The effect of neighbourhood diversity on volunteering:

Evidence from New Zealand

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Abstract:

We make two contributions to the emerging empirical literature that identifies a negative relationship between neighbourhood heterogeneity by factors such as race, ethnicity, income etc., and individuals' likelihood of contributing to public goods or trusting their neighbors. First, we show that studies that attempt to estimate the effect of a concave neighbourhood characteristic like heterogeneity on outcomes of interest may obtain biased results if they use small or large neighbourhood boundaries alone. Such approaches omit the effect of heterogeneity *between* small neighbourhoods, and can result in biased estimates of heterogeneity's effects even when this "between heterogeneity" has no economic effect. Second, with this problem in view, we use two levels of neighbourhood cross section and panel data from the 1996, 2001 and 2006 censuses in New Zealand to test whether heterogeneity by race/ethnicity, birthplace, income or language negatively affect New Zealander's probability of volunteering. We find that addressing neighbourhood size matters. We then find robust evidence that ethnic/racial neighbourhood heterogeneity is associated with lower volunteering rates. We also find some evidence that language, birthplace and household income heterogeneity lower volunteering rates, but the evidence is less robust, particularly for language and income.

Key words: heterogeneity, neighbourhood effects, volunteering

JEL Classification: D13, D64, H31

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I. Introduction

Do individuals in societies that become more heterogeneous lose concern for the welfare of others? Support for this provocative claim has emerged in the past decade over various dimensions of "heterogeneity" and various manifestations of "concern for others." Researchers have examined the effects of increased heterogeneity of neighbourhood by race, ethnicity, education, income or first language, on an individual's propensity to volunteer, contribute to fundraisers, be a member of any organization, trust others or support welfare programmes.[1] Others have examined the effect of local heterogeneity on government's propensity to provide core public goods or welfare programmes. While the bulk of empirical studies have been carried out using data from the United States, others have used surveys from Australia, Kenya, Sweden, and the United Kingdom (see below). By far the most common research approach has been to regress individuals' survey responses regarding a behaviour or belief about others on relevant individual and neighbourhood characteristics, with the latter separately taken from census data for the neighbourhood or region in which the respondents live.

A selective summary of the findings from this literature might suggest that there is indeed a robust negative relationship between increased heterogeneity and decreased support for public goods and trust in others. Alesina and La Ferrara (2000, 2002), using pooled cross sectional data from multiple years of the U.S. General Social Survey, find that increased neighbourhood heterogeneity of income or race lowers an individual's probability of reporting membership in any organization, or of agreeing with the view that "most people can be trusted." Costa and Kahn (2003a), using pooled cross section data from two years of the U.S. Current Population Survey (CPS), find that increased heterogeneity of income or

[1] Political scientists such as Robert Putnam (2007) have emphasized the effects of heterogeneity on "social capital", or peoples' beliefs and actions that contribute to "social networks and the associated norms of reciprocity and trustworthiness."

birthplace lowers an individual's probability of membership in any organization or of volunteering. Costa and Kahn (2003b) using the CPS and the DDB Lifestyle Survey, find that increased racial heterogeneity lowers individuals' probability of volunteering. Vigdor (2004) finds that U.S. census tracts that were more heterogeneous in race, age or educational attainment in 2000 had lower response rates of households mailing in completed census forms. Returning such forms can be seen as a local public good, because local public funding depends on enumerated census tract population. Putnam (2007), using responses from the U.S. Social Capital Community Benchmark Survey of 2000, finds that individuals in more racially heterogeneous census tracts were less likely to give to charity or volunteer, trust others (whether of their own or other races), or register to vote, and were more pessimistic that others would cooperate in dilemmas of collective action. Finally, Luttmer (2001), again using pooled cross section data from multiple years of the General Social Survey, finds that support for government welfare spending is lower in more racially heterogeneous states, and that this effect is significant in explaining some of the variation in generosity of welfare across states.

Other papers have found government responses to heterogeneity that are consistent with the above individual level effects. Poterba (1997) finds that the negative relationship between U.S. state level per child education spending and the proportion of elderly in the state population is larger when the elderly are predominantly from a different racial group than the school aged population. Alesina, Baqir and Easterly (1999) find using U.S. census and government expenditure data that increased racial heterogeneity reduces local government provision of core public goods such as roads, sewerage and education.

