DEPARTMENT OF ECONOMICS AND FINANCE

SCHOOL OF BUSINESS AND ECONOMICS

UNIVERSITY OF CANTERBURY

CHRISTCHURCH, NEW ZEALAND

Social Capital, Social Heterogeneity, and Electoral Turnout

NOTE: An updated version of this working paper is forthcoming in Kyklos

Jeremy Clark
Abel François
Olivier Gergaud

WORKING PAPER

No. 9/2024

Department of Economics and Finance
UC Business School
University of Canterbury
Private Bag 4800, Christchurch
New Zealand

WORKING PAPER No. 9/2024

Social Capital, Social Heterogeneity, and Electoral Turnout

Jeremy Clark[1]
Abel François[2]
Olivier Gergaud[3]

June 2024

Abstract: Among the many studied determinants of voting, we predict that i) increased social capital will be positively associated with turnout, while increased heterogeneity will be negatively associated, ii) that both factors will work through their influence on the costs of information gathering and on the social norms of voting; and iii) that heterogeneity will interact with social capital in its association with turnout. We test these predictions at the extremely fine "meshblock" level by regressing New Zealand voter turnout in its 2017 national election on its 2013 census characteristics. We use roughly 40,000 meshblock volunteering rates to measure social capital, and heterogeneity based primarily on ethnic fragmentation. We find social capital is positively associated with voter turnout, while heterogeneity is negatively associated. We find robust evidence consistent with ethnic heterogeneity working through information costs and social norms, but less so social capital. We also find a robust interaction between social capital and heterogeneity in their association with turnout, consistent with ethnic heterogeneity raising bridging social capital that has a stronger association with turnout than in-group bonding social capital.

Keywords: Electoral turnout, social capital, population diversity, ethnic heterogeneity, volunteering

JEL Categories: D72; D91, and H31

Acknowledgements: The authors would like to thank Anthony Pengelly of the New Zealand Electoral Commission for his assistance in providing voter turnout data mapped to census boundaries. Olivier Gergaud benefited from an Erskine Visiting Fellowship in the Department of Economics and Finance of the University of Canterbury (Christchurch, New Zealand) where this project was initiated. We would like to express our gratitude for this generous financial support.

[1] Department of Economics and Finance, University of Canterbury, NEW ZEALAND
[2] EM Strasbourg Business School (LaRGE), Strasbourg University, FRANCE
[3] KEDGE Business School and LIEPP Sciences Po, FRANCE

† Corresponding author: Jeremy Clark. Email: jeremy.clark@canterbury.ac.nz.

1. Introduction

Few topics have aroused greater interest and study in political science than the factors influencing voter turnout. Whether motivated by concern to promote the health of the democratic process, rational choice puzzlement over why people bother to vote, or concerns over effective dis-enfranchisement of particular groups, many policy makers and researchers keenly study this topic. Theories of turnout have been put forward to extend the rational choice model to include a sense of civic duty (Bowler and Donovan (2013)), or to emphasize the resources under people's control, the mobilization efforts by others, or explanations emphasizing socialization, psychology, or the political institutions under which people live (Smets and van Ham (2013)). An enormous number of individual studies have tested one or more of these theories, as summarized in literature reviews by Stockemer (2017) and Blair (2000), and in meta analyses by Geys (2006a), Smets and van Ham (2013), and Cancela and Geys (2016).

Two more recent factors that have received limited but growing attention for their association with turnout are social capital and social heterogeneity. While the concept of social capital has varied definitions (Portes, 1998) from different academic fields (Svendsen and Svendsen, 2009), it commonly links to "the social interactions accumulated by a person within his social network." For its part, ethnic heterogeneity has commonly been defined using a fragmentation measure (one minus a Herfindahl measure of concentration), meaning the probability that two people randomly drawn to interact will be from different groups.

Increased social capital has been predicted to raise voter turnout by lowering costs of gathering information on issues, candidates, and parties, and by strengthening social norms of civic participation. Empirical investigations have so far been limited, with most finding a positive association. Conversely, increased diversity by ethnicity or other dimensions has been predicted to lower voter turnout by raising costs of information gathering, or weakening social norms of civic participation (possibly by lowering trust). Again, empirical investigations have been limited, but half to three quarters have found a negative association, though many of these use simpler proxies for diversity such as minority shares of the population that may confound heterogeneity *per se* with different groups' differing propensities to vote.

To date, the limited studies of whether social capital or heterogeneity are associated with aggregated voter turnout rates have used coarse boundaries, tested one factor or the other without considering the interactions that could be expected between them, or have not tested the underlying mechanisms by which either could be affecting turnout.[1]

In this paper, we examine the association between social capital or heterogeneity and subsequent voter turnout, and two proposed underlying mechanisms for each, using high quality fine "meshblock" level data for the entire country of New Zealand. Our measure of social capital is each meshblock's volunteering rate, which together with ethnic fragmentation we source from the 2013 New Zealand census. We combined this with meshblock level data on subsequent voter turnout in the country's 2017 national election. Aside from testing whether each factor is associated with turnout, we provide indirect tests of whether either is working through information channels (proxied by education levels and proportion speaking English), or through social norms (proxied by population density or dominant ethnic affiliation). In addition, recognizing that changes in ethnic fragmentation could affect two underlying dimensions of social capital – bonding within groups and bridging between them, we test whether there is a significant interaction in the two factors' associations with turnout.

With caveats about causality due to omitted variable bias, we use both simple linear regression and propensity score matching. We find a robust positive association between social capital and turnout, and a robust negative association between ethnic fragmentation and turnout. We next find robust evidence consistent with ethnic fragmentation affecting turnout via its effects on the cost of gathering information or social norms, and less robust evidence of social capital operating through the same channels. Finally, we find robust interaction effects -- social capital's positive association with turnout is strongest in meshblocks with higher ethnic heterogeneity, and conversely ethnic fragmentation's negative association is strongest in meshblocks with low social capital. If we assume that the probability of developing bridging social capital increases with local ethnic heterogeneity, this

[1] Notable exceptions include Anderson and Paskevicute (2006) testing mechanisms by which ethnic or linguistic heterogeneity may affect citizenship behaviour, and Bower and Donovan (2013) testing underlying drivers of people's sense of civic duty to vote.

could imply that it is the bridging component of social capital that correlates with voter turnout.

The remainder of the paper is as follows. Section 2 summarizes the relevant literature behind the predictions we test. Section 3 describes our New Zealand data and 2017 national election. Section 4 provides our empirical estimation strategy, while Section 5 provides our linear regression results and regression sensitivity tests. Section 6 briefly summarizes our equivalent propensity score matching results, while Section 7 concludes.

2. Disentangling the relationships between social capital, ethnic heterogeneity, and voter turnout

Existing theoretical and empirical papers could be taken to predict that social capital will have an opposite effect to social heterogeneity on voter turnout. Social capital is thought to boost electoral participation, while social heterogeneity may lower it. Both factors may operate through similar causal channels, but in opposite directions. Finally, there are several reasons why the two factors may interact in their effects on turnout. We review the literature for each point in turn.

2.1. Social capital and voter turnout

Surprisingly, the literature testing a direct link between social capital and voter turnout is sparse. Smets and van Ham (2013, 351) consider 95 published papers dealing with determinants of turnout, and note "general measures of social capital were included in only three studies and were most often found not to have a significant effect." Instead, researchers have scrutinized a link between social capital and other forms of political participation, such as demonstrations, interest groups activities, or membership in political parties or unions. Voter turnout is sometimes included among multiple measures of political activity (e.g. Heath 2004) or incorporated into an *ad hoc* index of political participation (e.g. La Due Lake et al. 1998). Finally, voter turnout is sometimes used itself to measure social capital (e.g. Putnam, 2000).

As a result, few studies estimate the influence of social capital on voter turnout specifically. Liu et al. (2009) use data from the 2000 American presidential election survey, and find social capital has a positive effect on white and African-

American voting rates, though the magnitude is sensitive to the social capital measure used. Luengo-Cabrera et al. (2014) use data from the British Social Attitudes survey, and also find a positive effect of social capital on individual UK level turnout for the 2004 European Parliament election. Fiorino et al. (2021) build a composite indicator of social capital (including volunteering in social activities) which they label "social catalyst." They find that social catalyst (as well as volunteering specifically) is positively related to turnout rates in Italian parliamentary elections at regional level. Atkinson and Fowler (2012) instead exploit a natural experiment to test for a causal relationship between social capital and voting. Surprisingly, they find a decrease in voter turnout rates in municipalities where elections fell within two weeks of their patron saint's days fiestas presumed to produce social capital. Similarly, Condon (2011) conducts a field experiment in Texas and Arizona within elementary school communities. While Condon's results are not stable across specifications, she concludes that there is either no significant impact, or a negative impact of social capital on voter turnout.

At least two theoretical mechanisms have been proposed to explain why social capital affects voter turnout. The first is the cost of gathering information. Voting decisions cannot be meaningful unless they are informed, yet as Fiorina (1990) highlights, gathering information on candidates and party platforms is one of the primary costs of political participation. As Beck et al. (2002), Klofstad (2007), McClurg (2003) and others have argued, people with more social interactions can acquire information at less cost, including about upcoming elections. Through social interactions citizens talk about politics among other things and circulate information that reduces the cost of information gathering. This raises people's probability of voting.

The second mechanism is related to social norms. Social capital may increase voter turnout because it strengthens the enforcement of social norms of civic participation. An election's outcome is a public good whose outcome is non-excludable, so that voting suffers from the paradox of collective action, or free-riding (e.g. Riker et al. 1968 and Tollison et al. 1973). One of the strategies to limit free-riding is the spread of social norms encouraging participation. With such norms, social disapproval raises the cost to individuals of not casting a ballot, raising their probability of voting (Amaro de Matos et al. 2004). Following Uslander (1999), we expect "communities with strong positive values (including trust in others) and ties

that bind people to one another will have more powerful norms of generalized reciprocity and cooperation." (Uslander 1999, 122). Thus social capital strengthens the enforcement of social norms, including the civic duty to vote. And we know that people's sense of civic duty is a strong factor in their decision to vote (e.g. Bowler and Donovan 2013, François and Gergaud, 2019, and Blais and Achen, 2019).

2.2. Ethnic heterogeneity and voter turnout

In contrast to social capital, there is a larger literature probing a relationship between social heterogeneity and turnout. Ethnic heterogeneity in particular is sometimes used as a control factor in studies of the determinants of voting. Even so, given the enormous size of the "determinants of voting" literature, only a minority of empirical studies control for ethnic heterogeneity.[2] In their meta-analysis of 189 studies of turnout at national and subnational elections, Cancela and Geys (2016) find that only 5.3% control for ethnic fragmentation using a Herfindahl index, and only 27% use somewhat related measures such as the proportion of minorities, or of migrants. They report half of the (smaller) first group find ethnic heterogeneity has a significant negative effect on turnout, as do three quarters of the (larger) second group with poorer ethnic diversity measures.[3] Earlier literature summaries also note the preponderance of negative findings, such as Costa and Kahn (2003, 104): "different empirical economic papers have studied the consequences of community heterogeneity, and all these studies have the same punch line: heterogeneity reduces civic engagement. In more-diverse communities, people participate less."

As specific examples, in their large international comparative study using aggregate turnout rates, Martinez i Coma et al. (2017) find that ethnic fragmentation is correlated with lower turnout rates. Lago et al. (2018) show that both ethnic and linguistic fragmentation – through not religious fragmentation -- are linked to a reduction in electoral turnout. At the local municipal level, Barone et al. (2016) find a similar relation between diversity and turnout rate in Italy. These aggregated results are confirmed using more numerous individual data survey studies, both in different

[2] Conversely, Lago et al. (2018) note that in the many studies of the impact of fragmentation and segregation on economic success or the quality of democratic institutions, turnout is rarely considered.

[3] Geys' earlier but similar meta-analysis (2006a) did not find any relation between population homogeneity and turnout.

institutional contexts and with various measures of ethnic heterogeneity. For example, Forster (2018) finds that German respondents living in more ethnically heterogeneous neighborhoods are less likely to vote. With a proxy measure of ethnic heterogeneity, Belletini et al. (2016 and 2020) find similar results in Italy. However, Belletini et al. (2020) subsequently demonstrate that this effect is driven by those with low-income, with the relationship reversed for those with high-income. Others also find that this negative relationship may be restricted to subsamples of the population (see Cho et al. 2006, and Fieldhouse and Cutts 2008). There thus seems to be a general, though not universal consensus among studies that ethnic heterogeneity is often associated with lower voter turnout, using both aggregate and individual voter data.[4]

More broadly, ethnic heterogeneity is also found to affect other political behaviours. Alesina and La Ferrara (2000) have shown that US respondents living in more ethnically heterogeneous neighborhoods have a lower probability of participating in groups or clubs. Anderson and Paskeviciute (2006) find that national ethnic or linguistic heterogeneity have various and mixed impacts on four citizenship behaviours, with a robust negative effect on interpersonal trust. Aside from ethnic fragmentation, the effects of other measures of heterogeneity on turnout have also been explored, such as the proportion of minorities or the presence of migrants in the voters' neighborhood (e.g. Barone et al. 2016).

Various mechanisms have been proposed to explain a negative relationship between heterogeneity and voter turnout. As with social capital, one mechanism involves the cost of information. Increases in linguistic, cultural or other dimensions of heterogeneity can make interactions between people more difficult and less informative if they do not share enough culture to have an enriching exchange. Information is then less easily spread between people, including about elections. Working in the reverse direction as social capital, heterogeneity may thus increase the cost of gathering information, lowering the probability of voting.

A second mechanism is that heterogeneity may affect people's sense of civic duty. Referencing a model of Alesina and La Ferrara (2000), Lago et al. (2018: 114) establish two effects of social heterogeneity on participation: a direct effect through

[4] A few authors claim there should be a positive relationship between heterogeneity and participation, because a greater consensus in homogeneous constituencies should limit competition, and thus participation (e.g. Oliver 1999).

an aversion to ethnic mixing, and an indirect effect where sense of duty to vote depends on the voter's group. For example, people may be "less likely to construe voting as a civic duty when they belong to a minority group." (Lago et al. 2018, 114).

A related mechanism is that heterogeneity may alter social norms. We already noted that the existence and enforcement of social norms can offset free-riding to raise voter turnout. However social norms may differ according to the heterogeneity of the population. Greater heterogeneity may lead to weaker cooperative group norms across people (Chatman et al., 2001). A constituency with higher diversity may have less relevant social norms that reinforce voting and other cooperative behaviour (Anoll, 2018).

2.3. Interactions between heterogeneity and social capital regarding voter turnout

Based on the above literature, there are two reasons why heterogeneity and social capital may jointly affect voter turnout. First, both heterogeneity and social capital may share the same channels of influence on turnout, working in opposite directions.

Less obviously, changes in heterogeneity may also change the composition of social capital. We have not so far considered types of social capital. With heterogeneity, society by definition is comprised of at least two groups. Putnam (2000) therefore distinguishes in-group, or "bonding" social capital as interactions between people of the same group, and out-group or "bridging" social capital as interactions between people of different groups. Changes in heterogeneity may affect both kinds of social capital, and their relative proportions.

To illustrate, at the extreme of complete social homogeneity, people's interactions would accumulate social capital only in the unique in-group. Social capital could then only affect turnout through in-group effects. Conversely, under complete social heterogeneity, social capital could only affect turnout through bridging effects between a plethora of singleton out-groups.

With partial heterogeneity, the net effects of social capital on turnout are not obvious (Ariely 2014). Rising heterogeneity may lower social capital between groups, but raise it within them. Or it may lower both. Alesina and La Ferrara (2000) model people's propensity to participate in social activities - and thus

accumulate social capital- as a function of the composition of the community. On net, they predict more heterogeneous communities will have lower levels of social interactions, leading to less overall social capital. Putnam (2007) also argues that rising heterogeneity will have a net negative effect at least in the short term. However, empirical studies cannot always distinguish if the relevant social interactions are taking place within groups or between them. When the distinction is empirically possible, as in the aforementioned study by Liu et al. (2009), the impacts of bridging and bonding social capital seem to differ by the racial group of the respondent. McKenzie (2008) finds that bonding social capital between African-Americans has a positive effect on their political activities, including turnout.

Thus, although we have reason to predict there will be an interaction effect of heterogeneity and social capital on turnout, we do not have a clear prediction of its direction. Heterogeneity may increase or decrease bonding or bridging social capital, but most studies observe only the combined effect, even if they recognize this limitation (e.g. Laurence, 2011). It is plausible that rising heterogeneity reduces overall social capital (Coffé and Geys, 2006 and Coffé, 2009) or it may not (Gesthuizen et al., 2009)[5]. All we can say is that an interaction likely exists between ethnic heterogeneity, social capital, and civic engagement (Andrews, 2009), or between diversity, national identity and social capital (Reeskens et al., 2013). An interesting illustration of this interaction is given by Satyanath et al. (2017), regarding how social capital aided the rise of Nazism in 1930's Germany. Social capital can have a dark side according to its considered type and effects (Graeff, 2009).

We can summarize our predictions as follows:

Hypothesis 1a: social capital in the form of the 2013 meshblock volunteering rate will have a significant positive association with the 2017 meshblock voter turnout rate

Hypothesis 1b: 2013 ethnic fragmentation will have a significant negative association with the 2017 meshblock voter turnout rate

Hypothesis 2: the association of both social capital and ethnic fragmentation with turnout will operate in part via their effects on the cost of information gathering, and

[5] For a survey and a discussion, see van der Meer and Tolsma (2014).

on social norms. Social capital will reduce information costs and increase social norms, while ethnic fragmentation will do the opposite.

Hypothesis 3: there will be a significant interaction in the association of ethnic fragmentation and social capital with turnout. Its sign is unknown *ex ante*.

3. Data

To test our predictions, we use fine-grained aggregated data for all of New Zealand from its 2013 census and 2017 national election. We use both data sets at the finest possible level of geographical aggregation - the "meshblock".[6] The average meshblock population is 110 people.

Beyond the high quality of the data, New Zealand provides an interesting case study for several reasons. It is an advanced industrialized democracy, where volunteering activities related to social capital are measured in its census. It is also characterized by strong ethnic diversity that is not only related to recent immigration or enfranchisement.

3.1. Our measure of social capital

Unusually among countries, the five yearly New Zealand census asks all usually resident individuals 15 years or older about various "unpaid activities" performed over the four weeks prior to the fixed census night.[7] These include housework, looking after children or the ill or disabled in a person's own or other household, and separately, "other helping or voluntary work for or through any organisation, group or marae."[8] It is the final question that we use here.

It seems reasonable to take volunteering rates as a proxy of such interactions. For people can have rich social interactions without volunteering, but it seems safe to

[6] The official definition of a meshblock is "the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. A meshblock is defined by a geographic area, which can vary in size from part of a city block to a large area of rural land. Each meshblock borders on another to form a network covering all of New Zealand, including coasts and inlets and extending out to the 200-mile economic zone."

[7] For definition and statistical description of the variables, see Section A1 of the Supporting Information.

[8] A marae is a communal meeting place that serves religious and social purposes in Polynesian societies.

assume that meshblocks with high volunteering rates, all else equal, will contain people with higher degrees of social interaction than areas with low rates.[9]

Aggregated to meshblock level, the proportion of those 15 or older who reported having volunteered in the four weeks prior to the 2013 census was 14%. However, meshblock rates varied from 0% to 60% (for more detail, including the distribution of rates, see Supporting Information A1). In particular, 1.6% of meshblocks had a zero rate.

Unfortunately, the census volunteering question on its own does not enable us to tell if any social capital created or reflected by the volunteering is "in-group" or "out-group". We address this issue subsequently.

3.2. Our measure of ethnic diversity

We can also use the census to measure the social heterogeneity of meshblocks. It is possible to examine three dimensions of heterogeneity: language, religion and ethnicity. Each is released at different levels of detail. Frequencies of languages spoken are released in four categories (English, *te reo* Maori, Samoan, Other), while ethnic affiliations are reported in five (European, Maori, Pacific, Asian, and the rarer Middle Eastern/Latin American/African, or ME/LA/A). Frequencies of religious affiliation are released in a greater number of categories, but at meshblock level many categories' counts are bunched at zero. Where we address religion, we aggregate these to Religious Affiliation and No Religious Affiliation. Note that for language, ethnic and religious dimensions, multiple affiliations are allowed per respondent. The categorisations used in the census reflect the nation's history of Maori settlement from roughly the 1200's, European and British sealing, trading and missionary activity and colonization from the 1800's, and Pacific and more diverse international migration that increased from the mid 1900's onward. Of the three dimensions, based on the previous literature and greater number of categorizations feasible at meshblock level, we focus on ethnic diversity.[10]

Table 1 provides meshblock level descriptive statistics regarding New Zealand's 2013 ethnic composition, heterogeneity as measured by fragmentation, and

[9] For an explanation of the volunteering rate, see Thornton and Clark (2010) and Clark and Kim (2012).
[10] For robustness, we test if our conclusions hold with alternative heterogeneity dimensions.

Table 1. Ethnic affiliation shares in NZ (2013 census, meshblock level)

Ethnic Shares				
Proportion of	Mean	St. Dev.	Min	Max
European	0.71	0.22	0	1
Maori	0.13	0.13	0	1
Pacific	0.06	0.11	0	0.93
Asian	0.10	0.13	0	0.96
ME/LA/A	0.01	0.02	0	0.58
Ethnic Fragmentation				
	Mean	St. Dev.	Min	Max
Fractionalization	0.37	0.18	0	0.80
Highest or Majority Share				
	Largest ethnic group (highest proportion)		Majority ethnic group (proportion > 50%)	
	N	%	N	%
European	36,190	88.58	34,235	83.09
Maori	1,500	3.67	1,127	2.74
Pacific	1,374	3.36	750	1.82
Asian	1,788	4.38	1,038	2.52
ME/LA/A	4	0.01	1	0.00
No group	-	-	4,049	9.83

The observation unit is the "meshblock", the smallest aggregated geographic unit for which data is collected and released by Statistics New Zealand. The data comes from the 2013 census. Respondents self-report ethnic affiliation and can provide more than one. Results are aggregated to these categories. ME/LA/A refers to Middle Eastern/Latin American/African. Ethnic fragmentation is one minus a Herfindhal-Hirschman concentration index.

distribution of largest or majority ethnic group. On average, 71% of ethnic affiliations were European, with the second most frequent Maori at 13%. At the extremes, for every ethnicity there was at least one meshblock with zero share, and for European or Maori affiliations some with 100% share.

As foreshadowed, we measure ethnic fragmentation EF at the meshblock level. This is one minus a Herfindahl-Hirschman concentration index:

$$EF_m = 1 - \sum_{i=1}^{5} p_i^2. \quad (1)$$

Helpfully for our analysis to come, the variation of EF between meshblocks is very large, from 0 to 0.8 (see Supporting Information Figure A1.2). At the lower bound, 2.7% of meshblocks have full homogeneity (either European or Maori).

3.3. The 2017 New Zealand legislative election

New Zealand replaced its Westminster-style, first past the post (FPP) electoral system with a mixed member proportional (MMP) system in 1996. Similar to the German model, MMP combines elements of FPP and proportional representation (PR). In each electorate, voters each cast two votes: one for the party-affiliated representative they want to represent that electorate in parliament (FPP), and a second for their most preferred political party (PR). As a result of this dual vote system, 71 of the 120 members of parliament (MP's) in the 2017 national election were directly elected, while 49 "list MP's" were chosen according to the share of the popular vote won by their respective parties.[11]

For our empirical work, the MMP system implies that voter turnout in any given meshblock will be affected in part by the characteristics of the local electorate, such as quality of individual candidates, closeness of race, election spending, etc., such that electorate fixed effects are necessary. Nevertheless, while voters may have definite preferences regarding the local candidates for direct election, much emphasis in the media and commentary is at the national level, regarding national party leaders or policy platforms. This means there is a relatively low variance in political context between electorates, so that we can reasonably assume that these national effects are homogeneous across space.[12]

Beyond strong data availability, New Zealand's mixed voting system also provides a convenient framework for analyzing voter turnout. The country's relatively few large constituencies (electorates) with a uninominal vote, are unusual in being coupled with a national constituency for plurinominal votes. This means that political factors are mainly national and therefore constant across electorates, yet local socio-demographic characteristics of voters vary significantly within and across electorates. This combination of invariant political and varying socio-demographic characteristics makes the empirical analysis more straightforward. Controlling for the main political characteristics that might predict turnout is feasible using a few variables, while yet controlling for local factors like social capital.

