

Media and Social Capital

Filipe Campante,^{1,2} Ruben Durante,^{3,4,5,6,7}
and Andrea Tesei^{6,7,8,9}

¹School for Advanced International Studies and Department of Economics, Johns Hopkins University, Baltimore, Maryland, USA; email: fcampante@jhu.edu

²National Bureau of Economic Research, Cambridge, Massachusetts, USA

³Catalan Institution for Research and Advanced Studies (ICREA) and Department of Economics and Business, Universitat Pompeu Fabra, Barcelona, Spain; email: ruben.durante@upf.edu

⁴Barcelona School of Economics, Barcelona, Spain

⁵Institute of Political Economy and Governance (IPEG), Barcelona, Spain

⁶Centre for Economic and Policy Research (CEPR), London, United Kingdom

⁷Centre for Economic Studies and Ifo Institute (CESifo), Munich, Germany

⁸School of Economics and Finance, Queen Mary University of London, London, United Kingdom; email: a.tesei@qmul.ac.uk

⁹Centre for Economic Performance, London School of Economics, London, United Kingdom

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Abstract

We survey the empirical literature in economics on the impact of media technologies on social capital. Guided by a simple model of information and collective action, we cover a range of different outcomes related to social capital—from social and political participation to interpersonal trust—in its benign and destructive manifestations. The impact of media technologies hinges on their content (information versus entertainment), their effectiveness in fostering coordination, and the networks they create as well as on individual characteristics and media consumption choices.

1. INTRODUCTION

The impact of different media technologies on societal outcomes, ranging from politics to violence to individual behavior and attitudes, has been the subject of an extensive literature in the social sciences.¹ It stands to reason that they might also affect social capital, and a substantive body of work has emerged studying that link. The goal of this article is to provide an overview of some of the key takeaways from that wealth of contributions, focusing on those that investigate the empirical evidence on this relation.²

The connection between media and social capital emerges naturally once we stipulate that the latter is fundamentally about facilitating collective action (Putnam 1993, Ostrom & Ahn 2009, Guiso et al. 2011). This brings to the forefront the importance of the dissemination and exchange of information and of the possibilities for coordination—all of which are central functions performed by media technologies.

Yet it does not follow that the development and expansion of media technologies would necessarily foster social capital. Put simply, not all the information broadcast by a given technology will be of the kind that supports collective action. For instance, a lot of content may be purely related to what we can broadly refer to as entertainment; therefore, we will henceforth refer to collective action–related content simply as information, and to nonrelated content as entertainment. The extent to which each media technology disseminates these different types of content varies enormously, of course, with potentially different effects on social capital.

In addition, as other kinds of capital, social capital takes multiple forms (Ostrom & Ahn 2009). One can think of distinct forms of collective action—ranging from organizations involving longer-term commitment (clubs, professional associations, political parties, unions) to one-off or occasional initiatives (demonstrations, petitions, campaigns, voting)—as well as of the networks that underpin them and the trust they foster, which, in turn, makes them work. It is entirely conceivable that different media technologies interact with each of these aspects in different ways.

To organize our overview of the rich strand of literature studying these possibilities, we start by laying out a conceptual framework, based on work by Barbera & Jackson (2020), focusing on the role of information and coordination in solving a collective action problem. This stylized framework allows us to underscore a few key themes. First, although the effectiveness of media in spreading information generally facilitates collective action, this hinges on the content of that information. For instance, if media are more likely to expose their audience to content suggesting a low propensity of others to contribute to collective action (e.g., by focusing on entertainment), this could actually prevent collective action that would otherwise emerge. Second, the degree of homophily in the networks associated with the media technology—namely, their propensity to bring similar people together—conditions the effect of information on collective action.

Motivated by this, and by some suggestive survey evidence about the diffusion of the two key transformations of the media environment over the last century (TV and the Internet), we structure our overview of the literature as follows. First, we look at the evidence on how the information content of media technologies affects social capital over a range of social capital outcomes studied in the literature, from social participation and political participation to measures

¹Readers are referred to the comprehensive surveys by DellaVigna & La Ferrara (2015) on the effects of media on a range of economic and social outcomes, Prat & Strömberg (2013) and Strömberg (2015) on the political economy of media, Felson (1996) and Huesmann & Taylor (2006) on the link between media and violent behavior, and Valkenburg et al. (2016) on media effects in psychology.

²For an early survey of theoretical and empirical work on social capital in economics, readers may consult Durlauf & Fafchamps (2004).

of interpersonal trust.³ We also look at benign forms of collective action as well as those that are less so, or outright destructive, underscoring the fact that social capital can be put to good and bad uses. The impact of mass media technologies on social capital is highly dependent on the content they broadcast: Broadly speaking, it tends to be negative when relevant information is crowded out by unrelated content (entertainment, for short).⁴ This is mediated, however, by how the media technology interacts with personal characteristics and individual consumption choices as well as by the contextual environment.

We then focus on a specific kind of information, related to coordination. We cover both the more immediate coordination aspect, by which individuals can directly exchange information related to participation in collective action, and the more indirect one, whereby individuals learn and coordinate over what is socially acceptable. Broadly speaking, the evidence shows quite clearly that media play a significant role in facilitating coordination, and especially so in the case of the Internet and social media. This can again serve benign or destructive ends, and the role of media in affecting perceptions of social acceptability is particularly important.

We finish our survey with a brief discussion of the role of homophily in different media environments—namely, the degree to which individuals are likely to be connected to others that are relatively similar to themselves—and how it affects the media’s impact on social capital. Whereas the networks formed by media consumption tend toward homophily, given the preferences for like-minded content, the evidence shows that this is particularly salient in the case of the Internet and social media due to self-selection and to the role of algorithms. The impact can be again distinct across different kinds of collective action, as homophily could foster bonding social capital within groups while detracting from bridging social capital between them, as per Putnam’s (2000) distinction.

Our survey is meant to be concise as opposed to comprehensive, for reasons of space and scope. It is thus important to emphasize its confines. First, although the study of social capital (and of media, for that matter) is inherently multidisciplinary, we will focus on work in the field of economics. We will also mention contributions from other disciplines, particularly as they relate to some of the results and ideas we cover, but they are not our main focus. Second, we will focus on the empirical literature, but we will draw on some of the existing applied theoretical work to sketch a simple conceptual framework that can help us organize our discussion. Finally, we cannot do full justice to the sheer volume of work in related areas, although we try to cover enough ground that the interested reader can branch out from the references included here into different directions.

The remainder of the article is organized as follows. Section 2 describes the conceptual framework and the key takeaways from it, and Section 3 describes the motivating evidence. Section 4 surveys the literature on the role of informational content, Section 5 looks at the role of coordination, and Section 6 focuses on homophily. Section 7 concludes.

