

Social Fragmentation, Electoral Competition and Public Goods Provision

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Cesi Cruz[†]
Julien Labonne[‡]
Pablo Querubin[§]

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Abstract

In this paper we show that social fragmentation can trigger increased electoral competition and improved provision of public goods. We test this using large-scale data on family networks from over 20 million individuals in 15,000 villages of the Philippines. We take advantage of naming conventions to assess intermarriage links between families and use community detection network algorithms to identify the relevant clans in all of those villages. We show that there is more public goods provision and political competition in villages with more fragmented social networks, a result that is robust to controlling for a large number of village characteristics and to alternative estimation techniques. Using original survey data collected in 284 villages after the 2013 local elections, we also show that fragmented villages are associated with a broader distribution of political influence.

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[†]University of British Columbia: cesi.cruz@ubc.ca

[‡]University of Oxford: julien.labonne@bsg.ox.ac.uk

[§]New York University: pablo.querubin@nyu.edu

The campaign (...) is the culmination of a contest to see who makes best use of the social structure.

Mary Hollsteiner, The Dynamics of Power

1 Introduction

A broad literature in political economy has studied how social structure influences economic and political outcomes such as public goods provision (Alesina and La Ferrara, 2005; Montalvo and Reynal-Querol, 2005). For example, several scholars show that ethnic and linguistic fragmentation are negatively correlated with public goods provision across both developed and developing countries (Easterly and Levine, 1997). The most common explanation for this result is that ethnic fragmentation leads to heterogeneity in preferences (Alesina, Baqir and Easterly, 1999) and undermines collective action due to the inability in diverse communities to impose social sanctions on free-riding individuals (Miguel and Gugerty, 2005). As a result members of fragmented communities are less likely to demand or exert effort towards the provision of public goods.

These conventional explanations focus on bottom-up processes in which communities are responsible for the choice and funding of public goods. However, in most developing countries, public goods are provided by elected politicians who rely on transfers from higher levels of government. Moreover, in many societies ethnic and religious cleavages are not as politically salient but instead, clans or extended families play a prominent role in politics. Examples include the Philippines, Sierra Leone, China and Italy amongst others.

In this context, we must consider how social fragmentation across a different cleavage shapes the incentives of politicians to provide public goods as opposed to targeted or private transfers to some groups of the population. An often overlooked channel through which social structure may shape politicians' incentives is elite capture or, more generally, political competition. As society becomes more fragmented, the redistributive strategies adopted by politicians to attract voters may shift towards greater – rather than lower – public goods provision.

There are several reasons why social fragmentation may trigger higher public goods provision. First, when members in a society are concentrated in a relatively small number of groups, leaders

of larger groups have high bargaining power and can demand private, targeted, excludable transfers in exchange for the electoral support of its members. As a consequence political influence becomes more concentrated and politics becomes, overall, less competitive. In other words, social concentration increases the likelihood of elite capture which can potentially undermine politicians' incentives to provide public goods (Anderson, Francois and Kotwal, 2015). Reinforcing this channel, social fragmentation also increases the agency and transaction costs for politicians of engaging in the clientelistic exchange of private transfers for votes. Consider a society in which a large share of citizens belong to handful of groups; in this case politicians can secure a large number of votes by brokering deals with the leaders of a small number of groups, that they can also more easily monitor. As the number of groups becomes larger (and each group becomes smaller), this strategy becomes less attractive. Following Lizzeri and Persico (2004), as society becomes more fragmented, the incentives for politicians to provide policies with diffuse (as opposed to targeted and excludable) benefits increases which can encourage the provision of public goods.

In this paper, we study these questions in the context of local politics in the Philippines. The provision of public goods in the Philippines is partly the responsibility of elected municipal mayors whose budgets depend mostly on transfers from the central government. Mayors must allocate their budget across the different *barangays* (villages) that compose the municipality. Most municipalities in the Philippines are ethnically and religiously homogeneous.¹ However, a critical actor in Filipino social and political life are *clans* or extended families. Political alliances at the local level often involve securing the support of clan leaders who can leverage strong norms of in-group cooperation and reciprocity to deliver *en bloc* the votes of their family members (Hollnsteiner, 1963; Fegan, 2009). We study how politicians' decisions to provide public goods across the different villages that comprise the municipality vary as a function of the extent of social fragmentation of the village. In our context, we measure social fragmentation with a Herfindahl index that captures how the village population is distributed across the different clans. We hypothesize that in less fragmented villages clan leaders are more effective in concentrating political influence and capturing politicians for private, personal interests at the expense of public goods provision.

An important empirical challenge in our context is identifying the set of clans in each village.

¹There are important differences in ethnic composition and religious affiliation across regions, larger administrative divisions, but municipalities and villages are relatively homogeneous

Clans correspond to sets of families connected to each other through intermarriage (i.e. extended families). However, while individuals in the Philippines can easily identify the clan they belong to, absent detailed village-level surveys it is very hard to determine the boundaries of a clan since there are no formal criteria for defining clans. To address this, we use a unique dataset covering 20 million individuals in more than 15,000 villages across 709 municipalities of the Philippines. The dataset includes information on family names and we use naming conventions in the Philippines to establish ties between families through intermarriages. Following Padgett and McLean (2006, 2011) and Cruz, Labonne and Querubin (2017), we consider a tie between two families to exist whenever we observe at least one marriage between members of the two families. We graph the full family network in all villages in our sample. We then use community detection algorithms (Girvan and Newman, 2002; Pons and Latapy, 2005) to identify the set of clans in every village and compute a measure of village social fragmentation (a Herfindahl index) based on the share of families (or individuals) belonging to each clan.

Our results suggest that social fragmentation is *positively* correlated with village-level provision of public goods such as schools, public marketplaces, water systems and health centers. These correlations are sizable; for example, a one standard deviation increase in social fragmentation increases the probability that a health center is located in the village by around 6 percentage points (an increase in 10% relative to the sample mean). These correlations are robust to the inclusion of municipality fixed effects and a broad set of village covariates such as village population, the number of distinct families in the village, whether the village is classified as rural, as well as controls for different occupations and educational levels, amongst others. To address concerns about reverse causality (i.e. whether family ties, and thus our social fragmentation measures, are affected by public goods provision) we restrict our network to ties between individuals 45 years old or older, and use the social fragmentation measure in the restricted network - capturing marriages that took place at least 20 to 25 years ago - as an instrument for the corresponding measure in the full network. Our results are similar when we use this approach.

We next turn to the relationship between social fragmentation and political competition. Using electoral data from barangay elections we find that social fragmentation is correlated with two features of village-level electoral competition: (i) a larger number of candidates running for office; and (ii) narrower vote margins for the winning candidate. A similar pattern holds for winning

margins in mayoral elections. Finally, we make use of an original survey collected in two provinces shortly after the 2013 local elections, in which we asked respondents to list up to five (5) politically influential leaders of their community (not necessarily restricted to elected officials). We find that social fragmentation is correlated with a broader distribution of political influence (i.e. a larger number of influential individuals).

Our results should be interpreted cautiously since naturally, our social fragmentation measures are subject to measurement error and are not randomly assigned across villages. While we control for several village-level characteristics that may potentially confound our estimates, and follow an instrumental variables approach, we cannot fully account for all variables that may have shaped inter-marriage networks over many decades. However, the correlations uncovered in this paper point to the importance of understanding how a community's social structure shapes elite capture, electoral competition and the incentives of politicians to provide public goods. In contexts in which politicians, and not communities, are responsible for the provision of public goods, social fragmentation limits the extent of elite capture, and leads to the provision of more public goods.