[11] See the final part of Supporting Information A1 for further descriptions of the 2017 election.
[12] We discuss this further when we replace electorate fixed effects with characteristics.

In general, New Zealand has a relatively high voter turnout rate. In the previous 2014 national election, 7% of adults aged 18 or over reported being ineligible to vote, while 4% were eligible but not enrolled, leaving 89% of adults enrolled with the potential to vote.[13] In the 2017 national election 79% of the 3.3 million enrolled adults voted.[14] Reassuringly, our meshblock average turnout rate is also 79%. The full distribution of 2017 meshblock turnout rates is illustrated in Supporting Information Figure A1.3. It appears approximately normally distributed, though with a non-negligible proportion of meshblocks where everyone votes.

4. Our three-step empirical approach

Based on our hypotheses, we first test whether our social capital (volunteering) and ethnic heterogeneity measures can explain spatial variation in voter turnout rates at meshblock level. Our linear model for meshblock *m* located in electorate *e* is as follows:[15]

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC} SC_m + \alpha_{EF} EH_m + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (2)$$

SC_m and EF_m are the social capital and ethnic heterogeneity variables of interest, and from the literature we expect $\alpha_{SC} > 0$ and $\alpha_{EF} < 0$. Y_e is a set of electorate fixed effects, while $\boldsymbol{W}_m$ is a vector of observable meshblock covariates identified by others as determinants of aggregate voter turnout (Blais 2000, Geys 2006a, Geys 2006b and Cancela and Geys 2016). Among these are median household income, percentage owning their own home, percentage with university degrees, the unemployment rate, the percentage 65 or older, the proportion male, and population density (in logs).

Electorate fixed effect Y_e plays an important role in (2), as they capture factors related to local political races and campaign mobilization that could affect voter turnout. Alternatively, we try specifications replacing electorate fixed effects with electorate characteristics. These include the amount of election spending in the electorate, the number of candidates running for parliament, and fragmentation of local candidate vote shares. In robustness checks we also test the stability of results

[13] See https://www.stats.govt.nz/reports/voting-and-political-participation.
[14] See https://elections.nz/democracy-in-nz/historical-events/2017-general-election/voter-turnout-statistics-for-the-2017-general-election/.
[15] Our multilevel model has far more meshblocks (> 40,000) than clusters (40 electorates).

without any electorate fixed effects or characteristics, or replace fixed effects with random effects.

We estimate our first step using generalized least squares since we cluster standard errors at electorate level. Lacking any convincing instruments for SC_m and EF_m, we test the robustness of our results to the effects of unobserved variables correlated with these key variables, using the Oster (2019) and Diegert, Masten and Poirer (2022) (DMP) tests. With these tests showing that our results may not be stable to moderate omitted variable bias, we do three things for our entire analysis. First, we try various robustness checks that are described subsequently. Second, we repeat our main steps using Propensity Score Matching (PSM) of Rosenbaum and Rubin (1983) and Abadie and Imbens (2006). We define 'treated' meshblocks as those with above median social capital and/or below median ethnic fragmentation. Third, we confine ourselves to looking for evidence of associations or correlations consistent with theory, without claims to having established causality.

For our second step, we test for the information channels and social norms through which social capital or heterogeneity may be associated with turnout. We do this by adding interaction terms between proxy variables for the two channels with either social capital or heterogeneity. These proxy variables are summarized as we go, and described further in Supporting Information A6.

For our third step, we investigate an interaction effect between ethnic heterogeneity and social capital in their association with electoral turnout. This tests whether ethnic heterogeneity moderates the association between social capital and turnout because of its effect on the composition of bonding vs bridging interactions. However, our approach is empirically equivalent to asking if social capital moderates the association between ethnic heterogeneity and turnout.

5. Results on the association between social capital or ethnic diversity and turnout

We first report our baseline results on the impact on electoral turnout of social capital and ethnic heterogeneity. We then report tests on the sensitivity of these results to omitted variable bias. We then discuss the stability of the baseline results to

several robustness checks, such as alternative functional forms, sample restrictions or alternative variable definitions.[16]

5.1.1 Baseline results

The baseline results for voter turnout rates from equation (2) with electorate fixed effects are displayed in Table 2. Beginning with other control variables, we find the 2017 meshblock voter turnout rate is rising in 2013 meshblock median household income, share with university education, share aged 65 or older, share married, share of households owning own home, and proportion of people having no religious affiliation. Turnout is consistently falling in the share who are unemployed, and in population density. These results are stable to using a sparser or fuller sets of covariates.

Moving to our key variables, the outcomes are in line with Hypotheses (1a) and (1b). Regarding social capital, we find a significant positive association between the 2013 volunteering rate and the 2017 turnout rate. In column (3) with both key variables included and electorate fixed effects, a one percentage point increase in the volunteering rate is associated with a 6.0 percentage point increase in the voter turnout rate. Transforming to elasticities at sample means, a one-percent increase in social capital is related to a 0.01 percent increase in the turnout rate. We illustrate this key coefficient from column (3) in the left panel of Figure 1, showing how the predicted meshblock turnout rate varies with the prior volunteering rate. Predicted turnout is 78.4 percent with zero volunteering, increasing to 84.6 percent with 100% volunteering. Comparing between columns (1) and (3) of Table 2, the inclusion of ethnic heterogeneity slightly reduces the size of the association, from 6.5 to 6.0.

Regarding ethnic fragmentation, we find a statistically significant negative association between it and 2017 voter turnout. Again in column (3) of Table 2, a one percentage point increase in ethnic fragmentation is associated with a 7.3 percentage point decrease in turnout. Transforming to elasticities (at sample means), a one percent increase in fragmentation is associated with a 0.04 percent fall in the turnout rate. The right panel of Figure 1 illustrates this column (3) coefficient. The predicted turnout rate is 82.0 percent with zero fragmentation, falling to 76.1 percent

[16] PSM results will be reported after all three steps using linear regression.

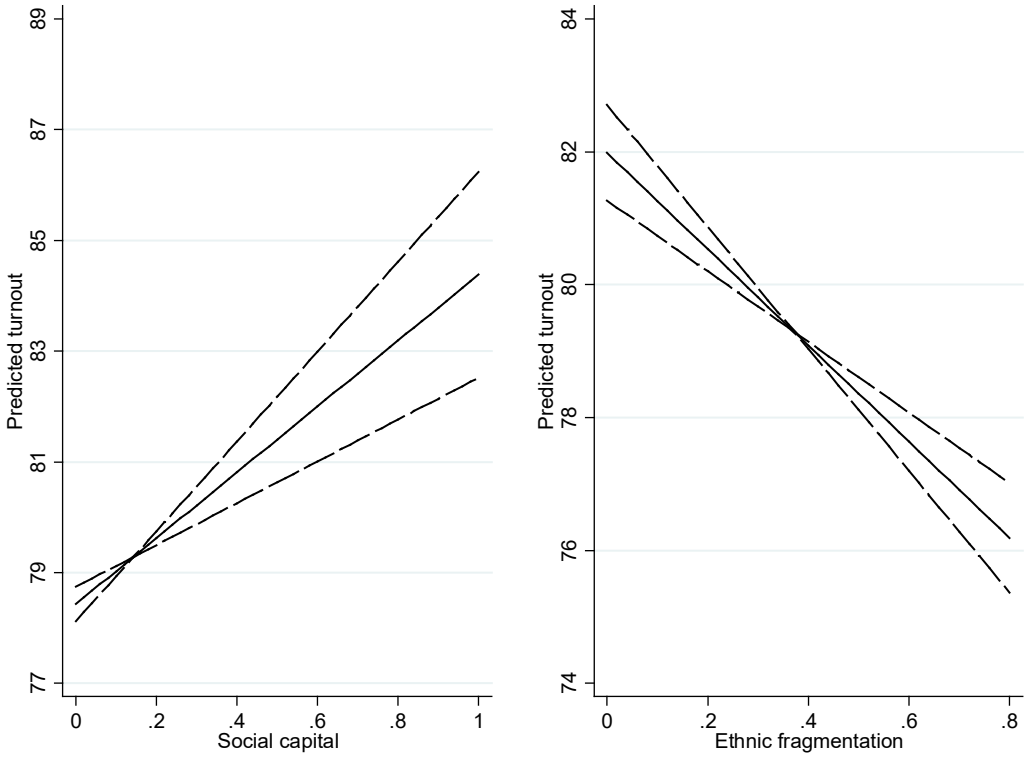
Table 2. Estimations of the turnout rate for the 2017 New Zealand national election

	(1) Coef. (se)	(2) Coef. (se)	(3) Coef. (se)	(4) Coef. (se)
Social capital	6.49***		5.95***	7.28***
	(1.11)		(1.09)	(1.51)
Ethnic heterogeneity		-7.36***	-7.25***	-7.70***
		(0.97)	(0.96)	(1.00)
Median household income	31.4***	23.7***	24.4***	24.7***
(1000 NZ$)	(3.70)	(3.79)	(3.73)	(4.31)
Home owners (%)	11.2***	9.98***	9.57***	10.6***
	(0.88)	(0.95)	(0.91)	(1.09)
% of ind. with univ. degrees	12.3***	11.8***	11.3***	15.1***
	(0.86)	(0.88)	(0.89)	(1.25)
Unemployment rate	-17.6***	-15.3***	-16.1***	-18.2***
	(1.56)	(1.60)	(1.64)	(2.17)
% of ind. aged 65 and +	13.1***	10.3***	10.3***	10.6***
	(0.65)	(0.82)	(0.82)	(1.00)
% No religious affiliation	6.23***	4.49***	4.93***	7.15***
	(0.85)	(0.89)	(0.88)	(1.40)
% Male	-2.29**	-1.97*	-1.88*	-2.07*
	(1.04)	(1.05)	(1.05)	(1.17)
% Married	5.00***	4.70***	4.56***	1.99
	(1.11)	(1.06)	(1.06)	(1.40)
Log (Pop density)	-0.79***	-0.69***	-0.67***	-0.63***
	(0.058)	(0.061)	(0.059)	(0.063)
Electorate features:				
Electoral fragmentation index				20.6***
				(5.07)
Party expenses				-0.052***
				(0.017)
Number of candidates				0.098
				(0.10)
Constant	67.7***	73.6***	72.5***	61.0***
	(0.90)	(1.23)	(1.23)	(2.96)
Electorate FE	yes	yes	yes	no
Observations	41,200	41,200	41,200	38,286
Adjusted R^2	0.40	0.41	0.41	0.38

The explained variable is the turnout rate (%). Social capital is measured by the volunteering rate. Ethnic heterogeneity is one minus the Hirschman-Herfindahl index. Standard errors are clustered by electorate. ***p<0.01, **p<0.05, *p<0.1. The estimation method is OLS.

in the meshblock with the highest observed fragmentation (0.8). Once again, the magnitude of the association only slightly decreases with the inclusion of social capital, from -7.4 to -7.3.

Figure 1. Predicted turnout, social capital and ethnic fragmentation



The predicted turnout is obtained from specifications with electorate fixed effects described in column three of Table 2. The dashed lines are 95% confidence intervals.

While our step one associations are as predicted, we recognize that in a cross section regression without valid instruments for either social capital or ethnic fragmentation, our estimates may be affected by omitted variable bias. In particular, our key explanatory variables may be correlated with (or selected on) unobserved factors that also influence the volunteering rate. While we cannot know the strength of such selection on un-observables relative to selection on observables, we can test the extent to which our estimates would be affected by different ratios of the two. In Table 3 we present two such tests, one by Oster (2019) that assumes any unobserved variables are themselves exogenous, and one by Diegert, Masten and Poirier (2023) that avoids this assumption.

Unfortunately, both tests indicate that if either of our key variables has a moderate degree of selection on unobservable factors (that also affect turnout), relative to selection on observable factors, both results could be overturned. The DMP test finds that a ratio (rxbar) as low as 19.0% could render social capital

Table 3: DMP and Oster Tests of Sensitivity of Key Variable Estimates to Omitted Variable Bias

	(1) Social Capital Coef.		(2) Ethnic Frag. Coef.
Table 2: Turnout Rate Key Variables			
DMP Bounds			
	β long		β long
Social capital		Ethnic heterogeneity	
rxbar = 0.000	[6.49***]	rxbar = 0.000	[-7.36***]
rxbar = 0.095	[2.27, 10.70]	rxbar = 0.083	[-11.99, -2.73]
rxbar = 0.190	[-2.07, 15.05]	rxbar = 0.166	[-16.79, 2.07]
rxbar = 0.285	[-6.70, 19.68]	rxbar = 0.249	[-21.95, 7.22]
rxbar = 0.380	[-11.82,24.80]	rxbar = 0.332	[-27.74, 13.02]
rxbar = 0.475	[-17.73,30.71]	rxbar = 0.415	[-34.62, 19.89]
rxbar = 0.570	[-24.97,37.95]	rxbar = 0.498	[-43.41, 28.68]
rxbar = 0.665	[-34.63,47.61]	rxbar = 0.581	[-56.04, 41.32]
rxbar = 0.760	[-49.44,62.42]	rxbar = 0.665	[-78.81, 63.99]
rxbar = 0.855	[-80.12,93.10]	rxbar = 0.748	[-162.17, 147.45]
rxbar = 0.950	[-inf , +inf]	rxbar = 0.776	[-inf , +inf]
R Squared (medium)	0.270		0.277
Oster Test			
Breakdown Ratio			
	Delta		Delta
If R^2 Long =	0.352, 106.6%		0.360, 65.1%
If R^2 Long =	1.000, 12.1%		1.000, 8.1%

The Diegert Masten Poirier (DMP) bounds on the true effect (β_{Long}) of either social capital or ethnic fragmentation on turnout (if all observable and unobservable controls were available), are calculated for the first two models of Table 2. All control variables other than electorate fixed effects were used for comparison. An rxbar of zero assumes no selection on unobservables relative to that on observables, while higher values represent an increasing proportion of selection on unobservables relative to that on observables (e.g. .095 means 9.5% as much selection). The bound at which the range of β_{Long} first includes zero shows the maximum extent to which unobservables can sufficiently influence our estimates that our findings are overturned. Alternatively, the Oster breakdown ratio (which assumes all non-key control variables are exogenous) provides the percentage of effect of unobservables relative to observables where we can no longer reject that $\beta_{Long} = 0$. This ratio depends on the assumed maximum attainable R^2 if unobservables could be observed. Run using the *regsensitivity* module in Stata.

insignificantly different from zero, as would a ratio of 16.6% for ethnic fragmentation. Slightly more optimistically, the Oster test finds for social capital that if the highest R^2 from a regression containing both observables and unobservables were .352, selection on unobservables relative to observables could be as high as 106.6% before it becomes insignificant. However if the highest R^2 were

1.0, the ratio could not exceed 12.2%. Analogously, if the highest R^2 for fragmentation were 0.360, the ratio could reach 65.1% before ethnic fragmentation became insignificant, but if the highest R^2 were 1.000, it could reach only 8.1%.

As foreshadowed, we thus consider several robustness checks of our Step 1 results, and later Propensity Score Matching results for all three Steps.

5.1.2. Robustness checks of baseline results

We summarize here four robustness checks of our baseline findings, with detailed results provided in Supporting Information.

We begin with how electorates are captured. Column (4) of Table 2 includes electorate characteristics rather than fixed effects. Of electorate controls, we find that voter turnout is positively associated with "electoral fragmentation" (closeness of contest), but surprisingly falling in the national parties' campaign expenditures in the electorate, and not correlated with the number of candidates running in the electorate. These variables may suffer from endogeneity – for example, more spending may be targeted at electorates with anticipated lower turnouts. Relevant here, our key variables (and the other meshblock control variables) are not greatly affected by the move from column (3) to (4). Turnout rates are again rising in volunteering rates and declining in ethnic fragmentation, with the coefficient on social capital rising to 7.3, and that on ethnic heterogeneity falling to -7.7. Given this stability, we focus on electorate fixed effects going forward.

Similarly, in case our key explanatory variables are themselves being driven by confounding factors related to electorates, we repeat our baseline specifications with neither electorate fixed effects nor characteristics. The results are similar in significance and magnitude (see Supporting Information Table A2.1). Similarly, using electorate random effects rather than fixed effects[17] gives very similar results (Supporting Information Table A2.2).

As a second robustness check, we vary the functional forms of the baseline relationship between social capital or heterogeneity and turnout. Campbell (2006), for example, finds a U-shaped relationship between heterogeneity and voter turnout. We thus try specifications with a log transformation of our main variables of interest,

[17] In Supporting Information A2, we present estimates from a hierarchical linear model where we model electorate effects with random components.

or with quadratic terms (Supporting Information Tables A.3.1 and A.3.2). The coefficient on social capital remains significant with ae log transformation or with a quadratic term added, though the square term is not significant. The results for ethnic heterogeneity are similar. We also apply a log transformation to turnout and both key variables simultaneously (Table A3.3) with similar findings.

Third, we vary the treatment of extreme observations in our sample to check whether our results are driven by them. Supporting Information Figure A1.3 indicates that a non-negligible proportion of meshblocks have 100 percent turnout. Excluding these meshblocks in Supporting Information Table A.4.1 does not alter our results. Similarly, excluding meshblocks with zero heterogeneity does not change our results, nor does applying a trimming and winsoring at 5% and 95%.

Fourth, we try alternative measures of social heterogeneity. First, we either replace or add to ethnic fragmentation the total number of ethnic groups present in the meshblock (ranging from 1 to 5) in Supporting Information Table A5.1 as in Coffé et al. (2006). As a replacement, the count variable is not significant, meaning categorical diversity is not related to turnout, whereas the degree of fragmentation is. Similarly, we either replace or add to fragmentation the ethnic affiliation shares of each meshblock, with share European the omitted baseline. This addresses the possibility that effects attributed to diversity could instead reflect differing propensities to vote among different ethnic groups. As a replacement, each share's coefficient is negative and significant relative to European, but do not differ from each other. As an addition, we find identical results for the shares, but the coefficient on ethnic fragmentation is now positive. However this may be due to multicollinearity between the shares and fragmentation (e.g. -.80 between share European and ethnic fragmentation). We also try replacing our fragmentation measure of ethnic diversity with ethnic polarization as in Kolo (2012). This is described in equation (3) of Supporting Information A5, with results in Supporting Information Table A5.2. We obtain similar signs and significance. We also try alternative dimensions of diversity by language or religion in Supporting Information Table A5.3. We find again that the coefficients on these alternative dimensions of fragmentation are negative and significant. Social capital also continues to have

positive effects when these alternative dimensions are used, or when all are used together (Table A5.4).[18]

5.2. Results on Potential Channels

In our second step, we examine the information and social norms channels of Hypothesis 2 by which social capital or heterogeneity may affect turnout.

5.2.1. The information channel

Recall our predictions that social capital reduces the cost of gathering information which increases turnout, while ethnic heterogeneity does the opposite.

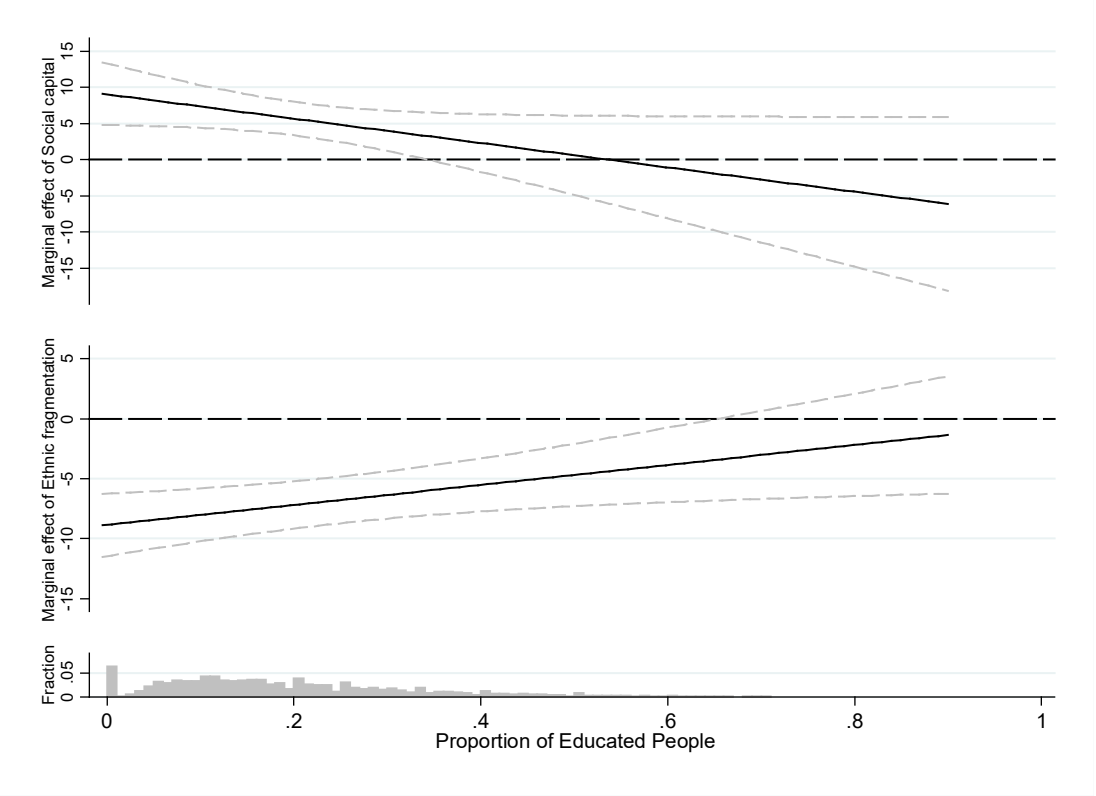
We proxy for the cost of gathering information two ways. Our first proxy is the proportion of people in each meshblock with university education. We predict the impact of social capital or ethnic heterogeneity on turnout will be conditional on this education measure. If an information channel is present, then by adding an education interaction term we should observe that when the population is more educated, the positive effect of social capital on turnout is reduced, as is the negative effect of heterogeneity.

Our second information cost proxy is the proportion of English in the languages spoken by people in each meshblock. For the most part the election campaign took place in English, so that access to information about the election would be easier to access if people spoke English, reducing the cost of information gathering and voting. As with education, with an interaction term included, we expect that when the share of English language spoken in a meshblock is higher, the positive association of social capital with turnout will be reduced, as will the negative association of ethnic heterogeneity.

We begin with results using our education proxy, with the main effect of either social capital or fragmentation plus the education interaction term summarized graphically in Figure 3, based on Supporting Information Table A6.1. Consistent with predictions, the upper panel of Figure 3 shows that the positive association between 2013 volunteering and 2017 turnout is greater when the proportion of educated people is lower. Similarly, the lower panel of Figure 3 shows that the

[18] For brevity, we omit a fifth robustness check that repeats our Table 2 analysis electorate by electorate, which broadly supports our findings. See Supplementary Information Figure A5.1.

Figure 3. Social capital or ethnic heterogeneity and turnout conditioned by percentage with university degrees



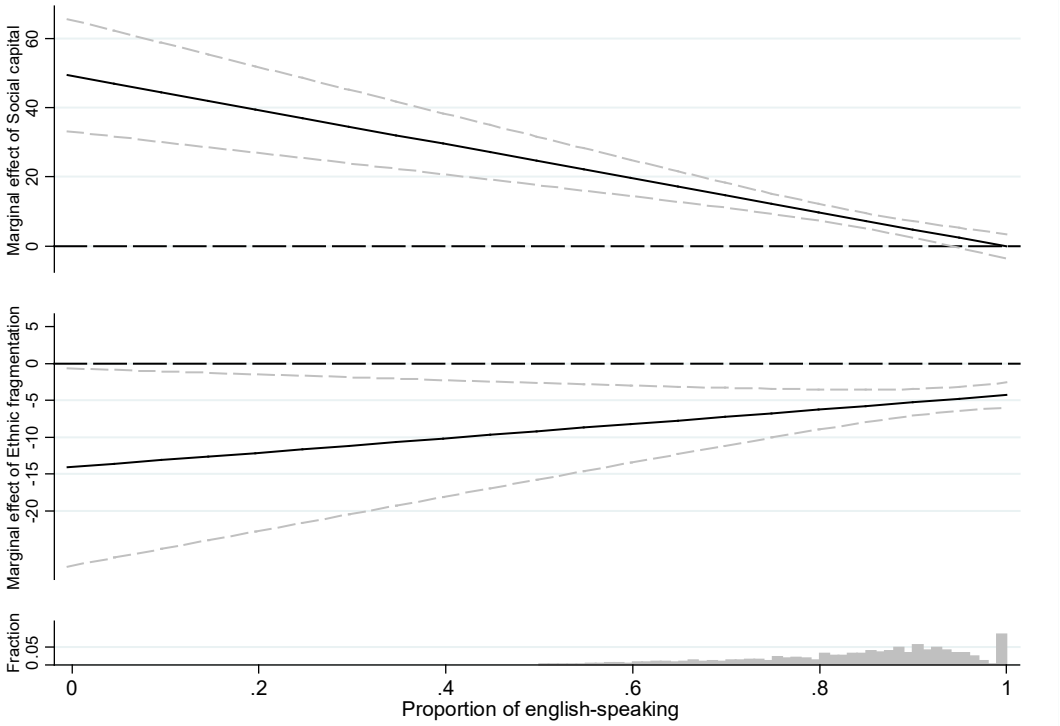
The dashed lines are 95% confidence intervals. For details, see Sup. Inf.. Table A6.1.

negative association between ethnic heterogeneity and turnout is stronger when the proportion of educated people is lower. In fact, in meshblocks with a high enough proportion of university educated people, both social capital and ethnic heterogeneity lose their significant associations with turnout.

