Delta g}{(1 - p)g'(y(\Delta x^*, \epsilon))y' + \frac{1}{2} \rho}.
\]

Thus, \(\frac{\partial V^*}{\partial p} > 0\) iff
\[
\Leftrightarrow \left( (1 - p)g'(y(\Delta x^*, \epsilon))y' + \frac{1}{2} \rho \right) \Delta G - 2(1 - p)g(y(\Delta x^*, \epsilon))y' \Delta g \geq 0
\]
\[
\Leftrightarrow (1 - p)y' \left[ \frac{g'(y(\Delta x^*, \epsilon))}{g(y(\Delta x^*, \epsilon))} - 2 \frac{\Delta g}{\Delta G} \right] + \frac{1}{2} \rho \geq 0
\]
\[
\Leftrightarrow (1 - p)y' \left[ \frac{g'(y(\Delta x^*, \epsilon))}{g(y(\Delta x^*, \epsilon))} - r_G(\hat{x}, y(\Delta x^*, \epsilon)) \right] + \frac{1}{2} \rho \geq 0
\]
where \(r_G(x, y) = \frac{g(x) - g(y)}{G(x) - G(y)}\) and we used \(G(y_R(x^*)) - G(y_L(x^*)) = 2(G(\hat{x}) - G(y))\). The latter follows from symmetry. By Lemma 6, \(\frac{g'(y)}{g(y)} - r_G(x, y) \geq 0\) and the expression above is positive as desired.

Proof of Proposition 2.
Let \(M\) be the market’s ideological variety and \(G_M\) be the associated distribution of citizens’ ideologies. If \(M\) is balanced with respect to \(\hat{x}\), the market variety span can be expressed as \(\Sigma(M) = [\hat{x} - k, \hat{x} + k]\) for some \(k > 0\). The variety span is entirely determined by \(k\), with larger \(k\) associated with more variety, we write \(M = M_k\). If \(M_{k'}\) is a balanced decrease in variety with respect to \(M_k\) then \(k' < k\). To establish (i) we show that a decrease in \(k\) is associated with a decrease of the equilibrium polarization level \(\Delta x^*(k)\) for the (smallest and largest equilibrium) or, equivalently, \(\Delta x^*(k)\) is increasing in \(k\).

(i) From Lemma 4 we have that the equilibrium level of polarization \(\Delta x^*(k)\) satisfies \(Q(\Delta x^*(k), \epsilon) = 0\), where
\[
Q(z, \epsilon) = pg_{M_k}(\hat{x}) + (1 - p)g_{M_k}(y(z, \epsilon)) - \frac{1}{2} \rho(x_{0R} - x_{0L} - z)
\]
Since \(\frac{\partial Q}{\partial z} > 0\) for the smallest and largest equilibrium, \(\Delta x^*(k)\) increases with \(k\) if \(Q(z, \epsilon)\) decreases with \(k\). From Lemma 3 \(g_{M_k}(\hat{x}) \leq g_{M_{k'}}(\hat{x})\) if \(k' < k\). The corresponding change in \(g_{M_k}(y(z, \epsilon))\) has an ambiguous sign. However, for \(p\) large enough the conclusion follows.

(ii) As illustrated in the main text the direct effect of the compression induced by the decrease in market variety is to reduce turnout as, all else equal, those who do not turnout are precisely the moderates with low motivation. The indirect effect derives from the change in turnout associated to the change in platforms. From (i), this movement promotes moderation by the candidates which, in turn, is associated with lower turnout by moderate citizens with low motivation.