Our findings show that fragmentation across clans may have very different implications than fragmentation across ethnic or religious groups as documented in other contexts. As mentioned earlier, existing studies on this subject focus on settings in which communities need to exert effort or make contributions towards the provision of public goods. Collective action problems may be less relevant in contexts in which politicians are responsible for providing public goods. Finally, we focus on a different type of cleavage. We show that fragmentation across different clans does not lead to more heterogeneous preferences as is shown to be the case for fragmentation across different ethnic groups. One final possibility is that our findings are very specific to the Philippines context, a natural limitation of most within-country studies. However, we believe our findings are relevant for a broader type of societies. Clans and extended families play an important political role in other parts of the world (see, for example, Acemoglu, Reed and Robinson (2014) for the case of Sierra Leone). Moreover, the importance of trust and reciprocity for coordinating group voting behavior has also been documented in other settings (see, for example, Finan and Schechter (2012) for the case of Paraguay).

Our paper contributes to several strands of literature in development and political economy. First, we add to the literature on local elite capture and the delivery of public goods (Bardhan,

2002; Bardhan and Mookherjee, 2006). Closely related to our paper is the work by Acemoglu, Reed and Robinson (2014) who find that places in Sierra Leone with more ruling families exhibit better development outcomes today. In these places “chiefs constrained by greater competition will be less able to manipulate access to land for their own benefit or will have to compete by offering and providing public goods” (p. 321). Similarly, for the case of the state of Maharashtra in India, Anderson, Francois and Kotwal (2015) show that the economic elite dominate local politics thanks to their within-group social cohesion, and use it to further their interests and undermine social government programs that would raise peasant wages. In our context, heads of clans who concentrate a large share of the village population can undermine political competition and provide votes in exchange for targeted transfers, at the expense of public goods.

Our paper is also related to a growing literature on the economic and political impact of families and kinship ties (Todd, 1985; Padgett and Ansell, 1993; Padgett and McLean, 2006; Alesina and Giuliano, 2013). For example, Moscona, Nunn and Robinson (2017) and Moscona, Nunn and Robinson (2018) study the effect of segmentary lineages on trust and conflict, respectively. Others study the role of families on outcomes as diverse as political regimes (Naidu, Robinson and Young, 2015) and firm performance (Bertrand and Schoar, 2006). More recently, the role of political dynasties has been studied in countries as diverse as the United States (Dal Bo, Dal Bo and Snyder, 2009), the Philippines (Querubin, 2016), Japan (Smith, 2018) and India (Chandra, 2016).

We also contribute to the literature on the role of social networks on the distributive strategies of politicians in the developing world (Auyero, 2000; Calvo and Murillo, 2009; Szwarcberg, 2012; Cruz, 2013; Larson and Lewis, 2017). In particular, we build on our own work (Cruz, Labonne and Querubin, 2017) where we show that a candidate’s centrality in family networks contributes to higher vote shares during the elections. In this paper, rather than exploiting the position of individual families or candidates in the network, we study how the overall network structure in a village conditions the distributive strategies of politicians.

We build on previous work that studies how ethnic fragmentation and ethnic favoritism may impact collective action, redistributive strategies and the provision of public goods (Easterly and Levine, 1997; Alesina, Baqir and Easterly, 1999; Miguel and Gugerty, 2005; Montalvo and Reynal-Querol, 2005; Habyarimana et al., 2007; Desmet, Weber and Ortuno-Ortin, 2009; Kramon and Posner, 2013; Burgess et al., 2015). More recently, Desmet, Ortuño-Ortín and Weber (2017) and

Munshi and Rosenzweig (2018) study, respectively, how diversity affects the choice of transfers vs. public goods and elected politicians' incentives to provide public goods. We contribute to this literature by studying these questions in the context of fragmentation and diversity across a different type of cleavage.

Finally, we also contribute to the literature on social diversity, political competition and public goods provision. A series of studies have documented that greater social diversity leads to a larger number of parties and stronger political competition (Amorim-Neto and Cox, 1997; Potter, 2014; Lublin, 2017). This is consistent with our finding that greater fragmentation is associated with a larger number of candidates and less concentrated political influence. Similarly, the papers by Besley and Burgess (2002); Besley, Persson and Sturm (2010); Crost and Kambhampati (2010); Rosenzweig (2015) provide evidence of a positive correlation between electoral competition and public goods provision.²

The rest of the paper is structured as follows. In Section 2 we provide some context on local politics in the Philippines and the role played by clans in elections. In Section 3 we discuss the challenge of identifying clans in family networks and introduce the community detection algorithms used in the analysis. In Section 4 we present the data and in Section 5 we report our main results. Finally, Section 6 concludes.

2 Clans and Electoral Competition in the Philippines

Local democracy in the Philippines is vibrant and highly relevant for public service delivery. The country is divided into roughly 1,600 cities and municipalities which are themselves divided into over 42,000 *barangays* (villages). The 1991 Local Government Code devolved significant responsibilities for the delivery of a number of social services to municipalities (Llanto, 2012). These include the extension of medical and health services, implementation of primary health care programs, repair and maintenance of infrastructure facilities including schools, provision of agriculture and fishery extension services, mines and geoscience services. Municipalities are expected to finance these services through yearly transfers from the central government, known as the Internal Revenue Allotment (IRA), which are based on municipal population and land area

²However, there are also studies that document a *negative* correlation between political competition and public goods provision. See, for example, Gottlieb and Kosec (2017).

(Llanto, 2012). Municipalities can also raise their own revenues through local taxes and other business fees but, on average, the IRA provides 85 percent of their budgets (Troland, 2014).

Municipalities are governed by a mayor, a vice-mayor and eight municipal councilors.³ All municipal officials are elected in first-past-the-post elections organized, by law, at fixed intervals of three years.⁴ Political parties tend to be weak and unstable, and there are typically large shifts in party affiliations after each election (Hutchcroft and Rocamora, 2003; Mendoza, Cruz and Yap, 2014). The mayor, as the chief executive of the municipal government, enjoys significant discretionary powers. Previous research has highlighted their often-excessive control over local policies and affairs, referring to them as “budget dictators” (Hutchcroft, 2012; Capuno, 2012). The average municipality only spends 90 percent of its budget every year, so mayors are expected to be able to determine how funds are spent in the short run.

Mayors must often decide how to allocate the budget across the different barangays that compose the municipality. Every three years each barangay also elects a barangay captain (village head) and a barangay council. These are responsible for the maintenance of public goods and assisting the mayor with the implementation of several municipal programs.

The nature of political competition revolves around family alliances (Lande, 1964; Hutchcroft and Rocamora, 2003) and it is characterized by strong clientelistic practices (Hutchcroft and Rocamora, 2003; Mendoza et al., 2016). As a result, electoral strategies tend to focus on contingent political exchange—which refers to the exchange of a wide range of clientelistic goods and services including jobs/patronage (Lande, 1964), money/vote buying (Cruz, 2013; Khemani, 2015), and other private goods and services.

Politicians competing in municipal and barangay elections must often seek the support of clans (extended families). Fegan (2009) argues that families are key political actors because their reputation, loyalties, and alliances are transferable from members who die or retire to the younger generations. Corpuz (1965, p 83) also makes reference to the importance of norms of behavior within families: “behavior in the family is regulated by ethics and norms that are unwritten and informal, depending for their effectiveness upon internalized sanctions.” In particular, one feature of Filipino culture is the concept of *utang na loob* (literally, “inner debt”), which refers to a debt

³Cities follow a similar pattern, but the number of councilors is determined by population.

⁴After the fall of Ferdinand Marcos’ autocratic regime, the first municipal elections were organized in 1988. In accordance with transitory provisions of the 1987 constitution, the next municipal elections were organized in 1992.

of gratitude that fosters reciprocity and feelings of social obligation. These norms of loyalty and reciprocity often extend beyond immediate relatives. As stated by Hollnsteiner (1963), “keeping with the highly familistic orientation of Philippine society whereby an individual represents his family, *utang na loob* is not limited to an individual-to-individual relationship but is rather seen as operative from family to family” (p.79).