We next use our English language proxy, similarly summarized graphically in Figure 4, based on Supporting Information Table A6.2. Again consistent with predictions, the upper panel shows that the positive association between social capital and turnout falls as the proportion speaking English rises. Social capital falls to having no association when only English is spoken. The lower panel similarly shows the negative association between ethnic heterogeneity and turnout weakens as the proportion speaking English rises, though notably it always remains significant.

Though only associations, this evidence consistent with the Hypothesis 2 prediction that both social capital and ethnic heterogeneity affect voter turnout in part by their effects on the cost of gathering information.

Figure 4. Social capital or ethnic heterogeneity and turnout conditioned by proportion of English in languages spoken



The dashed lines are 95% confidence intervals. For details, see Sup. Inf.. Table A6.2.

5.2.2. The social norms channel

Recall our prediction that social capital strengthens social norms of civic participation, while ethnic diversity does the opposite. To test this, we again try two alternative proxies for strength of social norms. First, we exploit the literature suggesting that people living in higher density areas require stronger social norms (e.g. Gelfand et al., 2017), and that social norms will tend to be weaker in such areas. Thus, if social capital reinforces social norms, or ethnic heterogeneity weakens them, these effects should be greater in higher density meshblocks where the strength of social norms is weaker.

Second, we exploit a literature suggesting that social norms are affected by dominant ethnic group. If we assume that social norms differ according to ethnic group (Gelfand et al., 2017), then the effect of social capital or ethnic heterogeneity on turnout will depend on the ethnic group dominant in the meshblock. We define each meshblock's dominant ethnic group among the five reported by the census as the one with the highest proportion of affiliations. Unlike for our other proxies, we

do not have expectations as to how a specific dominant group will affect the association of either social capital or heterogeneity with turnout. Rather, including interaction terms with dominant group is sufficient to test a social norm-based channel.

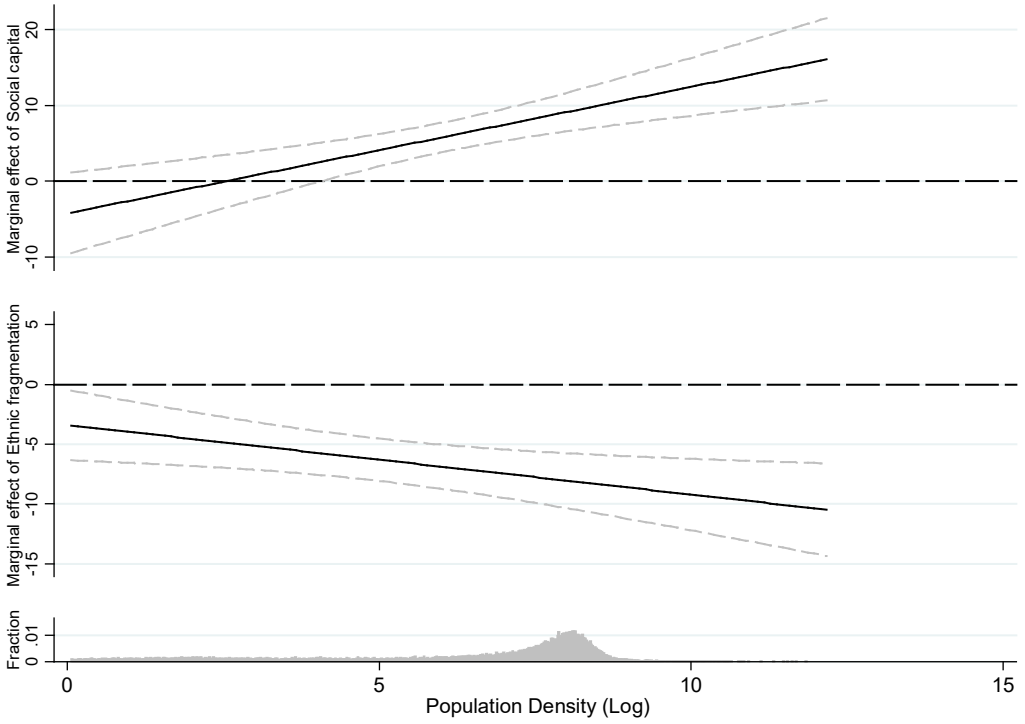
We first present results using population density, with the main effect of either social capital or fragmentation plus the population density interaction term summarized graphically in Figure 5. The underlying main effects and interaction terms come from Supporting Information Table A6.3. Consistent with predictions, we find (in the upper panel of Figure 5) the association between social capital and voter turnout is stronger in meshblocks with higher population density.

Similarly, we find in the lower panel that the negative association between ethnic heterogeneity and turnout is strengthened with higher density. While only associations, these results are consistent with Hypothesis 2 that both social capital and ethnic heterogeneity affect turnout by operating through a social norms channel (in opposite directions).

We second present results using dominant ethnic group interaction terms. Main effects of social capital or fragmentation plus interactions with dominant group are summarized graphically in Figure 6, based on Supporting Information Tables A6.5 for social capital, and A6.6 for fragmentation. Note that if we first add dominant ethnic affiliation without interactions, we observe substantial differences in turnout by dominant ethnic affiliation. Turnout is significantly higher where European is the dominant affiliation, while differences are not significant (at the 10% level) between Asian, Pacific or Maori being the dominant ethnic affiliation. When we include the key interaction terms with social capital in the left panel of Figure 6, we see the association of social capital with turnout varies significantly by dominant ethnic affiliation. Social capital has a stronger association with turnout in meshblocks with Asian or Pacific dominant affiliations than in those with European.

Similarly, when we include the key interactions with ethnic fragmentation on the right panel of Figure 6, we see the association of ethnic fragmentation with turnout differs significantly between European (lower) and Asian or Pacific (higher) dominant meshblock. In fact, the total effect of fragmentation in European dominant meshblocks is so low as to be negative, meaning increases in ethnic heterogeneity in such meshblocks is positively associated with turnout. This is contrary to our previous findings of a negative effect of ethnic fragmentation overall.

Figure 5. Social capital or ethnic heterogeneity and turnout conditioned by population density



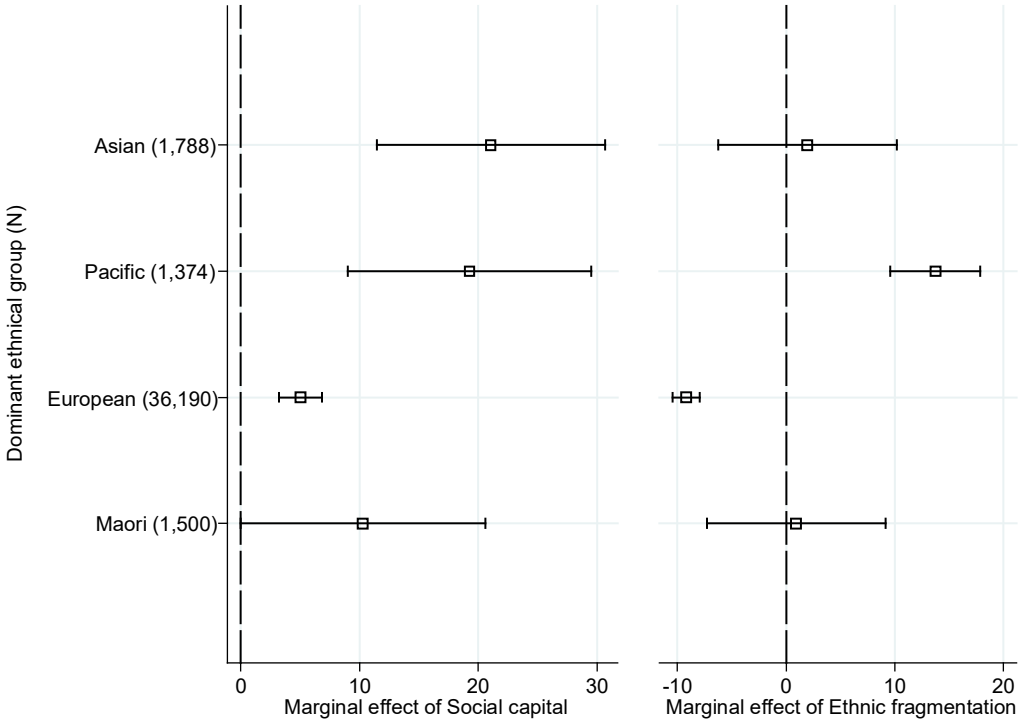
The dashed lines are 95% confidence intervals. For details, see Sup. Inf.. Table A6.3.

To sum up, using dominant ethnic group as our second proxy for the social norm channel, we again find evidence that it affects the strength of association of either social capital or ethnic heterogeneity and turnout. From both proxies we find evidence consistent with Hypothesis 2 that social capital and ethnic heterogeneity affect voter turnout by their effects on social norms.

5.3. Interactions between ethnic heterogeneity and social capital

In our third step, we test whether heterogeneity and social capital interact in their association with voter turnout. We use two approaches. First, we exploit the fact that a non-negligible number of meshblocks have no volunteering or ethnic fragmentation. We classify meshblocks with "positive volunteering" or "full homogeneity" separately from those with zero volunteering or at least some fragmentation using two dummy variables. We then interact ethnic fragmentation with the "positive volunteering" dummy, and social capital with the "full homogeneity" dummy. As our second approach, we simply add an interaction between our two key variables of interest.

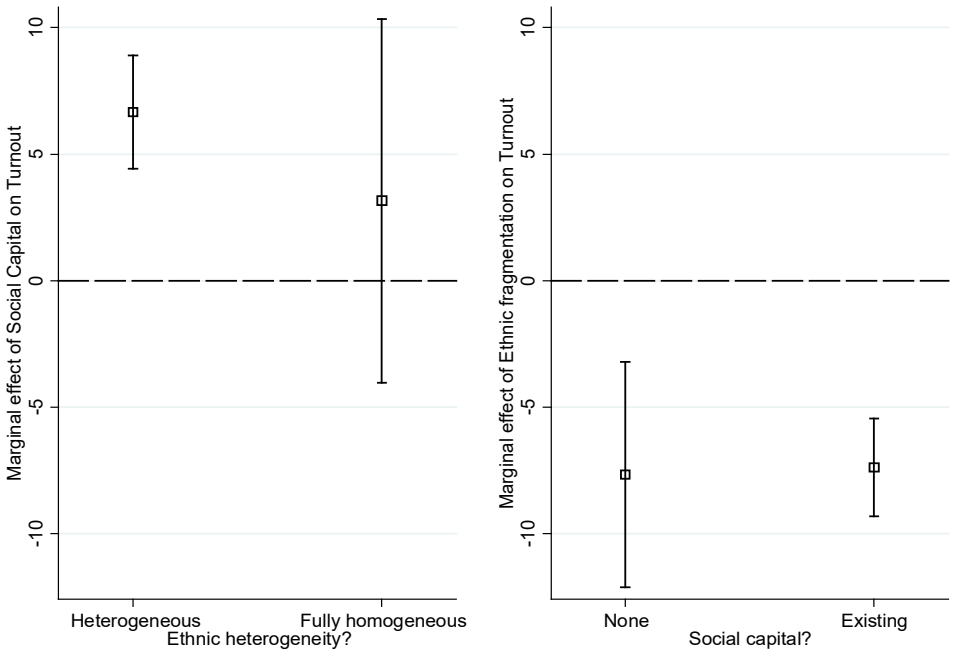
Figure 6. Social capital or ethnic heterogeneity and turnout conditioned by dominant ethnic group



An ethnic group is considered dominant when its proportion of affiliations is the highest in the meshblock. The lines are 95% confidence intervals. For details, see Sup. Inf.. Tables A6.5 and A6.6.

In Figure 7 we illustrate how the association between social capital and turnout is affected by whether meshblocks have full homogeneity (left panel), or how the association between fragmentation and turnout is affected by whether meshblocks have positive volunteering (right panel). The underlying results are reported in Supporting Information Table A7.1. In the left panel, we see that social capital has a significant positive association with turnout in meshblocks with at least some heterogeneity. This association is suggestively though not significantly lowered in meshblocks with complete homogeneity, resulting in social capital not even having a significant positive association with turnout in fully homogeneous meshblocks. In contrast, the right panel of Figure 7 indicates that the negative association between ethnic fragmentation and turnout does not seem to depend on whether the meshblock has positive volunteering. The estimated coefficients are very similar.

Figure 7. Social capital or ethnic heterogeneity and turnout by meshblock characteristics



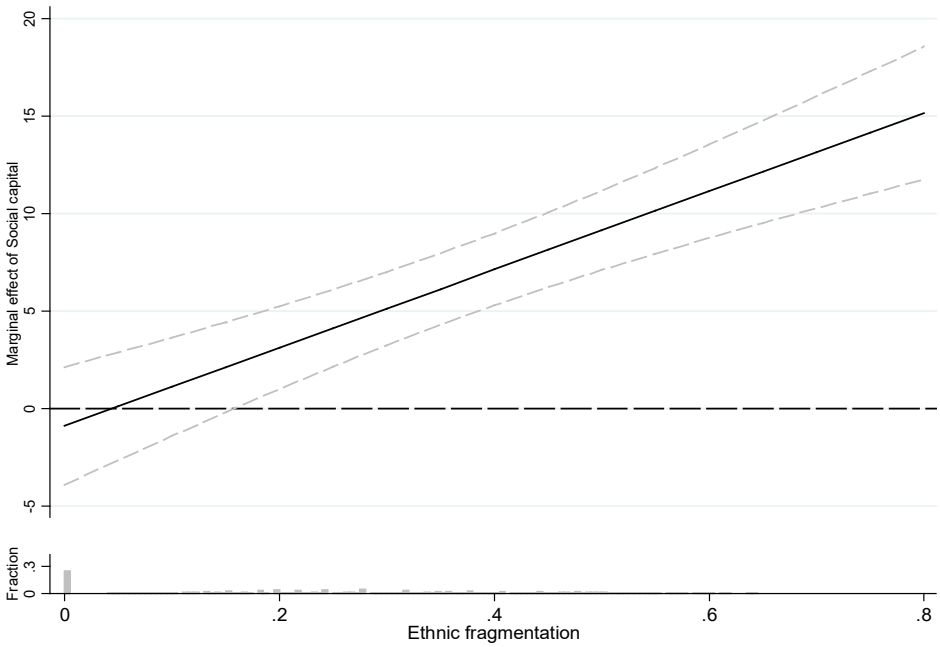
Fully homogeneous meshblocks have a single ethnic affiliation reported. The lines aret 95% confidence intervals. For details, see Sup. Inf.. Table A7.1.

We next examine the simpler continuous interaction between ethnic heterogeneity and social capital. Based on Supporting Information Table A7.2, Figure 8 illustrates the main effect of social capital plus interaction with fragmentation, while Figure 9 illustrates the main effect of fragmentation plus interaction with social capital. Unlike with our first approach, the results here are unambiguous.

Figure 8 shows social capital's association with turnout consistently increases with ethnic fragmentation. To the extent that bonding social capital is more likely to occur in homogeneous meshblocks, and bridging less likely, this may imply that bridging social capital has more effect on turnout than bonding social capital. We must be cautious in our conclusions, however, because people who live in homogeneous meshblocks may still volunteer in ethnically heterogenous settings, and vice versa.

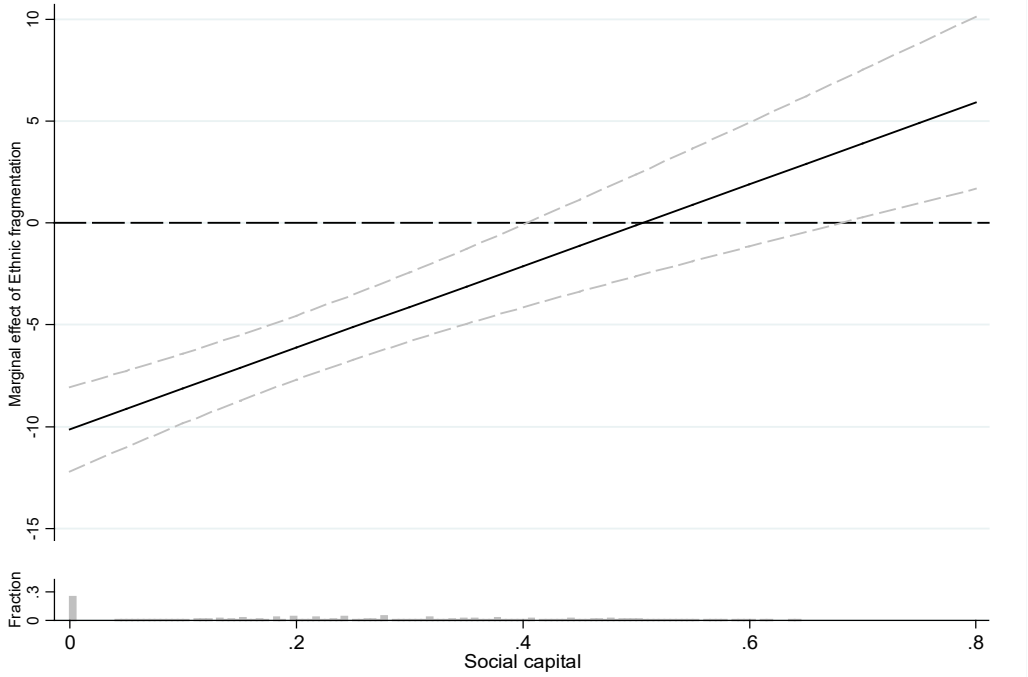
Conversely, Figure 9 shows that the negative association between ethnic fragmentation and turnout disappears (i.e. the estimated coefficient climbs to zero)

Figure 8. Association between social capital and turnout conditioned by ethnic heterogeneity



The dashed lines are 95% confidence intervals. For details, see Sup. Inf. A7.

Figure 9. Association between ethnic heterogeneity and turnout conditioned by social capital



The dashed lines are 95% confidence intervals. For details, see Sup. Inf. A7.

as social capital increases in the meshblock. We thus conclude that there is as predicted in Hypothesis 3 an interaction between ethnic heterogeneity and social capital in their association with voter turnout. High social capital attenuates the negative relationship between ethnic heterogeneity and turnout. If we assume that bridging social capital increases with meshblock ethnic diversity, then the finding that social capital has a stronger association as ethnic diversity rises may suggest that bridging social capital in particular increases turnout by moderating the negative effect of ethnic heterogeneity.

6. Comparing Results Using Propensity Score Matching Results

So far, we have been using cross section linear regression techniques that our Hypotheses 1-3 have been supported. Using data on New Zealand volunteering rates, ethnic fragmentation, and subsequent voter turnout rates, we have found that social capital is positively associated with voter turnout (Hypothesis 1a), and ethnic fragmentation is negatively associated (Hypothesis 1b). We have seen evidence consistent with both key factors affecting turnout rates by influencing (in opposite directions) the cost to voters of gathering information, and the strength of social norms to vote (Hypothesis 2). And we have seen evidence consistent with changes in heterogeneity affecting the degree to which social capital affects turnout (Hypothesis 3).

However we have also seen from Oster and DMP tests that our initial linear regression evidence that social capital and fragmentation are affecting turnout are potentially quite sensitive to omitted variable bias. We therefore here briefly summarize the results of our three step investigation using the alternative method of Propensity Score Matching (PSM).

We first (singly or jointly) classify those meshblocks that have an above median volunteering rate (0.14) or below median ethnic fragmentation (0.36) as "treated", and those with below median social capital or above median ethnic fragmentation as "untreated." PSM uses the average turnout rate of "close" meshblocks matched using our observable control variables to impute the counterfactual voter turnout for treated meshblocks as if they were untreated, and for untreated meshblocks as if they were treated. Our exact matching procedure is explained further with Stage One matching details for Table 2 in Supporting Information Table A8.1. With a counterfactual turnout imputed for each meshblock,

PSM calculates in Stage Two an average treatment effect of either social capital or ethnic fragmentation on turnout. PSM tries to address omitted variable bias by hoping that by matching on observables, it controls for any unobservables correlated with social capital or fragmentation. It succeeds only to the extent that matching "treated" and "untreated" meshblocks based on their observables also matches on their unobservables. Nonetheless, PSM provides a valuable check on the robustness of our linear regression results. Key Stage Two results are presented in Table 4 for all three steps, with the exception of the second social norms channel test of Step Two, which is instead illustrated in Figure 10.

Regarding Step 1, PSM Stage Two results are consistent with linear regression results in confirming Hypotheses (1a) and (1b). Whether sorting on the two key variables jointly or separately, we again find that social capital is positively associated with turnout, while ethnic fragmentation is negatively associated. Regarding Step 2 tests of causal channels, however, PSM results only partially overlap those of linear regression. PSM no longer finds evidence consistent with social capital affecting turnout via the cost of gathering information, whether through education or share of English spoken. PSM does find evidence consistent with ethnic fragmentation affecting turnout via share of English spoken, but not via education. Similarly, PSM only partially finds evidence consistent with social capital affecting turnout via social norms, by dominant ethnic group (Figure 10) but not by population density. Whereas PSM continues to find evidence consistent with ethnic fragmentation affecting turnout via its effects on social norms, whether proxied by population density or dominant ethnic group. In short, PSM finds more support for ethnic fragmentation working through both cost of information and social norms than it does for social capital working the same two mechanisms.

Regarding Step 3, PSM confirms finding a significant interaction term, in support of Hypothesis 3.