While the bulk of the adverse findings regarding heterogeneity have come from the United States, a limited number of papers have found similar results elsewhere, particularly related to the trust individuals report in others. Leigh (2006), using the 1997/98 Australian

Community Survey and 1996 Australian census data, finds that increased neighbourhood heterogeneity of country of birth or of language spoken at home lowers the probability of individuals trusting their neighbours. Letki (2008), using data from the British Home Office Citizenship Survey of 2001 and census, finds that increased ward level racial heterogeneity lowers individuals' trust in their neighbours. Gustavsson and Jordahl (2008), using the 1994 and 1998 Swedish Election Studies Panel and county level census data, find that increased income inequality in the lower half of the income distribution, or in the proportion of a respondent's county that is foreign born, lowered reported trust in others. Finally, Miguel and Gugerty (2005), using an NGO-funded survey of schools in rural Kenya, find that local ethnic heterogeneity is associated with sharply lower voluntary school fundraiser contributions, resulting in lower quality primary schools.

Theoretically, the negative effects of increased heterogeneity on people's trust of others or contributions to public goods has been attributed to their innate preference to interact with others like themselves, which can cause social networks and the trust they generate to atrophy as dissimilarities increase (Alesina and La Ferrara 2000, 2002, Putman 2007). People may be less likely to "internalize" the benefits they bestow on the community at large by contributing to public goods if they perceive less similarity between themselves and that community (Vigdor 2004). Linguistic heterogeneity in particular may increase the costs of communication and reduce of quality of information exchanged in networks, making investments in such networks less attractive (Leigh 2006). Ethnic or cultural heterogeneity may also reduce the ability of communities to impose negative social sanctions for free riding across ethnic lines (Miguel and Gugerty 2005). Increased heterogeneity along various dimensions may also lower government provision of public goods by increasing the median distance of people's preferred amounts of such goods from the amount preferred by the median voter (Alesina, Baqir and Easterly 1999).

While the above (selective) summary might suggest conclusive evidence that heterogeneity corrodes people's trust in others and their contributions towards public goods, a closer inspection of this literature show the results to be less robust, and more problematic than they first appear.

Regarding robustness, papers testing for the effects of different kinds of heterogeneity often find that some kinds matter, but others do not, or that multiple kinds may matter when tested individually, but not when tested jointly. And the type of heterogeneity that affects behaviour or trust seems to vary from study to study. For example, Alesina and La Ferrara (2002) find that higher neighbourhood racial heterogeneity (white, black, Asian etc) lowered trust in other people, but higher heterogeneity of ethnic origin did not, while higher income inequality lowered trust when racial heterogeneity was excluded, but had no significant effect when it was included. Similarly, Alesina and La Ferrara (2000) find that while income, racial and ethnic heterogeneity all lowered the probability of group membership when entered separately, only income heterogeneity mattered when all three measures were included (Alesina and La Ferrara 2002). And while Letki (2008) finds that higher racial heterogeneity lowers trust in the United Kingdom, it has no effect on people's likelihood of formal or informal volunteering, unlike Putnam (2007) and Costa and Kahn (2003b) for the United States. Again, while higher *birthplace* heterogeneity lowers trust in others in Sweden or Australia (Gustavsson and Jordahl 2008, Leigh 2006), higher *ethnic* heterogeneity (i.e. birthplace of ancestors) in Sweden does not.

Regarding problems, almost all of the existing empirical papers testing for causal links between neighbourhood heterogeneity and individual behaviour or beliefs must confront several limitations of data. First, researchers producing studies based on cross sectional data (Putnam 2007, Alesina et al. 1999, Letki 2008, Leigh (2006), Vigdor (2004), Miguel and Gugerty 2005) cannot be sure that effects attributed to heterogeneity are not instead caused

by omitted variables that are correlated with heterogeneity. Letki (2008) in particular argues that neighbourhood deprivation, poverty and crime may correlate with ethnic diversity yet be inadequately captured is many preceding studies, making diversity wrongly appear responsible for social withdrawal. Cross sectional studies also cannot determine whether it is the *level* of heterogeneity or *changes* in the level of heterogeneity that is affecting people's behaviour.[2]