An implication of this is that politicians can often secure a large number of votes by brokering deals with the heads of clans who can commit to deliver the votes of all clan members in exchange for access to private transfers and services including money, jobs, medical, educational and funeral expenses for family members, construction materials, preferential access to government programs and business and building permits, amongst others (Cruz, Labonne and Querubin, 2017; Fafchamps and Labonne, 2017a,b). These private transfers often come at the expense of the provision of public goods that would benefit all village residents equally. Barangay captains and councilors often operate as brokers between municipal candidates and local clans and must monitor that clans vote as promised and that resources flow to the families. The way in which both vertical and horizontal social norms of reciprocity enable these transactions is described in great detail by Hollnsteiner (1963) in her ethnography of one Filipino municipality:

The ease with which the elite politician can communicate with his lower-level segment proves invaluable when election time comes (...) Once the political elites choose their respective candidates they begin making contact with all their lower status allies. Any favors which these elites have done for the allies now pay off as the latter cannot refuse to vote for this person to whom they feel a strong debt of gratitude... Not only that, the lower status person seeking to discharge his utang na loob will pledge to get his segment to vote as he will. His success will depend to some extent on his abilities as salesman, but certainly also on the number of relatives, compadres, friends and utang na loob debtors he has in the town (...) An efficient political system, in the view of Hulo residents, chiefly involves the management of the downward flow of patronage from local leaders to the people and reciprocal flow of support from people to leaders. The system is realized through a network of vertical and horizontal alliances... (pp. 91, 110)

Importantly, the extent to which villages are highly fragmented influences the electoral strategies of politicians. In villages in which the population is concentrated, clientelistic transactions

between politicians and clan heads become more likely. On the one hand, the bargaining power of each individual clan head increases as they can deliver the votes of a relatively large number of village residents. On the other hand, candidates also favor these strategies since the concentration of voters in a relatively small number of clans decrease the transaction and monitoring costs involved in the distribution of private transfers. Similarly, in villages where voters are concentrated in fewer clans, we expect to observe a concentration of political influence in a small set of individuals. Thus, in villages with low levels of clan fragmentation we expect to observe lower public goods provision and weaker political competition.

On the other hand, in highly fragmented villages the provision of targeted transfers becomes relatively less attractive as clan leaders control relatively small numbers of voters and enforcing several individual transactions becomes infeasible. In highly fragmented villages, politicians may thus opt for adopting policies with more diffuse benefits and provide more public goods in order to attract the electoral support of a large number of voters. Consequentially, political influence should be more broadly distributed and political competition should be more intense in these highly fragmented villages.

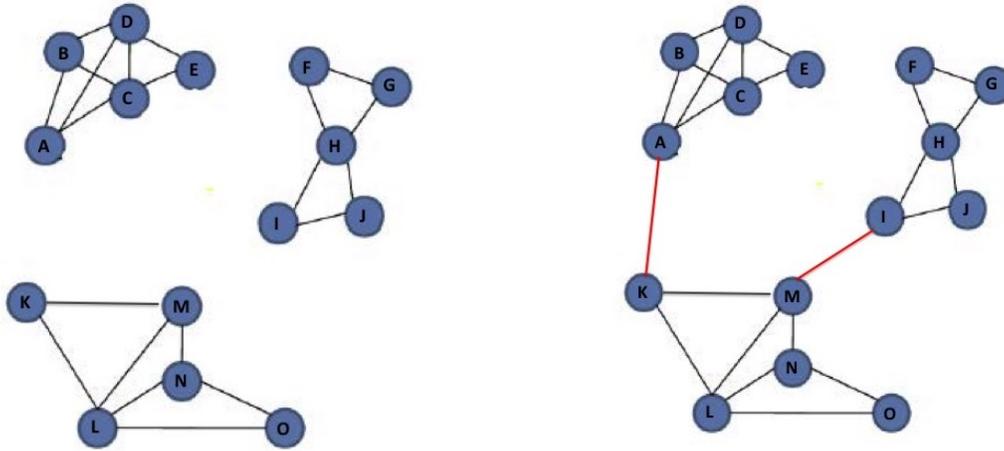
The importance of a village's social structure for electoral and distributive strategies is nicely summed up by Hollnsteiner (1963): "The campaign (...) is the culmination of a contest to see who makes best use of the social structure." (p. 86).

3 Identifying Clans: Community Detection Algorithms in Social Networks

An empirical challenge in our context is identifying the different clans or extended families in every village. Norms of reciprocity are not restricted to nuclear families but include other extended relatives through which individuals may be related through marriage. This raises the question of how far the boundaries of clans extend. Theoretically, for our purposes a clan is a set of families: i) connected to each other by marriage and ii) where mutual norms of cooperation and reciprocity are enforced by all its members. In other words, they are the set of individuals who would agree to vote for the politician that provides patronage or transfers to one of the clan members (most likely, the clan's leader). Naturally, an enumeration of every clan in every village based on survey data is beyond the scope of this paper. Instead, we propose to use network analysis to address this issue.

Consider a social network in which a node is a family (identified with a unique family name) and edges between nodes imply that a marriage has occurred between members of these families. An example is illustrated in panel a) of Figure 1 that shows a network with 15 different families. This network features three *components*, that is, groups within which nodes are path-connected, but disconnected from other sets of nodes in the network (Jackson, 2010). One intuitive approach would be to identify each different clan with the different components in the marriage network. This approach, while appealing, can be quite restrictive in practice since family networks in real life (and in our Filipino context, in particular) rarely feature neatly distinct components as those illustrated in panel a).

Consider, the slightly modified network in panel b) of Figure 1. This network is identical to that in panel a) only that we have added (in red) two additional edges: one between families A and K and another one between families I and M. The three distinct sets of nodes are still apparent, but this modified network has only one component (the full network). Thus, an approach based on components would identify only one clan in this network and all individuals would belong to that unique clan. An alternative that considers both the distinct sets of nodes but also the additional links among them is the concept of *communities*. In a social network, communities are groups of nodes with dense connections internally (i.e. within the group) and sparser connections between groups (Jackson, 2010). Intuitively, the social network in panel b) has three different communities even though it has only one component. Our approach is thus to associate different clans with the different communities detected in the social networks. At the same time, the community structure in a network is a latent feature that needs to be uncovered; there are several potential ways to partition a network's nodes into separate groups. We use two different approaches that we describe below.



Panel a): Network with 3 components

Panel b): Network with 1 component

Figure 1: Sample marriage networks. Nodes represent families and edges indicate a marriage between those families

3.1 Community Detection Algorithms

One approach to uncovering a community structure in social networks is based on edge removal. The intuition is as follows: if two groups of nodes are only loosely connected with each other, then removing the edges between those two groups will generate components in the restricted network. Communities correspond to those components in the restricted network. The networks in Figure 1 can be used to illustrate this approach. The two red edges in panel b) loosely connect groups of nodes that are densely connected with each other. Removing those two edges will yield a restricted network like the one illustrated in panel a) with three different components.

Approaches based on edge removal differ in terms of the selection rule regarding which edges to remove. We follow an algorithm proposed by Girvan and Newman (2002) that consists in the sequential removal of edges with high *betweenness centrality*. This centrality measure captures the extent to which the edge serves as a link between different groups. It is calculated using the number of shortest paths between nodes in the network that pass through that edge (Freeman, 1977).⁵ For example, the red edge in Figure 2 has the highest betweenness centrality in that network. Similarly, the red edges in panel b) of Figure 1 have a high betweenness centrality.

