SOCIAL NETWORK EFFECTS IN DEVELOPING COUNTRIES

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How do social networks influence and moderate electoral persuasion in developing countries? An extensive literature shows that social networks are important for understanding electoral persuasion in established democracies. At the same time, these theories might not necessarily apply to democracies in the developing world, particularly when they are characterized by clientelism, coercion, and other modes of political engagement outside of formal democratic institutions. In such contexts, networks can matter for politics in different, and sometimes unexpected, ways. In surveying the literature, we identify three general functions of networks that are important for understanding electoral persuasion behavior in developing countries: (i) information diffusion; (ii) social persuasion; and (iii) coordination and enforcement. We explore the implications of these network mechanisms by exploring the roles of both voter and politician networks.

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1 Introduction

Social networks are undoubtedly an important part of politics. In established democracies, social networks are associated with a host of positive outcomes, including increasing voter turnout, political interest and knowledge, and broader civic engagement (Sinclair 2012). However, in new democracies in the developing world, social networks can have different implications and effects on politics.

Indeed, social networks may play a particularly important role in politics in environments where programmatic parties are less developed or nonexistent, other institutions—including electoral institutions and media—are weak, and friends, family, and neighbors are the primary sources of political information and influence. Moreover, in many countries in the developing world, voters either have a direct connection with their local politicians or know someone who does. In fact, these direct and indirect connections are the basis for sustaining widespread clientelism—or longstanding relationships of political exchange—that characterize politics in many developing democracies. For example, drawing from Philippine data, almost 20 percent of survey respondents report knowing their mayor directly, while another 41 percent of respondents report an indirect link to the mayor through one intermediary (Cruz et al. 2017).

In places where social networks are dense and politicians or their intermediaries are situated at relatively short social distances from voters, networks serve a number of important functions across different spheres of interaction.[1] We focus on three main functions that are especially important for politics, particularly in the context of electoral persuasion: (i) information diffusion; (ii) social persuasion; and (iii) coordination and enforcement. This is not to say that these functions are all-encompassing, mutually exclusive, or easy to differentiate empirically, just that they are useful ways of conceptualizing the various channels through which social networks may influence politics in the developing world. In addition to the functions of networks for politics in

[1] See Chuang and Schechter (2015) for a comprehensive review.

the developing world, it is also useful to think about the implications of different types of networks in the contexts that we consider. We focus on how these functions mediate two types of networks: (i) voter networks; and (ii) politician networks, which include ties among politicians and ties between politicians and political intermediaries or brokers.

We focus primarily on studies where the effects of external factors are moderated by different types of individual and group relationships within a network. However, we also consider some studies that engage with the challenge of exogenously or endogenously varying network structures. To a large degree, we review the emerging literature leveraging creative research designs to overcome major empirical obstacles—including incomplete networks, common shocks, and reflection problems (e.g. Fafchamps 2015; Fowler et al. 2011)—that have made causal inference difficult in network settings.

2 Social networks in the developing world

At the most basic level, social networks are comprised of actors (nodes) and the relationships (ties) that connect them (Wasserman and Faust 1994). Actors can include individual voters, political intermediaries or brokers, and politicians, but also groups or organizations (Holland and Palmer-Rubin 2015). Relationships can include family ties (Arias et al. forthcoming; Cruz et al. 2017), friendships (Duarte et al. 2019), education and employment ties (Beaman 2012; Beaman and Magruder 2012; Gónzalez 2018), or modes of engagement such as informal interactions or membership in the same organization (Alatas et al. 2016). Although such relationships are often based on in-person interactions, recent revolutions in computer technologies have facilitated relationships sustained by mobile and online interactions (e.g. Enikolopov et al. 2017; Manacorda and Tesei 2016).

Relationships can also have a directional component. In a lending network, for example, the direction of the relationship is important because it denotes which individual is the lender and which

is the borrower, and thus characterizes relations of dependence. By contrast, bilateral relationships either do not have an implied directionality or the directionality is not relevant for the analysis. For example, family relationships may be considered bilateral when assessing information diffusion among relatives, while a study of information flow from different access points in a community would account for the directionality of these relationships. The extent to which directionality is important depends on the theoretical or empirical context.

In the developing world, these relationships can encompass a broader range of interactions and obligations. At the most general level, the different types of economic interactions, levels of urbanization, and forms of election campaigning imply different modes and intensities of interaction and dependence. Clientelism, for example, rests on the notion that informal economic transactions—including employment, insurance, or lending—or social interactions can convey obligations beyond what would be expected in the developed world, and often extend to the political sphere.[2] For example, Baland and Robinson (2008) provide evidence consistent with the informal contracts between landowners and tenant farmers establishing not only the expected agricultural output, but also the expected vote outcome before the introduction of the secret ballot reform in Chile.

The analysis of these networks has generally focused on the individual's position in the network, the relative position of two given individuals in the network, or the structural features of the network as a whole. We now provide a brief overview of how these core relationships are commonly measured.