7. Conclusion

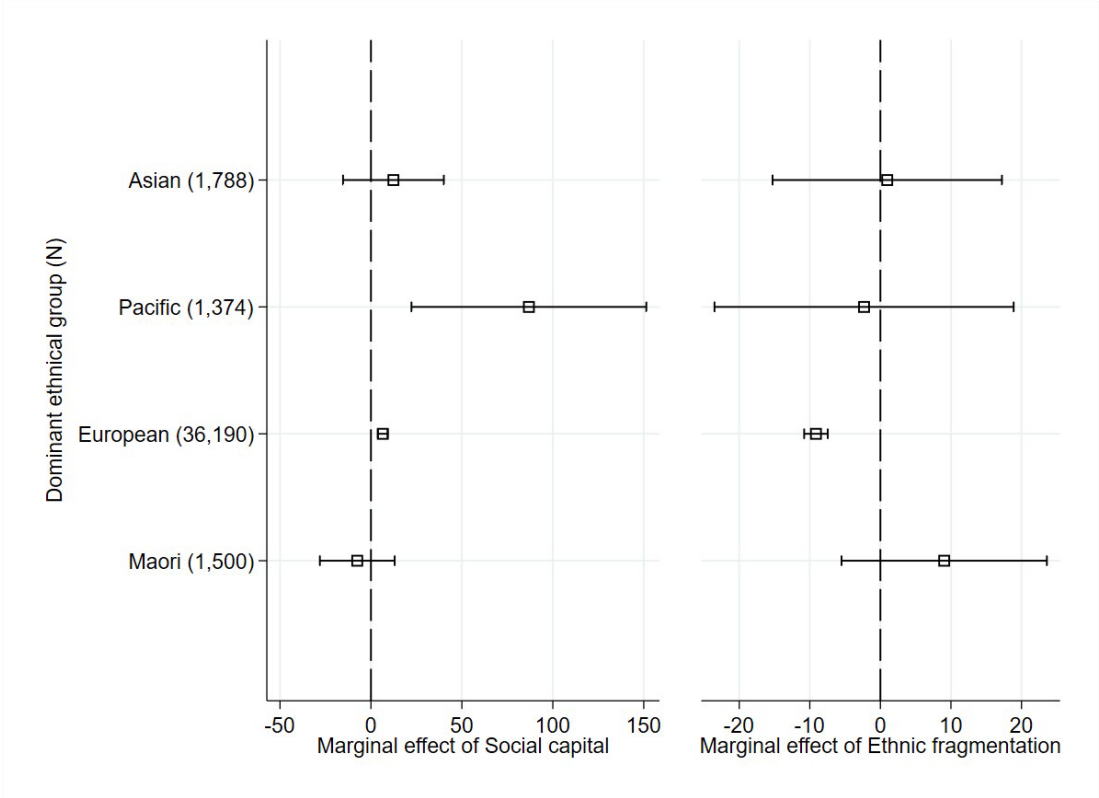
Within an enormous literature examining the determinants of voting, most studies of whether social capital or heterogeneity are associated with aggregate turnout rates have used coarse boundaries, tested one factor or the other without considering the interactions that could be expected between them, and have not

Table 4. Stage 2 Propensity Score Matching Results for Key Variables

	(1) Coef. (se)	(2) Coef. (se)	(3) Coef. (se)	(4) Coef. (se)
Table 2: The Turnout Rate				
Matching Key Variables Jointly				
Social capital	6.23***		5.81***	6.96***
	(1.52)		(1.54)	(1.71)
Ethnic heterogeneity		-8.96***	-8.88***	-8.75***
		(0.96)	(0.93)	(0.88)
Electorate FE	yes	yes	yes	No
Observations	18,507	18,507	18,507	17,370
Matching Key Variables Separately				
Social capital	6.05***			
	(1.19)			
Ethnic heterogeneity		-9.53***		
		(0.95)		
Electorate FE	yes	yes		
Observations	29,795	26,658		
Sup. Inf. Table 6.1: Interaction Education				
Social capital	6.25**	5.91***		
	(2.76)	(1.55)		
Social capital × %Univ. Degrees	-2.19			
	(8.93)			
Ethnic heterogeneity	-8.89***	-9.89***		
	(0.95)	(1.36)		
Ethnic heterogeneity × % Univ Degrees		4.91		
		(3.91)		
Sup. Inf. Table 6.2: Interaction Engl Lang				
Social capital	7.09	5.39***		
	(23.9)	(1.39)		
Social capital × Prop. Engl. in Lang.	-1.42			
	(26.1)			
Ethnic heterogeneity	-6.87***	-30.3***		
	(0.96)	(5.66)		
Ethnic heterogeneity × Prop. Engl. in Lang.		26.5***		
		(6.30)		
Sup. Inf. Table 6.3: Interaction Pop Dens				
Social capital	5.11	5.55***		
	(4.01)	(1.54)		
Social capital × Log (Pop. Density)	0.13			
	(0.61)			
Ethnic heterogeneity	-8.87***	-5.20***		
	(0.95)	(1.67)		
Ethnic heterogeneity × Log (Pop. Density)		-0.64**		
		(0.25)		
Sup. Inf. Table 7.2: Interaction 2 Key Variables				
Social capital	0.06	-0.21	0.86	
	(1.85)	(2.29)	(1.76)	
Ethnic heterogeneity	-12.5***	-13.1***	-11.6***	
	(1.74)	(1.88)	(1.72)	
Ethnic heterogeneity × Social capital	22.9***	23.0***	18.7**	
	(7.66)	(8.55)	(7.40)	

PSM results match meshblocks with above- or below median social capital and ethnic heterogeneity jointly (or separately for Table 2 columns (1) and (2)). Models include the same dependent and explanatory variables as in the corresponding OLS Tables.

Figure 10. Propensity Score Matching Results for effects of social capital or ethnic heterogeneity on turnout conditioned by dominant ethnic group



An ethnic group is considered dominant when its proportion of affiliations is the highest within the meshblock. The lines are 95% confidence intervals. These PSM results use the same sum of social capital plus interaction with dominant ethnic group as in Supporting Information Table A6.5, or sum of ethnic fragmentation plus interaction with dominant ethnic group in Supporting Information Table A6.6.

tested the underlying mechanisms by which either could be operating. Moreover, surprisingly few papers have tested for the effects of ethnic fragmentation specifically on voter turnout, and even fewer the effects of social capital on turnout, rather than other measures of civic engagement.

In this paper, we have used population census data on 2013 New Zealand volunteering rates (as a measure of social capital) and ethnic fragmentation to estimate the strength of their associations with voter turnout rates in the subsequent 2017 national election. We address three questions: 1) are social capital and ethnic fragmentation significantly associated in opposite directions with subsequent turnout? 2) Is there evidence consistent with both factors affecting turnout via their effects on the cost of gathering information, and on the strength of social norms? 3)

Do social capital and ethnic fragmentation interact in their association with voter turnout?

To address these questions, we use simple linear cross section regressions at the fine level of census meshblock, with electorate fixed effects. With regression sensitivity tests (Oster and DMP) finding evidence that our initial findings are sensitive to even moderate omitted variable bias, we try numerous robustness checks of our findings, and compare our main results from linear regression with those from propensity score matching (PSM). We also make no claims to having established causality.

Whether with linear regression or PSM, we consistently find a strong positive association between social capital (volunteering rates) and subsequent turnout, consistent with the observational studies by Liu et al. (2009), Luango-Cabrera (2014) and Fiorino et al. (2021), but inconsistent with experimental studies by Condon (2011) or Atkinson and Fowler (2012). We also find a strong negative association between ethnic fragmentation and subsequent turnout, consistent with Barone et al. (2016), Martinez i Coma et al. (2017), and Lago et al. (2018).

Almost as consistently, we find evidence consistent with ethnic fragmentation lowering turnout via its effects on the cost to voters of gathering information (proxied by share with university education or share of English spoken), and via its effects on the strength of social norms (proxied by population density, or dominant ethnic group per meshblock). We find these associations under linear regression or PSM. The social norm findings in particular are consistent with the findings of Chatman et al. (2001), Anoll (2018), and Lago et al. (2018). Less robustly, we find evidence consistent with social capital raising turnout via those same channels and proxies, but only for linear regression. Our (linear regression) findings are consistent with the arguments of Beck et al. (2002), McClury (2003) and Klofstad (2007) for information costs, and the arguments of Uslander (1999) for social norms. Using PSM rather than linear regression however, social capital is found to have a significant interactive effect on turnout only with social norms (not information gathering), and only as proxied by dominant ethnic group.

Finally, we find consistent evidence that ethnic fragmentation and social capital interact in their strength of association with turnout. Using linear regression or PSM, we consistently find that social capital's positive association with turnout is weakest (or zero) in ethnically homogeneous meshblocks, but strengthens as

diversity increases. Conversely, ethnic fragmentation's negative association with turnout is strongest in meshblocks with low social capital, and becomes zero and then positive as social capital rises. These interaction effects are consistent with the arguments of Coffee and Geys (2006), Coffee (2009) and Andrews (2009). They may reflect that rising ethnic heterogeneity changes the composition of social capital, as people's interactions become more likely to build bridging rather than bonding social capital. It is possible that it is the bridging component of social capital that is positively associated with voter turnout.

Though we cannot claim causality, the associations we find suggest several policy conclusions for raising voter turnout. First, given the robust positive association found between volunteering rates and subsequent voter turnout, and the ability of high volunteering rates to reverse fragmentation's negative association with turnout (Figure 9), governments should consider providing tax or other incentives for donations of time as they do donations of money. Second, the fact that voter turnout rates differed significantly by ethnic affiliation shares, with the various non-European affiliations all significantly lower than the European share but not significantly different from each other (Sup. Inf. A.5.1), would suggest that increasingly diverse societies like New Zealand should work to ensure election campaigns (and campaigning) better target minority language/ethnic populations. Finally, the fact that ethnic fragmentation lost its significant negative association with turnout as our cost of information proxy -- education -- rose (Figure 3) suggests positive spillovers to encouraging education, and more generally to lowering the cost for people of all ethnicities to learn about upcoming elections.

However, subsequent investigations that better address causality could test whether our conjectures explaining these robust associations, and resulting policy recommendations, are correct.

Data Availability Statement : upon acceptance, the data and Stata code underlying the analysis reported in this paper will be made available.

Supporting Information including data definitions and full analysis of various robustness checks summarized in the text are available in a separate file included with the article submission.

Competing Interests: the authors declare there are no conflicts of interest in the creation of this work.

9. References

Abadie, A. and Imbens, G.W. (2006). Large sample properties of matching estimators for average treatment effects. Econometrica, 74: 235-267.

Alesina, A. and La Ferrara, E. (2000). Participation in heterogeneous communities. The Quarterly Journal of Economics, 115(3), 847-904.

Alesina, A. and Zhuravskaya, E. (2011). Segregation and the quality of government in a cross section of countries. American Economic Review, 101(5), 1872-1911.

Alesina, A; Baqir, R. and Easterly, W. (1999). Public goods and ethnic divisions. The Quarterly Journal of Economics, 114(4), 1243-1284.

Amaro de Matos, J. and Barros, P. (2004). Social norms and the paradox of elections' turnout. Public Choice, 121(1), 239-255.

Anderson, C; and Paskeviciute, A. (2006). How ethnic and linguistic heterogeneity influence the prospects for civil society: A comparative study of citizenship behavior. The Journal of Politics, 68(4), 783-802.

Andrews, R. (2009). Civic engagement, ethnic heterogeneity, and social capital in urban areas: Evidence from England. Urban Affairs Review, 44(3), 428-440.

Anoll, A. (2018) "What makes a good neighbor? Race, place, and norms of political participation." American Political Science Review 112.3, 494-508.

Ariely, G. (2014). Does diversity erode social cohesion? Conceptual and methodological issues. Political Studies, 62(3), 573-595.

Barone, G.; D'Ignazio, A.; De Blasio, G. and Naticchioni, P. (2016). Mr. Rossi, Mr. Hu and politics. The role of immigration in shaping natives' voting behavior. Journal of Public Economics, 136, 1-13.

Beck, P.; Dalton, R.; Greene, S. and Huckfeldt, R. (2002). The social calculus of voting: Interpersonal, media, and organizational influences on presidential choices. American Political Science Review, 96(1), 57-73. doi:10.1017/S0003055402004239

Blais, A. (2000). *To Vote or Not to Vote ? The Merits and Limits of Rational Choice Theory*. Pittsburgh: University of Pittsburgh Press.

Blais, A. and Achen, C. (2019). Civic duty and voter turnout. Political Behavior, 41(2), 473-497.

Campbell, D. (2006). *Why We Vote: How Schools and Communities Shape our Civic Life*. Princeton University Press.

Cancela, J. and Geys, B. (2016). Explaining voter turnout: A meta-analysis of national and subnational elections. Electoral Studies, 42, 264-275.

Chatman, J. and Flynn, F. (2001). The influence of demographic heterogeneity on the emergence and consequences of cooperative norms in work teams. Academy of Management Journal, 44(5), 956-974.

Cho, W.; Gimpel, J. and Dyck, J. (2006). Residential concentration, political socialization, and voter turnout. The Journal of Politics, 68(1), 156-167.

Clark, J. and Kim, B. (2012). The effect of neighborhood diversity on volunteering: Evidence from New Zealand. The B.E. Journal of Economic Analysis and Policy, 12, (Topics), Article 5 (47pp).

Coffé, H. (2009). Social capital and community heterogeneity. Social Indicators Research, 91(2), 155-170.

Coffé, H. and Geys, B. (2006). Community heterogeneity: a burden for the creation of social capital? Social Science Quarterly, 87(5), 1053-1072.

Condon, M. (2011) "The Effect of Social Capital on Voter Turnout: A Field Experiment in Two Southwestern Cities", paper presented at the Annual Meeting of the American Political Science Association, Seattle. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.539.6284&rep=rep1&type=pdf

Costa, D. and Kahn, M. (2003). Civic engagement and community heterogeneity: An economist's perspective. Perspectives on Politics, 1(1), 103-111.

Diegert, P.; Masten, M. and Poirier, A. (2023) Assessing omitted variable bias when the controls are endogenous. Working Paper. arXiv:2206.02303v4 [econ.EM] https://doi.org/10.48550/arXiv.2206.02303

Fieldhouse, E. and Cutts, D. (2008). Diversity, density and turnout: The effect of neighbourhood ethno-religious composition on voter turnout in Britain. Political Geography, 27(5), 530-548.

Fiorina, M. (1990). Information and rationality in elections. Information and Democratic Processes, 329–42.

Fiorino, N.; Galli, E. and Pontarollo, N. (2021). Does social capital affect voter turnout? Evidence from Italy. Social Indicators Research, 156(1), 289-309.

Förster, A. (2018). Ethnic heterogeneity and electoral turnout: Evidence from linking neighbourhood data with individual voter data. Electoral Studies,53,57-65.

François, A. and Gergaud, O. (2019) Is civic duty the solution to the Paradox of Voting?", Public Choice, 180(3-4): 257-283, https://doi.org/10.1007/s11127-018-00635-7

Gelfand, M.; Harrington, J. and Jackson, J. (2017). The strength of social norms across human groups. Perspectives on Psychological Science, 12(5), 800-809.

Gesthuizen, M.; Van der Meer, T. and Scheepers, P. (2009). Ethnic diversity and social capital in Europe: tests of Putnam's thesis in European countries. Scandinavian political studies, 32(2), 121-142.

Geys, B. (2006a). Explaining voter turnout: A review of aggregate-level research. Electoral Studies, 25(4), 637–663.

Geys, B. (2006b). 'Rational' theories of voter turnout: A review. Political Studies Review, 4, 16–35.

Graeff, P. (2009). Social capital: The dark side. Handbook of Social Capital, 143-161.

Heath, O. (2004). Modelling the components of political action in Britain: The impact of civic skills, social capital and political support. British Elections & Parties Review, 14(1), 75-93.

Klofstad, C. (2007). Talk leads to recruitment: How discussions about politics and current events increase civic participation. Political Research Quarterly 60(2):180.

Kolo, P. (2012). Measuring a new aspect of ethnicity: The appropriate diversity index (No. 221). IAI Discussion Papers. https://www.econstor.eu/bitstream/10419/92997/1/720108012.pdf

La Due Lake, R. and Huckfeldt, R. (1998). Social capital, social networks, and political participation. Political Psychology, 19(3), 567-584.

Lago, I.; Bermúdez, S; Guinjoan, M.; and Simón, P. (2018). Turnout and social fractionalisation. Politics, 38(2), 113-132.

Laurence, J. (2011). The effect of ethnic diversity and community disadvantage on social cohesion: A multi-level analysis of social capital and interethnic relations in UK communities. European Sociological Review, 27(1), 70-89.

Liu, B.; Austin, S. and Orey, B. (2009). Church attendance, social capital, and black voting participation. Social Science Quarterly, 90(3), 576-592.

Luengo-Cabrera, J.; Patel, N. and Schlosberg, D. (2014) Participation in elections to the European Parliament. PRIAD Policy Paper. PRIAD_Policy_Paper_-_European_Elections-with-cover-page-v2.pdf (d1wqtxts1xzle7.cloudfront.net)

Martinez i Coma, F. and Nai, A. (2017). Ethnic diversity decreases turnout. Comparative evidence from over 650 elections around the world. Electoral Studies, 49, 75-95.

McClurg, S. (2003). Social networks and political participation: The role of social interaction in explaining political participation. Political Research Quarterly, 56(4), 449-464. doi:10.2307/3219806

McKenzie, B. (2008). Reconsidering the effects of bonding social capital: A closer look at Black civil society institutions in America. Political Behavior, 30(1), 25-45.

Oliver, J. E. (1999). The effects of metropolitan economic segregation on local civic participation. American Journal of Political Science, 186-212.

Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. Journal of Business & Economics Statistics, 37, 2, 187-204.

Portes, A. (1998). Social capital: Its origins and applications in modern sociology. Annual Review of Sociology, 24(1), 1-24.

Putnam, R. (2000). *Bowling alone: The collapse and revival of American community*. Simon and Schuster.

Putnam, R. (2007). E pluribus unum: Diversity and community in the twenty-first century the 2006 Johan Skytte Prize Lecture. Scandinavian Political Studies, 30(2), 137-174.

Reeskens, T. and Wright, M. (2013). Nationalism and the cohesive society: A multilevel analysis of the interplay among diversity, national identity, and social capital across 27 European societies. Comparative Political Studies, 46(2), 153-181.

Rosenbaum, P. and Rubin, D. (1983). The central role of the propensity score in observational studies for causal effects. Biometrika 70:41–55.

Riker, W. and Ordeshook, P. (1968) A theory of the calculus of voting. American Political Science Review, 62, 25–43.

Satyanath, S.; Voigtländer, N. and Voth, H. J. (2017). Bowling for fascism: Social capital and the rise of the Nazi Party. Journal of Political Economy, 125(2), 478-526.

Smets, K. and Van Ham, C. (2013). The embarrassment of riches? A meta-analysis of individual-level research on voter turnout. Electoral Studies, 32(2), 344-359.

Stockemer, D. (2017). What Affects Voter Turnout? A Review Article/Meta-Analysis of Aggregate Research. Government and Opposition, 52(4), 698-722.

Svendsen, G. and Svendsen, G. (Eds.). (2009). *Handbook of Social Capital: the Troika of Sociology, Political Science and Economics.* Edward Elgar Publishing.

Thornton, S. and Clark, J. (2010) Does higher social diversity lower people's contributions to public goods? The case of volunteering in New Zealand. New Zealand Economic Papers, 44, 1, 27-60.

Tollison, R. and Willett, T. (1973) Some simple economics of voting and non-voting, Public Choice, 16, 59–72.

Traugott, M. and Katosh, J. (1979). Response validity in surveys of voting behavior. Public Opinion Quarterly, 43(3), 359-377.

Uslander, E. (1999). Democracy and social capital. in M.Warren ed. *Democracy and Trust* Cambridge University Press. pp121-150.

Van der Meer, T. and Tolsma, J. (2014). Ethnic diversity and its effects on social cohesion. Annual Review of Sociology, 40(1), 459-478.

Supporting Information for
Social capital, social heterogeneity, and electoral turnout

Here, we provide additional materials for our paper "Electoral turnout, social capital and ethnic heterogeneity".

Section A1 describes the variables used in our empirical work.

Section A2 presents two additional estimations for Section 5.1.2: one excluding all variables related to electorate fixed effects or characteristics, and one using electorate random effects rather than fixed effects.

Section A3 presents estimations for alternative functional forms regarding social capital and ethnic heterogeneity variables for Section 5.1.2.

Section A4 presents estimations for various subsamples according to meshblock characteristics for Section 5.1.2.

Section A5 presents estimations with alternative definitions or dimensions of heterogeneity for Section 5.1.2.

Section A6 presents estimations underlying Section 5.2's investigation of social norm or information cost channels by which social capital or heterogeneity may affect voter turnout.

Section A7 presents detailed estimations underlying Section 5.3's investigation of interaction effects of social capital and ethnic heterogeneity in their association with turnout.

Section A8 presents details of our Stage 1 propensity score matching (PSM) for our first step (Table 2) results underlying Stage 2 PSM results for Table 2 appearing in Table 4.

A1 Description of the variables used and the 2017 national election

Table A1.1 Description of Variables

Variable	Description
Volunteering	2013 Proportion of meshblock reporting "Other Helping or Voluntary Work For or Through any Organization, Group or Marae" in the previous four weeks. Excludes the following unpaid activities outside the household: caring for a child or someone who is ill, elderly, or disabled. *Construction*: "Other Helping…."/(Total Who Answered)
Ethnic Shares	2013 The proportion of ethnic affiliations reported by meshblock usual residents, aggregated to five categories: European/Other (where Other primarily includes those who wrote in "New Zealander"), Maori, Pacific, Asian, and Middle Eastern/Latin American/African. Individuals could select more than one ethnic affiliation. *Construction*: frequencies were summed across the five affiliation categories to create a base of total ethnic affiliations from which shares were calculated. "Other" ethnicities does include very small numbers of North American Inuit or Indian, Mauritian, etc., but is overwhelmingly those refusing to report ethnicity and answering "New Zealander." (In the 2006 census, 90% of those reporting New Zealander were thought to be European, and so we combine "Other" with European for 2013.)
Language Shares	2013. Meshblock usual residents indicated if they could speak either English, Maori, Samoan, or Other languages. Individuals could select more than one language (or none). Language shares, including English language shares, are constructed from the baseline of total languages spoken, not total people.
Religious Affiliation	2013. The share of each meshblock's usually resident population aged 15+ reporting no religious affiliation, vs. the share of people reporting one or more religious affiliations. (Individuals can identify with more than one affiliation, which are aggregated to include Atheist, Christian, Buddhist, Hindu, Islam/Muslim, Judaism, Maori Christian, Spiritualist/New Age and Other.) *Construction*: No religious affiliation frequencies were divided by the total usually resident population aged 15+ who provided answers to the religious affiliation question.
Ethnic Fragmentation	2013. One minus the Hirschman-Herfindahl index, which is defined over the affiliation shares of the 5 ethnic categories above.
Ethnic Polarization	2013. Defined as $EP_m = 1 - \sum_{i=1}^{5} \left(\frac{0.5-p_i}{0.5}\right)^2 \times p_i$, where 'm' refers to meshblock, and p_i refers to the ethnic affiliation share of group 'i' of the 5 ethnic categories above.

Lang. Fragmentation	2013. One minus the Hirschman-Herfindahl index, which is defined over the affiliation shares of the 4 language categories above.
Religion Fragmentation	2013. One minus the Hirschman-Herfindahl index, which is defined over the affiliation shares of the 9 categories above.

Table A1.1 Description of Variables (Cont'd)

Variable	Description
Median HH Income	2013 The median household income from all sources for usual residents of meshblock aged 15 or older. Not yet deflated by GDP deflator.
Male	2013. The share of a meshblock's usually resident population that is male. *Construction*: frequency "Male" over "Total People"
Population Density	2013. Meshblock usually resident population divided by meshblock square kilometres.
Age – Share 65+ greater.	2013. Proportion of usually resident population aged 65 or
Married	2013. The share of each meshblock's usually resident population 15 and over who were currently legally married or in a civil union. *Construction*: share identifying as Married divided by share identifying as married, separated/divorced/widowed, never married, or not answering.
University Degree	2013. The share of each meshblock's usually resident population 15 or over whose highest degree is a bachelor's degree or higher. *Construction*: summed frequencies of "Bachelor's Degree or Level 7 Qualification," "Postgraduate and Honours Degrees," "Masters" and PhD degrees, divided by total people who answered.
Home Ownership HH	2013. The share of households owned or partially owned by their usual residents, or held in a family trust. *Construction*: frequencies of households 1) owned/partially owned by residents or 2) held in family trusts, summed and divided by total number of households who provided ownership information.
Unemployed	2013. The share of the usually resident population in each meshblock aged 15 or over who report currently being unemployed. *Construction*: frequencies for four possible labour force status categories summed to provide a baseline from which shares calculated.
Turnout rate	Overall number of votes cast (including blank and invalid) over all registered voters in the 2017 national legislative elections. The Electoral Commission freely provides data on voter turnout rates for the 2017 national election, mapped to 2017 meshblock level.