2. A SIMPLE CONCEPTUAL FRAMEWORK

We start by laying out a conceptual framework that allows us to consider the impact of information and coordination on collective action. More than to derive specific predictions, which would not

³Using novel survey data for over half a million respondents in Italy, Durante et al. (2021) show that social participation, political participation, and trust in others indeed emerge as three clearly distinct components, which explain most of the variation in social capital and correlate very differently with a range of individual characteristics.

⁴The importance of crowding out in conditioning the impact of media technologies is common across a number of different domains, as highlighted by DellaVigna & La Ferrara (2015).

do justice to the vast array of possibilities reflected in the literature, this will be helpful to highlight key forces on which to focus in surveying that literature.

For simplicity, we use the term “project” as a shorthand for the collective action under consideration—be it a public demonstration, the formation of a labor union or neighborhood association, or similar. The project will succeed only if enough people decide to participate, which poses a problem for each potential participant: Will enough people join that it will make sense to pay the cost of participation?⁵

2.1. Model

Following Barbera & Jackson (2020), consider a continuum of citizens, indexed by $i \in [0, 1]$, who choose to participate or not, with the project being successful if and only if at least a fraction $q \in (0, 1]$ join. We can normalize the payoff from not joining at zero, assuming that it is the same regardless of the success or failure of the project.⁶ The payoff from participating, in contrast, is given by θ_i in case of success, capturing the personal benefit of membership in a successful project, and by $-C < 0$ in case of failure, capturing the cost of being part of a failed effort. θ_i can assume two values, $\theta_H > \theta_L$, summarizing the heterogeneity in preferences regarding the project, so that C can be assumed constant across individuals without loss of generality. There are two states of the world: high (with probability π), in which the share of H types is $z > q > 1/2$, and low (with probability $1 - \pi$), where that share is $1 - z < 1/2$. We can interpret those as situations with relatively strong and weak underlying preferences for the collective action in the population.

The key assumptions are that the individual type is private information—that is, individuals do not directly observe other citizens’ types—and that the state of the world is not directly observed. Instead, individuals form a posterior belief on the probability of the high state upon observing their own type. In this simple model, H types infer that the probability of being in the high state is

$$\frac{\pi z}{\pi z + (1 - \pi)(1 - z)}. \quad 1.$$

This illustrates that the parameter z captures the correlation between individual preferences: A high z allows each individual to figure out with high confidence what the state of the world is, based on their knowledge of their own type.

Such a game obviously has multiple equilibria, as usual with coordination games, and some of these have participation: For some parameter values, there exists an equilibrium in pure strategies in which all H types participate. Following Barbera & Jackson (2020), we focus on those cases. To characterize such equilibria, let $p(\theta_i)$ be i ’s belief that at least a fraction q of agents will join the collective action, if i has observed θ_i . Then the expected payoff from participation is $p(\theta_i)\theta_i - [1 - p(\theta_i)]C$, and it follows that the individual will participate if and only if

$$p(\theta_i) \geq \frac{C}{\theta_i + C}. \quad 2.$$

⁵This framing emphasizes the aspect of strategic complementarity in collective action, but there could also be substitutability: An individual may be less likely to participate if others are already taking on the cost of acting, according to standard free-rider logic (e.g., Olson 1965). We take this approach for simplicity, as it seems useful as a framework to understand the evidence we will discuss. Yet our evidence does not adjudicate between the overall weight of those different forces. For a discussion, and for some empirical evidence on the importance of substitutability, readers are referred to Cantoni et al. (2019).

⁶As discussed by Barbera & Jackson (2020), we can assume that success and failure have different payoffs beyond individual participation, but such a game is strategically equivalent to one where those are the same. This is because each individual has an infinitesimal impact on success or failure, and therefore the only thing that matters for their decision is the personal costs and benefits of participation.

Given Equation 1, there exists an equilibrium in which all H types participate if and only if

$$\frac{\theta_H}{C} \geq \frac{(1 - \pi)(1 - z)}{\pi z}. \quad 3.$$

Note that two things are required for such an equilibrium. First, it must be that the number of interested individuals, in the high interest state, needs to be sufficiently high that the project will succeed ($z > q$); otherwise, it would never make sense for H types to join and fail with certainty. Second, beliefs must place a sufficiently high weight on the high interest state in which the project is successful, that is, πz needs to be relatively high, as captured by Equation 3. In other words, as long as the likelihood of success is sufficiently high (i.e., q is not too large), the probability of being in a state of high interest matters, as given by π , as well as the correlation between type and state—that is, how likely it is that the type matches the state, as given by z . In that case, observing one's own high type makes one confident that others will show up as well.

2.2. Key Lessons

The importance of information/coordination is already evident in the role of π and z : It matters how confident agents can be that they are in the high state of the world and how much they can expect others to share their own preferences.⁷

To see this more clearly, consider what happens when each agent, besides observing their own type, gets to observe that of another (randomly drawn) agent. This naturally affects the posterior probability of a high state. Specifically, if a type- H agent sees another H -type, that reinforces the perceived probability of a high state, which goes from Equation 1 to

$$\frac{\pi z^2}{\pi z^2 + (1 - \pi)(1 - z)^2}. \quad 4.$$

However, if they see a type- L , that observation cancels out the realization of their own type, such that the probability of a high state goes back to π .

What does this mean for the role of the media in the diffusion of information? It immediately highlights the importance of the content of that information. For instance, imagine that the media are more likely to expose their audience to L -types, perhaps because they broadcast entertainment content unrelated to collective action, inducing viewers to infer low levels of interest in such action. Either this is perfectly known, and the media signals are uninformative, or it will tend to depress the likelihood of participation in the collective action. Importantly, this is amplified because even H -types who are exposed to other H -types will have their incentive for participation depressed, as they know that others will be exposed to L -types and will thus be less likely to participate themselves. In fact, it may be the case that the collective action would have occurred if agents had not been able to observe another agent's type, but it fails to occur when they do observe it. By the same token, the converse may also be true, as long as H -types are sufficiently likely to observe other H -types.

In short, the first key lesson is: The role of media in spreading information may facilitate or hinder collective action, depending on the content of that information.

Yet the model so far considers a rather limited form of information transmission: Each agent gets to observe a single individual's type. However, a more effective media technology, in terms of facilitating information/coordination, could be thought of as allowing for the observation of many

⁷We are leaving aside the role of collective action itself as a provider/aggregator of information—for example, the fact that the occurrence of public protest serves as a signal of preferences and/or information held by participants (see, e.g., Battaglini 2017 or Ekmekci & Lauer mann 2020).

other agents' types. In that case, it can be shown that, if the number of randomly drawn signals observed is large enough, there is an equilibrium in which H -types choose to participate as long as a sufficiently large fraction of the types they get to observe are also H -types (Barbera & Jackson 2020). What is more, as the number of signals increases, the fraction of H -types participating goes to one in the high state and to zero in the low state: Information eventually enables efficient collective action.