2.1 Individual position within networks

When focusing on the position of a given individual (or node) within a network, researchers have generally focused their attention on an individual's centrality—an important way of conceptualizing influence. Measures of centrality range from simply counting ties to other nodes (in-degree and out-degree) to using fairly complex algorithms to compute the position of the node in the overall

[2]For an overview of the literature on clientelism, see Hicken (2011).

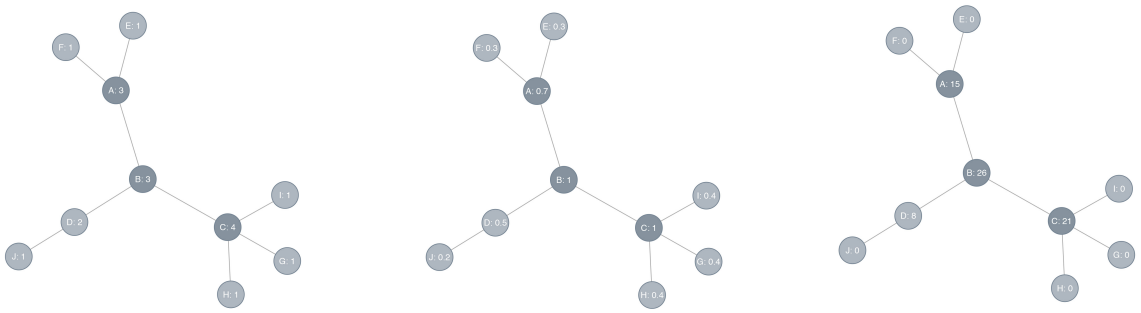
network (eigenvector and betweenness centrality). Each of these measures captures the relative connectivity of a node, either locally or globally, within a given network.

Degree centrality is the simplest measure, which counts a node's direct (or first degree) ties. In networks where the direction of the ties matter, in-degree centrality counts the number of ties pointing to the node, while out-degree counts the number of ties going from that node to others. These measures have the advantage of being easier to collect, and serving as proxies for moments of network graphs when information on the complete network is unavailable (see e.g. Cruz 2019 and Schaffer and Baker 2015 for the use of out-degree measures as proxies for the local importance of voters).

More sophisticated, and somewhat conceptually distinct, measures of centrality provide a greater amount of information about the position of individuals within their social network. *Eigenvector centrality* accounts not only for the node's number of ties, but also whether these ties are themselves highly-connected (Bonacich 1972, 1987; Jackson 2010). While computationally more intensive, eigenvector centrality is one of the most intuitive measures in that the centrality of a node is recursively defined in proportion to the centrality of its ties. *Betweenness centrality* is the extent to which the node serves to link different parts of the network, and is calculated as the share of the shortest paths between all nodes in the network that necessarily pass through that node (Freeman 1977).

Because of demanding data collection requirements needed to calculate these measures of centrality, which rely on or more or less complete network graphs, research using these types of measures generally relies on either detailed survey data (Banerjee et al. forthcoming; Duarte et al. 2019; Larson and Lewis 2017) or the use of large-scale administrative datasets (Alt et al. 2019; Arias et al. forthcoming; Cruz et al. 2017; Gónzalez 2018) to infer relationships.[3] Figure 1 provides an example of the degree, eigenvector, and betweenness centrality values for a sample network. It illustrates how the network centrality values can differ, despite the fact that they tend to

[3]This review concludes by discussing data issues in greater detail.



A) Degree-centrality values B) Eigenvector-centrality values C) Betweenness-centrality values

Figure 1: Network-centrality measures for the same network graph

be very correlated in practice. For example, the most central node in terms of degree centrality is node C, which has one more tie than node B. However, node C and B are almost equally central when measured using eigenvector centrality, while node B is more central than node C when using betweenness centrality.

Beyond centrality, further measures at the node level have been proposed to capture other dimensions of a node's position in a network. Most notably, researchers have looked at *clustering* and *support* (Jackson et al. 2012). These measures capture the extent to which individuals can sustain informal exchanges between groups of interconnected individuals by capturing the extent to which any two individuals share other common ties (Duarte et al. 2019; Jackson et al. 2012). While they have received relatively less attention in comparative politics, their importance in governing the credibility of exchanging economic favors in rural India (Jackson et al. 2012) suggests that they may merit future examination in political contexts.

2.2 Relative position within networks

There are two primary network measures of the relative position of two individuals within a given network. While they vary in terms of computational complexity, both capture the scope for information diffusion (Alatas et al. 2016; Banerjee et al. forthcoming; Duarte et al. 2019) or coordinated action. *Social distance* is simply the shortest path between two individuals (Jackson et al. 2012),

and thus captures degrees of separation.