There is another problem, however, to which existing studies have generally paid little attention: how is the (often constrained) choice of "neighbourhood" size affecting results? The coarseness of neighbourhoods used has varied widely. Gustavsson and Jordahl (2008) define a respondent's "neighbourhood" as his/her Swedish county, which contains 200,000 – 300,000 or even over one million people. Alesina and La Ferrara (2000, 2002), Costa and Kahn (2003a) and Luttmer (2001) define neighbourhood as a respondent's US Metropolitan or Primary Metropolitan Statistical Area (MSA/PMSA), which contain a urban core of at least 50,000 and surrounding suburbs and affiliated towns. Letki defines neighbhourhood as the U.K census level of ward, which contain anywhere from hundreds to over 30,000 people in the London area. Alesina et al. (1999) uses U.S. county. Leigh (2006) defines neighbourhood as a respondent's Australian postal area, typically containing 20,000 people. Since heterogeneity of income, race etc. can vary dramatically in just a short distance, the heterogeneity people experience may vary widely within these coarsely defined neighbourhoods. At the smaller end, Vigdor (2004) and Putnam (2007) define neighbourhood at the U.S. census tract level, which commonly involves several thousand people. As we shall show, when the neighbourhood characteristic of interest – here heterogeneity – is concave, its estimated effects on outcomes of interest may be very

[2] Luttmer (2001), Costa and Kahn (2003a, 2003b), and Alesina and La Ferrara (2000, 2002), construct pseudo panels of cross sectional survey data, which rely for legitimacy on the representativeness of each wave of the survey. Poterba (1997) uses panel data at the state level. Of the papers we have identified, only Gustavsson and Jordahl (2008) use true panel data at the individual level, using survey data.

sensitive to neighbourhood size, and the problem cannot be addressed by using small *or* large neighbourhoods alone.

We make two contributions in this paper. First, we demonstrate the problems that arise from trying to estimate the effect of concave neighbourhood characteristics on people's behaviour. Second, we contribute to the empirical investigation of the effects of neighbourhood heterogeneity on people's contribution of time to public goods, or volunteering. We use a heretofore untapped data source that provides several advantages over preceding studies: New Zealand census data on volunteering rates at the level of "meshblock" (= 100 people) and "area unit" (= 2000 people) for 1996, 2001 and 2006. We test whether heterogeneity of ethnicity/race, languages spoken, birthplace, or household income affects New Zealander's likelihood of volunteering. Questions regarding volunteering were asked of all New Zealanders in 1996, 2001 and 2006, enabling us to construct both pooled cross section and neighbourhood fixed effects regressions for the entire country. The New Zealand census releases an unusually comprehensive list of covariates for all three years, allowing our cross section regressions to better control for confounding neighbourhood characteristics such as deprivation, crime, housing and employment status, that may be correlated with heterogeneity. Our fixed effects regressions, while not ideal, can go part way to addressing any residual endogeneity in our cross section analysis. With two levels of neighbourhood data at our disposal, we can address the sensitivity of our results to geographic boundaries, and test explicitly for effects on volunteering that come from heterogeneity *within* small neighbourhoods, and heterogeneity *between* them.

The rest of the paper will proceed as follows. In Section 2, we present a simple model that highlights the importance of neighborhood size when estimating the effects of concave neighbourhood characteristics on outcomes of interest. In Section 3 we present descriptive

statistics regarding volunteering and various measures of heterogeneity in New Zealand, followed by our estimation methods and results. In Section 4 we provide a summary.

II. Who Are the People in Your Neighbourhood? A Model

In this section, we present a simple model that illustrates the importance of neighborhood size for empirical attempts to estimate the effect of a concave neighbourhood characteristic (.e.g heterogeneity) on an outcome of interest (e.g. volunteering). Consider a society with heterogeneity defined in terms of ethnicity, and assume for simplicity that there are only ethnicities 1 and 2. Assume next that the society is comprised of a number of "small" neighbourhoods, each of equal size. Each small neighbourhood *i* is one of *n* contained within a "large" neighbourhood *j*. Following the literature already cited, we shall assume that ethnic heterogeneity can be correctly measured using a fragmentation index, though the following argument will hold for any concave neighbourhood variable.[3] Ethnic fragmentation x_{ij} can be constructed for each small neighbourhood *i* contained within large neighbourhood *j*, and expressed as the product of the two ethnicities' shares:

$$x_{ij} = [1-\theta_{1ij}^2-\theta_{2ij}^2] = [1-\theta_{1ij}^2-(1-\theta_{1ij})^2] = 2\theta_{ij}(1-\theta_{ij}) . \qquad (1)$$