⁵For more information on calculating betweenness centrality, please refer to Appendix A.

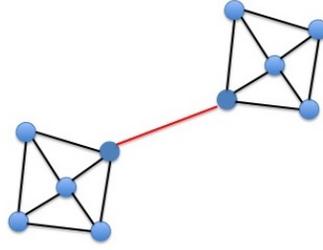


Figure 2: Edge with High Betweenness Centrality

The Girvan-Newman algorithm proceeds as follows:

1. Calculate the betweenness for all edges in the network
2. Remove the edge with the highest betweenness
3. Recalculate betweenness for all edges affected by the removal
4. Repeat from step 2 until no edges remain
5. From resulting dendrogram, select the partition that maximizes network modularity

The algorithm delivers a partition of C communities (indexed by $c = 1, \dots, C$), each containing a share s_c of nodes.

While in our baseline analysis we focus on communities identified by the Girvan-Newman algorithm, for robustness we also implement the *walktrap* algorithm developed by Pons and Latapy (2005). Intuitively, the algorithm relies on the idea that random walks on a graph tend to get “trapped” into densely connected parts corresponding to communities. The algorithm thus generates a large number of random walks and groups together nodes that are tied together through those walks. See Pons and Latapy (2005) for more details.

4 Data

In this section we present our various data sources and describe our main dependent and independent variables.

4.1 Social Fragmentation

Our main independent variable is the extent to which a village’s population is fragmented into several clans. To do this we identify network communities and use them as proxies for clans

in the family network of the village. To construct the family networks, we use data collected for the National Household Targeting System for Poverty Reduction (NHTS-PR). The large-scale household-survey, implemented between 2008 and 2010, reports several socio-economic characteristics of the household as well as the gender, age, educational attainment and occupational category of every household member. We have access to the full dataset but focus on the 709 municipalities where full enumeration took place.⁶ This leaves us with information on 20 million individuals in about 15,000 barangays in 709 municipalities. Importantly, we secured access to the non-anonymized version of the dataset and have two family names (the middle and last name) for every individual.⁷

We are able to measure large scale family networks in the Philippines due to naming conventions with three convenient features:

(i) within a municipality, a shared family name implies family connections; (ii) each individual carries two family names, which establishes that a marriage took place between members of those two families; (iii) names are difficult to change.⁸

More concretely, family names in the Philippines have the following structure:

firstname midname lastname

where *firstname* corresponds to the individual's given first name, *midname* corresponds to the mother's maiden name (for men and single women) or the father's family name (for married women) and *lastname* corresponds to the father's family name (for men and single women) or the husband's family name (for married women).

The naming structure and distribution of family names in the Philippines can be traced back to the 19th century. In 1849, concerned with the arbitrary way in which Filipinos chose their surnames and the implications for tax collection, Governor Narciso Claveria y Zaldúa created a catalog with a list of 61,000 different surnames. Municipal officials throughout the country then assigned a different name to each family. Since then, names have been transmitted through generations according to well-established and enforced naming conventions. As a consequence very common family names are not as prevalent in the Philippines as in other countries and thus, sharing a

⁶In the remaining municipalities, only households in so-called *pockets of poverty* were interviewed.

⁷Fernandez (2012) describes the data in more detail.

⁸As indicated by Fafchamps and Labonne (2017a), there are strict legal constraints on name changes in the Philippines which reduce concerns about strategic name changes.

family name is very strongly correlated with an actual family tie. This is especially the case within municipalities and villages.

Given the full names of all individuals in an area, we are able to reconstruct all of the ties (edges) in the family network by examining the joint occurrences of middle and last names. As noted above, each individual maintains two family names: their father's name and either their mother's maiden name or their husband's name, in the case of married women. Thus each individual's set of family names indicates an intermarriage between the two families—either in their generation (in the case of married women) or their parents' generation (in the case of men and single women). As a result, we are able to observe ties between families merely by the occurrence of the names within an individual.

For example, Figure 3 below depicts the family network that can be drawn from a list of relatives of the previous Philippine President, Benigno Cojuangco Aquino. His middle name is his mother's maiden name, Cojuangco, and his last name is his father's last name, Aquino. Just by observing his full name, we are able to infer a tie between his mother's family, the Cojuangcos, and his father's family, the Aquinos. To use one example from his sisters, Aurora Aquino Abellada is married, so we can draw a tie between the Aquino family and the family of her husband, as indicated by Aurora's last name. Similarly, we can show a tie between the Aguirre and Aquino families by adding the name of President Aquino's cousin, Bam Aguirre Aquino. Last, the names of President Aquino's cousin Gilberto Cojuangco Teodoro and uncle Jose Sumulong Cojuangco show ties between the Cojuangco family and the Teodoro and Sumulong families, as well as an indirect tie to the Prieto family through Gilberto's wife Monica Prieto Teodoro.

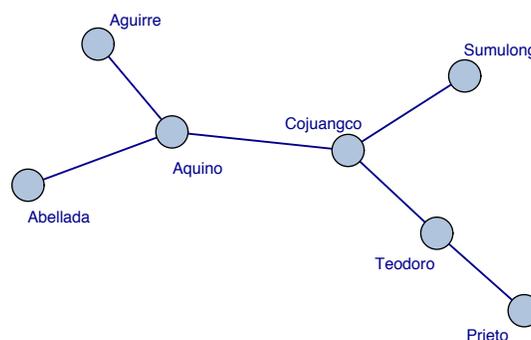


Figure 3: Family network for selected members of former President Aquino's family.

Once the networks are constructed, we implement the Girvan-Newman algorithm that delivers, for every village, a partition of C communities (indexed by $c = 1, \dots, C$), each containing a share s_c of nodes. We then use this to compute our main independent variable, the measure of social fragmentation (SF), using a standard Herfindahl-Hirschman index:

$$SF = 1 - \sum_{c=1}^C s_c^2$$

4.2 Outcome Variables

4.2.1 Public Goods

For our main outcome, we use data from the 2010 population census that lists the public goods available in every barangay. We use this to code dummies for whether the barangay has an elementary school, a high school, a public market, a health center or a community water system.

4.2.2 Political Competition

To examine the correlation between social fragmentation and political competition we use electoral outcomes from the 2010 municipal elections and the 2010 and 2013 barangay elections collected from the Commission of Elections (COMELEC) website. For municipal elections, we have precinct-level data on the number of registered voters, the number of individuals who voted and the number of votes received by each mayoral candidate. For barangay-level elections, we have precinct-level data on the votes obtained by every candidate for barangay head (*punong barangay*) and for the barangay council (*barangay kagawad*). We combine this information with data from the Project of Precincts to match each precinct to a specific village (in the Philippines there is at least one precinct per village).

Our main variables to measure political competition are the win margin (vote share of the candidates that received the most votes in that precinct minus vote share of the runner-up in that precinct) and the number of candidates running in the race. We also use the indices of effective number of candidates, proposed by Laakso and Taagepera (1979) and Golosov (2010).⁹

⁹The Laakso and Taagepera (1979) index is given by $N = 1/\sum_{i=1}^n s_i^2$, where n is the number of candidates and s_i is the share of votes of candidate i . The index by Golosov (2010) is defined as $N = \sum_{i=1}^n s_i/(s_i + s_1^2 - s_i^2)$, where s_1 is the vote share of the candidate with the largest number of votes.

To capture the effects on non-electoral political competition - the concentration of political influence - we use data from an original survey conducted shortly after the 2013 local elections. The survey covers 3,408 households in 284 villages in 12 municipalities in the provinces of Ilocos Norte and Ilocos Sur.¹⁰ We asked respondents to “name five individuals living in the barangay, but not living in your household, whose opinions you respect the most when it comes to politics.” This allows us to test whether social fragmentation affects the overall number of influential leaders that villagers mention in their responses.