In other words, there is a second key lesson: The effectiveness of the media in spreading information eventually facilitates collective action.

Yet this has been predicated based on observations randomly drawn from the population. In practice, however, this is unlikely to be true, even leaving aside exogenous media bias. After all, the networks through which the information gets diffused often tend to display what the literature on networks refers to as homophily: An individual is disproportionately likely to be exposed to other individuals who are similar to them.

This is also easy to incorporate in our simple framework by considering that there is a fraction b of matches that would have been between different types under random drawing but are instead within the same type (H - H or L - L). Homophily (measured by b) makes matches less informative about the true state of the world: Meeting an individual with the same type tells one less about the type's prevalence in the world at large. This entails that agents update their beliefs less upon meeting their own type, as long as they understand the true degree of homophily (Golub & Jackson 2012). This weakens the impact of information, but given that the impact of information on collective action can be ambiguous at low levels, as per our first key lesson, the same can be true for homophily.

Yet homophily could impact collective action beyond this relatively simple setup. To the extent that coordination could be easier within types, additional exposure to same-type individuals could actually enhance collective action. What is more, when agents underestimate its true degree, homophily can make them overconfident: They are likely to meet their own type and overinterpret that as evidence about the state of the world. This could also facilitate collective action within homophilic networks, with H -types interpreting their disproportionate number of encounters with other H -types as a feature of the broader population.

We thus have our third key lesson: Homophily in social networks dampens the effect of information on collective action but may also facilitate it, especially when misperceived (i.e., underestimated).

In sum, to understand the impact of different media technologies on social capital, we first need to consider the extent to which they expand access to information relevant to collective action, as opposed to entertainment. Expanding access to information may help or hinder collective action, depending on the content of the information acquired, but eventually allowing individuals to communicate and learn from others facilitates collective action. Second, we need to take into account the degree of homophily in the networks formed by a given technology and how it is perceived.

3. SOME MOTIVATING EVIDENCE

A natural starting point for considering the interplay between new media technologies and social capital is to look at survey evidence that allows us to link (different kinds of) social capital with the two most recent transformations of the media environment, each with very different bundles of information/coordination/entertainment: TV and the Internet.

We use individual-level data on social capital from the Integrated Values Surveys (IVS). This data set combines information from two large-scale, cross-national survey programs, the European Values Study and the World Values Survey. We restrict attention to respondents in 36 OECD

countries over the period 1990–2020, which allows us to obtain a fairly balanced representation across countries and over time.⁸ Our final sample includes 197,547 individuals for whom we have information on several dimensions of social capital—from group membership to political interest and activity to generalized trust—plus a large array of individual socioeconomic characteristics. We match this information with country-year level data on TV and Internet penetration from the International Telecommunication Union (ITU) World Communication/ICT Indicators Database.⁹

In what follows, we report separately the estimated coefficients of TV and Internet penetration on different measures of social capital, based on specifications that include country fixed effects and continent-wide time trends as well as individual respondent characteristics (age, gender, education, and marital and employment status). Clearly, the estimates should not be interpreted as causal, given the many unobservable correlates that potentially characterize the relationship. Nevertheless, they represent an interesting first step toward understanding the role played by different media on measures of social capital and serve as illustrative motivating evidence.

We start by constructing a broad measure of social capital that summarizes the different dimensions that we consider. Specifically, for each individual we calculate the average across a number of indicator variables that capture group membership (in trade unions, parties, and professional, cultural, and religious organizations); political participation (signing a petition or participating in a boycott, a political demonstration, or a strike); and self-reported political interest.¹⁰ **Figure 1** plots the TV and Internet penetration coefficients, with 95% confidence intervals from standard errors double-clustered at the continent and year level. On average, Internet penetration is associated with an increased level of social capital, whereas TV penetration appears to be largely uncorrelated. This seems *prima facie* consistent with the possibility that the Internet is a more effective vehicle for the transmission of information and coordination among citizens, thereby facilitating collective action.

The “Internet” label is blending together two very different technologies. Compared to its original incarnation, the subsequent introduction and widespread use of social media greatly reduced the barriers to individual production of content, thereby expanding access to information and, especially, pushing the role of coordination to the forefront. On the other hand, as we discuss below, social media appear to be particularly prone to homophily in the diffusion of information. **Figure 1** therefore breaks the average Internet effect into separate pre- and post-social media components.¹¹ We can see that the positive association between Internet and social capital is entirely driven by the pre-social media environment, consistent with the idea that the added homophily induced by social media may indeed slow down the impact of increased information.

⁸All countries are represented in at least three waves, with some countries—like Germany, Spain, and Turkey—covered by as many as six waves.

⁹ICT stands for information and communication technologies. ITU data on Internet penetration were retrieved from the World Bank website at <https://data.worldbank.org/indicator/IT.NET.USER.ZS>. The data are available for the period 1990–2020 and refer to the percentage of individuals who have used fixed or mobile Internet in the previous 3 months. Data on TV penetration were retrieved from the NationMaster website at <https://www.nationmaster.com/country-info/stats/Media/Households-with-television>. The data refer to the percentage of households with TV and are available for the period 1975–2005. We impute the 2005 value to all subsequent years, but results are similar if we restrict the analysis to the pre-2005 period.

¹⁰Results are both qualitatively and quantitatively similar if we consider the first principal component of these dimensions instead of the simple average.

¹¹In particular, for each country we identify the year in which Facebook became available in the language of the country—using data kindly provided by Leopoldo Fergusson (see Fergusson & Molina 2021)—thus defining indicator variables for pre- and post-social media periods.

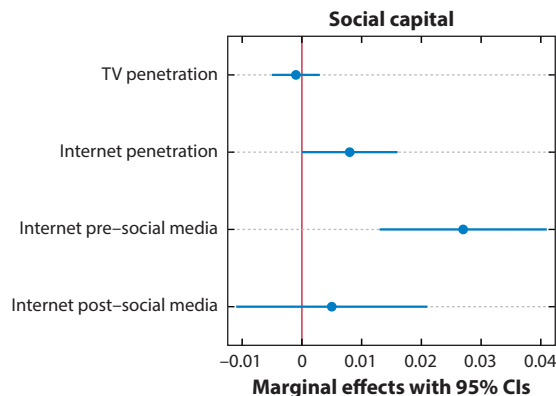


Figure 1

Aggregate measure of social capital, TV, and Internet penetration. The figure plots the coefficients from two separate regressions of our broad measure of social capital on TV and Internet penetration. Internet pre-social media (Internet post-social media) is the interaction between Internet penetration and a dummy equal to one for the period before (after) the year in which Facebook became available in the language of the country of the respondent. The specification includes country and continent \times year fixed effects, plus age, gender, education, marriage, and employment status of the respondent. The associated 95% confidence intervals (CIs) are based on standard errors double-clustered at the continent and year levels.