$\theta_{ij} \equiv \theta_{1ij}$ is ethnicity 1's share of the population in the ith small neighborhood of large neighborhood *j*. With just two ethnicities, the fragmentation index reaches its maximum value at $\theta_{ij} = 0.5$. In the same way, we can also construct an ethnic fragmentation index x_j for the large neighbourhood. This will be the product of the two ethnicity's shares in the large neighbourhood, but can be equivalently expressed as each ethnicity's average share over the n constituent small neighbourhoods.

$$x_j = [1-\theta_{1j}^2-\theta_{2j}^2] = [1-\theta_{1j}^2-(1-\theta_{1j})^2] = 2\theta_j(1-\theta_j) , \qquad (2)$$

[3] Another plausible measure of neighbourhood heterogeneity is entropy (see Hansmann and Quigley 1982). It too is concave. We have repeated the empirical analysis reported in this paper using entropy rather than fragmentation measures, and found similar results.

where $\theta_j \equiv \theta_{1j} = \frac{\sum_{i=1}^{n} \theta_{1ij}}{n}$ is ethnicity 1's share in neighbourhood *j*. From the (strict) concavity of x_{ij} and x_j in (1) and (2), it follows from Jensen's inequality that the fragmentation of the large neighbourhood will be (strictly) greater than the mean fragmentation of the *n* constituent small neighbourhoods, or

$$E(x_{ij}) = E(f(\theta_{ij})) < f(E(\theta_{ij})) = f(\theta_j) = x_j. \tag{3}$$

So long as fragmentation levels vary across small neighbourhoods, heterogeneity will appear greater, the larger the neighbourhood over which it is defined. Intuitively, the cause of the discrepancy is that a large neighbourhood's fragmentation comes not only from the heterogeneity *within* each of its constituent small neighbourhoods, but also from differences in heterogeneity *between* them. More formally, we can define "between" heterogeneity x_j^B as the difference between the fragmentation index of large neighbourhood *j*, and the average fragmentation index of its $i = 1,\ldots,n$ constituent small neighbourhoods, the latter equivalent to "within" heterogeneity x_j^W :

$$x_j^B = x_j - E(x_{ij}) = x_j - \frac{\sum_i x_{ij}}{N_i} = x_j - x_j^W . \tag{4}$$

This mathematical discrepancy may have an empirical consequence: a study's choice of neighborhood size may greatly affect the relationship it finds between social heterogeneity (or indeed, any concave neighbourhood characteristic) and people's behaviour.

To see the empirical consequences, consider a linear regression model that correctly decomposes the effect of small neighbourhood heterogeneity on the (small neighbourhood) volunteering rate y_{ij} as that coming from heterogeneity within each neighbourhood, β_W, and that from heterogeneity between them, β_B :

$$y_{ij} = \alpha + \beta_W x_{ij} + \beta_B x_j^B + u_{ij} . \tag{5}$$

Here u_{ij} is a pure random error. If instead of (5), an empirical study uses only small neighbourhood boundaries, and regresses y_{ij} on x_{ij} alone, the population regression coefficient β_S that results will be biased because of the omission of x_j^B. Even if the researcher only cares about the within effect of heterogeneity β_W, β_S will only capture this without bias when $\beta_B = 0$, since a standard result from omitted variable bias is that $\beta_S = \beta_W + \beta_B \frac{\text{cov}(x_{ij}, x_j^B)}{\text{var}(x_{ij})}$. More generally, the between effect of heterogeneity will be missed altogether, and the estimated within effect will be biased.

Alternatively, suppose an empirical study uses only large neighbourhood boundaries, (perhaps in order to capture the effect of between heterogeneity), and regresses y_j on x_j. What will happen? As a benchmark, a simple aggregation over the correct small neighbourhood specification in (5) yields the correct large neighbourhood specification:

$$y_j (= \frac{\sum_i y_{ij}}{N_i}) = \alpha + \beta_W x_j^W + \beta_B x_j^B + u_j \quad . \tag{6}$$

By adding and subtracting a common term, (6) can be re-expressed as:

$$\begin{aligned} y_j &= \alpha + \beta_W (x_j^W + x_j^B) + (\beta_B - \beta_W) x_j^B + u_j \\ &= \alpha + \beta_W (x_j) + (\beta_B - \beta_W) x_j^B + u_j \end{aligned} \tag{7}$$

From (7), we can see that a study using only large neighbourhoods is again missing x_j^B. This time, the resulting estimated effect of large neighbourhood heterogeneity x_j on y_j, β_L, can be expressed as

$$\beta_L = \beta_W + (\beta_B - \beta_W) \frac{\text{cov}(x_j, x_j^B)}{\text{var}(x_j)} . \tag{8}$$