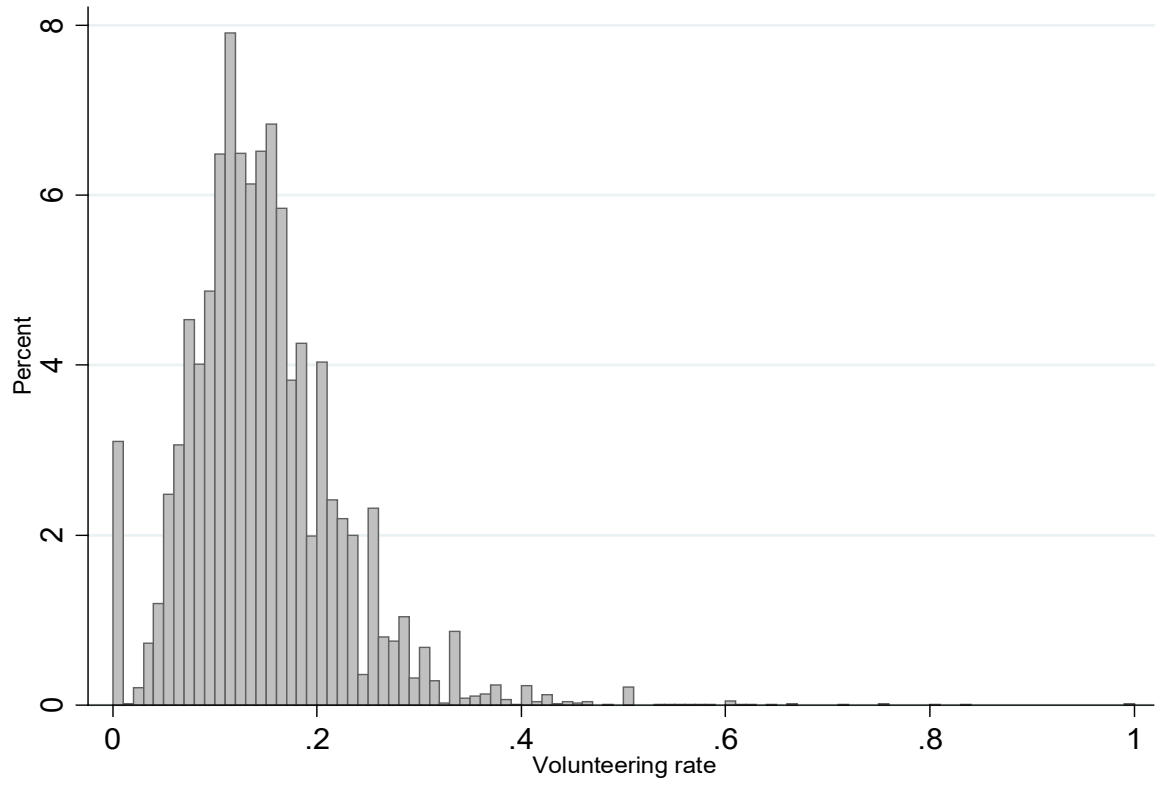
Electoral Fragmentation between candidates running in that electorate. Proxies for closeness of contest.	2017. The fragmentation of vote shares at the electorate level *Construction:* 1 - the Hirschman-Herfindahl index, where the vote share categories was determined by the number of
number of candidates running.	
Polit. Party Expenditures parties in each electorate. In thousands of New Zealand dollars.	2017. The total electorate level expenditures from all political
Number of candidates	2017. The total number of candidates running in each electorate.

Table A1.2 Descriptive statistics of all meshblock level variables (N=42,100)

Variable	Mean	St. Dev.	Min	Max
Voter turnout rate (%)	79.28	9.93	22.22	100
Volunteering rate	0.14	0.06	0	0.60
Ethnic fragmentation	0.37	0.19	0	0.80
Ethnic polarization	0.59	0.24	0	1
Language fragmentation	0.25	0.14	0	0.66
Religious fragmentation	0.63	0.09	0	0.98
Median household income (NZ$)	0.07	0.03	0	0.15
Share households homeowners (%)	0.51	0.18	0	1.11
% of individuals with univ. degrees	0.19	0.13	0	0.90
% of individuals married	0.44	0.15	0	1
Unemployment rate	0.05	0.04	0	0.35
% of ind. aged 65 and over	0.15	0.11	0	1.05
% Male	0.49	0.05	0.12	0.94
Log of Population density (per square km)	6.77	2.12	0.08	12.19

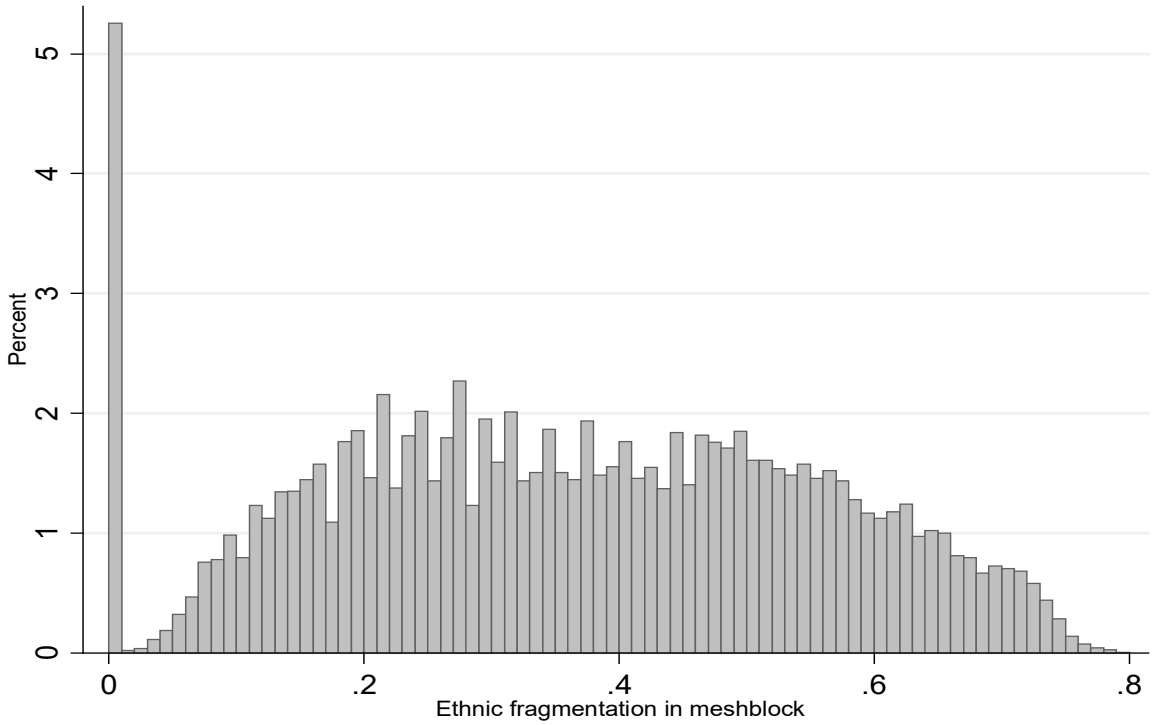
Notes. "meshblock" is the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. Shares for low population meshblocks may exceed 1 due to randomized rounding. The sample is our baseline estimation with electorate FE (see Table 2 in the main part of the text). For the definition of the variables see Supporting Information A1.

Figure A1.1. Distribution of volunteering rates



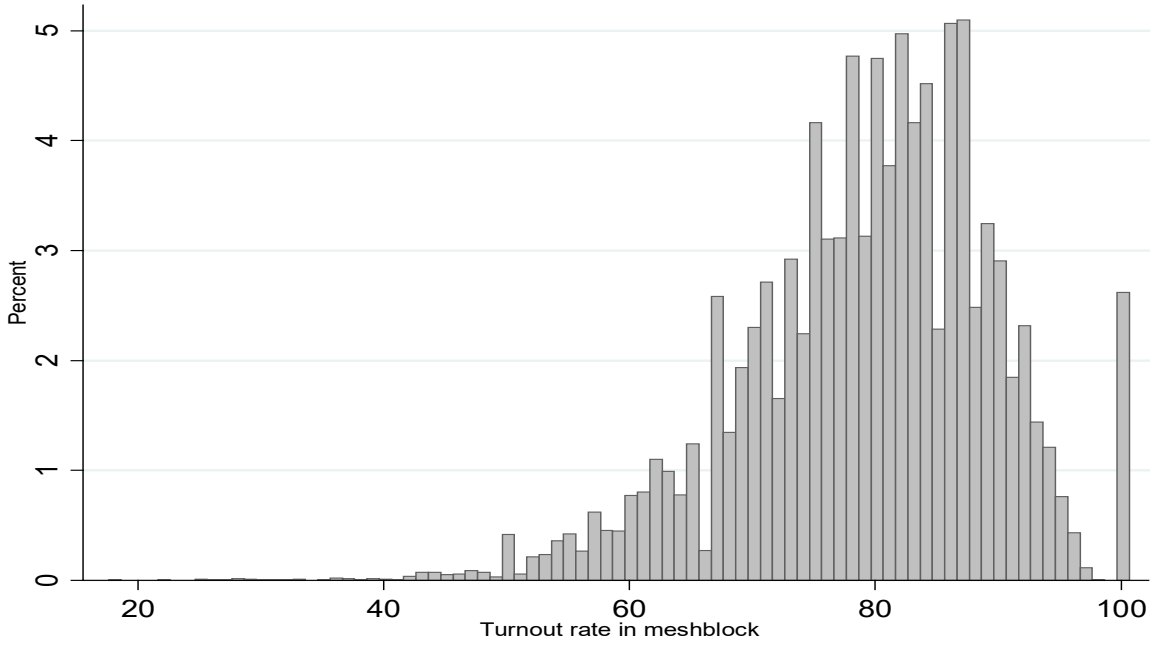
Notes: The volunteering rate is measured by the 2013 census as the proportion of respondents within the meshblock reporting "Other helping or voluntary work for or through any organization, group or marae" in the previous four weeks over the total who answered. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. Source: Census 2003.

Figure A1.2. Distribution of ethnic fragmentation



Notes. Ethnic fragmentation is defined as one minus the Hirschman-Herfindahl index of concentration. The observation unit is the "meshblock", the smallest geographic unit for which data is collected and processed by Statistics New Zealand. Source: Census 2003.

Figure A1.3. The distribution of voter turnout rate for the 2017 legislative elections



Notes. The meshblock voter turnout rate (%) is defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 national election. The observation unit is the

"meshblock", the smallest geographic unit for which data is collected and processed by Statistics New Zealand. The turnout rate is defined as the overall number of votes (including blank and invalid votes) out of the registered voters.

Further information on the 2017 national election

The 2017 New Zealand general election took place on Saturday 23 September 2017 at the regular three-year term of the 51st New Zealand Parliament. About 3.57 million people were registered to vote for members of the House of Representatives, with 2.63 million (79.8%) turning out. Advance voting represented 1.24 million votes cast before election day. Note that advance voting is integrated into our turnout measure. The incumbent Prime Minister, Bill English, from the center-right National Party led a minority government supported by a coalition containing several small parties. The main Labour opposition party, led by Jacinda Ardern, supported by a coalition of two smaller parties, won the greatest number of MP's and thus the election. Given the frequency of general election, the political and economic contexts, and the absence of important political event before and during the campaign, we can assume that mobilization was at usual New Zealand levels for this election.

Another feature of the New Zealand MMP system is that those of indigenous Maori descent may opt to enrol in the "general roll" and vote in their local general electorates (which comprise 64 of the total 71 electorates), or enrol in the "Maori roll" and vote in their broader geographic Maori electorate (7 of the 71 electorates). Slightly less than half of Maori choose the Maori roll.[19] This dual roll system was designed to ensure a minimum threshold of Maori representation in parliament. This feature means that every meshblock in New Zealand simultaneously maps to a (smaller) general electorate boundary, and a (larger) Maori electorate boundary. Given that our meshblock level voter data does not distinguish turnout rates between the general and Maori rolls, and that 92.5% of enrolled voters are on the general roll, we map meshblocks to the general rather than Maori electorates for our study.[20]

[19] It was estimated in 2018 that 250,000 of 600,000 who identify as Maori chose the Maori roll. See "General roll or Māori roll - which one to choose?" at https://www.maoritelevision.com/news/politics/general-roll-or-maori-roll-which-one-choose.

[20] For April 2019 enrolment data on the general and Maori rolls, see the country's Electoral Commission site https://www.elections.org.nz/research-statistics/enrolment-statistics-electorate.

A2 Estimation of baseline results without electorate variables or with random effects

Table A2.1 presents results showing our conclusions about the estimated coefficients of our two key variables are not affected by the exclusion of electorate fixed effects or characteristics. Other covariates also are not much impacted, though the adjusted R squared is lower. This indicates our results are not driven by the electorate characteristics.

Table A2.1. Estimations of turnout without any variables related to electorates

	Coef.	se
Volunteering rate	9.19***	(1.68)
Ethnic fragmentation	-7.88***	(1.11)
Log (Population density)	-0.61***	(0.061)
Median household income (1000 NZ$)	19.7***	(4.29)
Share households homeowners (%)	11.5***	(1.26)
% of individuals with univ. degrees	16.5***	(1.34)
Unemployment rate	-17.3***	(2.32)
% of ind. aged 65 and over	11.6***	(1.17)
Proportion no religious affiliation	8.70***	(1.80)
% of individuals married	0.67	(1.55)
% Male	-1.42	(1.11)
Constant	70.3***	(1.75)
Electorate FE	no	
Electorate characteristics	no	
Observations	41,200	
Adjusted R^2	0.37	

Note: The explained variable is meshblock voter turnout defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 national election. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The measure of volunteering rate comes directly from the census. Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the10%, 5%, and 1% levels, respectively. Estimation by OLS

Next, Table A2.2 presents estimated coefficients using electorate random effects, rather than fixed effects. It again finds that our two variables of interest are not affected.

Table A2.2. Estimation of turnout with electorate random effects

	Coef.	se
Volunteering rate	6.04***	(1.09)
Ethnic fragmentation	-7.28***	(0.95)
Log (Population density)	-0.67***	(0.059)
Median household income (1000 NZ$)	24.2***	(3.68)
Share households homeowners (%)	9.60***	(0.92)
% of individuals with univ. degrees	11.5***	(0.86)
Unemployment rate	-16.2***	(1.65)
% of ind. aged 65 and over	10.3***	(0.83)
Proportion no religious affiliation	5.05***	(0.90)
% of individuals married	4.46***	(1.07)
% Male	-1.86*	(1.05)
Constant	72.7***	(1.41)
Meshblock-level sd	0.88***	(0.12)

Electorate-level sd	2.03***	(0.012)
Electorate FE	no	
Observations	41,200	
Adjusted R^2	0.37	

Note: see the notes for Table A2.1.

A3 Alternative functional forms in the baseline estimation

We test alternative functional forms such as log transformations or quadratic terms for the volunteering rate and ethnic fragmentation. We also present a log-log model.

A3.1 Alternative functional form for the social capital variable

Table A3.1 compares the key coefficients for three functional forms: linear, log transformation of social capital (where we add 0.1 to the volunteering rate before the log transformation to solve the absence of the logarithm of zero), and quadratic. We observe that all coefficients are significant. The negative coefficient on the square of the volunteering rate might suggest there is an inverse U shaped relationship with voting. Before drawing that conclusion, however, we explore further the validity of the quadratic form.

Table A3.1 Alternative functional forms for the social capital variable

	(1) Linear	(2) Log of Volunteering	(3) Quadratic
	Coef. (se)	Coef. (se)	Coef. (se)
Volunteering rate	5.95***		20.8***
	(1.09)		(2.34)
Log transformation of volunteering rate		1.72***	
		(0.25)	
Squared volunteering rate			-43.6***
			(6.16)
Ethnic fragmentation	-7.25***	-7.24***	-7.28***
	(0.96)	(0.96)	(0.96)
Constant	72.5***	75.8***	71.7***
	(1.23)	(1.30)	(1.24)
Meshblock characteristics	Yes	Yes	yes
Electorate FE	Yes	Yes	yes
Observations	41,200	41,200	41,200
Adjusted R^2	0.41	0.41	0.41

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand.

A3.2 Alternative functional forms for ethnic heterogeneity

Here, we test alternative functional forms for our second variable of interest: ethnic fragmentation. To foreshadow, we find that all estimated coefficients retain a negative sign, including even a quadratic square term, though it is not significant. The estimated extreme point for the quadratic form of ethnic fragmentation is -0.103, which is clearly out of the range of the variable. Combined with the lack of significance of the squared coefficient (Table A3.3), we can conclude that the quadratic form is not relevant.

Table A3.2 Alternative functional forms for ethnic heterogeneity

	(1) Linear	(2) Log of Fragmentation	(3) Quadratic
	Coef. (se)	Coef. (se)	Coef. (se)
Ethnic fragmentation	-7.25***		-0.91
	(0.96)		(1.59)
Log transformation of ethnic fragmentation		-2.01***	
		(0.27)	
Squared ethnic fragmentation			-9.07***
			(3.13)
Volunteering rate	5.95***	6.12***	5.91***
	(1.09)	(1.08)	(1.10)
Constant	72.5***	67.3***	71.9***
	(1.23)	(0.91)	(1.19)
Meshblocks characteristics	yes	Yes	yes
Electorate FE	yes	Yes	yes
Observations	41,200	41,200	41,200
Adjusted R^2	0.41	0.40	0.41

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand.

As with the volunteering rate, this leaves the linear and log specifications. Once again, lacking *ex ante* arguments to choose logs, we use the linear form as our baseline.

A3.3 Log-log estimations

Finally, we also test a log-log form for our dependent and both interest variables. The results are presented in Table A3.3 and show no difference to the linear relationship. The estimated coefficients are again significant at the strictest level and have the same signs. Our baseline conclusions thus do not depend on the form of the relationship estimated.

Table A3.3. Log-log estimations of turnout

	Coef.	se
Log of volunteering rate	0.024***	(0.0035)
Log of ethnic fragmentation	-0.021***	(0.0039)
Constant	-0.35***	(0.014)
Meshblock characteristics	yes	
Electorate FE	yes	
Observations	41,200	
Adjusted R^2	0.41	

Note: The explained variable is the log of meshblock voter turnout defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 election. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The volunteering rate comes directly from the census. Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS.

A4 Estimations on restricted samples of meshblocks

In this section, we present estimates based on various restricted samples of meshblocks in order to check the sensitivity of our results to outlier observations. We first exclude those meshblocks with a 100 percent turnout rate. These 820 meshblocks account for about 2 percent of the distribution. Second, we instead exclude meshblocks with zero ethnic fragmentation (full homogeneity). Our third and fourth subsamples are defined by a standard trimming method (using a 5% threshold), or winsoring method (also at a 5% threshold), respectively. Table A4.1, which is keyed to the first specification (with electorate fixed effects) in Table 2 of the text, displays the outcomes.

Our restricted samples estimates are quite similar to our full-sample estimates; hence we conclude that our main results are not driven by outlier meshblocks.

Table A4.1. Estimations of turnout excluding extreme observations

	(1) Without full turnout rate obs.	(2) Without homogeneous obs.	(3) Trimming 5% and 95%	(4) Winsoring 5% and 95%
	Coef. (se)	Coef. (se)	Coef. (se)	Coef. (se)
Volunteering rate	5.36*** (1.10)	5.90*** (1.12)	7.19*** (1.27)	5.95*** (1.09)
Ethnic fragmentation	-6.76*** (0.96)	-7.54*** (1.05)	-7.54*** (0.95)	-7.25*** (0.96)
Constant	71.5*** (1.17)	72.3*** (1.27)	72.9*** (1.20)	72.5*** (1.23)
Electorate FE	yes	yes	Yes	yes
Meshblock characteristics	yes	yes	Yes	yes
Observations	40,368	40,072	38,009	41,200
Adjusted R^2	0.42	0.41	0.41	0.41

Notes: See notes to Table A3.3.

A5 Estimations with alternative measures or dimensions of heterogeneity

To check if our results regarding ethnic fragmentation are robust, we try alternative measures of ethnic heterogeneity, as well as alternative dimensions of social fragmentation, or repeat analysis electorate by electorate. To begin, in Table A5.1 we use simpler measures of meshblock ethnic heterogeneity, either instead of or in addition to fragmentation. Next, in Table A5.2 we use ethnic polarization in place of fragmentation. Third, in Table A5.3 we try instead two alternative dimensions of fragmentation: languages spoken, or religious affiliation. Finally, in Table A5.4 we control for multicollinearity between the three dimensions of fragmentation.

Table A5.1. Estimations of the turnout rates with simpler ethnic diversity measures

	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
	(se)	(se)	(se)	(se)
Volunteering rate	6.55***	6.38***	6.21***	6.46***
	(1.11)	(1.09)	(0.84)	(0.87)
Ethnic fragmentation		-9.75***		4.03***
		(1.12)		(1.08)
Number of ethnic groups present	0.072	0.68***		
	(0.060)	(0.072)		
Proportion of affiliations:				
European			ref	ref
Maori			-14.3***	-17.2***
			(1.18)	(1.70)
Pacific			-16.7***	-18.7***
			(1.33)	(1.42)
Asian			-15.4***	-18.1***
			(1.13)	(1.63)
ME/LA/A			-14.1***	-19.3***
			(2.44)	(2.97)
Constant	67.4***	71.5***	79.1***	78.4***
	(0.99)	(1.24)	(0.96)	(0.93)
Control variables	yes	yes	yes	yes
Electorate FE	yes	yes	yes	yes
Observations	41,200	41,200	41,200	41,200
Adjusted R^2	0.40	0.41	0.43	0.43

Note: The explained variable is the meshblock voter turnout rate (%) defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 national election. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The measure of volunteering rate comes directly from the census. Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS.

Table A5.1 displays the estimates with simpler ethnic diversity measures. The simple number of ethnic groups present in the meshblock is not significantly associated

with voter turnout when used instead of ethnic fragmentation (Column (1)), but has a positive association of modest size when used alongside ethnic fragmentation (Column (2)). The sign and magnitude of fragmentation in Column (2) is not deeply affected. In the two last columns, we first introduce the proportion of every ethnic affiliation (European baseline) instead of fragmentation, and then add them alongside fragmentation. The estimated coefficients on affiliation shares are all significant and negative compared to European, with no difference between them.[21] When we keep ethnic fragmentation in Column (4), its coefficient is now modestly positive and significant, but this may simply reflect multicollinearity between ethnic affiliation proportions and the fragmentation index. Indeed, the correlation coefficients between the ethnic fragmentation measure and the ethnic affiliation proportions are -0.8 for European, 0.4 for Maori, 0.5 for Pacific, 0.5 for Asian, and 0.3 for ME/LA/A.

Next, we try an ethnic polarization index in place of ethnic fragmentation. Ethnic polarization is defined as:

$$EP_m = 1 - \sum_{i=1}^{5} \left(\frac{0.5 - p_i}{0.5}\right)^2 \times p_i, \quad (3)$$

where p_i is the relative group size of group i. Using this replacement measure, and regardless of whether we use electorate fixed effects or characteristics, we observe very similar results. Ethnic polarization has a negative coefficient significant at the 1% level.

Table A5.2. Estimations of turnout using ethnic polarization

	(1) With electorate FE	(2) With electorate features
	Coef. (se)	Coef. (se)
Volunteering rate	6.22***	7.95***
	(1.06)	(1.49)
Ethnic polarization	-4.92***	-5.50***
	(0.51)	(0.61)
Constant	72.4***	60.7***
	(1.06)	(2.88)
Electorate FE	Yes	no
Electorate characteristics	No	yes
Meshblock characteristics	Yes	yes
Observations	41,200	38,286
Adjusted R^2	0.41	0.38

[21] The linear tests for equivalence are respectively for Column (3) F(3,63)=0.90 (p=0.45), and for Column (4) F(3,63)=0.43 (p=0.73).

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The variables for electorate characteristics are identical to those in Table 2 of the paper. The polarization index is defined in Supporting Information A1.

Next, we try alternative dimensions of heterogeneity within the meshblock – fragmentation by languages spoken, or by religious affiliation. The results are provided in Table A5.3. Regardless of the dimension of social diversity, we observe similar results; fragmentation is negatively associated with electoral turnout.

Table A5.3. Estimations of turnout with alternative dimensions of heterogeneity

	Language fragmentation		Religious fragmentation	
	(1)	(2)	(3)	(4)
	Coef. (se)	Coef. (se)	Coef. (se)	Coef. (se)
Volunteering rate	6.45*** (0.92)	7.35*** (1.26)	3.83*** (1.18)	4.66*** (1.73)
Language fragmentation	-11.6*** (1.00)	-13.3*** (1.30)		
Religious fragmentation			-8.80*** (1.47)	-11.8*** (1.77)
Constant	73.7*** (0.87)	63.5*** (2.73)	73.4*** (1.34)	61.2*** (4.13)
Electorate FE	yes	no	yes	no
Electorate characteristics	no	yes	no	yes
Meshblock characteristics	yes	yes	yes	yes
Observations	41,200	38,286	41,200	38,286
Adjusted R^2	0.41	0.38	0.41	0.36

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The electorate characteristics variables are identical to those in Table 2 of the paper. For definitions of the fragmentation indices, see Supporting Information A1.

Next, we include all three fragmentation measures by pair or all together in Table A5.4. Even though the fragmentation measures are correlated,[22] we observe that all their coefficients are significant with a negative sign.

Table A5.4. Estimations of turnout with multiple dimensions of heterogeneity

	(1) Coef. (se)	(2) Coef. (se)	(3) Coef. (se)	(4) Coef. (se)
Volunteering rate	5.48***	4.07***	4.89***	4.83***
	(1.03)	(1.17)	(0.97)	(1.00)
Ethnic fragmentation	-4.36***	-6.93***		-3.64***
	(1.04)	(0.92)		(1.04)
Language fragmentation	-10.0***		-11.8***	-9.68***
	(1.25)		(1.00)	(1.29)
Religious fragmentation		-5.51***	-5.76***	-4.57***
		(1.37)	(1.25)	(1.21)
Constant	76.5***	78.9***	78.9***	79.4***
	(0.93)	(1.65)	(1.34)	(1.45)
Electorate FE	yes	yes	yes	yes
Meshblock characteristics	yes	yes	yes	yes
Observations	41,200	41,200	41,200	41,200
Adjusted R^2	0.41	0.41	0.41	0.41

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. Electorate characteristic variables are identical to those in Table 2 of the paper. For the precise definition of the fragmentation indices, see Supporting Information A1.