4.2.3 Other Outcomes

We also use the 2013 survey to examine the extent to which social fragmentation is correlated with heterogeneity in preferences over public goods and collective action. Previous studies have found these variables to be important channels to understand the effect of ethnic and religious fragmentation on public goods provision.

More specifically we asked respondents about their preferred allocation of the municipality’s Local Development Fund (LDF) across 10 different sectors.¹¹ As a measure of heterogeneity in preferences, we simply take the standard deviation in respondents preferred allocation for each budget item.

To measure social capital and collective action we simply use dummy variables for whether the household participated in any formal group (such as unions, farmer’s or other professional associations, community development associations, micro finance groups and cooperatives) or in communal voluntary work activities (known locally as *bayanihan*) and average those over all village respondents.

5 Empirical Analysis and Results

Our main analysis consists of village-level cross-sectional regressions between public goods and political competition outcomes and our index of social fragmentation. More concretely, we estimate

¹⁰More information on the survey is available in Cruz, Keefer and Labonne (2018).

¹¹Every year, each municipality receives transfers from the central government and mayors are encouraged to allocate 20 percent of the transfers to development projects. The 10 sectors on which we have data are: public health services, public education services, cash or in-kind transfers (such as loans or job assistance), water and sanitation services, road construction and rehabilitation, construction of community facilities (such as multipurpose halls or basketball courts), business loans and other private economic development programs, agricultural assistance and irrigation systems, peace and security and community events and festivals.

OLS regressions of the form:

$$y_{vm} = \alpha + \beta SF_{vm} + \gamma X_{vm} + \delta_m + \epsilon_{vm} \quad (1)$$

where y_{vm} is the outcome variable in village v in municipality m (public goods provision and political competition), SF_{vm} is our measure of social fragmentation, X_{vm} corresponds to a full set of village covariates and δ_m is a full set of municipality fixed-effects. Standard errors are clustered at the municipality level.

The inclusion of municipality fixed effects is important in this context since they allow us to absorb all municipality-specific characteristics that may be correlated with both social fragmentation and our different outcome variables. Moreover, we are interested in how mayors adjust their electoral and distributive strategies across the different villages in their municipality as a function of the level of social fragmentation. Thus, we are interested in exploiting within-municipality variation. For ease of interpretation, in all regressions we include a standardized version (mean zero, standard deviation one) of the social fragmentation index.

5.1 Public Goods

We begin by looking at the simple correlation between social fragmentation and indicator functions for the presence of different public goods in the village. Estimates of β are reported in Panel A of Table 1. The coefficients reveal a positive and statistically significant correlation between social fragmentation and public goods provision. For example a one-standard deviation increase in social fragmentation is associated with an increase in 8 percentage points in the likelihood of having a secondary school in the village, and a 6 percentage point increase in the likelihood of having a public market or a health center in the village. Some of these estimates are sizable; relative to the mean they correspond to an increase of 40% for high schools and 30% for public markets.

However, these coefficients must be interpreted very cautiously since social fragmentation is not randomly assigned across villages. While municipality fixed effects account for municipal-level confounders, omitted variable bias remains a concern since other village characteristics may be correlated with social fragmentation and public goods provision. For example, it is possible that larger, heavily populated, urban villages feature more social fragmentation and are also more

likely to have public goods located in them. It may also be the case that wealthier villages feature greater fragmentation and can use their resources to secure more public goods from politicians. Finally, reverse causality may also be a concern: there may be higher migration into villages with a larger supply of public goods, and new migrants may generate more social fragmentation (i.e. more disperse marriage networks).

To deal with this concern, we follow two approaches. First, we control for a wide range of village characteristics. To deal with potential demographic confounders we include average age, gender ratio, village population, and the number of distinct families in the village. We also include average length of stay in the village which may account for differential migration patterns. To control for economic characteristics of the village we control for a dummy indicating whether the village is classified as rural, as well as population in each of 17 educational and 11 occupational categories, average per capita income and poverty incidence. The estimates of β once we include this set of controls are reported in Panel B of Table 1. The point estimates become smaller but remain statistically significant at conventional levels.

Our second approach to address concerns of endogeneity and reverse causality is to construct networks based on individuals aged 45 or older. These networks would mostly reflect marriage decisions made prior to when public goods are observed (i.e. a generation earlier) and thus the social fragmentation measures based on these networks are less likely to reflect reverse causality. In Panel A of Table 2 we report reduced form estimates of equation (1) but using the social fragmentation index from the network restricted to those 45 and older (i.e. regressing public good outcomes on the “lagged” social fragmentation index). In Panel B of Table 2 we instead use the social fragmentation index in the restricted network as an instrument for social fragmentation in the full network and report 2SLS estimates of β . In both panels we include the full set of village controls. The point estimates are all positive and statistically significant and slightly larger than the OLS estimates.

In the Online Appendix we report several additional robustness tests (we include the full set of village covariates in all of them). We show that our estimates are similar when we construct social fragmentation indices based on a network in which edges are weighted by family size (Panel A, Table A.1) or if we use the share of voters (rather than the share of families) belonging to each community when computing the social fragmentation index (Panel B, Table A.1). Our estimates

are also similar when we instead use the *walktrap* algorithm to identify the set of communities (clans) in every village (Panel C, Table A.1). This is reassuring and suggests our estimates do not depend on our particular choice of community detection algorithm. In Table A.2 we show that our estimates are also robust to: dropping urban areas (Panel A), dropping the village where the largest number of the incumbent mayor reside (Panel B) and dropping municipalities in the Autonomous Region of Muslim Mindanao (ARMM), a majority muslim region and one of the poorest in the country, and where shared family names may be less likely to represent actual family ties (Panel C). Finally in Table A.3 we show that our estimates remain relatively unchanged when we control for characteristics of the incumbent and the challengers' families in the village.¹² This addresses the concern that more fragmented villages are more likely to house immediate relatives of politicians and this is what drives the higher provision of public goods. In Panel C of Table A.3 we show that our estimates remain stable once we control for Herfindahl indices that capture fragmentation across ethnicity, religious affiliation and educational attainment and a Gini coefficient that measures economic (income) inequality in the village.

In sum, our results suggest that public goods provision is positively correlated with social fragmentation. This contrasts with the findings of the literature on ethnic and religious fragmentation that documents a negative correlation between public goods provision and fragmentation. As mentioned earlier, a key difference in our setting is that politicians and not communities are responsible for providing public goods. Moreover, cleavages or fragmentation across clans (as opposed to across ethnic or religious groups) may not have the same implications on preference heterogeneity and collective action documented by previous studies. We explore this directly in Tables 3 and 4 where we show respectively that: i) fragmented villages do not exhibit more heterogeneous preferences over 10 different public goods categories, as measured by the standard deviation of respondent's average desired budget share on each item; ii) social fragmentation is not robustly correlated with collective action as measured by participation in voluntary work or membership in groups and civil associations.¹³

¹²These include the politician's number of relatives, number of females relatives, number of relatives in each education/occupation category and eigenvector centrality of the family.

¹³The municipalities in which we conducted our surveys are not part of the NHTS-PR sample. Thus, to generate social networks we rely on the lists (family names) of registered voters in every village. However, in Cruz, Labonne and Querubin (2017) we show that network statistics based on NHTS-PR yield relatively similar results to those based on registered voter lists.