The outcome here is even worse than in the case of small neighbourhoods. Now even when between heterogeneity has no economic effect on volunteering (or $\beta_B = 0$), the β_L that

emerges will not be identical to the true within effect β_W. If $\text{cov}(x_j, x_j^B) < 0$ and $\beta_B = 0$, then it follows from (8) that $|\beta_L| > |\beta_W|$, and the heterogeneity's estimated effect will be exaggerated. If $\text{cov}(x_j, x_j^B) > 0$ and $\beta_B = 0$, then $|\beta_L| < |\beta_W|$, and heterogeneity's estimated effect will be attenuated. Intuitively, in the extreme case where between heterogeneity has no economic effect on volunteering, so that small boundary regressions are correct, the concavity of the fragmentation measure introduces a sort of measurement error in large boundary regressions. In cases where $|\beta_B| > 0$, large boundary regressions will continue to provide biased estimates of within (or total) effects of heterogeneity, with one notable exception. In the special case that volunteering is identically affected by within and between heterogeneity, or $\beta_W = \beta_B$, equations (5) and (6) produce $\beta_S = \beta_L = \beta_W$ and $\beta_W = \beta_B$. It is only in this case that the estimated effect of heterogeneity on volunteering will be unaffected by measurement error, and independent of choice of neighbourhood size.

To summarize, there are potential problems associated with using either small or large neighbourhood boundaries when attempting to estimate the effect of a concave variable (such as heterogeneity) on an outcome of interest (such as volunteering). Using small boundaries will miss the effect on volunteering of heterogeneity between small neighbourhoods, and even the estimated effect of heterogeneity within small neighbourhoods will be biased if between effects exist. Using large neighbourhoods will address these between heterogeneity effects, but simultaneously introduce measurement error that may under- or overestimate heterogeneity's true effect.

To address these issues, we will proceed pragmatically by using both small and large neighbourhood regressions. But we will also try to correctly control for within- and between effects of heterogeneity by adding a hybrid specification that regresses small neighbourhood volunteering on small *and* large neighbourhood heterogeneity measures simultaneously.

With the within effect of meshblock heterogeneity controlled, the remaining effect of area unit heterogeneity on volunteering will be equivalent to the between effect, as required in (5). Thus the hybrid regression will allow us to estimate the within and between effects of heterogeneity on volunteering without the measurement error created by the concavity of our heterogeneity measure. The hybrid regression will also enable us to say something about the overall effect of heterogeneity on volunteering. The change in y_{ij} caused by heterogeneity can be decomposed as $\beta_W \Delta x_{ij}$ and $\beta_B \Delta x_j^B$. Thus the total effect on y_{ij} is a weighted average of β_W and β_B. The lower and upper bound of the total effect are thus $\min\{|\beta_B|, |\beta_W|\}$ and $\max\{|\beta_B|, |\beta_W|\}$, respectively.

III. Empirical Analysis

3.1 The Case of New Zealand

Common to other Western nations, New Zealand has experienced a marked increase in social diversity over the past 25 years. Starting as a British colony in the mid-nineteenth century, New Zealand's population was predominantly of British ancestry, with a significant indigenous Maori population (Phillips, 2008). Immigration from other European and Commonwealth countries increased from the time of the second World War, and from neighbouring Pacific Island and South East Asian nations. Changes to the Immigration Act of 1987, and the introduction of an ethnicity-blind points system in 1991 was followed by a substantial further diversification of migrants from China, India, and North African and Middle Eastern countries (Phillips, 2008). For more detail about social diversity and volunteering in New Zealand, we turn to the data.

3.2 Data

Our data comes from the New Zealand census rounds of 1996, 2001 and 2006. The New Zealand census collects data on an exhaustive list of individual and household characteristics including volunteering activities, ethnicity/race, languages spoken, birthplace and household income. These data are released by Statistics New Zealand at various levels of neighbourhood aggregation, including meshblock (≈ 100 people) and area unit (≈ 2000 people). Constant 2006-defined neighbourhood geographic boundaries are used for all three rounds to ensure consistency. Our sample is restricted to those neighborhoods without missing or censored explanatory variables.[4] Over the three years of the census, our pooled sample is 3,507 area units and 49,612 meshblocks in New Zealand.