Still, **Figure 1** paints with a rather coarse brush. In particular, this broad measure of social capital combines very different modes of collective action, which may entail different degrees of individual engagement. To capture this aspect, we split the aggregate variable into its different components. First, there is the actual membership in groups such as political, cultural, professional, or religious organizations. This entails a more significant and sustained (and presumably costlier) engagement in a collective enterprise. Within these types of organizations, we can further distinguish those that are more political in their nature, such as parties and labor unions. This political membership can in turn be compared with arguably weaker forms of political action, which range from signing a petition to attending a political demonstration or participating in a boycott. Finally, we can contrast those with an even weaker interest in politics that does not entail collective action per se but can help capture the diffusion of relevant information.

Figure 2 displays how the media technologies correlate with these different types of social capital. It is immediately apparent that the pattern in **Figure 1** hides a more nuanced set of correlations. When it comes to the post-social media Internet, what under the aggregate measure looked like the absence of a relationship hides in fact two divergent patterns: a positive association with weaker forms of action and a negative association with forms of action that imply greater commitment. This might suggest that the easy access to information and the enhanced possibilities for coordination provided by online social media can spur political interest and action, but this does not necessarily translate, on average, into the stronger and more sustained engagement that membership entails. In fact, it could be that the enhanced access to other kinds of information and entertainment increases the opportunity costs of such engagement.

As for TV penetration, while this does not appear to have much of a relationship with the costlier forms of social capital like group membership—for which the estimated effect is very close to zero—there is a hint of a negative association with the weaker forms of collective action, as captured by our measure of political activity. This is consistent with the ideas that TV represents a weaker mechanism for coordination and that the expansion of politically relevant information it provides is insufficient to balance the expanded entertainment opportunities it offers.

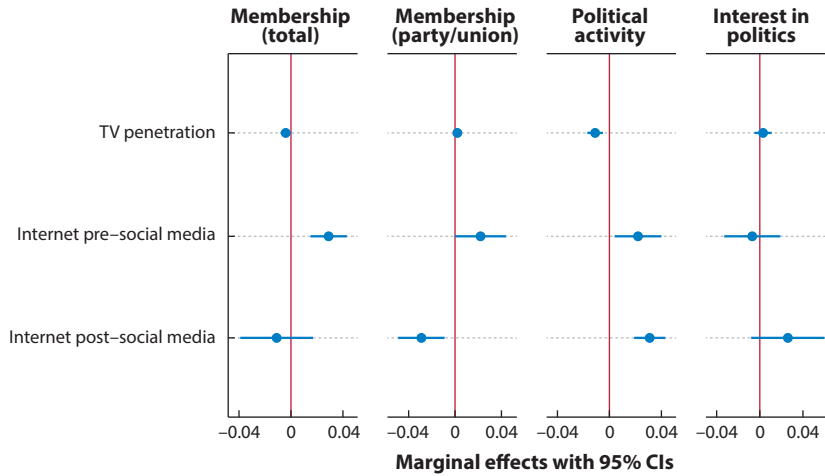


Figure 2

Dimensions of social capital, TV, and Internet penetration. Membership (total) is the average individual response to the following questions (classified as indicator variables): “Do you belong to any of the following voluntary organizations: trade union; party; professional/cultural/religious organization?” Membership (party/union) restricts to answers about individual membership in trade unions and parties. Political activity is the average individual response to the following questions (classified as indicator variables): “Which of the following political actions have you ever done: signing a petition; participating in a boycott; participating in a political demonstration; joining a strike?” Interest in politics is an indicator variable equal to one for individuals who report to be “somewhat” or “very interested” in politics, and zero otherwise. Abbreviation: CI, confidence interval.

The nuanced relationship between media and social capital is put into stark relief when we look at yet another outcome at the heart of discussions pertaining to social capital: generalized trust. Trust is what enables cooperation in pursuing collective action, and in this sense social capital can be understood as deeply intertwined with trust (Ostrom & Ahn 2009). **Figure 3** displays a pattern similar to the one in **Figure 1** in terms of a small negative relationship with TV penetration. In

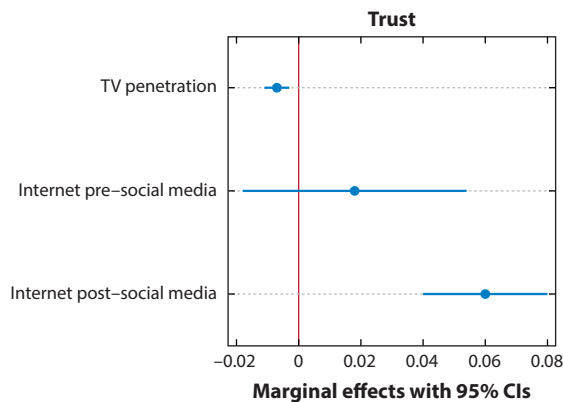


Figure 3

Trust, TV, and Internet penetration—overall and different technologies. Trust is an indicator variable equal to one for individuals who agree that “Most people can be trusted” and to zero for those who agree that “You need to be very careful in dealing with people.” Abbreviation: CI, confidence interval.

contrast, the positive association between the Internet and trust is entirely driven by the social media era, matching the pattern for the weaker forms of engagement in **Figure 2**.

It is important to reiterate that none of these figures warrants any causal interpretation. By the same token, the possible interpretations for the correlations are speculative and far from exhaustive. Yet the key message from this motivating evidence underscores the lessons from the conceptual framework: rather than expecting a clear-cut relationship between media technologies and social capital, we should instead focus on how different kinds of technologies may affect different kinds of collective action and the trust that underpins them. That should vary with the content they broadcast, their effectiveness in coordination, and the kinds of networks they help form.

4. THE ROLE OF CONTENT

At a fundamental level, mass media certainly expand users' access to information, yet not all of that expanded access is of the sort that would enhance collective action. On the one hand, the availability of content related to social and political issues can facilitate citizens' engagement in various social and political activities. On the other hand, increased exposure to entertainment content can crowd out participation in such collective activities and ultimately affect individual attitudes toward others.¹² Given these concurrent forces, assessing the effects of media on different kinds of social capital is ultimately an empirical question, which a number of studies have investigated.

4.1. Social Engagement

Regarding social engagement, there is evidence that TV and radio reduce participation, which is consistent with crowding out by entertainment content. A seminal study is the one by Olken (2009), who exploits variations in signal reception across villages in Indonesia due to the presence of mountains as well as differences in the timing of the introduction of private TV channels in different areas of the country. The results indicate that increased signal reception—which leads to more TV and radio consumption—is associated with lower participation in neighborhood, school, and local financial associations. Additional evidence supporting the view that TV consumption crowds out interpersonal relationships is provided, for instance, by Bruni & Stanca (2008), who use data for a large sample of respondents to the World Values Survey.