5.2 Political Competition

We conjecture that in a context in which public service delivery is the responsibility of elected politicians, social fragmentation across clans may trigger greater political competition and shift politicians towards the provision of public (as opposed to private) goods. In this section we explore this possibility by estimating regression (1) but using different measures of political competition as outcomes. In Table 5 we first report the correlation between social fragmentation and political competition in barangay elections. Social fragmentation is positively correlated with the raw and effective number of candidates running for barangay captain (columns 1-3) and for the barangay council (column 5). For example, a one standard deviation increase in social fragmentation is associated with roughly an additional candidate in the barangay council elections. Also, social fragmentation is positively correlated with more competitive races as measured by the win margin between the winner and runner-up in barangay captain elections (column 4). A one-standard deviation increase in social fragmentation is associated with a decrease in the win margin of almost 2 percentage points, an effect of almost 5% relative to the sample mean. The point estimates are remarkably stable to controlling for the same set of village covariates included in the public goods regressions (Panel B, Table 5) or to reduced form or instrumental variables regressions based on the network of individuals older than 45 (Table 6). In Tables A.4-A.6 we also report the same set of robustness checks conducted on the public goods estimates in the previous section.

Our underlying theory suggests that higher social fragmentation undermines the ability of a handful of individuals (for example, clan leaders) to exercise disproportionate influence on the political choices of village residents. For this reason, we also consider a non-electoral measure of political competition defined as the number of politically influential individuals mentioned by village respondents in our 2013 survey. We can consider both the raw number of individuals nominated as well the effective number of nominees (where we take into account the number of nominations). The estimates reported in Table 7 suggest that political influence is less concentrated in highly fragmented villages: a one standard deviation increase in social fragmentation is associated with approximately one additional politically influential leader.

Finally, we study how social fragmentation correlates with political competition in mayoral elections at the village level. In this case, we keep the number of candidates constant, allowing us

to explore whether races in more fragmented villages are more competitive. The estimates reported in columns 1-2 of Table 8 are consistent with previous findings and suggest that mayoral races are more tightly contested in highly fragmented villages.

Unfortunately we do not have access to systematic measures of vote buying or private transfers across a wide number of villages in the Philippines. Our theory suggests that socially fragmented villages receive more public goods at the expense of private or clientelistic transfers to clan leaders. However, a very strong correlate of vote-buying or clientelism in the Philippines is turnout. In villages with a high prevalence of clientelism, clan leaders deliver the votes of their clan members and this maps into particularly high turnout rates. Consistent with this, in columns 3-4 of Table 8 we show that a one standard deviation increase in social fragmentation is associated with a 1 percentage point decrease in turnout. While indirect, this evidence is consistent with lower clientelism in highly fragmented villages.

6 Conclusion

Using a unique dataset and approach, we are able to execute the largest study of village social network structures than has been previously possible using traditional survey-based methods of collecting social network data. We find compelling evidence that network structures—specifically, the fragmentation of social networks—are associated with higher levels of electoral competition and greater incentives for politicians to provide public goods. Our paper is amongst the first to provide evidence of how local social structures can affect electoral competition and public goods provision across the developing world. These correlations should be interpreted cautiously; while we have attempted to account for several potential confounders of social fragmentation at the village level we cannot be confident that other unobserved village characteristics do not bias our estimates. This is a common limitation of network studies; absent a natural experiment it is hard to leverage random variation in network characteristics and thus endogeneity is always a concern. However, the correlations uncovered in this paper point to the importance of understanding how a community's social structure shapes elite capture, electoral competition and the incentives of politicians to provide public goods.

We highlight alternative ways in which social fragmentation across different groups (cleavages) relevant in many societies (such as clans) may have different economic and political consequences,

depending on the institutional context that shapes the incentives for politicians and citizens to exert effort towards the provision of public goods. While fragmentation may indeed make it difficult for the community to act collectively, fragmentation is also associated with less concentration of political influence, making it more difficult for politicians to circumvent normal channels of political competition by mobilizing voters through elite capture.

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Table 1: Network Fragmentation and Public Goods Provision

	(1)	(2)	(3)	(4)	(5)
	Elem. School	High School	Market	Health Centre	Waterworks
Panel A: No Controls					
Fragmentation	0.01** (0.01)	0.08*** (0.01)	0.06*** (0.01)	0.06*** (0.01)	0.05*** (0.01)
Observations	15,449	15,449	15,449	15,449	15,449
R-squared	0.001	0.027	0.020	0.014	0.010
Mean Dep. Var.	0.806	0.209	0.190	0.639	0.597
Panel B: Full Controls					
Fragmentation	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.03*** (0.01)	0.02*** (0.01)
Observations	15,432	15,432	15,432	15,432	15,432
R-squared	0.075	0.172	0.139	0.049	0.037
Mean Dep. Var.	0.806	0.209	0.190	0.639	0.597

Notes: Results from village-level regressions with municipal fixed-effects. The dependent variable is a dummy equal to one if there is an elementary school in the village (Column 1), an high school in the village (Column 2), a market in the village (Column 3), an health centre in the village (Column 4) and a waterworks system in the village (Column 5). In Panel B regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 2: Fragmentation on over 45 Networks and Public Goods Provision

	(1)	(2)	(3)	(4)	(5)
	Elem. School	High School	Market	Health Centre	Waterworks
Panel A: OLS					
Fragmentation (over 45)	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.04*** (0.01)	0.02*** (0.01)
Observations	15,428	15,428	15,428	15,428	15,428
R-squared	0.078	0.173	0.139	0.052	0.036
Mean Dep. Var.	0.806	0.209	0.190	0.641	0.599
Panel B: IV					
Fragmentation	0.06*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	0.08*** (0.01)	0.03*** (0.01)
Observations	15,428	15,428	15,428	15,428	15,428
Mean Dep. Var.	0.806	0.209	0.190	0.641	0.599

Notes: Results from village-level regressions with municipal fixed-effects. The dependent variable is a dummy equal to one if there is an elementary school in the village (Column 1), an high school in the village (Column 2), a market in the village (Column 3), an health centre in the village (Column 4) and a waterworks system in the village (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 3: Network Fragmentation and Preferences over Public Goods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Health	Education	Emergencies	Water	Road	ComFaci	EconProg	Agriculture	Peace	Festivals
Panel A: No Controls										
Fragmentation	-0.05 (0.53)	-0.29 (0.35)	-0.21 (0.30)	-0.50** (0.22)	-0.00 (0.25)	0.15* (0.07)	0.19 (0.32)	-0.33 (0.30)	-0.14 (0.13)	-0.04 (0.10)
Observations	283	283	283	283	283	283	283	283	283	283
R-squared	0.000	0.002	0.002	0.020	0.000	0.005	0.001	0.002	0.004	0.000
Mean Dep. Var.	11.19	11.19	8.285	7.425	6.836	5.526	7.798	15.14	5.855	4.064
Panel B: Full Controls										
Fragmentation	0.05 (0.51)	-0.20 (0.35)	-0.09 (0.30)	-0.51** (0.22)	-0.03 (0.27)	0.12 (0.07)	0.28 (0.29)	-0.29 (0.32)	-0.12 (0.11)	-0.03 (0.09)
Observations	283	283	283	283	283	283	283	283	283	283
R-squared	0.082	0.066	0.118	0.057	0.023	0.043	0.065	0.071	0.049	0.011
Mean Dep. Var.	11.19	11.19	8.285	7.425	6.836	5.526	7.798	15.14	5.855	4.064

Notes: Results from villages regressions with municipal fixed-effects. The dependent variable is the standard deviation in the budget share that voters in the village would like to spend on Health (Column 1), Education (Column 2), Emergencies (Column 3), Water (Column 4), Roads (Column 5), Community Facilities (Column 6), Business Loans (Column 7), Agriculture (Column 8), Security (Column 9) and Community Events/Festivals (Column 10). In Panel B regressions control for village population, whether the village received the PPCRV experiment, is classified as rural, average education, age, household size, and length of residence, as well as the share of population that is female, receives remittances from abroad, and benefits from a CCT program. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 4: Network Fragmentation and Collective Action