A description of the dependent and explanatory variables used is provided in Appendix Table I, and corresponding descriptive statistics are provided in Appendix Table II. Key descriptive statistics for volunteering and 4 prominent dimensions of heterogeneity are provided at the Meshblock level in Table 1. These are weighted by population, and based on those meshblocks providing complete observations for our analysis, or our "common sample."[5] The average proportion of New Zealanders aged 15 or over who reported volunteering at least once outside the household in the previous four weeks was 18.7% in 1996, and then, using a slightly different definition, 15.5% in 2001 and 14.6% in 2006.[6] During this same period, heterogeneity by ethnicity/race, languages usually spoken,

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[4] In general, we constructed share variables for each neighbourhood in such a way as to ensure they were weakly positive and summed to one. In the case of gender, for example, we constructed "ShareFemale" by dividing the frequency of "Number Female" by ("Number Female"+"Number Male"). This assumes that non respondents had the same gender composition as respondents, and ensures that shares add to one. See Appendix II for details of each variable's construction.

[5] Corresponding descriptive statistics using all meshblocks providing observations for a given variable (or our "maximum sample"), are provided in Appendix Table III.

[6] For 1996 volunteering was defined as having "Attended Committee Meeting etc Unpaid for Group, Church or Marae." For 2001 and 2006 the definition of volunteering was changed to be defined as any "Other Helping or Voluntary Work For or Through any Organisation, Group or

{Table 1 about here.}

birthplace, and household income increased. Regarding ethnicity/race, a fragmentation index (the equivalent of one minus the Herfindahl Index of concentration) could conceivably range between 0 and .8 for five categories. The population-weighted mean fragmentation across all meshblocks rose from .347 in 1996, to .352 in 2001, to .378 in 2006. A similar index for language fragmentation, which could range from 0 to .75 over four categories, rose from 0.246 in 1996 to .254 in 2001 to .275 in 2006. The index for birthplace fragmentation, which could range from 0 to .5 over two categories (inside or outside of New Zealand), rose from .293 in 1996 to .300 in 2001 to .329 in 2006. Finally, the index for nominal household income band fragmentation, constructed from six unadjusted nominal income bands, rose from .746, to .757, to .766.[7]

Consistent with the findings of earlier studies, the fall in volunteering rates in New Zealand coincided with increasing heterogeneity by ethnicity/race, language, birthplace status, and nominal household income inequality. Nonetheless, many other changes were taking place in New Zealand over these years which could have influenced people's decision to volunteer (via their tastes or opportunity costs), or organizations' decisions to demand volunteers (via their non-wage costs and productivity (Handy and Srinivasan (2005))). We construct measures for many of these confounding factors, which are described in Appendix Table I, including real median household income, and the ethnicity, language, and birthplace

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Marae." For all three years our definition excludes those caring for a child or someone who was ill, elderly, or disabled outside the household. See the start of Appendix Table II for more detail. Because of the change in volunteering question, we have repeated all the analysis to follow using just the 2001 and 2006 data. The results concerning heterogeneity's effects are very similar to what we report here, with the exception that the upper bound of income heterogeneity's (negative) effect is slightly greater in cross section analysis, and lower in fixed effects analysis.

[7] Because the six household income bands were not adjusted for inflation between each census, we can only measure how the dispersion of unadjusted nominal incomes across bands has changed over time. We cannot characterize how the dispersion of real household income across bands has changed over time.

shares that underlie our fragmentation measures. Among these variables, the average real median household income across meshblocks rose from NZ$ 37,800 in 1996, to $39,000 in 2001, to $45,000 in 2006. The mean share of females remained steady at 51%, while the mean percentage whose highest education was a bachelor's or honour's degree rose from 8% to 10% to 12%. At the same time, the mean percentage of those aged 15 or over not in the labour force fell from 34% to 33% to 31%. The mean percentage claiming Christian religious affiliation also fell from 67% to 62% to 56%, while the mean percentage claiming no religious affiliation rose from 28% to 31% to 36%. We will try to untangle the effects of these various changes on volunteering rates in the regression analysis that follows.

Finally, with regard to the effect of "neighbourhood" size, Table 2 compares the mean and standard deviation of meshblock and area unit measures of volunteering and heterogeneity.[8] As predicted in Section II, the means of all four types of heterogeneity appear greater over area units than over meshblocks. In addition, the standard deviation of neighbourhood heterogeneity is consistently lower at the area unit level than at the meshblock level for every measure. These findings together imply that our choice of neighborhood size may greatly affect the empirical relationship we estimate between social heterogeneity and volunteering.