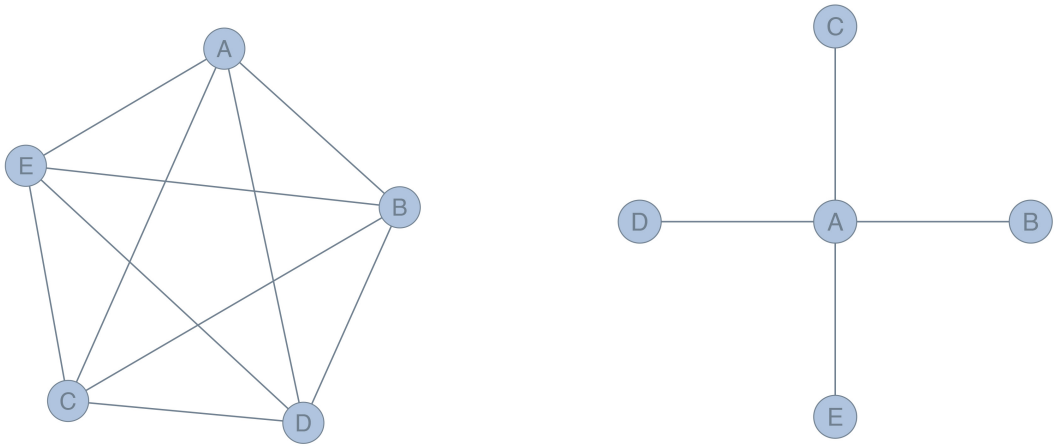
In contrast with social distance, what Banerjee et al. (forthcoming) define as *gossip centrality* accounts for the fact that information might flow imperfectly between connected nodes, and that it travels not only via the shortest path but also through all other possible paths. This network measure of information diffusion between two individuals might be particularly important in the developing world, where individuals are more likely to receive their information from in-person or community-based sources (Duarte et al. 2019).

2.3 Characterizing entire networks

Network-level measures assess community features with implications for politics, such as social fragmentation, overall information diffusion, or the distribution of influence in the community (Alatas et al. 2016; Arias et al. forthcoming; Haim 2018; Halberstam and Knight 2016; Larson 2017). These measures aim to summarize patterns of relationships across the entire network. While some of these measures—such as the average of centrality or clustering metrics—simply aggregate across individual-level measures, other statistics derive from the full network graph.

Network density is a way of assessing the connectedness of a network by considering the number of actual ties between actors as a share of the total potential ties (Jackson 2010; Wasserman and Faust 1994). Networks with dense social ties bring to mind the common characterization of close-knit small communities, where everyone knows everyone else. Figure 2 illustrates two networks with contrasting density. Panel A depicts a network where all nodes have ties to one another, yielding a density value of 1. Panel B, in turn, portrays a star network, in which one node has ties to all of the others, but no others have ties among them, yielding a density value of 0.4.

The *largest eigenvalue* measure evaluates the aggregate centrality among nodes in a network by accounting for the structure of their network as a whole (Alatas et al. 2016). In particular, the largest eigenvalue captures the extent to which the average individual is central in the sense that they are connected to other central individuals, with their centrality being recursively determined



A) Density $= 1$
Largest eigenvalue $= 4$
Centralization $= 2$

B) Density $= 0.4$
Largest eigenvalue $= 2$
Centralization $= 1$

Figure 2: Network density, largest-eigenvalue, and centralization across different network graphs

(Arias et al. forthcoming). Figure 2, again, shows two examples of networks with very different largest eigenvalues. In the network in Panel A, the largest eigenvalue is 4. By contrast, the largest eigenvalue of the network in panel B is 2.

The family of *centralization* measures assesses the structure of the network as a whole by accounting for differences in centrality among actors. Intuitively, centralization captures structural inequalities in social position and is calculated by comparing the centrality of the most central node to all of the other nodes. Figure 2 shows two extreme types of network centralization. In the network in Panel A, the centralization value is 0, the lowest possible value. By contrast, the network in panel B has the maximum centralization value of 1.

3 Voter networks

Voter networks refer to connections among voters across a variety of relationships and modes of social interaction. Socially well-connected voters tend to be those with more ties to other voters (i.e. those with a higher degree centrality), and whose relationships are stronger as a result of

regular interactions. These also tend to be individuals who are more active in their communities and exhibit more pro-social behaviors such as reciprocity and altruism (Guinote et al. 2015; Leider et al. 2009).

Such voter networks can have important implications for electoral persuasion. Specifically, we next examine how individuals within networks mediate the diffusion of politically-relevant information, seek to persuade others to adopt their positions, and support the coordination and enforcement of voter behavior. As noted above, these three functions are not necessarily mutually exclusive or independent of each other. Consequently, these conceptually-distinct mechanisms are often hard to disentangle empirically. Nevertheless, they represent useful ways of organizing the various channels through which voter networks influence political outcomes.