	(1)	(2)	(3)	(4)
	Bayanihan		Group	
Fragmentation	0.09*	0.08	-0.05	-0.05
	(0.05)	(0.05)	(0.04)	(0.05)
Controls	No	Yes	No	Yes
Observations	283	283	283	283
R-squared	0.008	0.092	0.002	0.128
Mean Dep. Var.	0.751	0.751	0.658	0.658

Notes: Results from villages regressions with municipal fixed-effects. The dependent variable is the share of the village population that participates in bayanihan activities (Columns 1-2) and the share of the village population that is a member of a formal group (Columns 3-4). In Columns 2 and 4, regressions control for village population, whether the village received the PPCRV experiment, is classified as rural, average education, age, household size, and length of residence, as well as the share of population that is female, receives remittances from abroad, and benefits from a CCT program. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 5: Network Fragmentation and Competition in Barangay Elections

	(1)	(2)	(3)	(4)	(5)
	# Candidates	Bgy. Cpt.		Win	# Candidates
	Raw	Laakso	Golosov	Margin	Bgy. Councilors
Panel A: No Controls					
Fragmentation	0.06*** (0.01)	0.04*** (0.01)	0.03*** (0.00)	-1.73*** (0.28)	0.72*** (0.09)
Observations	31,344	30,985	31,344	30,593	31,344
R-squared	0.004	0.003	0.002	0.002	0.012
Mean Dep. Var.	2.175	1.875	1.667	36.89	16.84
Panel B: Full Controls					
Fragmentation	0.05*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	-1.68*** (0.32)	0.59*** (0.08)
Observations	31,306	30,947	31,306	30,555	31,306
R-squared	0.012	0.009	0.008	0.007	0.054
Mean Dep. Var.	2.175	1.875	1.667	36.89	16.84

Notes: Results from village elections regressions with municipal*election-year fixed-effects. The dependent variable is the number of candidates for barangay captain (Column 1), the effective number of candidates for barangay captain computed as Laakso (Column 2), the effective number of candidates for barangay captain computed as Golosov (Column 3), the win margin in the barangay captain election (Column 4) and the number of candidates for barangay councilor (Column 5). In Panel B regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 6: Fragmentation on over 45 Networks and Competition in Barangay Elections

	(1) # Candidates Raw	(2) Bgy. Cpt. Laakso	(3) Golosoov	(4) Win Margin	(5) # Candidates Bgy. Councilors
Panel A: OLS					
Fragmentation (over 45)	0.06*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	-1.74*** (0.36)	0.67*** (0.09)
Observations	31,298	30,939	31,298	30,544	31,298
R-squared	0.014	0.010	0.009	0.007	0.067
Mean Dep. Var.	2.175	1.875	1.667	36.88	16.84
Panel B: IV					
Fragmentation	0.10*** (0.01)	0.07*** (0.01)	0.06*** (0.01)	-2.89*** (0.55)	1.13*** (0.12)
Observations	31,298	30,939	31,298	30,544	31,298
Mean Dep. Var.	2.175	1.875	1.667	36.88	16.84

Notes: Results from village elections regressions with municipal*election-year fixed-effects. The dependent variable is the number of candidates for barangay captain (Column 1), the effective number of candidates for barangay captain computed as Laakso (Column 2), the effective number of candidates for barangay captain computed as Golosoov (Column 3), the win margin in the barangay captain election (Column 4) and the number of candidates for barangay councilor (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 7: Network Fragmentation and Politically Influential Individuals

	(1)	(2)	(3)
	# Influential Individuals		
	Raw	Laakso	Golosov
Panel A: No Controls			
Fragmentation	0.74*** (0.24)	0.47** (0.16)	0.45** (0.15)
Observations	269	269	269
R-squared	0.017	0.014	0.014
Mean Dep. Var.	9.137	5.900	5.157
Panel B: Full Controls			
Fragmentation	0.80** (0.27)	0.54*** (0.16)	0.53*** (0.14)
Observations	269	269	269
R-squared	0.054	0.073	0.075
Mean Dep. Var.	9.137	5.900	5.157

Notes: Results from villages regressions with municipal fixed-effects. The dependent variable is the number of individuals named as influential by survey respondents (Column 1), the effective number of individuals named as influential by survey respondents computed as Laakso (Column 2), the effective number of individuals named as influential by survey respondents computed as Golosov (Column 3). In Panel B regressions control for village population, whether the village received the PPCRV experiment, is classified as rural, average education, age, household size, and length of residence, as well as the share of population that is female, receives remittances from abroad, and benefits from a CCT program. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table 8: Network Fragmentation, Turnout and Win Margin in Municipal elections

	(1)	(2)	(3)	(4)
	Win Margin		Turnout	
Fragmentation	-1.94*** (0.35)	-0.63* (0.33)	-0.80*** (0.14)	-0.68*** (0.15)
Controls	No	Yes	No	Yes
Observations	17,023	17,021	18,352	18,350
R-squared	0.006	0.021	0.004	0.016
Mean Dep. Var.	33.60	33.60	72.64	72.64

Notes: Results from precinct-level regressions with municipal fixed-effects. The dependent variable is win margin in the 2010 municipal elections (Columns 1-2) and turnout in the 2010 municipal elections (Columns 3-4). In Columns 2 and 4, regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Social Fragmentation, Electoral Competition and Public Goods Provision

Online Appendix

Cesi Cruz
Julien Labonne
Pablo Querubin

A.1 Network Measures

Edge Betweenness Centrality

Edge betweenness centrality is the extent to which an edge (marriage between 2 families) serves as a link between different groups of families. It assesses centrality by looking at whether the edge is an important hub in the paths traversing the network and is calculated using the number of shortest paths in the network that necessarily pass through the edge. This measure is analogous to betweenness centrality, which considers the relative importance of a node in the paths traversing the network (Freeman, 1977).

In the family network f , let $P_e(kj)$ indicate the number of shortest paths between family k and family j that necessarily pass through edge e , while $P(kj)$ is the total number of shortest paths between k and j .

The ratio $P_e(kj)/P(kj)$ approximates the importance of edge e in connecting k and j . If $P_e(kj) = P(kj)$, yielding a ratio of 1, then edge e lies on all of the shortest paths connecting families k and j . Conversely, if $P_e(kj) = 0$, then the intermarriage represented by edge e is not important for connecting families k and j .

Edge betweenness centrality is calculated by averaging this ratio for the entire network.

$$\text{Betweenness}_e(f) = \sum \frac{P_e(kj)}{P(kj)} \quad (2)$$

A.2 Additional Results

Table A.1: Network Fragmentation and Public Goods Provision (Alternative Measures)

	(1)	(2)	(3)	(4)	(5)
	Elem. School	High School	Market	Health Centre	Waterworks
Panel A: Edge removal, weighted by family size					
Fragmentation	0.03*** (0.01)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.01)	0.02*** (0.01)
Observations	15,432	15,432	15,432	15,432	15,432
R-squared	0.076	0.172	0.139	0.049	0.037
Mean Dep. Var.	0.806	0.209	0.190	0.639	0.597
Panel B: Edge removal, communities weighted by number of voters					
Fragmentation	0.03*** (0.01)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.01)	0.02*** (0.01)
Observations	15,432	15,432	15,432	15,432	15,432
R-squared	0.076	0.172	0.139	0.049	0.037
Panel C: Walktrap algorithm					
Fragmentation	0.03*** (0.01)	0.02*** (0.00)	0.02*** (0.00)	0.04*** (0.00)	0.02*** (0.00)
Observations	15,432	15,432	15,432	15,432	15,432
R-squared	0.077	0.172	0.139	0.051	0.037
Mean Dep. Var.	0.806	0.209	0.190	0.639	0.597