3.3 Estimation Strategy and Results

In this section, we lay out and implement our strategy for estimating the cross-sectional and longitudinal empirical relationship between social heterogeneity and volunteering. Because we have a wide, shallow panel of many neighbourhoods over just three census years, our pooled data contains substantial variation *between* neighbourhoods at any point in time, but less variation *within* neighbourhoods over time. In line with the vast majority of studies in our literature review, we shall begin by using pooled cross sectional OLS as our baseline

[8] The descriptive statistics in Table 1 and Table 2 use the common sample used for subsequent regression analysis.

{Table 2 about here.}

specification. To address the problem of omitted variable bias that attends cross section analysis, and to test the robustness of our results, we shall then add two steps. First, we will repeat the baseline cross sectional analysis using various additional groups of control variables. Second, we will switch to fixed effects analysis. Throughout this process, we will run both small and large neighbourhood regressions individually, and then a more correct hybrid specification as in (5).

Beginning with our baseline cross sectional analysis, we estimate regressions of the form

$$y_{ijt} = X'_{ijt}\beta + u_{ijt} \tag{9}$$

where y_{ijt} is meshblock i's volunteering rate in area unit j in year t. X_{ijt} is a vector of neighborhood characteristics, year dummies, and social heterogeneity measures, while u_{ijt} is a random error. In each case, we regress volunteering rates on one type of heterogeneity at a time, along with its underlying share variables, and the unchanging baseline covariates of share female, median age, mean household size, share married, and shares of families comprised of couples with children, and couples without .[9]

Table 3 provides the results. Column (1) shows our baseline estimate of meshblock ethnic/racial heterogeneity's effect on meshblock volunteering rates with controls for (meshblock) ethnic/racial affiliation shares and baseline covariates. The estimated coefficient on ethnic/racial fragmentation (-.127) implies a relatively strong negative effect of this type of heterogeneity on volunteering. In particular, a 10 percentage point increase in meshblock ethnic/racial fragmentation is estimated to decrease the (meshblock) volunteering rate by 1.3

[9] We have added ethnic share composition to the baseline covariates used when examining the effects of birthplace or income fragmentation on volunteering. This is because of the clear effect that Maori ethnic affiliation has on volunteering rates. Ethnic share composition remains omitted when examining the effects of language fragmentation on volunteering, because it is highly correlated with the language shares included there.

{Table 3 about here.}

percentage points. Moving to area unit anlysis in column (2), a 10 percent increase in area unit ethnic/racial fragmentation decreases the (area unit) volunteering rate by 1.4 percentage points. Recalling from our theory section that both of these estimates could be biased, however, we move to column (3). Recall that the coefficient on meshblock fragmentation measures the effect of within meshblock heterogeneity on volunteering. With this effect captured, the coefficient on the corresponding area unit fragmentation captures the remaining effect of between meshblock heterogeneity x_j^B. From these two coefficients, we see that a 10 percent increase in within meshblock heterogeneity decreases (meshblock) volunteering by 1.0 percentage points, whereas a 10 percent increase in between meshblock heterogeneity decreases volunteering by .4 percentage points. These two numbers, .4 and 1.0, provide the lower and upper bounds, respectively, of ethnic fragmentation's negative effect on the volunteering rate.

The estimated effects of language, birthplace and household income heterogeneity are similarly provided in columns (4) – (12) of Table 3. In the case of language and birthplace heterogeneity, these too are strongly negatively associated with volunteering rates under all baseline specifications. From column (6), the lower and upper bounds of language fragmentation's total effect on volunteering are .7 percentage points, and 2.3 percentage points, respectively. From column (9), the corresponding lower and upper bounds for birthplace fragmentation are .5 and .9 percentage points, respectively. Nominal household income band inequality also looks to be negatively associated with volunteering, though from column (12) the lower and upper bounds of the effect are zero and .7 percentage points. Thus, our baseline cross section results might suggest that New Zealand's shifting immigration and

tax policy has been responsible for a drop in New Zealander's tendency to contribute time towards public goods.