3.1 Information diffusion

Social connectedness plays an important role in disseminating political information in many developing democracies, which may in turn shape voters' beliefs and behaviors. This function is particularly important in low-information political environments characterized by limited voter engagement with elected politicians and limited media markets, such as the rural parts of Senegal where 38 percent of young adults report discussing the legislator performance report cards that they received with others within their village (Bhandari et al. 2018). However, even in countries with relatively extensive and free media markets, such as Mexico and the Philippines, survey respondents still report that in-person and community-based sources are important for local politics. In Mexico, 47 percent of respondents report discussing politics with their household members during the week prior to being interviewed (Arias et al. forthcoming). Similarly, in the Philippines, 42 percent of respondents cite personal networks as their primary source of information about local politics (Campos and Hellman 2005).

The dissemination of information pertaining to candidate positions and performance has proven to be particularly relevant for understanding voting behavior. Considering information that voters

already possess, Ames et al. (2016) show that networks in Brazil—within which voter disagreement is common—help to disseminate information about candidates and their issue positions, which in turn appears to influence vote choices. Recent experimental studies have also demonstrated that NGO campaigns distributing novel information relating to incumbent performance also diffuses within communities, with important electoral consequences. Bhandari et al. (2018) find that Senegalese voters randomly assigned to receive legislator performance scorecards share the information that they receive with other voters in their village. Indeed, despite reaching only 9 young adults within rural polling stations containing around 500 voters, the vote shares of the best-performing incumbents increased by 5-10 percentage points. Similarly, Enríquez et al. (2019) suggest that information diffusion of some form played an important role in amplifying the effects of a large-scale Facebook ad campaign that disseminated the results of independent audit reports documenting mayoral malfeasance reports in Mexico. Leveraging a design that varied the saturation of the information campaigns within treated municipalities, this study demonstrates a substantial increase in support for the best-performing municipal incumbent parties in parts of municipalities where the campaign was not directly targeted.

Beyond information pertaining to candidate positions and quality, informational campaigns promoting electoral integrity have also been found to spread within networks. For example, Fafchamps and Vicente (2013) find that information from an anti-electoral violence campaign in Nigeria spread to individuals not targeted by the campaign through kinship and local discussion connections. However, such diffusion dynamics can simultaneously create risks for voters as well. Indeed, Cruz (2018) shows that because networks moderate the efficacy of targeting electoral violence and intimidation toward specific communities, politicians in the Philippines target coercion toward networks where the effect of intimidation is more likely to spread.

3.2 Social persuasion

It is also commonly argued that networks contribute to persuasion and social pressure, independently of their role in supplying novel information. This function of networks often rests on the desire of individuals to ensure that their behaviors confirm with those of others within their network (Bernheim 1994), but could also emanate from argumentation and discussion that does not provide additional informational content (Algan et al. 2018). Earlier work in this area focuses on voter behavior in developed democracies, and especially the United States (e.g. Rolfe 2012; Huckfeldt and Sprague 1991, 1995; Nickerson 2008; Sinclair et al. 2012). For example, an extensive body of research provides evidence suggesting that social pressure leads people to change their voting behavior in order to conform with community norms of turning out to vote (Abrams et al. 2011; DellaVigna et al. 2016; Gerber et al. 2008).

Recent work focusing on developing democracies has also emphasized the persuasion and social pressure role of networks in influencing voting behavior. The deliberate and persuasive potential of local networks is perhaps most vividly illustrated in rural parts of Africa, where bloc electoral choices can be *de facto* determined by community meetings led by chiefs (Koter 2013). In less coercive settings, findings from voter mobilization campaigns in developing democracies show that information campaigns in Mozambique (Fafchamps et al. Forthcoming) and Nigeria (Fafchamps and Vicente 2013) affected not only treated voters, but also the voting behavior of their peers. Fafchamps and Vicente (2013) argue that this is not only due to information diffusion, but also to a reinforcement effect whereby direct treatment is complemented by discussion of the information with others. Ames et al. (2016) similarly suggest that the dissemination of political information through voter network affects voting behavior in Brazil through persuasive mechanisms beyond just information diffusion. Eubank et al. (2019) also provide evidence suggesting that predicted village level pressures to participate increase turnout and participation in village governance.

Politicians have, perhaps unsurprisingly, also proved eager to capitalize on citizens' persuasive capabilities. Schaffer and Baker (2015) provide evidence from Latin America indicating that politicians target vote buying to socially connected and influential individuals in order to maximize the "social multiplier" effect: in addition to buying the individuals' vote, they are buying their ability to persuade others in their network as well. By providing evidence indicating that the central individuals targeted are core supporters, Schaffer and Baker's (2015) findings add nuance to the focus of the vote-buying literature on whether to target core or swing voters (Nichter 2008; Stokes 2005) by highlighting how central voters can persuade others with different preferences.

Increasing evidence points to the importance of social networks in mediating persuasion and social pressure for a broad range of politically-relevant behavior. For example, Marshall (2019) provides experimental and observational evidence suggesting that social expectations encourage voters to acquire political information before elections in Mexico, and McDoom (2013) highlights how social networks encouraged participation in the Rwandan genocide.