Notes: Results from village-level regressions with municipal fixed-effects. The dependent variable is a dummy equal to one if there is an elementary school in the village (Column 1), an high school in the village (Column 2), a market in the village (Column 3), an health centre in the village (Column 4) and a waterworks system in the village (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table A.2: Network Fragmentation and Public Goods Provision (Exc. Outliers and ARMM)

	(1)	(2)	(3)	(4)	(5)
	Elem. School	High School	Market	Health Centre	Waterworks
Panel A: Remove urban areas					
Fragmentation	0.03*** (0.01)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.01)	0.02*** (0.01)
Observations	13,728	13,728	13,728	13,728	13,728
R-squared	0.074	0.140	0.061	0.053	0.033
Panel B: Remove "home" village of the incumbent					
Fragmentation	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.03*** (0.01)	0.02*** (0.01)
Observations	10,914	10,914	10,914	10,914	10,914
R-squared	0.074	0.160	0.112	0.048	0.034
Panel C: Remove ARMM					
Fragmentation	0.03*** (0.01)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.01)	0.02*** (0.01)
Observations	13,728	13,728	13,728	13,728	13,728
R-squared	0.074	0.140	0.061	0.053	0.033

Notes: Results from village-level regressions with municipal fixed-effects. The dependent variable is a dummy equal to one if there is an elementary school in the village (Column 1), an high school in the village (Column 2), a market in the village (Column 3), an health centre in the village (Column 4) and a waterworks system in the village (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table A.3: Network Fragmentation and Public Goods Provision (Rob. Checks)

	(1)	(2)	(3)	(4)	(5)
	Elem. School	High School	Market	Health Centre	Waterworks
Panel A: Controlling for Incumbent Characteristics					
Fragmentation	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.03*** (0.01)	0.02*** (0.01)
Observations	9,697	9,697	9,697	9,697	9,697
R-squared	0.078	0.179	0.149	0.054	0.046
Panel B: Controlling for Incumbent and Challenger Characteristics					
Fragmentation	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.03** (0.01)	0.02** (0.01)
Observations	8,739	8,739	8,739	8,739	8,739
R-squared	0.091	0.184	0.153	0.061	0.050
Controlling for Gini and Fragmentation in Ethnicity, Religion and Educational Attainment					
Fragmentation	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.00)	0.04*** (0.01)	0.02*** (0.01)
Observations	15,216	15,216	15,216	15,216	15,216
R-squared	0.080	0.175	0.139	0.054	0.038

Notes: Results from village-level regressions with municipal fixed-effects. The dependent variable is a dummy equal to one if there is an elementary school in the village (Column 1), an high school in the village (Column 2), a market in the village (Column 3), an health centre in the village (Column 4) and a waterworks system in the village (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table A.4: Network Fragmentation and Competition in Barangay Elections (Alternative Measures)

	(1)	(2)	(3)	(4)	(5)
	Raw	# Candidates Laakso	Bgy. Cpt. Golosov	Win Margin	# Candidates Bgy. Councilors
Panel A: Edge removal, ties weighted by family size					
Fragmentation (over 45)	0.04*** (0.01)	0.03*** (0.01)	0.03*** (0.00)	-1.38*** (0.31)	0.51*** (0.07)
Observations	31,306	30,947	31,306	30,555	31,306
R-squared	0.012	0.009	0.008	0.007	0.052
Panel B: Edge removal, communities weighted by number of voters					
Fragmentation	0.05*** (0.01)	0.03*** (0.01)	0.03*** (0.00)	-1.52*** (0.31)	0.52*** (0.07)
Observations	31,306	30,948	31,306	30,558	31,306
R-squared	0.012	0.008	0.007	0.007	0.048
Panel C: Walktrap algorithm					
Fragmentation	0.04*** (0.01)	0.03*** (0.01)	0.02*** (0.01)	-1.46*** (0.32)	0.53*** (0.06)
Observations	31,306	30,947	31,306	30,555	31,306
R-squared	0.011	0.009	0.008	0.007	0.054

Notes: Results from village elections regressions with municipal*election-year fixed-effects. The dependent variable is the number of candidates for barangay captain (Column 1), the effective number of candidates for barangay captain computed as Laakso (Column 2), the effective number of candidates for barangay captain computed as Golosov (Column 3), the win margin in the barangay captain election (Column 4) and the number of candidates for barangay councilor (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table A.5: Network Fragmentation and Competition in Barangay Elections (Exc. Outliers)

	(1)	(2)	(3)	(4)	(5)
	# Candidates		Bgy. Cpt.	Win	# Candidates
	Raw	Laakso	Golosov	Margin	Bgy. Councilors
Panel A: Remove urban areas					
Fragmentation	0.05*** (0.01)	0.03*** (0.01)	0.03*** (0.00)	-1.81*** (0.33)	0.42*** (0.07)
Observations	27,249	26,915	27,249	26,603	27,249
R-squared	0.019	0.015	0.014	0.010	0.071
Panel B: Remove "home" village of the incumbent					
Fragmentation	0.05*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	-2.17*** (0.38)	0.44*** (0.08)
Observations	21,716	21,421	21,716	21,146	21,716
R-squared	0.014	0.011	0.011	0.009	0.063
Panel C: Remove ARMM					
Fragmentation	0.06*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	-2.28*** (0.36)	0.72*** (0.07)
Observations	27,267	27,185	27,267	26,864	27,267
R-squared	0.019	0.012	0.011	0.009	0.071

Notes: Results from village elections regressions with municipal*election-year fixed-effects. The dependent variable is the number of candidates for barangay captain (Column 1), the effective number of candidates for barangay captain computed as Laakso (Column 2), the effective number of candidates for barangay captain computed as Golosov (Column 3), the win margin in the barangay captain election (Column 4) and the number of candidates for barangay councilor (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.

Table A.6: Network Fragmentation and Competition in Barangay Elections (Rob. Checks)

	(1)	(2)	(3)	(4)	(5)
	# Candidates	Bgy. Cpt.	Golosov	Win	# Candidates
	Raw	Laakso		Margin	Bgy. Councilors
Panel A: Controlling for Incumbent Characteristics					
Fragmentation	0.05*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	-2.11*** (0.39)	0.51*** (0.09)
Observations	19,703	19,440	19,703	19,197	19,703
R-squared	0.025	0.018	0.016	0.015	0.077
Panel B: Controlling for Incumbent and Challenger Characteristics					
Fragmentation	0.05*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	-1.99*** (0.40)	0.50*** (0.09)
Observations	17,777	17,543	17,777	17,330	17,777
R-squared	0.032	0.025	0.022	0.023	0.084
Panel C: Controlling for Gini and Fragmentation in Ethnicity, Religion and Educational Attainment					
Fragmentation	0.06*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	-2.27*** (0.34)	0.62*** (0.07)
Observations	30,862	30,503	30,862	30,115	30,862
R-squared	0.012	0.010	0.009	0.009	0.055

Notes: Results from village elections regressions with municipal*election-year fixed-effects. The dependent variable is the number of candidates for barangay captain (Column 1), the effective number of candidates for barangay captain computed as Laakso (Column 2), the effective number of candidates for barangay captain computed as Golosov (Column 3), the win margin in the barangay captain election (Column 4) and the number of candidates for barangay councilor (Column 5). Regressions control for village-level average age, average length of stay in the village, gender ratio, village population, the number of distinct families in the village, whether the village is classified as rural, as well as education levels in the village, occupation in the village and average per capita income and poverty incidence. The standard errors (in parentheses) account for potential correlation within municipality. * denotes significance at the 10%, ** at the 5% and, *** at the 1% level.