Finally, we repeat our column (3) analysis of Table 2 electorate by electorate, to see how stable our overall estimated associations are across electorates. (There are enough meshblocks within each of the 64 electorates to do this, ranging from 446 to 966.) The resulting estimated marginal effects of both social capital and ethnic heterogeneity on turnout are summarized graphically in Figure A5.1.

Here we see that estimated coefficients across electorates are less stable for social capital than they are for ethnic heterogeneity. For social capital (the left panel), the coefficients have wider confidence intervals, and a non-negligible number are not significantly different from zero at the 5% level. However their point

[22] The simple coefficients of linear correlation are 0.41 between religious and language fragmentation, 0.52 between religious and ethnic fragmentation, and 0.74 between ethnic and language fragmentation.

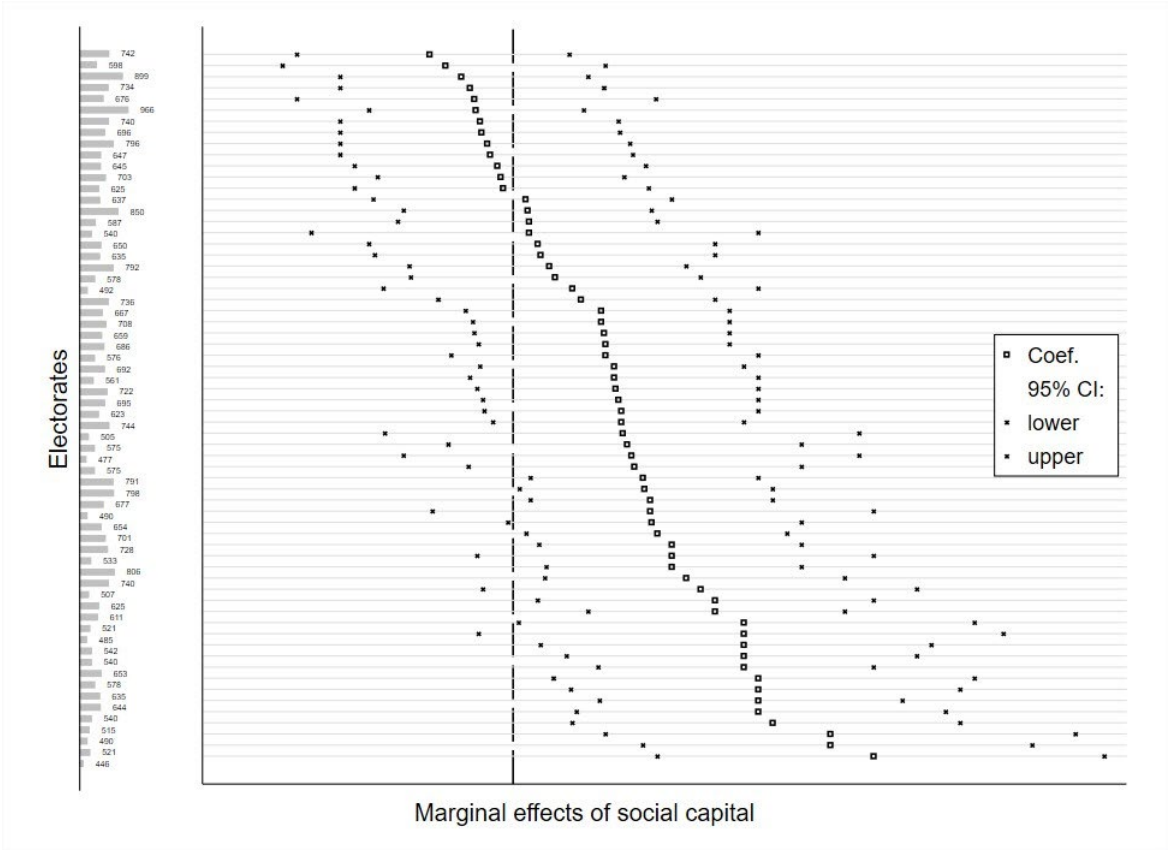
estimates are predominantly positive, and none of the few negative point estimates are significant. In contrast, for ethnic fragmentation (the right panel), coefficient point estimates are almost uniformly negative, with narrower confidence intervals, and mostly significant. We observe a single electorate, Manukau East in South Auckland, for which the coefficient is significantly positive.[23] Thus, more granular analysis indicates that the association between social capital and turnout is less stable than that for ethnic fragmentation. This could be caused by differences in underlying mechanisms linking social capital and turnout, which we investigate in Section 5.2.

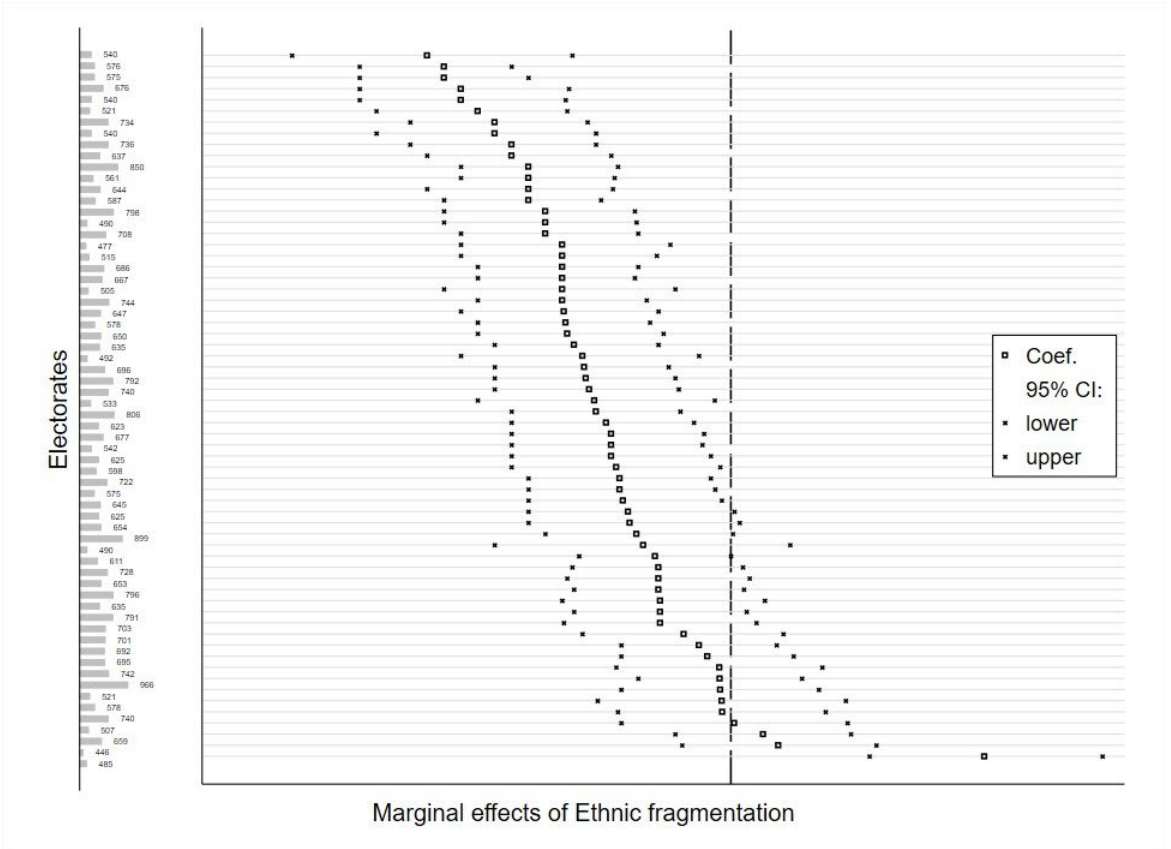
A6 Tests of channels through which social capital and heterogeneity affect turnout

Here, we present regressions investigating the information and social norm channels by which social capital and ethnic heterogeneity may affect voter turnout. We first address information. The following tables contain the outcomes used to produce figures in Section 6.

Figure A5.1. Coefficients on social capital or ethnic fragmentation – by electorate

[23] This electorate has an unusually high proportion of people with Pacific ethnicity (44.8%), a high proportion who rent rather than own their own homes, and the lowest proportion who had cell phones or internet access of all general electorates https://www.parliament.nz/en/mps-and-electorates/historical-electorate-profiles/electorate-profiles-data/document/DBHOH_Lib_EP_Manukau_East_Electoral_Profile .





Dotted vertical lines at zero. The coefficients are obtained from the third column model described in Table 2, applied separately for the 64 New Zealand electorates.

A6.1 Interactions with education level

First, we look for evidence whether social capital and heterogeneity are associated with turnout through information costs. Our empirical strategy is to interact a channel CH with our social capital measure in model (3a), or our heterogeneity measure in model (3b):

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC}SC_m + \alpha_{CH}CH_m + \alpha_{INT}(SC_m \times CH_m) + \alpha_{EF}EF_m + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (4a)$$

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC}SC_m + \alpha_{CH}CH_m + \alpha_{EF}EF_m + \alpha_{INT}(EF_m \times CH_m) + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (4b)$$

Since we try two proxies for each of the two channels, we ultimately carry out eight supplementary estimations (four with social capital and four with ethnic heterogeneity).

Table A6.1 presents outcomes regarding turnout rate when we introduce an interaction between either volunteering or ethnic fragmentation, and the proportion of those 15 or older with a bachelor's degree or higher. These two regressions are used to calculate the conditioned marginal effect of social capital displayed in Figure 4.

Table A6.1. Estimations of turnout including an education interaction term

	(1) Coef. (se)	(2) Coef. (se)
Proportion of ind. with univ. degrees	13.8***	8.31***
	(1.54)	(1.44)
Volunteering rate	9.12***	6.22***
	(2.16)	(1.09)
Volunteering rate X proportion of ind with univ. degrees	-16.9*	
	(8.57)	
Ethnic fragmentation	-7.31***	-8.90***
	(0.97)	(1.32)
Ethnic fragmentation X proportion ind with univ degrees		8.39**
		(3.48)
Constant	71.9***	73.0***
	(1.21)	(1.29)
Control variables	Yes	
Electorate FE	Yes	
Observations	41,200	
Adjusted R^2	0.41	0.41

Notes: See the notes for Table A3.4.

A6.2 Interactions with proportion speaking English

The second test of the information channel is based on the proportion of English in the languages spoken in the meshblock. As in the previous test in our regression of voter turnout we include an English language interaction with either volunteering or ethnic fragmentation. Table A6.2 provides the two estimates underlying Figure 5 in the text.

Table A6.2. Estimations of turnout including an English language interaction term

	(1) Coef. (se)		(2) Coef. (se)
Proportion of English in spoken languages	22.1***		9.83***
	(2.14)		(3.58)
Volunteering rate	43.4***		5.55***
	(9.40)		(0.90)
Volunteering rate X proportion of English in lang.	-44.1***		
	(10.8)		
Ethnic fragmentation	-3.80***		-16.4**
	(0.92)		(6.48)
Ethnic fragmentation X proportion of English in lang.			14.6**
			(6.73)
Constant	53.7***		64.7***
	(2.37)		(3.93)
Control variables		Yes	
Electorate FE		Yes	
Observations		41,200	
Adjusted R^2	0.42		0.42

Notes: See the notes for Table A3.4.

A6.3 Interactions with population density

Table A6.3 presents the two estimates regressing turnout rate with an interaction between the volunteering rate and the log of population density. These estimates are used to calculate the conditioned marginal effect of volunteering displayed in Figure 6 of the text.

Table A6.3. Estimations of turnout including a population density interaction term

	(1) Coef. (se)	(2) Coef. (se)
Log (Pop density)	-0.94***	-0.51***
	(0.095)	(0.091)
Volunteering rate	-4.26	5.78***
	(2.69)	(1.10)
Volunteering rate X Log (Pop density)	1.67***	
	(0.41)	
Ethnic fragmentation	-7.18***	-3.39**
	(0.97)	(1.48)
Ethnic fragmentation X Log (Pop density)		-0.58**

				(0.24)
Constant	74.4***		71.5***	
	(1.15)		(1.25)	
Control variables		yes		
Electorate FE		yes		
Observations		41,200		
Adjusted R^2	0.41		0.41	

Notes: See the notes for Table A3.4.

A6.4 Interactions with dominant ethnic group

As second test of the social norm channel, we include an interaction between dominant ethnic group and volunteering rate or ethnic fragmentation on turnout. To set the stage, Table A6.4 first provides the coefficients of dominant (or majority) ethnic groups on turnout directly, once we introduce them into the baseline estimation. We observe substantial differences in voter turnout rate by dominant ethnic affiliation. It is largely higher when European is the dominant or majority ethnic affiliation, or when there is no ethnic group that represents more than half of affiliations. In contrast, there are no significant differences in turnout between the three other ethnic affiliations (Asian, Pacific and Maori).

Table A6.4. Estimations of turnout rates with dominant ethnic group included

	Dominant ethnic group (highest proportion)		Majority ethnic group (proportion > 0.5)	
	Coef.	se	Coef.	se
Volunteering rate	6.08***	(0.89)	6.12***	(0.90)
Ethnic fragmentation	-7.67***	(0.84)	-7.37***	(0.73)
No ethnicity in majority	-	-	-3.07***	(0.27)
European	reference		reference	
Maori	-4.31***	(0.61)	-4.88***	(0.65)
Pacific	-5.91***	(0.60)	-7.94***	(0.66)
Asian	-5.00***	(0.51)	-6.02***	(0.62)
ME/LA/A	-4.18***	(0.62)	-1.62**	(0.67)
Constant	76.1***	(1.09)	76.4***	(1.00)
Control variables	yes		yes	
Electorate FE	yes		yes	
Observations	40,856		41,200	
Adjusted R^2	0.42		0.42	

Notes: See the notes for Table A3.4.

When we include interactions with volunteering in Table A6.5, we can then compare the total marginal effect of volunteering plus the interaction term by dominant ethnic affiliation as in Figure 7. For example, the marginal effect of volunteering on turnout for European dominant meshblocks (10.3–5.24=5.06), is less than that for Pacific or Asian dominant meshblocks. We can similarly include interactions with ethnic fragmentation in Table A6.6, and we find similar differences in the marginal effect of fragmentation by dominant ethnic group.

Table A6.5. Estimations including a dominant ethnic group interaction - volunteering

	Coef.		s.e.
Volunteering rate	10.3*		(5.16)
Dominant ethnic group:			
European	5.20***		(1.18)
Maori		reference	
Pacific	-2.29		(1.38)
Asian	-1.31		(1.35)
ME/LA/A	-2.41		(2.55)
European x Volunteering rate	-5.24		(5.25)
Maori x Volunteering rate		reference	
Pacific x Volunteering rate	8.99		(7.41)
Asian x Volunteering rate	10.8		(7.09)
ME/LA/A x Volunteering rate	37.3		(44.5)
Ethnic fragmentation	-7.73***		(0.83)
Constant	71.0***		(1.33)
Electorate FE		yes	
Observations		40,856	
Adjusted R^2		0.42	

Notes: See notes on Table A6.4.

Table A6.6. Estimations including a dominant ethnic group interaction - fragmentation

	Coef.		se
Ethnic fragmentation	0.92		(4.11)
Dominant ethnic group :			
European	9.81***		(2.00)
Maori		reference	
Pacific	-10.4***		(2.40)
Asian	-1.82		(3.14)
ME/LA/A	14.4		(11.9)
European x Ethnic fragmentation	-10.1**		(4.10)
Maori x Ethnic fragmentation		reference	
Pacific x Ethnic fragmentation	12.8***		(4.26)
Asian x Ethnic fragmentation	1.04		(5.38)
ME/LA/A x Ethnic fragmentation	-23.5		(19.0)
Volunteering rate	6.20***		(0.85)
Constant	67.7***		(2.07)
Electorate FE		yes	
Observations		40,856	
Adjusted R^2		0.42	

Notes: See notes on Table A6.4.

A.7 Interactive effects of ethnic heterogeneity and social capital on turnout

We test for interactions between ethnic heterogeneity and social capital on turnout in two ways. First, we classify meshblocks with at least some (positive) volunteering separately from those without any using a dummy variable, and meshblocks with full homogeneity (no heterogeneity) separately from those with at least some heterogeneity using a second dummy variable. We then interact the

volunteering rate with the "full homogeneity" dummy, and the ethnic fragmentation variable with the "positive volunteering" dummy.

Second, we simply interact our two continuous key variables. Model (2) becomes

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC}SC_m + \alpha_{EF}EF_m + \alpha_{INT}(SC_m \times EF_m) + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (5)$$

The results in Table A7.1 below underlie Figure 7.

Table A7.1. Impact of social capital on turnout according to whether the meshblock has positive ethnic fragmentation, and whether it has positive volunteering

	(1) Coef. (se)		(2) Coef. (se)
Volunteering rate	6.66***		
	(1.12)		
1 if the meshblock is fully homogeneous	0.97		
	(0.75)		
Fully homogeneous x Volunteering rate	-3.51		
	(3.62)		
Ethnic fragmentation			-7.66***
			(2.23)
1 if the meshblock has positive volunteering			1.63*
			(0.84)
Positive volunteering x Fully homogeneous			0.28
			(2.08)
Constant	67.7***		72.0***
	(0.90)		(1.54)
Control variables		yes	
Electorate FE		yes	
Observations		41,200	
Adjusted R^2	0.40		0.41

Notes: See the notes for Table A3.4.

A7.2 Simple interaction between ethnic fragmentation and volunteering on turnout

Table A7.2 below underlies Figures 8 and 9 in the text. The second and third models are included to be sure the significant interaction effect found in the first model is not driven by meshblocks lacking any ethnic diversity or volunteering.

Table A7.2. Turnout estimations with social capital and ethnic heterogeneity interaction

	(1) Sample: all meshblocks		(2) Sample: excluding meshblocks with no ethnic diversity		(3) Sample: excluding meshblocks with no volunteering	
	Coef.	se	Coef.	se	Coef.	se
Volunteering rate	-0.90	(1.81)	-1.79	(2.07)	-1.84	(2.06)
Ethnic fragmentation	-10.1***	(1.24)	-10.6***	(1.35)	-10.4***	(1.32)
Volunteering rate X Ethnic fragmentation	20.1***	(3.95)	21.3***	(4.42)	21.3***	(4.47)
Constant	73.4***	(1.23)	73.3***	(1.26)	73.4***	(1.24)
Control variables	Yes		yes		yes	
Electorate FE	Yes		yes		yes	
Observations	41,200		40,072		40,536	
Adjusted R^2	0.41		0.41		0.41	

Notes: See the notes for Table A3.4.

A.8 Stage One Matching Procedures Information Underlying Stage Two PSM Results for Step One in Table 4

We used the psmatch2 command in Stata to generate Stage One and Stage Two results for all PSM analysis. Key results for Stage Two are summarized in Table 4.

Here, we provide further detail on our exact matching procedures for meshblocks. We used the following matching options:

1. Neighbor: we used 1 meshblock neighbor only to calculate the matched outcome.
2. Caliper: we allowed a maximum distance of controls of 0.01 .
3. Ties: we not only matched meshblocks to their nearest neighbor, but also other controls with identical (tied) propensity scores.
4. Common: we imposed a common support by dropping treatment observations whose propensity score was higher than the maximum or less than the minimum propensity score of the controls.

Table A8.1. Turnout estimations with social capital and ethnic heterogeneity interaction

PSM: Stage One Results When Meshblocks are Jointly or Singly Sorted

	Ethnic Frag low & Volunteering high b/se	Ethnic Frag low b/se	Volunteering high b/se
Median household income (1000 NZ$)	-4.32***	4.39***	-1.17***
	(0.31)	(0.36)	(0.35)
Home owners (%)	2.03***	2.79***	3.11***
	(0.047)	(0.059)	(0.061)
% of ind. with univ. degrees	1.63***	0.54***	1.90***
	(0.062)	(0.074)	(0.073)
Unemployment rate	2.48***	-5.72***	-3.03***
	(0.18)	(0.25)	(0.25)
% ind. aged 65 and +	0.41***	3.57***	1.67***
	(0.071)	(0.091)	(0.083)
% No religious affiliation	-0.57***	2.47***	0.63***
	(0.053)	(0.080)	(0.070)
% Male	-0.37***	0.27*	0.47***
	(0.14)	(0.17)	(0.17)
Log (Pop. density)	-0.11***	-0.16***	-0.14***
	(0.0034)	(0.0040)	(0.0037)
Constant	-0.11	-2.36***	-2.37***
	(0.087)	(0.11)	(0.11)
Observations	42673	42673	42673
Adjusted R^2			
AIC	54127.0	40354.1	39633.9

Standard errors are clustered at the electorate level. ***p < 0.01, **p < 0.05, * p < 0.1

Supporting Information for
Social capital, social heterogeneity, and electoral turnout

Here, we provide additional materials for our paper "Electoral turnout, social capital and ethnic heterogeneity".

Section A1 describes the variables used in our empirical work.

Section A2 presents two additional estimations for Section 5.1.2: one excluding all variables related to electorate fixed effects or characteristics, and one using electorate random effects rather than fixed effects.

Section A3 presents estimations for alternative functional forms regarding social capital and ethnic heterogeneity variables for Section 5.1.2.

Section A4 presents estimations for various subsamples according to meshblock characteristics for Section 5.1.2.

Section A5 presents estimations with alternative definitions or dimensions of heterogeneity for Section 5.1.2.

Section A6 presents estimations underlying Section 5.2's investigation of social norm or information cost channels by which social capital or heterogeneity may affect voter turnout.

Section A7 presents detailed estimations underlying Section 5.3's investigation of interaction effects of social capital and ethnic heterogeneity in their association with turnout.

Section A8 presents details of our Stage 1 propensity score matching (PSM) for our first step (Table 2) results underlying Stage 2 PSM results for Table 2 appearing in Table 4.

A1 Description of the variables used and the 2017 national election

Table A1.1 Description of Variables

Variable	Description
Volunteering	2013 Proportion of meshblock reporting "Other Helping or Voluntary Work For or Through any Organization, Group or Marae" in the previous four weeks. Excludes the following unpaid activities outside the household: caring for a child or someone who is ill, elderly, or disabled. *Construction*: "Other Helping…."/(Total Who Answered)
Ethnic Shares	2013 The proportion of ethnic affiliations reported by meshblock usual residents, aggregated to five categories:European/Other (where Other primarily includes those who wrote in "New Zealander"), Maori, Pacific, Asian, and Middle Eastern/Latin American/African. Individuals could select more than one ethnic affiliation. *Construction*: frequencies were summed across the five affiliation categories to create a base of total ethnic affiliations from which shares were calculated. "Other" ethnicities does include very small numbers of North American Inuit or Indian, Mauritian, etc., but is overwhelmingly those refusing to report ethnicity and answering "New Zealander." (In the 2006 census, 90% of those reporting New Zealander were thought to be European, and so we combine "Other" with European for 2013.)
Language Shares	2013. Meshblock usual residents indicated if they could speak either English, Maori, Samoan, or Other languages. Individuals could select more than one language (or none). Language shares, including English language shares, are constructed from the baseline of total languages spoken, not total people.
Religious Affiliation	2013. The share of each meshblock's usually resident population aged 15+ reporting no religious affiliation, vs. the share of people reporting one or more religious affiliations. (Individuals can identify with more than one affiliation, which are aggregated to include Atheist, Christian, Buddhist, Hindu, Islam/Muslim, Judaism, Maori Christian, Spiritualist/New Age and Other.) *Construction*: No religious affiliation frequencies were divided by the total usually resident population aged 15+ who provided answers to the religious affiliation question.
Ethnic Fragmentation	2013. One minus the Hirschman-Herfindahl index, which is defined over the affiliation shares of the 5 ethnic categories above.
Ethnic Polarization	2013. Defined as $EP_m = 1 - \sum_{i=1}^{5} \left(\frac{0.5-p_i}{0.5}\right)^2 \times p_i$, where 'm' refers to meshblock, and p_i refers to the ethnic affiliation share of group 'i' of the 5 ethnic categories above.
Lang. Fragmentation	2013. One minus the Hirschman-Herfindahl index, which is defined over the affiliation shares of the 4 language categories above.
Religion Fragmentation	2013. One minus the Hirschman-Herfindahl index, which is defined over the affiliation shares of the 9 categories above.