However, it remains difficult to conclusively distinguish between the information diffusion and persuasion functions of networks empirically. For example, assuming that we can be confident that a given individual did not directly receive voter mobilization information, observing that their probability of turning out increases is often consistent with the informed member of their network both: (i) relaying the mobilization information; and (ii) persuading them to change their behavior on the basis of information that they received, which may or may not involve also relaying the information. Some recent studies have proposed some potential methods for addressing this challenge. For example, Alt et al. (2019) suggest addressing the risk of conflating information diffusion with emotional persuasion and social conformity by leveraging degrees of separation. Specifically, they examine the effects of information provision on second-degree connections living in other locations, i.e. cases where persuasion is likely to be limited. Nevertheless, separating between these types of mechanisms represents an important challenge for the next generation of research in this area.

3.3 Coordination and enforcement

Various studies also highlight the potential role of coordination and enforcement within social networks (Hughes 2016; McCubbins et al. 2009). In the case of coordination, social networks can coordinate voters through explicit interactions where action plans are formulated and agreements are reached (Arias et al. forthcoming; Little 2016) or through tacit expectations about what others believe or how they will act (Arias et al. forthcoming; Little 2016; Morris and Shin 2002; Siegel 2009). In contrast, the role of social networks in enforcement is typically to mitigate the free riding that can drive collective action failures when binding agreements cannot be implemented (e.g. Fearon and Laitin 1996; Larson 2017; Ostrom 1990; Wolitzky 2012).

Coordination and enforcement are sometimes mediated by information diffusion, persuasion, or social pressure, and thus much of the work discussed above could be taken as capturing the coordinating role of social networks. It is difficult to empirically distinguish whether electoral behavior reflects coordination or not, at least in part because information diffusion, social persuasion, and coordination around provided information often imply similar voter responses (Arias et al. forthcoming) and because it is hard to know whether an individual had already internalized available information before the effects of social interactions kick in. With these caveats in mind, we proceed by describing the phenomena attributed to different classes of coordination and enforcement mechanisms.

The presence of networks could provide a forum for the dissemination of politically-relevant information, and stimulate discussion and agreement upon a common response. Larson (2017) formalizes this argument showing how information diffusion can sustain cooperation between individuals within networks more generally. We introduced evidence consistent with this in the context of voting behavior earlier. In particular, Ames et al. (2016) provide evidence from Brazil, Fafchamps et al. (Forthcoming) from Mozambique, Enríquez et al. (2019) from Mexico, Fafchamps and Vicente (2013) from Nigeria, and Bhandari et al. (2018) from Senegal.

Even without the dissemination of novel information, communication with others may induce coordinated behavior by revealing to voters that others also received the same information (Morris and Shin 2002). For example, Enikolopov et al. (2017) argue that, in Russia, social media has facilitated anti-government protest by reducing the costs of coordination, rather than by spreading information critical of the government. Similar arguments and evidence are provided by Fergusson and Molina (2017) worldwide, Gónzalez (2018) in Chile, Larson et al. (2017) in France, Steinert-Threlkeld (2017) in the Middle East and North Africa, and Manacorda and Tesei (2016) and Pierskalla and Hollenbach (2013) in Africa. A number of these studies develop creative tests designed to show that voters are not simply learning about grievances that may dictate a decision to protest in isolation, although the magnitudes of coordination effects remain hard to isolate. Indeed, Cantoni et al. (forthcoming) find that informing students about the intention of others to attend Hong Kong's annual pro-democracy march suggests that the desire to protest alongside many other people is dominated by the incentive to free ride.

To the extent that coordination occurs, it remains hard to establish whether it is facilitated by logistical communication between individuals or common knowledge that relies on limited interpersonal interaction (Little 2016). The clearest evidence separating the common knowledge component comes from a recent experimental study in India by George et al. (2018), that explicitly varied whether SMS messages informed voters about criminal charges against candidates and whether others also received the same SMS. Suggesting that common knowledge can play an important role in voter behavior, they find that voter sanctioning of candidates facing serious criminal charges—particularly murder—by those receiving an SMS is greater among voters that were also told that the messages were disseminated widely in their local area.

Recent work has also highlighted the importance of the coordination role of networks to understand the effect of information campaigns and other interventions on voter behavior. Adida et al. (2017) point to the potential relevance of community coordination around information for the effect of campaigns on electoral accountability by showing, when a larger fraction of their

commune also received the treatment, voters are more responsive to a village-level informational and civics campaign emphasizing the importance of programmatic politics in Benin. Arias et al. (forthcoming) similarly show how individuals in more connected networks are better able to remove poorly-performing politicians because they can coordinate around disseminated campaign information. Collier and Vicente (2014) claim that an anti-violence campaign served as a coordination device to help Nigerian communities reach an equilibrium in which peaceful participation became the norm. Rubin (2018) links village social network structures in the Philippines to the ability to coordinate and engage in collective action against insurgent groups pursuing territorial control.