The evidence on how the Internet affects social interactions is more varied. In the context of Germany, Bauernschuster et al. (2014) exploit a quasi-experiment due to a mistake of the state-owned telecommunication provider in the 1990s, which delayed access to broadband Internet for part of the population. The study documents no significant impact of access to broadband Internet on the propensity to spend time with family and friends or to participate in voluntary associations, but it does report an increase in cultural activities such as going to the theater, opera, and exhibitions. These results suggest that the (pre-social media) Internet, by facilitating access to information about certain socially oriented activities, may have favored rather than crowded out participation, though less so for more structured forms of engagement.

Geraci et al. (2018) study the same question for the United Kingdom using data from 2005 to 2018 and exploiting exogenous variation in signal quality induced by the preexisting telephone network. They find that better access to the Internet is negatively associated with participation in voluntary associations, whereas there is no significant effect on the likelihood of talking with

¹²The idea that different types of content may have opposite effects on social capital was put forth by Putnam (2000) in his discussion of the role of television in the decline of social capital in the United States.

neighbors, meeting friends, or attending cinemas or theaters. Interestingly, the negative effect on voluntary associations, again consistent with crowding out, holds for both the pre-social media and the post-social media period, though it is smaller in the latter.¹³

Direct evidence of the specific impact of social media emerges from a recent important contribution by Allcott et al. (2020). The study is based on a large-scale randomized experiment in which subjects were paid to deactivate their Facebook account for a month. The study examines the effect of the treatment on a wide range of outcomes, and one result that is especially relevant for our discussion is that, while their Facebook account was deactivated, individuals in the treatment group spent significantly more time with their families and friends compared to those in the control group. This finding supports the view that the use of social media can crowd out social interactions, including interactions with people in one's closest circle.¹⁴ This pattern is consistent with work in both economics and sociology that warns about the potentially negative effect of the Internet and social media on social relations, well-being, and even health outcomes (e.g., Kross et al. 2013, Hunt et al. 2018, Twenge et al. 2018, Braghieri et al. 2021).

Although their results are generally consistent with crowding out, the aforementioned papers cannot separate the effect of different types of content, due to the source of variation they exploit or to data limitations. One piece of evidence regarding the specific effect of entertainment content on social participation is provided by Durante et al. (2019). The authors study the persistent effect of the staggered introduction in Italy during the 1980s of the commercial TV network Mediaset, which only featured light entertainment shows. Their empirical strategy mirrors that of Olken (2009), exploiting differences in Mediaset signal intensity between municipalities within the same narrow area. They find that individuals exposed to Mediaset channels at a young age display lower levels of civic engagement as adults, measured by the likelihood to participate in voluntary associations.

4.2. Political Engagement

A larger body of work has examined the impact of media technologies on political engagement, with particular regard to voter turnout. On the more traditional end, there is evidence that newspaper presence increases political participation; using the timing of newspaper entry and exit at the local level, researchers have found evidence of this in the United States between 1869 and 1928 (Gentzkow et al. 2011) and in Italy between 1993 and 2010 (Drago et al. 2014).

Yet the picture can be more complex as well. For instance, experimental evidence shows that randomly assigning newspaper subscriptions for 10 weeks, in the context of the 2005 Virginia gubernatorial elections, had no tangible effect on turnout (Gerber et al. 2009). Although this could be due to the specific nature of the variation, even at a more aggregate level, Cagé (2020) finds that newspaper entry was associated with lower electoral turnout in France between 1944 and 2014. She attributes the result to increased competition that reduced newspaper profit margins, leading to cost-cutting reductions in political news coverage.

This once again highlights the crucial importance of the kind of content that the media are providing. In this regard, Snyder & Strömberg (2010) neatly document that it is indeed political content that influences turnout. Exploiting exogenous variation due to the differential overlap between electoral districts and media markets in the United States, they show that more extensive

¹³Relatedly, some studies have investigated the effect of access to broadband Internet on well-being and health outcomes. Examples include studies by McDool et al. (2020), Golin (2021), and Donati et al. (2021).

¹⁴There is some evidence that access to the Internet may also be detrimental to the self-reported quality of face-to-face interactions with friends (see, e.g., Rotondi et al. 2017 for Italy).

news coverage of local House members increases voters' knowledge of their representative and aggregate turnout in House elections (relative to concurrent presidential elections).¹⁵

Other studies have explored the effect of other legacy media, such as radio and TV, on political participation. Strömberg (2004) looks at the introduction of the radio in the United States in the 1920s and 1930s, finding that counties with a larger share of radio listeners displayed higher rates of turnout in gubernatorial elections. A different picture emerges, however, from the advent of TV: Using variation across markets in the timing of TV introduction in the United States after World War II, Gentzkow (2006) documents that access to TV significantly contributed to the sharp decline of voter turnout during the 1950–1990 period, particularly in local elections.

What explains the different impact of these two media technologies? Again, the culprit seems to be the different way in which they affected the balance of information and entertainment in the average viewer's media diet. Whereas both decreased the cost to access political information, TV brought an unprecedented amount of entertainment content, encouraging users to substitute the former for the latter.¹⁶ Direct evidence of this crowding-out effect comes from Ellingsen & Hernæs (2018). In the same spirit as Durante et al. (2019), they study the introduction of entertainment-only cable TV channels in Norway and show that earlier access to cable TV was associated with a significant decline in turnout in local elections, particularly for less-educated individuals.

The interplay between different types of content may be more nuanced, and in some cases, some complementarities may emerge. An interesting example is discussed by Prat & Strömberg (2005), who examine the impact of the entry of commercial TV in Sweden and find that individuals who started watching the new channels became more politically aware and likely to vote. The effect is stronger for individuals who were ex ante less informed, which suggests that, when entertainment and information content are bundled together, viewers attracted by the former may be accidentally exposed to the latter.¹⁷

Other papers have studied the impact of media content in the shape of partisan news bias. In their influential work on the effect of conservative cable channel Fox News on US elections, DellaVigna & Kaplan (2007) find that access to Fox News was associated with increased turnout by Republicans, particularly in Democratic strongholds, a result that attests to the ability of (biased) news content to mobilize voters.¹⁸ Along the same lines, looking at Russia, Enikolopov et al. (2011) find that exposure to the independent TV channel NTV, which was critical of then-prime minister Putin, had a significant negative effect on turnout, arguably demobilizing voters that would have otherwise supported Putin and his party.

Other studies have looked at the impact of the Internet on political participation.¹⁹ There is some evidence of an initial negative impact of high-speed Internet on turnout. For instance, Falck et al. (2014) provide such evidence for (West) Germany, using variation from the preexisting voice

¹⁵Schulhofer-Wohl & Garrido (2013) find consistent effects on both coverage and turnout of the closure of the *Cincinnati Post*.

¹⁶In some cases, the information potential of TV may dominate. An interesting example is discussed by Oberholzer-Gee & Waldfogel (2009), who document that the availability of Spanish-language TV news content positively affected Hispanic minority turnout in US elections.