Table A1.1 Description of Variables (Cont'd)

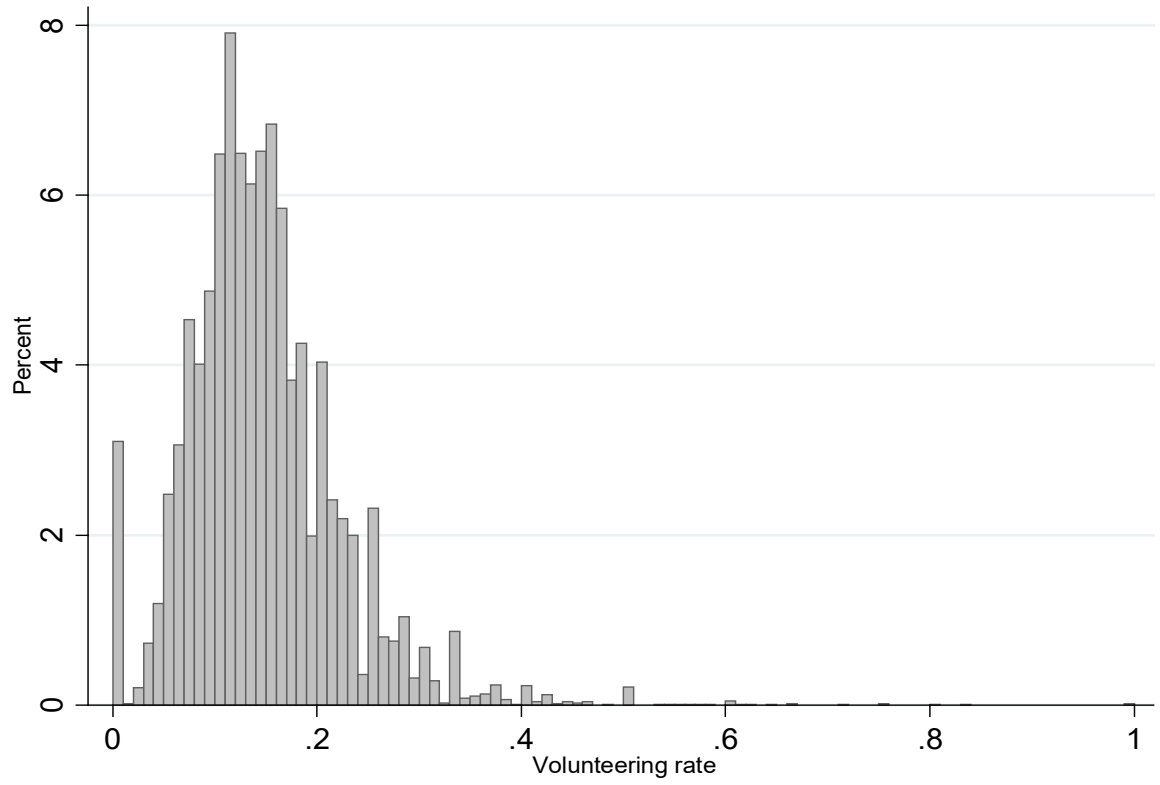
Variable	Description
Median HH Income	2013 The median household income from all sources for usual residents of meshblock aged 15 or older. Not yet deflated by GDP deflator.
Male	2013. The share of a meshblock's usually resident population that is male. *Construction*: frequency "Male" over "Total People"
Population Density	2013. Meshblock usually resident population divided by meshblock square kilometres.
Age – Share 65+	2013. Proportion of usually resident population aged 65 or greater.
Married	2013. The share of each meshblock's usually resident population 15 and over who were currently legally married or in a civil union. *Construction*: share identifying as Married divided by share identifying as married, separated/divorced/widowed, never married, or not answering.
University Degree	2013. The share of each meshblock's usually resident population 15 or over whose highest degree is a bachelor's degree or higher. *Construction*: summed frequencies of "Bachelor's Degree or Level 7 Qualification," "Postgraduate and Honours Degrees," "Masters" and PhD degrees, divided by total people who answered.
Home Ownership HH	2013. The share of households owned or partially owned by their usual residents, or held in a family trust. *Construction*: frequencies of households 1) owned/partially owned by residents or 2) held in family trusts, summed and divided by total number of households who provided ownership information.
Unemployed	2013. The share of the usually resident population in each meshblock aged 15 or over who report currently being unemployed. *Construction*: frequencies for four possible labour force status categories summed to provide a baseline from which shares calculated.
Turnout rate	Overall number of votes cast (including blank and invalid) over all registered voters in the 2017 national legislative elections. The Electoral Commission freely provides data on voter turnout rates for the 2017 national election, mapped to 2017 meshblock level.
Electoral Fragmentation	2017. The fragmentation of vote shares at the electorate level between the candidates running in that electorate. Proxies for closeness of contest. *Construction:* 1 - the Hirschman-Herfindahl index, where the number of vote share categories was determined by the number of candidates running.
Polit. Party Expenditures	2017. The total electorate level expenditures from all political parties in each electorate. In thousands of New Zealand dollars.
Number of candidates	2017. The total number of candidates running in each electorate.

Table A1.2 Descriptive statistics of all meshblock level variables (N=42,100)

Variable	Mean	St. Dev.	Min	Max
Voter turnout rate (%)	79.28	9.93	22.22	100
Volunteering rate	0.14	0.06	0	0.60
Ethnic fragmentation	0.37	0.19	0	0.80
Ethnic polarization	0.59	0.24	0	1
Language fragmentation	0.25	0.14	0	0.66
Religious fragmentation	0.63	0.09	0	0.98
Median household income (NZ$)	0.07	0.03	0	0.15
Share households homeowners (%)	0.51	0.18	0	1.11
% of individuals with univ. degrees	0.19	0.13	0	0.90
% of individuals married	0.44	0.15	0	1
Unemployment rate	0.05	0.04	0	0.35
% of ind. aged 65 and over	0.15	0.11	0	1.05
% Male	0.49	0.05	0.12	0.94
Log of Population density (per square km)	6.77	2.12	0.08	12.19

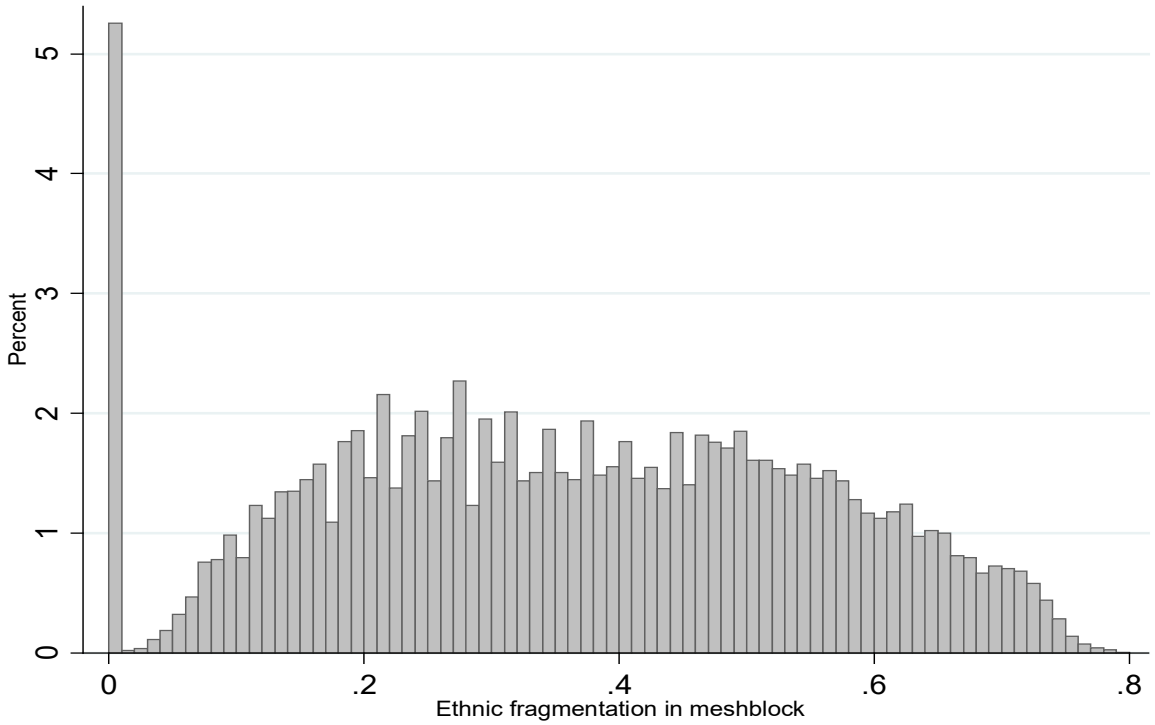
Notes. "meshblock" is the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. Shares for low population meshblocks may exceed 1 due to randomized rounding. The sample is our baseline estimation with electorate FE (see Table 2 in the main part of the text). For the definition of the variables see Supporting Information A1.

Figure A1.1. Distribution of volunteering rates



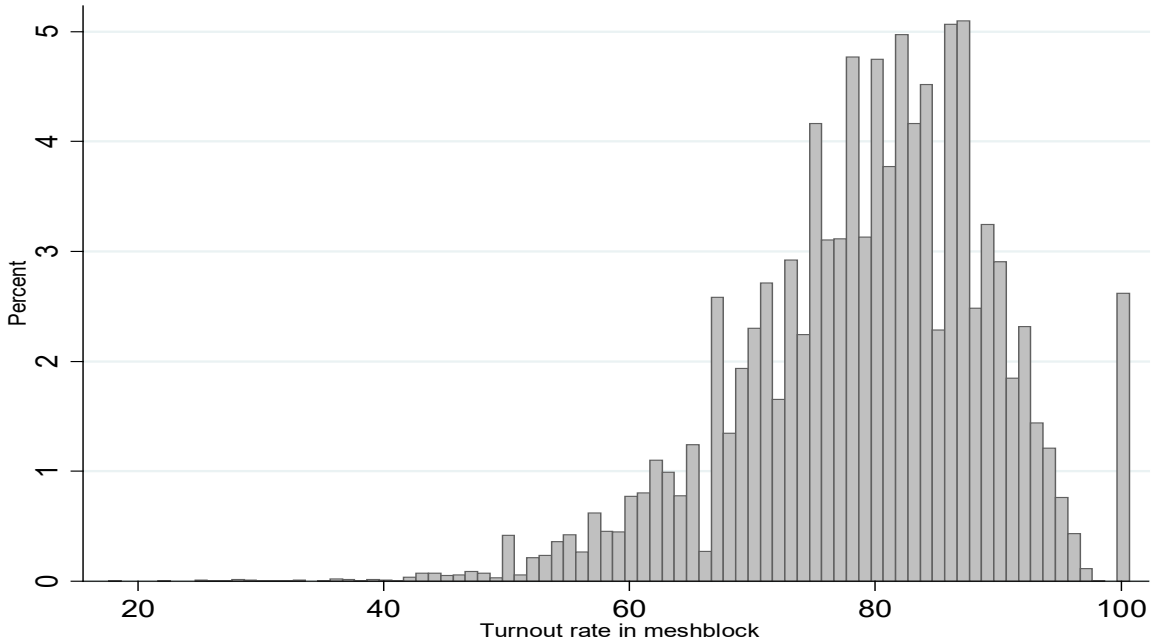
Notes: The volunteering rate is measured by the 2013 census as the proportion of respondents within the meshblock reporting "Other helping or voluntary work for or through any organization, group or marae" in the previous four weeks over the total who answered. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. Source: Census 2003.

Figure A1.2. Distribution of ethnic fragmentation



Notes. Ethnic fragmentation is defined as one minus the Hirschman-Herfindahl index of concentration. The observation unit is the "meshblock", the smallest geographic unit for which data is collected and processed by Statistics New Zealand. Source: Census 2003.

Figure A1.3. The distribution of voter turnout rate for the 2017 legislative elections



Notes. The meshblock voter turnout rate (%) is defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 national election. The observation unit is the "meshblock", the smallest geographic unit for which data is collected and processed by Statistics New Zealand. The turnout rate is defined as the overall number of votes (including blank and invalid votes) out of the registered voters.

Further information on the 2017 national election

The 2017 New Zealand general election took place on Saturday 23 September 2017 at the regular three-year term of the 51st New Zealand Parliament. About 3.57 million people were registered to vote for members of the House of Representatives, with 2.63 million (79.8%) turning out. Advance voting represented 1.24 million votes cast before election day. Note that advance voting is integrated into our turnout measure. The incumbent Prime Minister, Bill English, from the center-right National Party led a minority government supported by a coalition containing several small parties. The main Labour opposition party, led by Jacinda Ardern, supported by a coalition of two smaller parties, won the greatest number of MP's and thus the election. Given the frequency of general election, the political and economic contexts, and the absence of important political event before and during the campaign, we can assume that mobilization was at usual New Zealand levels for this election.

Another feature of the New Zealand MMP system is that those of indigenous Maori descent may opt to enrol in the "general roll" and vote in their local general electorates (which comprise 64 of the total 71 electorates), or enrol in the "Maori roll" and vote in their broader geographic Maori electorate (7 of the 71 electorates). Slightly less than half of Maori choose the Maori roll.[1] This dual roll system was designed to ensure a minimum threshold of Maori representation in parliament. This feature means that every meshblock in New Zealand simultaneously maps to a (smaller) general electorate boundary, and a (larger) Maori electorate boundary. Given that our meshblock level voter data does not distinguish turnout rates between the general and Maori rolls, and that 92.5% of enrolled voters are on the general roll, we map meshblocks to the general rather than Maori electorates for our study.[2]

[1] It was estimated in 2018 that 250,000 of 600,000 who identify as Maori chose the Maori roll. See "General roll or Māori roll - which one to choose?" at https://www.maoritelevision.com/news/politics/general-roll-or-maori-roll-which-one-choose.

[2] For April 2019 enrolment data on the general and Maori rolls, see the country's Electoral Commission site https://www.elections.org.nz/research-statistics/enrolment-statistics-electorate.

A2 Estimation of baseline results without electorate variables or with random effects

Table A2.1 presents results showing our conclusions about the estimated coefficients of our two key variables are not affected by the exclusion of electorate fixed effects or characteristics. Other covariates also are not much impacted, though the adjusted R squared is lower. This indicates our results are not driven by the electorate characteristics.

Table A2.1. Estimations of turnout without any variables related to electorates

	Coef.	se
Volunteering rate	9.19***	(1.68)
Ethnic fragmentation	-7.88***	(1.11)
Log (Population density)	-0.61***	(0.061)
Median household income (1000 NZ$)	19.7***	(4.29)
Share households homeowners (%)	11.5***	(1.26)
% of individuals with univ. degrees	16.5***	(1.34)
Unemployment rate	-17.3***	(2.32)
% of ind. aged 65 and over	11.6***	(1.17)
Proportion no religious affiliation	8.70***	(1.80)
% of individuals married	0.67	(1.55)
% Male	-1.42	(1.11)
Constant	70.3***	(1.75)
Electorate FE	no	
Electorate characteristics	no	
Observations	41,200	
Adjusted R^2	0.37	

Note: The explained variable is meshblock voter turnout defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 national election. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The measure of volunteering rate comes directly from the census. Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the10%, 5%, and 1% levels, respectively. Estimation by OLS

Next, Table A2.2 presents estimated coefficients using electorate random effects, rather than fixed effects. It again finds that our two variables of interest are not affected.

Table A2.2. Estimation of turnout with electorate random effects

	Coef.	se
Volunteering rate	6.04***	(1.09)
Ethnic fragmentation	-7.28***	(0.95)
Log (Population density)	-0.67***	(0.059)
Median household income (1000 NZ$)	24.2***	(3.68)
Share households homeowners (%)	9.60***	(0.92)
% of individuals with univ. degrees	11.5***	(0.86)
Unemployment rate	-16.2***	(1.65)
% of ind. aged 65 and over	10.3***	(0.83)
Proportion no religious affiliation	5.05***	(0.90)
% of individuals married	4.46***	(1.07)
% Male	-1.86*	(1.05)
Constant	72.7***	(1.41)
Meshblock-level sd	0.88***	(0.12)
Electorate-level sd	2.03***	(0.012)
Electorate FE	no	
Observations	41,200	
Adjusted R^2	0.37	

Note: see the notes for Table A2.1.

A3 Alternative functional forms in the baseline estimation

We test alternative functional forms such as log transformations or quadratic terms for the volunteering rate and ethnic fragmentation. We also present a log-log model.

A3.1 Alternative functional form for the social capital variable

Table A3.1 compares the key coefficients for three functional forms: linear, log transformation of social capital (where we add 0.1 to the volunteering rate before the log transformation to solve the absence of the logarithm of zero), and quadratic. We observe that all coefficients are significant. The negative coefficient on the square of the volunteering rate might suggest there is an inverse U shaped relationship with voting. Before drawing that conclusion, however, we explore further the validity of the quadratic form.

Table A3.1 Alternative functional forms for the social capital variable

	(1) Linear	(2) Log of Volunteering	(3) Quadratic
	Coef. (se)	Coef. (se)	Coef. (se)
Volunteering rate	5.95***		20.8***
	(1.09)		(2.34)
Log transformation of volunteering rate		1.72***	
		(0.25)	
Squared volunteering rate			-43.6***
			(6.16)
Ethnic fragmentation	-7.25***	-7.24***	-7.28***
	(0.96)	(0.96)	(0.96)
Constant	72.5***	75.8***	71.7***
	(1.23)	(1.30)	(1.24)
Meshblock characteristics	Yes	Yes	yes
Electorate FE	Yes	Yes	yes
Observations	41,200	41,200	41,200
Adjusted R^2	0.41	0.41	0.41

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand.

A3.2 Alternative functional forms for ethnic heterogeneity

Here, we test alternative functional forms for our second variable of interest: ethnic fragmentation. To foreshadow, we find that all estimated coefficients retain a negative sign, including even a quadratic square term, though it is not significant. The estimated extreme point for the quadratic form of ethnic fragmentation is -0.103, which is clearly out of the range of the variable. Combined with the lack of significance of the squared coefficient (Table

Table A3.2 Alternative functional forms for ethnic heterogeneity

	(1) Linear	(2) Log of Fragmentation	(3) Quadratic
	Coef. (se)	Coef. (se)	Coef. (se)
Ethnic fragmentation	-7.25***		-0.91
	(0.96)		(1.59)
Log transformation of ethnic fragmentation		-2.01***	
		(0.27)	
Squared ethnic fragmentation			-9.07***
			(3.13)
Volunteering rate	5.95***	6.12***	5.91***
	(1.09)	(1.08)	(1.10)
Constant	72.5***	67.3***	71.9***
	(1.23)	(0.91)	(1.19)
Meshblocks characteristics	yes	Yes	yes
Electorate FE	yes	Yes	yes
Observations	41,200	41,200	41,200
Adjusted R^2	0.41	0.40	0.41

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand.

A3.3), we can conclude that the quadratic form is not relevant.

As with the volunteering rate, this leaves the linear and log specifications. Once again, lacking *ex ante* arguments to choose logs, we use the linear form as our baseline.

A3.3 Log-log estimations

Finally, we also test a log-log form for our dependent and both interest variables. The results are presented in Table A3.3 and show no difference to the linear relationship. The estimated coefficients are again significant at the strictest level and have the same signs. Our baseline conclusions thus do not depend on the form of the relationship estimated.

Table A3.3. Log-log estimations of turnout

	Coef.	se
Log of volunteering rate	0.024***	(0.0035)
Log of ethnic fragmentation	-0.021***	(0.0039)
Constant	-0.35***	(0.014)
Meshblock characteristics	yes	
Electorate FE	yes	
Observations	41,200	
Adjusted R^2	0.41	

Note: The explained variable is the log of meshblock voter turnout defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 election. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The volunteering rate comes directly from the census. Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS.

A4 Estimations on restricted samples of meshblocks

In this section, we present estimates based on various restricted samples of meshblocks in order to check the sensitivity of our results to outlier observations. We first exclude those meshblocks with a 100 percent turnout rate. These 820 meshblocks account for about 2 percent of the distribution. Second, we instead exclude meshblocks with zero ethnic fragmentation (full homogeneity). Our third and fourth subsamples are defined by a standard trimming method (using a 5% threshold), or winsoring method (also at a 5% threshold), respectively. Table A4.1, which is keyed to the first specification (with electorate fixed effects) in Table 2 of the text, displays the outcomes.

Our restricted samples estimates are quite similar to our full-sample estimates; hence we conclude that our main results are not driven by outlier meshblocks.

Table A4.1. Estimations of turnout excluding extreme observations

	(1) Without full turnout rate obs.	(2) Without homogeneous obs.	(3) Trimming 5% and 95%	(4) Winsoring 5% and 95%
	Coef. (se)	Coef. (se)	Coef. (se)	Coef. (se)
Volunteering rate	5.36*** (1.10)	5.90*** (1.12)	7.19*** (1.27)	5.95*** (1.09)
Ethnic fragmentation	-6.76*** (0.96)	-7.54*** (1.05)	-7.54*** (0.95)	-7.25*** (0.96)
Constant	71.5*** (1.17)	72.3*** (1.27)	72.9*** (1.20)	72.5*** (1.23)
Electorate FE	yes	yes	Yes	yes
Meshblock characteristics	yes	yes	Yes	yes
Observations	40,368	40,072	38,009	41,200
Adjusted R^2	0.42	0.41	0.41	0.41

Notes: See notes to Table A3.3.

A5 Estimations with alternative measures or dimensions of heterogeneity

To check if our results regarding ethnic fragmentation are robust, we try alternative measures of ethnic heterogeneity, as well as alternative dimensions of social fragmentation, or repeat analysis electorate by electorate. To begin, in Table A5.1 we use simpler measures of meshblock ethnic heterogeneity, either instead of or in addition to fragmentation. Next, in Table A5.2 we use ethnic polarization in place of fragmentation. Third, in Table A5.3 we try instead two alternative dimensions of fragmentation: languages spoken, or religious affiliation. Finally, in Table A5.4 we control for multicollinearity between the three dimensions of fragmentation.

Table A5.1. Estimations of the turnout rates with simpler ethnic diversity measures

	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
	(se)	(se)	(se)	(se)
Volunteering rate	6.55***	6.38***	6.21***	6.46***
	(1.11)	(1.09)	(0.84)	(0.87)
Ethnic fragmentation		-9.75***		4.03***
		(1.12)		(1.08)
Number of ethnic groups present	0.072	0.68***		
	(0.060)	(0.072)		
Proportion of affiliations:				
European			ref	ref
Maori			-14.3***	-17.2***
			(1.18)	(1.70)
Pacific			-16.7***	-18.7***
			(1.33)	(1.42)
Asian			-15.4***	-18.1***
			(1.13)	(1.63)
ME/LA/A			-14.1***	-19.3***
			(2.44)	(2.97)
Constant	67.4***	71.5***	79.1***	78.4***
	(0.99)	(1.24)	(0.96)	(0.93)
Control variables	yes	yes	yes	yes
Electorate FE	yes	yes	yes	yes
Observations	41,200	41,200	41,200	41,200
Adjusted R^2	0.40	0.41	0.43	0.43

Note: The explained variable is the meshblock voter turnout rate (%) defined as the overall number of votes (including blank and invalid) out of registered voters in the 2017 national election. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The measure of volunteering rate comes directly from the census. Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS.

Table A5.1 displays the estimates with simpler ethnic diversity measures. The simple number of ethnic groups present in the meshblock is not significantly associated with voter turnout when used instead of ethnic fragmentation (Column (1)), but has a positive association of modest size when used alongside ethnic fragmentation (Column (2)). The sign and magnitude of fragmentation in Column (2) is not deeply affected. In the two last columns, we first introduce the proportion of every ethnic affiliation (European baseline) instead of fragmentation, and then add them alongside fragmentation. The estimated coefficients on affiliation shares are all significant and negative compared to European, with no difference between them.[3] When we keep ethnic fragmentation in Column (4), its coefficient is now modestly positive and significant, but this may simply reflect multicollinearity between ethnic affiliation proportions and the fragmentation index. Indeed, the correlation coefficients

[3] The linear tests for equivalence are respectively for Column (3) F(3,63)=0.90 (p=0.45), and for Column (4) F(3,63)=0.43 (p=0.73).

between the ethnic fragmentation measure and the ethnic affiliation proportions are -0.8 for European, 0.4 for Maori, 0.5 for Pacific, 0.5 for Asian, and 0.3 for ME/LA/A.