While the enforcement role of social networks has been central to understanding community action (Ostrom 1990), limited research has examined enforcement in electoral contexts. Considering protests and petition signing in Venezuela, Eubank and Kronick (2018) join almost-nationwide network data based on cell phone interactions with a matching design to show that network exposure—the likelihood that information about an individual's action will spread quickly—increases participation in both forms of risky collective action. The authors argue that the threat of social sanctioning with their networks sustains such behaviors. These findings suggest that enforcement's role in electoral persuasion may merit future research.

4 Politician Networks

Politician networks can be characterized by both formal ties, such as party affiliations and political alliances, as well as informal ties, such as friendships. The structure of these networks also matters: *vertical* networks link politicians across levels and to their intermediaries and constituencies (i.e. politician-broker-voter connections), while *horizontal* politician networks connect politicians at the same level (e.g. voting blocs of legislators).

Vertical politician networks have been used to explain differences in party structures and in-

stitutionalization across countries (Calvo and Murillo 2013; Kitschelt and Wilkinson 2007). An important aspect of the vertical dimension of politician networks, which has received considerable recent attention, is the extent of ties between the politicians and local political elites that interact directly with citizens. These elites are not merely individuals that hold higher social status or are socially well-connected, and their privileged position does not necessarily follow from formal power or political positions. Rather, they tend to belong to the same networks as politicians and exploit their influence within their networks to serve as political intermediaries, or brokers, between politicians and voters. Examples of the ties between voters and local brokers, and between brokers and politicians are abundant. Larreguy et al. (2017) highlight the importance of the influence that teachers have over the parents of their students for the enforcement of clientelistic exchanges in Mexico, while local brokers often play important roles in helping voters to access public resources (e.g. Auerbach and Thachil 2018; Diaz-Cayeros et al. 2016; Larreguy et al. 2019). Cruz et al. (2017) and Duarte et al. (2019) similarly demonstrate the importance of the ties of local brokers for the effectiveness of clientelistic strategies.

Horizontal politician networks are also an important determinant of political outcomes. In particular, recent work highlight their role in career advancement by both politicians and bureaucrats connected to politicians. Jia et al. (2015) show that the chances of politician promotion in China depend not only on their past performance in office, but also their connections to top politicians. Similarly, Gulzar and Pasquale (2017) and Nath (2015) provide evidence that suggests that connections to politicians are important for the career advancement of bureaucrats in India. Furthermore, horizontal connections between political and economic elites have been shown to be important alternatives to democratic political institutions in twentieth-century Mexico (Razo 2008).

While the relevance of politicians' networks for politics is not limited to developing democracies (Dal Bó et al. 2009), these network connections might be especially important in these settings. To a large degree, this is because developing contexts are often characterized by weak political parties and institutions, which make it difficult for politicians to operate without informal

ties and alliances. Politician networks can thus significantly affect politicians' electoral prospects, their interactions with other political actors, and their choice of campaign strategies.

4.1 Information diffusion

As with voters, politician networks also have the potential to transmit politically-relevant information. For example, networks can convey important information from voters to brokers, facilitating clientelistic exchanges. Voter information that might be transmitted includes partisan preferences (Duarte et al. 2019; Finan and Schechter 2012), the likelihood of turnout (Larreguy et al. 2016; Nichter 2008), social preferences (Finan and Schechter 2012; Lawson and Greene 2014), and even actual voting behavior (Stokes 2005).

For political brokers, such information plays a key role in electoral persuasion. Duarte et al. (2019) address the extent to which vote-buying exchanges are supported by information diffusion through non-political networks. Using exceptionally detailed network data from 10 villages in Paraguay, as well as detailed survey data from brokers and voters, they show that brokers are more likely to target vote buying at individuals from whom they may acquire information about partisanship and reciprocity through networks. Szwarcberg (2012) points to the overlap between problem-solving networks—formed by those assisting with issues such as childcare, counseling, or money lending—and political networks, thereby suggesting that a broker's ability to influence vote choice is linked to his or her central position in problem-solving networks.

Conversely, brokers' vertical connections also play a role in attracting voters. Baldwin (2013) similarly concludes that voters vote with the chiefs that are best connected to the politicians able and willing to provide local public goods in Zambia. Auerbach and Thachil (2018) further report evidence from urban Indian slums, where brokers succeed to the extent that they can outperform competitors in lobbying on voters' behalves.

Connections between politicians and local elites matter for understanding the targeting of not only vote buying, but also electoral violence (Robinson and Torvik 2009). Hoglund and Piyarathne

(2009) suggest that such social ties explain which individuals are subject to violence within villages in Sri Lanka. Specifically, they find that the degree of social influence and affiliation with opposition parties are determinants of individual vulnerability to electoral violence. Similarly, Fergusson et al. (2017) show that right-wing paramilitaries targeted violent attacks on left-wing activists and mobilizers in Colombia.