B.1 Proportional Representation
Under Assumption (A4) we can introduce definitions similar to the ones used for the analysis of electoral competition under Assumption (A4) to obtain the comparative statics we are interested in. As before let
\( \epsilon \) be the parameters of the model and define \( \gamma = \frac{g(\tilde{x})}{x_{0R} - x_{0L} |p|} \). The analogues of \( y(\cdot, \cdot) \) and \( Q(\cdot, \cdot) \) defined above are given by

\[
y(z, \epsilon) = \tilde{x} - \frac{c}{2|x_{0R} - x_{0L}|} \frac{1}{z} \\
\Gamma(z; \epsilon) = \gamma \left[ 1 + \frac{1-p}{p} \frac{g(y(z, \epsilon))}{g(\tilde{x})} \right] - (1 - z) \left[ 1 + \frac{1-p}{p} \frac{G(y(z, \epsilon))}{G(\tilde{x})} \right].
\]

The proofs of the following two Lemmas parallel those of Lemmas 4 and 5, and are thus omitted. They are available upon request.

**Lemma 7** If \( x^* \) is an interior equilibrium of the electoral game then \( \Delta^* = \frac{x_{R}^* - x_{L}^*}{x_{R0} - x_{L0}} \) solves \( \Gamma(\Delta^*; \epsilon) = 0 \).

**Lemma 8** \( \Gamma(\Delta^*; \epsilon) = 0 \) has a solution \( \Delta^* \in (0, 1) \). Furthermore, the largest and smallest solution of \( \Gamma(\Delta^*; \epsilon) = 0 \) satisfy \( \frac{\partial}{\partial z} \Gamma(\Delta^*; \epsilon) > 0 \). These two solutions correspond to equilibria of the electoral competition game.

**Proof of Proposition 3.**

(i) From Lemma 7, an interior equilibrium satisfies \( \Gamma(\Delta^*; \epsilon) = 0 \). It follows that \( \frac{\partial \Delta^*}{\partial p} = -\frac{\partial \Gamma}{\partial p} / \frac{\partial \Gamma}{\partial \Delta^*} \). For the highest and lowest equilibrium \( \frac{\partial \Gamma}{\partial \Delta^*} > 0 \) (Lemma 8). Hence, if \( \frac{\partial \Gamma}{\partial p} < 0 \) then \( \frac{\partial \Delta^*}{\partial p} > 0 \). Now,

\[
\frac{\partial \Gamma}{\partial p} = \frac{1}{p^2} \left( -\gamma \frac{g(y(\Delta^*, \epsilon))}{g(\tilde{x})} + (1 - \Delta^*) \frac{G(y(\Delta^*, \epsilon))}{G(\tilde{x})} \right).
\]

From \( \Gamma(\Delta^*; \epsilon) = 0 \) we have that \( \gamma = \frac{1+\frac{1-p}{p} \frac{G(y(\Delta^*, \epsilon))}{G(\tilde{x})}}{1+\frac{1-p}{p} \frac{g(y(\Delta^*, \epsilon))}{g(\tilde{x})}} \) so the above expression becomes

\[
\frac{\partial \Gamma}{\partial p} = \left( 1 - \Delta^* \right) \left( 1 + \frac{1-p}{p} \frac{G(y(\Delta^*, \epsilon))}{G(\tilde{x})} \right) \left( 1 - \frac{g(y(\Delta^*, \epsilon))}{g(\tilde{x})} \right) \left( 1 + \frac{1-p}{p} \frac{G(y(\Delta^*, \epsilon))}{G(\tilde{x})} \right)
\]

where \( r(z) \equiv \frac{z - \frac{1-p}{p}}{1+\frac{1-p}{p} z} \). Our hypothesis that on the log-concavity of \( G \) implies that \( \frac{\partial}{\partial \Delta^*} \) is decreasing. Since \( y(\Delta^*, \epsilon) < \tilde{x} \), we have that \( \frac{g(y(\Delta^*, \epsilon))}{g(\tilde{x})} > \frac{G(y(\Delta^*, \epsilon))}{G(\tilde{x})} \). Since \( r(\cdot) \) is increasing we conclude that \( \frac{\partial \Gamma}{\partial p} < 0 \).

(ii) As argued in the main text, the direct effect of an increase in \( p \) on turnout is positive. In addition, from (i) we have that the indirect effect on turnout (which arises from the change in platforms) as an increase in polarization \( \Delta^* \) without changing \( x_{1/2} = \tilde{x} \) leads to higher turnout from citizens with low political motivation. \( \blacksquare \)