¹⁷Relatedly, Prior (2007) argues that, by unbundling different types of content and allowing individuals to sort more efficiently into their preferred ones, cable TV, and even more so the Internet, has reduced the scope for such accidental exposure.

¹⁸In their follow-up study on Fox News, Martin & Yurukoglu (2017) find no significant effect of Fox News viewership (instrumented using cable channel positions) on turnout.

¹⁹Enikolopov et al. (2020) provide an excellent review of recent work on Internet and political outcomes, with a special focus on social media.

telecommunication network, which affected the cost of providing high-speed Internet services to different localities.²⁰ Gavazza et al. (2019) find similar results for the United Kingdom, using rainfall intensity as a source of variation in the cost of maintaining broadband infrastructure.²¹ In both cases, the papers document that the Internet crowded out consumption of other media (TV, radio, and newspapers) that provided a greater news component relative to entertainment. Importantly, however, Gavazza et al. (2019) find that the pattern applies only to the young and the least well-off, whereas older and wealthier individuals are likely to use the Internet to inform themselves about local issues. This highlights the possibility that the same technology may trigger different dynamics depending on the specific inclinations of each individual and amplify preexisting cleavages.

The impact of the Internet on political participation, however, may change over a longer time period. Campante et al. (2017) analyze how the Internet affected political outcomes in Italy over the nearly two decades between 1994 and 2013. In the short run, access to the Internet was associated with a decline in voting turnout, driven by previously engaged voters becoming disillusioned with the system and dropping out of electoral politics.²² In the longer run, however, this effect gradually reversed as the supply side of politics reacted, and new political entrepreneurs used the Internet to enter the political arena and remobilize disenchanted voters. This underscores the importance of content, or who gets to broadcast information through the media.

More recent work has looked more directly at the social media era, focusing on the expansion of mobile Internet. Evidence from South Africa between 2006 and 2016 (Donati 2019), using terrain ruggedness for identification, shows a positive effect on turnout (and lower support for incumbents), suggesting that improved access to information may lead to more accountability. Yet a broader study by Guriev et al. (2021), using longitudinal subnational data from 33 European countries between 2007 and 2018, shows that better access to mobile Internet reduced turnout and trust in government, arguably driven by voters' increased awareness of government corruption. This underscores that the media environment and the political context can interact in complex ways in affecting political engagement.

4.3. Interpersonal Trust

The literature has also studied how information spread through mass media can influence interpersonal trust.

For instance, in his aforementioned study on Indonesia, Olken (2009) finds that respondents in villages with better access to TV and radio report significantly lower levels of generalized trust in others (i.e., "people in general") as well as in their fellow villagers. On the same issue, but with regard to the effect of the Internet, Geraci et al. (2018), also mentioned above, find no significant association between access to broadband Internet and trust in others in the United Kingdom. Because data on trust are available only for the period 2005–2008, this result only applies to pre-social media Internet.

²⁰Using similar data and empirical strategy, Czernich (2012) finds instead no significant relationship between broadband access and turnout when instrumenting the former using distance to the nearest voice network exchanger.

²¹The decline in electoral participation they observe is consistent with evidence from Geraci et al. (2018) that access to broadband Internet is negatively associated with membership in political parties and unions. Yet Miner (2015) finds no significant effect on turnout in Malaysia, and Larcinese & Miner (2018) and Jaber (2013) find evidence of positive effects on turnout and campaign contributions in the United States.

²²A similar situation is discussed by Perilla (2019), who finds that access to the Internet in Colombia is associated with lower turnout due not to people's becoming less informed, but, to the contrary, to their becoming more aware of the (mis)conduct of their politicians, less trustful of institutions, and more disengaged.

Looking directly at the role of social media, Antoci et al. (2019) present the results of an online experiment in which 412 Facebook users were randomly assigned to be exposed to one of three types of content: (a) uncivil comments on divisive topics, (b) healthy and civil discussions, and (c) neutral discussions (control group). Subjects who experienced civil interactions displayed a higher level of trust in others (measured using a standard trust game) compared to the control group, whereas exposure to uncivil interactions had no significant impact on trust. This highlights, yet again, the importance of content.

A substantial part of this literature has focused on the particularly important issue, from a policy perspective, of trust across different ethnic groups. One example is the work of Blouin & Mukand (2019). Looking at post-genocide Rwanda, they exploit topography-induced variation in the signal intensity of government-controlled station Radio Rwanda to study how exposure to reconciliation messages broadcast by the station affects the ability to cooperate with and trust people from other ethnicities. The results of their lab-in-the-field experiments indicate a significant and sizeable positive effect of radio messages on inter-ethnic trust, which confirms the subtle but powerful influence that media content can have on listeners' attitudes.

The power of content is illustrated in a particularly stark fashion in instances in which media are used to fuel animosity between groups. A prominent example is offered by Yanagizawa-Drott (2014), who uses a strategy similar to Olken's (2009) to show that hate messages against the Tutsi minority, broadcast on the radio, contributed to the widespread violence perpetrated by the Hutu majority during the 1994 genocide. Similar results, also using variation in signal intensity, hold for radio exposure and anti-Semitism in the 1930s. They have been found both in Nazi Germany (Adena et al. 2015)—with a stronger effect in areas traditionally hostile to Jews, suggesting that media content can activate latent animosity—and in the United States, with the anti-Semitic populist preacher Father Coughlin (Wang 2021). Even unintentional exposure can have such an impact, as shown by DellaVigna et al. (2014) in their study of Croatians exposed to Serbian nationalistic radio content. By the same token, content that is *prima facie* meant for entertainment can have the same kind of impact, as illustrated by recent studies showing the short- and long-term effects of the openly racist 1915 blockbuster movie *The Birth of a Nation* on violence and discrimination against Black Americans in the United States (Ang 2020, Esposito et al. 2021).

4.4. Summary

The weight of the evidence underscores the idea that the impact of media technologies on different outcomes related to social capital hinges on the nature of the content they bring. Broadly speaking, when content is tilted toward entertainment it tends to crowd out social and political engagement, whereas increases in the consumption of relevant information tend to increase that engagement.

Importantly, this need not be interpreted as implying that some kinds of content are inherently good or bad, even from the narrow standpoint of whether and how they affect social capital. First, the effects depend on individual characteristics and contextual features, which means that the same content can lead to different responses from different people in different situations. Second, and just as importantly, increased social and political engagement can also lead to destructive outcomes.

5. THE ROLE OF COORDINATION

There is one specific kind of informational content that is particularly relevant for collective action: information about the beliefs and behavior of others. While any content arguably speaks to that at some level, it is clear that there is potentially a distinct role for media technologies in directly facilitating coordination toward collective action.