4.2 Social persuasion

Beyond the targeting of electoral strategies, politicians' networks can extend to facilitating less direct—but nevertheless important—modes of social persuasion. This is particularly true of influence over media outlets, where there is evidence that politicians' networks matter for media content and manipulation, and ultimately, for the influence of media on voter behavior. Boas and Hidalgo (2011) show that local politicians influence and slant media content through their family ties. Similarly, Adena et al. (2015) point to the increase in anti-Semitic content in state-controlled radio stations in Germany after the Nazis came to power, while Yanagizawa-Drott (2014) finds evidence that Rwanda's RTLM radio station incited 10% of Tutsi deaths during the Rwandan genocide. Bleck and Michelitch (2017) also show that in the wake of Mali's 2012 coup, the incumbent infused state-run radio with nationalist programming in an attempt to legitimize their rule. In turn, Enikolopov et al. (2011) provide evidence that when Gazprom—Russia's national natural gas company—took control of the NTV, favorable coverage of anti-Putin parties in Russia was significantly reduced.

4.3 Coordination and enforcement

Networks can also facilitate informal transactions in the absence of more explicit contract enforcement (Bloch et al. 2008; Chandrasekhar et al. 2018; Karlan et al. 2009; Jackson et al. 2012; Ligon and Schechter 2012). Applied to electoral persuasion, these features of politician networks are

particularly applicable for addressing inherent agency problems associated with vote buying, both between politician and brokers, and between brokers and voters.

Various studies provide evidence suggesting that the networks of politicians have important implications for their ability to successfully contest elections in clientelistic contexts. Larreguy et al. (2017) argue that ideological proximity might be necessary for mitigating the agency problems facing politicians that struggle to monitor their brokers. Specifically, they provide evidence that ideological alignment is necessary for teachers in Mexico to mobilize the parents of their students. Along the same lines, Blattman et al. (2019) document the results of an anti-vote buying intervention in Uganda designed to assess brokers' responses. They provide evidence that candidates only enter local vote-buying markets when there are brokers that they can trust.

Similarly, the centrality of brokers in many communities also appears to increase the efficacy of clientelistic transactions. Ravanilla et al. (2017) provide evidence from the Philippines that brokers are able to enforce clientelistic exchanges with voters not only because they are able to target voters who are more likely to reciprocate intrinsically (Finan and Schechter 2012; Lawson and Greene 2014), but also because they can exploit their network position to foster instrumental reciprocity, whereby voters reciprocate with the expectation that they will benefit from future interactions with the broker. Similarly, Cruz (2019) points out that voter social ties also facilitate network-based monitoring and enforcement, because connected voters are more sensitive to the group-level consequences of reneging on vote buying agreements.

Finally, while only weakly related to electoral persuasion, there is also evidence that points to the importance of networks for coordinating behavior among politicians. In particular, Acemoglu et al. (2014) and Naidu et al. (2017) argue that politician and elite networks matter for political control of voters. Using data from Haiti, Naidu et al. (2017) demonstrate the importance of elite networks for understanding political transitions, showing that families that are more central within elite networks are more likely to support a coup against democracy with the goal of increasing the retail prices of the goods that they import.

5 Frontiers in the collection of network data

While social networks can convey useful information for the study of electoral persuasion and political science more generally, they can also pose major challenges for data collection. As noted above, the wide variety of potentially important relationships makes it difficult to collect the information needed to measure the relevant connections between actors and identify features of overall networks. Consequently, a key concern is the extent to which network data is incomplete. Chandrasekhar and Lewis (2016) highlight the severe inference problems that arise when researchers estimate network effects using sampled network data. Beyond the standard concern that classical measurement error in independent variables—that is to say, noisy measurement of network variables that is correct in expectation—may attenuate estimates, they show that treating sampled networks as the true networks of interest might also lead to non-classical measurement error and therefore introduce additional systematic biases that are hard to correct. Fortunately, network scholars now rely on a number of methodological innovations for measurement and analysis of networks that ameliorate some of these challenges and have opened up research agendas previously considered unfeasible.

Early work on social networks used detailed ethnography and survey data to map out connections between individuals (e.g. Auyero 2000; Banerjee et al. forthcoming; Ligon and Schechter 2012; Szwarcberg 2012; Trager 1988). A major virtue of this approach was researchers' capacity to generate insights about the nature of relationships and establish which types of relationships matter. However, the challenge of collecting such data at scale has also given rise to new approaches that develop and test these insights. Here, we briefly describe three particularly fruitful innovations: direct questioning that allows researchers to compute moments of network graphs without necessarily having information on the complete network; using administrative data to measure at least some dimensions of social ties; and using measures of network access to proxy for the potential to interact with others.