Next, we try an ethnic polarization index in place of ethnic fragmentation. Ethnic polarization is defined as:

$$EP_m = 1 - \sum_{i=1}^{5} \left(\frac{0.5 - p_i}{0.5}\right)^2 \times p_i, \quad (3)$$

where p_i is the relative group size of group i. Using this replacement measure, and regardless of whether we use electorate fixed effects or characteristics, we observe very similar results. Ethnic polarization has a negative coefficient significant at the 1% level.

Table A5.2. Estimations of turnout using ethnic polarization

	(1) With electorate FE	(2) With electorate features
	Coef. (se)	Coef. (se)
Volunteering rate	6.22*** (1.06)	7.95*** (1.49)
Ethnic polarization	-4.92*** (0.51)	-5.50*** (0.61)
Constant	72.4*** (1.06)	60.7*** (2.88)
Electorate FE	Yes	no
Electorate characteristics	No	yes
Meshblock characteristics	Yes	yes
Observations	41,200	38,286
Adjusted R^2	0.41	0.38

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The variables for electorate characteristics are identical to those in Table 2 of the paper. The polarization index is defined in Supporting Information A1.

Next, we try alternative dimensions of heterogeneity within the meshblock – fragmentation by languages spoken, or by religious affiliation. The results are provided in Table A5.3. Regardless of the dimension of social diversity, we observe similar results; fragmentation is negatively associated with electoral turnout.

Table A5.3. Estimations of turnout with alternative dimensions of heterogeneity

	Language fragmentation		Religious fragmentation	
	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
	(se)	(se)	(se)	(se)
Volunteering rate	6.45***	7.35***	3.83***	4.66***
	(0.92)	(1.26)	(1.18)	(1.73)
Language fragmentation	-11.6***	-13.3***		
	(1.00)	(1.30)		
Religious fragmentation			-8.80***	-11.8***
			(1.47)	(1.77)
Constant	73.7***	63.5***	73.4***	61.2***
	(0.87)	(2.73)	(1.34)	(4.13)
Electorate FE	yes	no	yes	no
Electorate characteristics	no	yes	no	yes
Meshblock characteristics	yes	yes	yes	yes
Observations	41,200	38,286	41,200	38,286
Adjusted R^2	0.41	0.38	0.41	0.36

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. The electorate characteristics variables are identical to those in Table 2 of the paper. For definitions of the fragmentation indices, see Supporting Information A1.

Next, we include all three fragmentation measures by pair or all together in Table A5.4. Even though the fragmentation measures are correlated,[4] we observe that all their coefficients are significant with a negative sign.

Table A5.4. Estimations of turnout with multiple dimensions of heterogeneity

	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
	(se)	(se)	(se)	(se)
Volunteering rate	5.48***	4.07***	4.89***	4.83***
	(1.03)	(1.17)	(0.97)	(1.00)
Ethnic fragmentation	-4.36***	-6.93***		-3.64***
	(1.04)	(0.92)		(1.04)
Language fragmentation	-10.0***		-11.8***	-9.68***
	(1.25)		(1.00)	(1.29)
Religious fragmentation		-5.51***	-5.76***	-4.57***
		(1.37)	(1.25)	(1.21)
Constant	76.5***	78.9***	78.9***	79.4***
	(0.93)	(1.65)	(1.34)	(1.45)
Electorate FE	yes	yes	yes	yes
Meshblock characteristics	yes	yes	yes	yes
Observations	41,200	41,200	41,200	41,200
Adjusted R^2	0.41	0.41	0.41	0.41

Note: Standard errors in parentheses are clustered by electorate. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The estimation method is OLS. The explained variable is the meshblock voter turnout rate defined as the overall number of votes (including blank and invalid) out of registered voters. The observation unit is the "meshblock", the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. Electorate characteristic variables are identical to those in Table 2 of the paper. For the precise definition of the fragmentation indices, see Supporting Information A1.

[4] The simple coefficients of linear correlation are 0.41 between religious and language fragmentation, 0.52 between religious and ethnic fragmentation, and 0.74 between ethnic and language fragmentation.

Finally, we repeat our column (3) analysis of Table 2 electorate by electorate, to see how stable our overall estimated associations are across electorates. (There are enough meshblocks within each of the 64 electorates to do this, ranging from 446 to 966.) The resulting estimated marginal effects of both social capital and ethnic heterogeneity on turnout are summarized graphically in Figure A5.1.

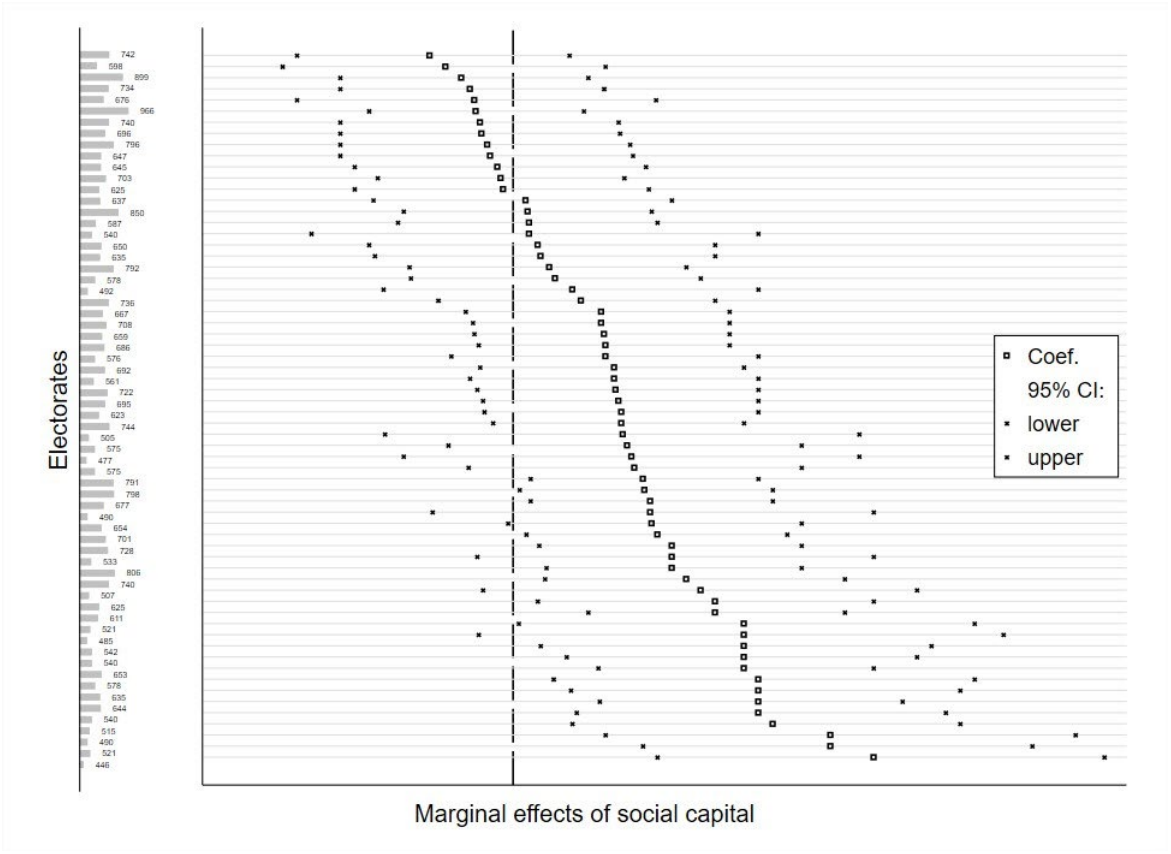
Here we see that estimated coefficients across electorates are less stable for social capital than they are for ethnic heterogeneity. For social capital (the left panel), the coefficients have wider confidence intervals, and a non-negligible number are not significantly different from zero at the 5% level. However their point estimates are predominantly positive, and none of the few negative point estimates are significant. In contrast, for ethnic fragmentation (the right panel), coefficient point estimates are almost uniformly negative, with narrower confidence intervals, and mostly significant. We observe a single electorate, Manukau East in South Auckland, for which the coefficient is significantly positive.[5] Thus, more granular analysis indicates that the association between social capital and turnout is less stable than that for ethnic fragmentation. This could be caused by differences in underlying mechanisms linking social capital and turnout, which we investigate in Section 5.2.

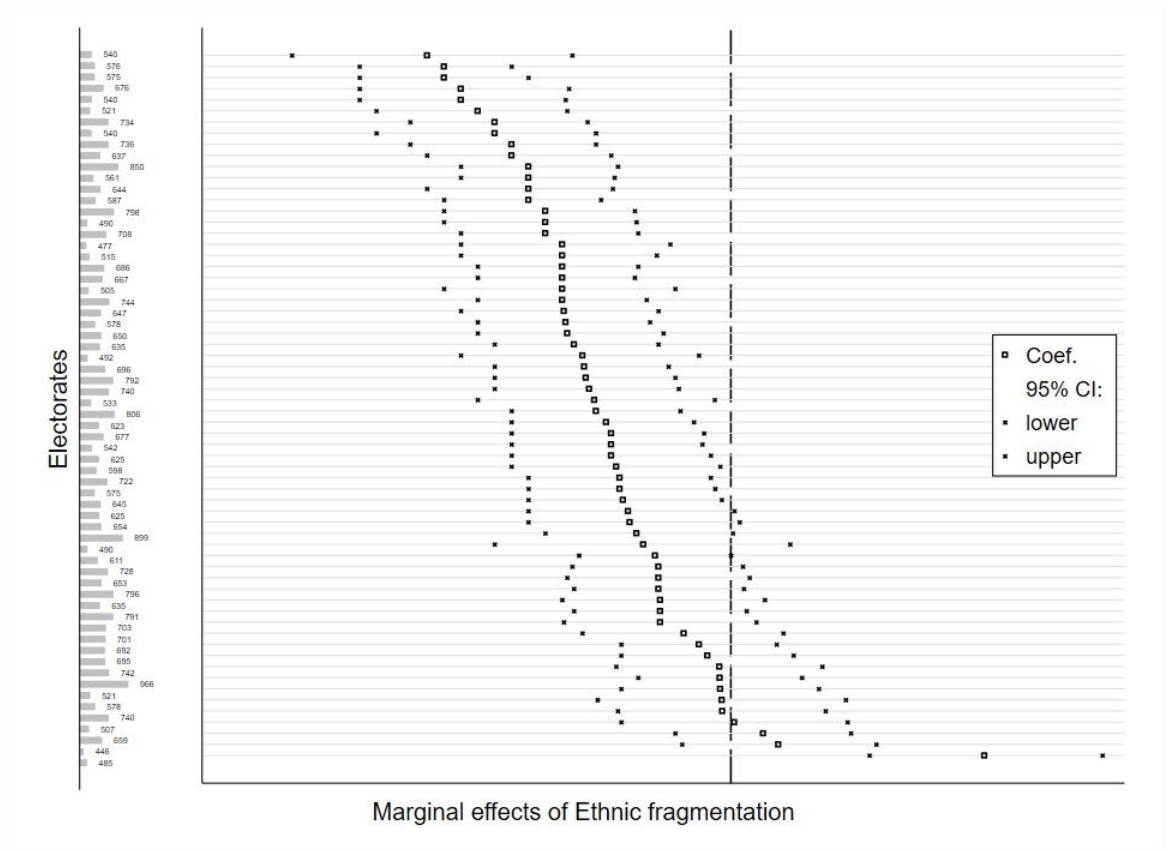
A6 Tests of channels through which social capital and heterogeneity affect turnout

Here, we present regressions investigating the information and social norm channels by which social capital and ethnic heterogeneity may affect voter turnout. We first address information. The following tables contain the outcomes used to produce figures in Section 6.

[5] This electorate has an unusually high proportion of people with Pacific ethnicity (44.8%), a high proportion who rent rather than own their own homes, and the lowest proportion who had cell phones or internet access of all general electorates https://www.parliament.nz/en/mps-and-electorates/historical-electorate-profiles/electorate-profiles-data/document/DBHOH_Lib_EP_Manukau_East_Electoral_Profile .

Figure A5.1. Coefficients on social capital or ethnic fragmentation – by electorate





Dotted vertical lines at zero. The coefficients are obtained from the third column model described in Table 2, applied separately for the 64 New Zealand electorates.

A6.1 Interactions with education level

First, we look for evidence whether social capital and heterogeneity are associated with turnout through information costs. Our empirical strategy is to interact a channel CH with our social capital measure in model (3a), or our heterogeneity measure in model (3b):

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC}SC_m + \alpha_{CH}CH_m + \alpha_{INT}(SC_m \times CH_m) + \alpha_{EF}EF_m + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (4a)$$

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC}SC_m + \alpha_{CH}CH_m + \alpha_{EF}EF_m + \alpha_{INT}(EF_m \times CH_m) + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (4b)$$

Since we try two proxies for each of the two channels, we ultimately carry out eight supplementary estimations (four with social capital and four with ethnic heterogeneity).

Table A6.1 presents outcomes regarding turnout rate when we introduce an interaction between either volunteering or ethnic fragmentation, and the proportion of those 15 or older with a bachelor's degree or higher. These two regressions are used to calculate the conditioned marginal effect of social capital displayed in Figure 4.

Table A6.1. Estimations of turnout including an education interaction term

	(1) Coef. (se)	(2) Coef. (se)
Proportion of ind. with univ. degrees	13.8***	8.31***
	(1.54)	(1.44)
Volunteering rate	9.12***	6.22***
	(2.16)	(1.09)
Volunteering rate X proportion of ind with univ. degrees	-16.9*	
	(8.57)	
Ethnic fragmentation	-7.31***	-8.90***
	(0.97)	(1.32)
Ethnic fragmentation X proportion ind with univ degrees		8.39**
		(3.48)
Constant	71.9***	73.0***
	(1.21)	(1.29)
Control variables	Yes	
Electorate FE	Yes	
Observations	41,200	
Adjusted R^2	0.41	0.41

Notes: See the notes for Table A3.4.

A6.2 Interactions with proportion speaking English

The second test of the information channel is based on the proportion of English in the languages spoken in the meshblock. As in the previous test in our regression of voter turnout we include an English language interaction with either volunteering or ethnic fragmentation. Table A6.2 provides the two estimates underlying Figure 5 in the text.

Table A6.2. Estimations of turnout including an English language interaction term

	(1) Coef. (se)		(2) Coef. (se)
Proportion of English in spoken languages	22.1***		9.83***
	(2.14)		(3.58)
Volunteering rate	43.4***		5.55***
	(9.40)		(0.90)
Volunteering rate X proportion of English in lang.	-44.1***		
	(10.8)		
Ethnic fragmentation	-3.80***		-16.4**
	(0.92)		(6.48)
Ethnic fragmentation X proportion of English in lang.			14.6**
			(6.73)
Constant	53.7***		64.7***
	(2.37)		(3.93)
Control variables		Yes	
Electorate FE		Yes	
Observations		41,200	
Adjusted R^2	0.42		0.42

Notes: See the notes for Table A3.4.

A6.3 Interactions with population density

Table A6.3 presents the two estimates regressing turnout rate with an interaction between the volunteering rate and the log of population density. These estimates are used to calculate the conditioned marginal effect of volunteering displayed in Figure 6 of the text.

Table A6.3. Estimations of turnout including a population density interaction term

	(1) Coef. (se)		(2) Coef. (se)
Log (Pop density)	-0.94***		-0.51***
	(0.095)		(0.091)
Volunteering rate	-4.26		5.78***
	(2.69)		(1.10)
Volunteering rate X Log (Pop density)	1.67***		
	(0.41)		
Ethnic fragmentation	-7.18***		-3.39**
	(0.97)		(1.48)
Ethnic fragmentation X Log (Pop density)			-0.58**
			(0.24)
Constant	74.4***		71.5***
	(1.15)		(1.25)
Control variables		yes	
Electorate FE		yes	
Observations		41,200	
Adjusted R^2	0.41		0.41

Notes: See the notes for Table A3.4.

A6.4 Interactions with dominant ethnic group

As second test of the social norm channel, we include an interaction between dominant ethnic group and volunteering rate or ethnic fragmentation on turnout. To set the stage, Table A6.4 first provides the coefficients of dominant (or majority) ethnic groups on turnout

directly, once we introduce them into the baseline estimation. We observe substantial differences in voter turnout rate by dominant ethnic affiliation. It is largely higher when European is the dominant or majority ethnic affiliation, or when there is no ethnic group that represents more than half of affiliations. In contrast, there are no significant differences in turnout between the three other ethnic affiliations (Asian, Pacific and Maori).

Table A6.4. Estimations of turnout rates with dominant ethnic group included

	Dominant ethnic group (highest proportion)		Majority ethnic group (proportion > 0.5)	
	Coef.	se	Coef.	se
Volunteering rate	6.08***	(0.89)	6.12***	(0.90)
Ethnic fragmentation	-7.67***	(0.84)	-7.37***	(0.73)
No ethnicity in majority	-	-	-3.07***	(0.27)
European	reference		reference	
Maori	-4.31***	(0.61)	-4.88***	(0.65)
Pacific	-5.91***	(0.60)	-7.94***	(0.66)
Asian	-5.00***	(0.51)	-6.02***	(0.62)
ME/LA/A	-4.18***	(0.62)	-1.62**	(0.67)
Constant	76.1***	(1.09)	76.4***	(1.00)
Control variables	yes		yes	
Electorate FE	yes		yes	
Observations	40,856		41,200	
Adjusted R^2	0.42		0.42	

Notes: See the notes for Table A3.4.

When we include interactions with volunteering in Table A6.5, we can then compare the total marginal effect of volunteering plus the interaction term by dominant ethnic affiliation as in Figure 7. For example, the marginal effect of volunteering on turnout for European dominant meshblocks (10.3–5.24=5.06), is less than that for Pacific or Asian dominant meshblocks. We can similarly include interactions with ethnic fragmentation in Table A6.6, and we find similar differences in the marginal effect of fragmentation by dominant ethnic group.

Table A6.5. Estimations including a dominant ethnic group interaction - volunteering

	Coef.	s.e.
Volunteering rate	10.3*	(5.16)
Dominant ethnic group:		
European	5.20***	(1.18)
Maori	reference	
Pacific	-2.29	(1.38)
Asian	-1.31	(1.35)
ME/LA/A	-2.41	(2.55)
European x Volunteering rate	-5.24	(5.25)
Maori x Volunteering rate	reference	
Pacific x Volunteering rate	8.99	(7.41)
Asian x Volunteering rate	10.8	(7.09)
ME/LA/A x Volunteering rate	37.3	(44.5)
Ethnic fragmentation	-7.73***	(0.83)
Constant	71.0***	(1.33)
Electorate FE	yes	
Observations	40,856	
Adjusted R^2	0.42	

Notes: See notes on Table A6.4.

Table A6.6. Estimations including a dominant ethnic group interaction - fragmentation

	Coef.		se
Ethnic fragmentation	0.92		(4.11)
Dominant ethnic group :			
European	9.81***		(2.00)
Maori		reference	
Pacific	-10.4***		(2.40)
Asian	-1.82		(3.14)
ME/LA/A	14.4		(11.9)
European x Ethnic fragmentation	-10.1**		(4.10)
Maori x Ethnic fragmentation		reference	
Pacific x Ethnic fragmentation	12.8***		(4.26)
Asian x Ethnic fragmentation	1.04		(5.38)
ME/LA/A x Ethnic fragmentation	-23.5		(19.0)
Volunteering rate	6.20***		(0.85)
Constant	67.7***		(2.07)
Electorate FE		yes	
Observations		40,856	
Adjusted R^2		0.42	

Notes: See notes on Table A6.4.

A.7 Interactive effects of ethnic heterogeneity and social capital on turnout

We test for interactions between ethnic heterogeneity and social capital on turnout in two ways. First, we classify meshblocks with at least some (positive) volunteering separately from those without any using a dummy variable, and meshblocks with full homogeneity (no heterogeneity) separately from those with at least some heterogeneity using a second dummy variable. We then interact the volunteering rate with the "full homogeneity" dummy, and the ethnic fragmentation variable with the "positive volunteering" dummy.

Second, we simply interact our two continuous key variables. Model (2) becomes

$$Turnout\ Rate_{m,e} = \alpha + \alpha_{SC} SC_m + \alpha_{EF} EF_m + \alpha_{INT}(SC_m \times EF_m) + \alpha_W \boldsymbol{W}_m + \alpha_e Y_e + \varepsilon_{m,e}. \quad (5)$$

The results in Table A7.1 below underlie Figure 7.

Table A7.1. Impact of social capital on turnout according to whether the meshblock has positive ethnic fragmentation, and whether it has positive volunteering

	(1) Coef. (se)		(2) Coef. (se)
Volunteering rate	6.66***		
	(1.12)		
1 if the meshblock is fully homogeneous	0.97		
	(0.75)		
Fully homogeneous x Volunteering rate	-3.51		
	(3.62)		
Ethnic fragmentation			-7.66***
			(2.23)
1 if the meshblock has positive volunteering			1.63*
			(0.84)
Positive volunteering x Fully homogeneous			0.28
			(2.08)
Constant	67.7***		72.0***
	(0.90)		(1.54)
Control variables		yes	
Electorate FE		yes	
Observations		41,200	
Adjusted R^2	0.40		0.41

Notes: See the notes for Table A3.4.

A7.2 Simple interaction between ethnic fragmentation and volunteering on turnout

Table A7.2 below underlies Figures 8 and 9 in the text. The second and third models are included to be sure the significant interaction effect found in the first model is not driven by meshblocks lacking any ethnic diversity or volunteering.

Table A7.2. Turnout estimations with social capital and ethnic heterogeneity interaction

	(1) Sample: all meshblocks		(2) Sample: excluding meshblocks with no ethnic diversity		(3) Sample: excluding meshblocks with no volunteering	
	Coef.	se	Coef.	se	Coef.	se
Volunteering rate	-0.90	(1.81)	-1.79	(2.07)	-1.84	(2.06)
Ethnic fragmentation	-10.1***	(1.24)	-10.6***	(1.35)	-10.4***	(1.32)
Volunteering rate X Ethnic fragmentation	20.1***	(3.95)	21.3***	(4.42)	21.3***	(4.47)
Constant	73.4***	(1.23)	73.3***	(1.26)	73.4***	(1.24)
Control variables	Yes		yes		yes	
Electorate FE	Yes		yes		yes	
Observations	41,200		40,072		40,536	
Adjusted R^2	0.41		0.41		0.41	

Notes: See the notes for Table A3.4.

A.8 Stage One Matching Procedures Information Underlying Stage Two PSM Results for Step One in Table 4

We used the psmatch2 command in Stata to generate Stage One and Stage Two results for all PSM analysis. Key results for Stage Two are summarized in Table 4.

Here, we provide further detail on our exact matching procedures for meshblocks. We used the following matching options:

1. Neighbor: we used 1 meshblock neighbor only to calculate the matched outcome.
2. Caliper: we allowed a maximum distance of controls of 0.01 .
3. Ties: we not only matched meshblocks to their nearest neighbor, but also other controls with identical (tied) propensity scores.
4. Common: we imposed a common support by dropping treatment observations whose propensity score was higher than the maximum or less than the minimum propensity score of the controls.

Table A8.1. Turnout estimations with social capital and ethnic heterogeneity interaction

PSM: Stage One Results When Meshblocks are Jointly or Singly Sorted

	Ethnic Frag low & Volunteering high b/se	Ethnic Frag low b/se	Volunteering high b/se
Median household income (1000 NZ$)	-4.32***	4.39***	-1.17***
	(0.31)	(0.36)	(0.35)
Home owners (%)	2.03***	2.79***	3.11***
	(0.047)	(0.059)	(0.061)
% of ind. with univ. degrees	1.63***	0.54***	1.90***
	(0.062)	(0.074)	(0.073)
Unemployment rate	2.48***	-5.72***	-3.03***
	(0.18)	(0.25)	(0.25)
% ind. aged 65 and +	0.41***	3.57***	1.67***
	(0.071)	(0.091)	(0.083)
% No religious affiliation	-0.57***	2.47***	0.63***
	(0.053)	(0.080)	(0.070)
% Male	-0.37***	0.27*	0.47***
	(0.14)	(0.17)	(0.17)
Log (Pop. density)	-0.11***	-0.16***	-0.14***
	(0.0034)	(0.0040)	(0.0037)
Constant	-0.11	-2.36***	-2.37***
	(0.087)	(0.11)	(0.11)
Observations	42673	42673	42673
Adjusted R^2			
AIC	54127.0	40354.1	39633.9

Standard errors are clustered at the electorate level. ***p < 0.01, **p < 0.05, * p < 0.1