This is true to some extent of any media technology, of course, but it is particularly salient in the case of the Internet. The Internet has revolutionized the way people communicate with each other, allowing them to bypass the gatekeepers typical of the functioning of legacy media. Since the early stages of the Internet, diffusion tools such as blogs or mailing lists have allowed people to share information. Still, social media platforms have further boosted this ability, allowing ordinary citizens to instantaneously share information and content with large numbers of users at a negligible cost. In the context of this most recent transformation in the media environment, the study of this particular role of the media has become especially relevant.

The issue of coordination is perhaps most salient when it comes to political protest. Protest constitutes a canonical example of collective action in which one's willingness to act depends very crucially on the expectation of what others will think or do, as the costs and benefits of participation can be heavily affected by the number of people who show up.²³ It is hence not surprising that the impact of new media on protests has been the topic of several recent studies.

One example is provided by Manacorda & Tesei (2020), who use geo-referenced data for Africa over the period 1998–2012 to study the effects of expanded access to mobile phones. Importantly, the context refers to 2G mobile technology, which means that voice and text communications are the central uses, as opposed to Internet access. They find an increased mobilization of citizens to participate in anti-government protests, but only in a context of economic downturn, when reasons for grievance emerge and the opportunity cost to participate falls. The authors attribute this result to a combination of enhanced information and enhanced coordination, as information becomes more easily available both about economic conditions and about the participation and intentions of others with respect to the protests.²⁴

As for the role of the Internet, and social media in particular, *prima facie* evidence comes from Acemoglu et al. (2018), who document that the volume of messages published on Twitter predicted participation in protests in Egypt during the Arab Spring. Similar findings are available from Steinert-Threlkeld (2017), who uses data on protests in 16 North African and Middle Eastern countries between 2010 and 2011.

This begs the question of whether any association between more intense social media activity and higher protest participation is driven by coordination or by the diffusion of information more broadly. A recent study by Enikolopov et al. (2020) tackles precisely this question. The authors examine the impact of the online social media platform VK on participation in protests against the Putin regime across Russia in 2011; they use variation in the city of origin of university classmates of VK's founder, which was associated with early and persistent adoption, to address the possible endogeneity of VK penetration. The latter was associated with a large increase in the probability and size of protests, but it was not associated with lower support for the government. This supports the view that social media facilitated coordination itself, rather than spreading information critical of the government.

Fergusson & Molina (2021) take a more aggregate approach to exploring the link between online social media and political engagement, using data on a large number of countries over more than a decade. For identification, they exploit the arguably exogenous timing of the release of Facebook versions in different languages. In line with Enikolopov et al. (2020), they find that

²³Note that coordination is important both in the “think” (preferences) and the “do” (action) aspects—what Little (2016) terms, respectively, “political” and “tactical” coordination. His model highlights that more information always tends to facilitate the latter, if not the former.

²⁴Relatedly, Pierskalla & Hollenbach (2013) and Christensen & Garfias (2018) find consistent results regarding mobile phone coverage and violent conflict and protest.

access to Facebook had a significant positive effect on protests, but it had no impact on other forms of political engagement—consistent, again, with a key role for coordination.

The role of coordination goes beyond participation in protests, of course. For instance, Campante et al. (2017) find, in their study on Italy, that access to broadband Internet favored the emergence of local online grassroots movements organized through the Meetup.com platform. These groups allowed local participants to voice their dissatisfaction and coordinate with like-minded individuals, and they would later spur the emergence of the populist Five Star Movement.

This evidence supports the view that the role of media technologies, and of the Internet and social media in particular, as coordination devices for collective action entails a positive impact of such technologies on social capital. Yet, as was the case in our discussion on content, it is also true that the coordinating power of media can support less benign outcomes.

In his work on Rwanda, Yanagizawa-Drott (2014) finds that radio messages were more effective at spurring collective acts of violence (i.e., involving the coordinated action of multiple perpetrators) rather than individual violence. One possible interpretation is that the radio provided Hutu listeners with practical information regarding the location of potential victims and of ongoing anti-Tutsi attacks they could join, thereby highlighting the coordination aspect.

Similarly, social media can also be a powerful tool for spreading ethnic hatred and for coordinating actions against members of other groups. A recent study by Bursztyn et al. (2020a) delves into this issue. Using the same identification strategy as Enikolopov et al. (2020), the authors document a significant positive impact of social media on ethnic hate crimes and xenophobic attitudes in Russia. The effect appears to be driven by a combination of coordination (i.e., larger effect on collective crimes) and persuasion (i.e., people becoming more xenophobic). Evidence from Germany (Müller & Schwarz 2021), in the context of the country's large influx of refugees in 2015, confirms this pattern: The volume of anti-refugee messages published on Facebook predicted crimes against refugees, and improved coordination was the likely mechanism.

A related yet more subtle form of coordination, which is particularly important for the less benign forms of action, has to do with individual perceptions of what others think about those actions, that is, whether they are socially acceptable. That can naturally also be impacted by media.²⁵ Müller & Schwarz (2020) provide evidence on how that can facilitate violent action, focusing on social media in the United States during Donald Trump's rise to power. Using an instrumental variable approach, they find that counties with higher Twitter usage experienced significantly more hate crimes against Muslims, and that such crimes were especially likely to occur in the days following Trump's tweets about Muslim-related topics. In this case, direct coordination does not seem to be the relevant mechanism, since most of these crimes were committed by isolated perpetrators. Yet one natural interpretation is that having high-ranked officials, such as the president, overtly attack a minority group may affect people's beliefs about how acceptable the majority of the population may consider that action.²⁶

All in all, the message from the literature is quite clear: Media play a significant role in facilitating direct coordination toward collective action, and the Internet, in its social media incarnation, is especially effective at that. As is the case with the role of content more broadly, this can be applied toward benign or destructive ends, which brings to the forefront the indirect aspect of coordination around social acceptability. In this regard, social media are not necessarily special, except

²⁵There is extensive evidence showing that second-order beliefs—namely, beliefs about belief—can have tangible effects on actual behavior (Bursztyn et al. 2020c,d; Bursztyn & Yang 2022).

²⁶This is consistent with the findings from the experiment described by Bursztyn et al. (2020b), which show that Donald Trump's rise in popularity and eventual victory increased individuals' willingness to publicly express xenophobic views and decreased the likelihood of incurring sanctions for doing so.

insofar as they allow more individuals to become content providers and to form networks with distinct characteristics. It is to those media-formed networks, and how they affect social capital, that we now turn.

6. THE ROLE OF HOMOPHILY

As discussed above, media can affect social capital either through content or by facilitating coordination. Both channels pertain to the provision of information, either about facts or about others' actions and/or beliefs. Yet a key aspect of media is that individuals choose what sources to consume and hence what kinds of content they expose themselves to. In addition to the information versus entertainment dichotomy discussed in Section 4, another dimension relates to the networks formed by media consumption.