First, increasingly sophisticated survey techniques have enabled researchers to economically measure networks at scale. Survey questions have been used to directly inquire about out-degree measures of political discussion networks (Cruz 2019; Schaffer and Baker 2015), within-village connections of various types (Eubank et al. 2019), and elicit network size (Calvo and Murillo 2013). These methods allow researchers to compute some measures of social connectedness without requiring data that maps all relationships within a network. Furthermore, Breza et al. (2018) extend the work by Calvo and Murillo (2013) by showing that simple questions of the form "how many X do you know" enable researchers to not only to estimate the size of each respondent's personal network, but also to recover the parameters of a general network formation model permitting the estimation of any arbitrary node- or graph-level statistic. Of course, these approaches are not a panacea for mapping entire network graphs, as they rest on assumptions about the accuracy of citizen responses and the structure of networks.

Second, the increasing availability of administrative data has allowed researchers to measure at least some dimensions of social ties more objectively. For example, Arias et al. (forthcoming) and Cruz et al. (2017) use data from social program (potential) beneficiaries and apply name matching techniques to infer family relationships in Mexico and the Philippines, respectively. Similarly, Alt et al. (2019) use Danish government register data for the entire population to establish family, occupational, and educational ties. Gónzalez (2018) also uses administrative school records to compute educational networks in Chile. Administrative data has also been obtained from non-governmental sources, as illustrated by Eubank and Kronick's (2018) use of cell phone user network data to illuminate protest participation in Venezuela and Larson et al.'s (2017) use of Twitter networks to show the importance of network structure for participation in protests in Paris. Although these networks can be quite particular, they nevertheless offer an unprecedented potential to analyze population-level networks and thereby analyze the effects of a wide range of independent variables.

Third, other researchers have leveraged qualitative understandings with regard to differential presence or access to particular types of network. With respect to differential presence, Larreguy

(2013) focuses on communal lands where PRI clientelistic networks are known to operate, while Larreguy et al. (2019) look at the dependence of squatters on local government in settlements in semi-urban parts of Mexico. With respect to access, the focus has been largely on access to social media (Enikolopov et al. 2017; Fergusson and Molina 2017) or other technologies for information diffusion and coordination, such as cellphones (Manacorda and Tesei 2016; Pierskalla and Hollenbach 2013).

6 Conclusions

For voters in many countries in the developing world, politics is a social activity. Political institutions and organizations are overlaid on existing social relationships and hierarchies. Elections and campaigns are punctuated by rallies, fiestas, community meetings, and other social events. Voters in tight-knit villages share information and exert influence over each other. For politicians, this social context means that the *network*—and not just individual voters or precincts—is the relevant constituency to consider for campaign strategies. Consequently, networks have a number of implications for understanding electoral politics in the developing world.

First, the network mechanisms of information diffusion, social persuasion, coordination, and enforcement mediate the effectiveness of political campaigns (Cruz et al. 2017; Duarte et al. 2019; Ravanilla et al. 2017), including interventions aimed at informing voters about incumbent performance and contributing to electoral accountability (Adida et al. 2017; Arias et al. forthcoming; Bhandari et al. 2018; Collier and Vicente 2014; Enríquez et al. 2019; Fafchamps et al. Forthcoming). In particular, differential access to clientelistic networks might allow candidates to be more responsive to those interventions through vote buying (Cruz et al. 2019). This may have important implications for electoral accountability, as well as candidate retention.

Second, networks shape both the emergence of politicians and brokers, and the ways that they organize voters in their bailiwicks. The relative position of individuals in the network determine

who the most effective brokers might be. In particular, in places with a more conducive social network for brokering, we should observe much more clientelism (Duarte et al. 2019; Davidson et al. 2017). Similarly, Cruz et al. (2017) show that local politicians in the Philippines are disproportionately drawn from more central families. Moreover, they show that candidates with access to reliable brokers within those networks will benefit differentially, and thus might be more likely to select into politics where the prevalence of such networks is greater.

Third, the configuration of networks can also affect the choice of electoral strategies and subsequent policies. The mere presence of broker-voter networks that can support clientelistic exchange might then crowd out public policy (Robinson and Verdier 2013; Wantchekon 2003), or encourage politicians to focus on clientelistic political strategies. With regards to politician networks, Cruz (2018) shows that Philippine mayors with vertical connections to politicians at different levels are associated with individually-targeted vote buying because the overlapping constituencies create incentives to collude to target the same voters. By contrast, mayors with primarily horizontal connections are associated with group-targeted electoral strategies such as funding projects in certain constituencies, because without the shared constituencies, their connections function primarily for cooperation and information sharing. The importance of network structures may therefore also generate incentives for strategic network formation (e.g. Bala and Goyal 2000), an important topic that has yet to receive much attention from political scientists.

The political institutions in the developing world are layered on complex social structures, such as families, clans, ethnolinguistic, or religious groups. Consequently, understanding politics and electoral persuasion necessitates new approaches to account for the ways that social networks can mediate political interactions. We focus on three general mechanisms: (i) information diffusion; (ii) social persuasion; and (iii) coordination and enforcement. Our survey of the literature demonstrates how these mechanisms link voter and politician networks to a wide range of political outcomes.

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