In particular, it is widely recognized that people tend to prefer content that confirms their priors (i.e., that is like-minded or pro-attitudinal) and to avoid information that challenges them (i.e., to have confirmation bias).²⁷ This will naturally lead to homophily in the networks associated with the diffusion of media content, which, as clarified by our conceptual framework, will mediate the impact of media on collective action.²⁸ The individual choice of content is obviously constrained by media technology: One's ability to sort into like-minded content depends on the number of available options and on the nature of the specific content they provide. This was evident in media technologies such as TV or the radio (Prior 2007, Durante & Knight 2012, Campante & Hojman 2013), yet the Internet has made it particularly salient.

The advent of the Internet has made it far easier to avoid counter-attitudinal information (Prior 2007). The risk of echo chambers in online environments was promptly recognized, as well as the associated risk of increased polarization of political views and attitudes (Sunstein 2001, 2007, 2017; Iyengar & Krupenkin 2018). On the other hand, the Internet has made it easier to access multiple news sources and more diverse opinions—say, by making it possible to consult multiple websites—which was not common with traditional media, with the implication that online news consumption need not be more segregated than other media environments (Gentzkow & Shapiro 2011).

The subsequent evolution of the Internet, with the diffusion of social media and the increased personalization of the search results, has further transformed this scenario. In this context, users' preferences for sorting into like-minded content can be amplified by technological features, such as algorithmic biases built into search engines and social media news feeds, aimed at matching content to users' views. This entails the risk of creating so-called filter bubbles (Pariser 2011) where users are disproportionately exposed to such like-minded content, as has indeed been documented by a growing literature, though with some debate over the magnitude of the issue (Flaxman et al. 2016, Halberstam & Knight 2016, Guess & Coppock 2020, Peterson et al. 2021). At the same time, attitudes are not set in stone and can be influenced by exposure to more rather than less diverse information sources (Levy 2021).

As elaborated in the previous section, the Internet and social media also allow people to interact directly with others, creating individualized online communities. Here, too, individuals naturally tend to match themselves with people who share their own views, which induces further homophily in the associated networks and then feeds back into content through recommendations and news feeds.

²⁷For models exploring different reasons for that, readers are referred to Mullainathan & Shleifer (2005) and Gentzkow et al. (2016).

²⁸For a comprehensive discussion of the concept of homophily and of its presence in online social networks, readers may consult McPherson et al. (2001).

This is likely to have implications for coordination, collective action, and social capital. As described in our conceptual framework, homophily can blunt the effects of the spread of information through the population (Golub & Jackson 2012, Barbera & Jackson 2020), as each individual takes longer to learn information held by those who are different from them. While this can slow collective action, we also discussed two forces that may work in the opposite direction. First, there is the possibility that individuals, failing to recognize the homophily in their networks, will overestimate the prevalence of their own types in the population and will be more likely to engage in collective action than would have been the case with less homophily (Barbera & Jackson 2020).

In addition, the homogeneity within the different parts of the network could itself facilitate coordination within the smaller groups. This could happen, for instance, by facilitating mobilization through shared norms, goals, and aspirations.²⁹ This could certainly increase cooperation within those groups, at the same time as it makes cooperation across groups more difficult. To borrow from the distinction drawn by Putnam (2000), it could have a positive effect on bonding social capital but hinder the bridging variety. The implications of these dynamics could be far-reaching: Such forms of in-group tribalism (amplified by social media) could lead voters to turn away from universalistic values in favor of a more communitarian ideology and to increase their support for parties that advocate radical positions of in-group protection and exclusion of other groups (Manacorda et al. 2021); it could also lead to growing distrust between members of different parties (Iyengar et al. 2019).³⁰

In sum, there is substantial evidence that networks formed by media consumption tend to display homophily, given consumer preferences for pro-attitudinal content—and particularly so for social media, due both to choice in forming online communities and to algorithmic amplification. What does this imply when it comes to estimating the impact of media technologies on social capital? First, the estimated impact of an exogenous shock to access to a given technology has to be interpreted as conditional on the degree of homophily that is present in the relevant network. Yet this naturally begs the question of what is the specific impact of homophily itself, in the sense of increased exposure to like-minded content. On this front, Levy (2021) experimentally varies that exposure and shows that it amplifies affective polarization. The extent to which this affects social capital is an interesting question for future research.

7. CONCLUSION

The empirical literature in economics linking media and social capital is rich and diverse, and necessarily so given the many possible interactions between different media technologies and distinct facets of social capital. Still, it is possible to extract a few lessons from the work we have surveyed.

First, the impact of a given media technology on social capital hinges decisively on the content it provides and how this relates to collective action. In particular, expanded access to information is not sufficient, as more plentiful entertainment content can crowd out the consumption of

²⁹Alstott et al. (2014) provide supportive evidence of this, based on a field experiment on homophily and recruitment for social mobilization. The literature on the effect of diversity/homogeneity on collective action is extensive, particularly in the context of ethnic fractionalization [see the surveys by Van der Meer & Tolsma (2014) and Alesina & Ferrara (2005) on the sociological and economic literatures, respectively].

³⁰Indeed, a number of distinctive features of social media could contribute to promoting tribalism. Existing research shows, in particular, that emotionally charged content (Brady et al. 2017), false news (Vosoughi et al. 2018), and out-group animosity (Rathje et al. 2021) capture users' attention and generate engagement on social media platforms, thereby creating incentives for the production and sharing of content that appeals to such emotional feelings. On moral universalism and some of its links with social capital, Enke et al. (2021) find, for instance, that universalists tend to have smaller networks.

that information and hence reduce social and political engagement as well as interpersonal trust. Moreover, the impact depends on individual choices and contextual features, which further add to the set of possible connections.

Second, the media can foster collective action by facilitating coordination, with the Internet and social media being particularly effective in this respect. Such coordination can be direct, as individuals can share information about their actions and/or beliefs, but also indirect, as media content can affect perceptions of what is deemed to be socially acceptable. This is of particular importance in collective action of a destructive nature, underscoring the point that social capital is not necessarily put to benign uses only.

Third, there is substantial homophily in the networks created by media due to consumers' sorting into like-minded content and communities, and this is particularly true in the case of social media, where the sorting can be amplified by algorithms. This may affect the impact of media on social capital, and such impact could vary for different kinds of social capital and also depending on whether collective action takes place within or across more homogeneous groups and on whether homophily is properly recognized. Understanding the impact of homophily itself, however, remains an open question.

Many other directions for future research remain open. There is certainly scope for investigating outcomes related to different forms of social engagement, particularly in comparison with the larger literature on political participation. More granular evidence on what specific kinds of content may be more conducive to increasing social capital, and on how subgroups of individuals may be affected differently, would also add considerably to our understanding of the extent and nature of the interplay. Last but not least, looking at the downstream effects of social capital on variables of interest to economists—on policy and, ultimately, welfare—is also important. Many of the contributions we have surveyed make progress in these specific directions, but much remains to be learned.

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