However, while our estimates of the effects of each type of heterogeneity on volunteering are almost uniformly negative, these results could simply reflect the omission of other influences on volunteering that are correlated with heterogeneity. Omitted factors could include variation in religious affiliation, neighbourhood deprivation, labour force status, or education. We have also yet to test whether one type of heterogeneity affects volunteering once other dimensions of heterogeneity (and their underlying share variables) are controlled for. Thus, in Table 4 we extend our cross sectional analysis to include groups of other confounding variables one at a time.[10] These groups are: 1) religious affiliation: Christian, other religion, and no religion affiliation rates, 2) neighbourhood deprivation: home ownership rates, median number of bedrooms, crime rates, and percentage of individuals receiving single parent domestic benefits, 3) employment status: shares in full time work, part time work, unemployed, and not in the labour force, 4) education levels: the share of individuals lacking minimum high school qualifications and the share with bachelor's or (additional year) honour's degrees, and 5) including all heterogeneity measures simultaneously, together with their underlying share variables. Note that care must be taken in evaluating the estimated effects of each type of heterogeneity when all are included simultaneously in 5), because they (and their underlying share variables) may be highly correlated.

[10] High degrees of correlation between various covariates precluded us from including all clusters simultaneously.

{Table 4 about here.}

While many of our baseline and additional covariates explain variation in volunteering rates,[11] we focus in Table 4 on coefficients showing the direct (remaining) effect of each type of heterogeneity on volunteering. Column (2) of Table 4 shows the direct (remaining) effect of meshblock ethnic heterogeneity on meshblock volunteering as each group of confounding variables is added to the baseline covariates of Table 3. In each case, ethnic/racial heterogeneity retains a significant, negative effect on volunteering. The same holds true in column (3), where area unit ethnic heterogeneity lowers area unit volunteering rates. The same also holds true in column (4), where the effects of within- and between heterogeneity on volunteering are captured. In general, the lower and upper bounds of ethnic heterogeneity's total effect on meshblock volunteering are roughly .4 and 1.0 percentage points, respectively, for every 10 percentage point rise in within or between meshblock heterogeneity.

Language heterogeneity retains almost as robust a negative effect on volunteering as does ethnic heterogeneity. From columns (4) to (6), the coefficients on language fragmentation remain negative and statistically significant as groups of covariates are added. The one exception is in the hybrid specification where all types of heterogeneity are entered simultaneously; here the estimated effect of *between* meshblock language heterogeneity is positive, while the within effect remains negative. In general, the lower and upper bounds of language heterogeneity's total (negative) effect on meshblock volunteering from column (6) are around 0 and 2 percentage points, respectively, for every 10 percentage point rise in

[11] Those covariates consistently positively related to volunteering rates were share with Maori ethnic affiliation, Maori and Samoan language shares, median age, share married, share of families that had couple with kids, and less so families that had a couple without kids, share with Christian or other religious affiliation, share who owned own home, median number of bedrooms, share with bachelors or honours degrees, and share employed part time. Those covariates consistently negatively related to volunteering rates were share with Asian or MELAA ethnic affiliation, English or "other" language share, household size, share with no religious affiliation, share of families that were single parent, and share employed full time.

within or between meshblock heterogeneity. If the specification with all heterogeneity types is excluded, the lower and upper bounds are roughly .6 and 2 percentage points.

Birthplace heterogeneity is similar to language heterogeneity in retaining a robust negative effect on volunteering rates as covariates are added, except when all types of heterogeneity are entered simultaneously. In general, the lower and upper bounds of birthplace heterogeneity's total (negative) effect on meshblock volunteering from column (9) are around 0 and .9 percentage points, respectively, for every 10 percentage point rise in within- or between meshblock heterogeneity. If the specification with all heterogeneity types is excluded, the lower and upper bounds are roughly .4 and .9 percentage points.

Finally, the effect of nominal household income band heterogeneity on volunteering is slightly less robust to the addition of covariates or other types of heterogeneity. While most coefficients are negative and significant in columns (10) to (12), it cannot be ruled out that nominal income heterogeneity has no negative effect on volunteering when all other types of heterogeneity are controlled for. Excluding that specification, the lower and upper bounds are roughly 0 and .7 percentage points.

The combined baseline and extended cross sectional evidence so far points strongly to a negative effect of ethnic/racial heterogeneity on volunteering, and possibly to a negative effect of linguistic, birthplace and income heterogeneity as well. Nevertheless, as with any cross section analysis, it is possible that there remain unobserved characteristics that are correlated with heterogeneity that are skewing its estimated effects. For example, if people who are less sympathetic to volunteering are attracted to live in urban centres, which tend to be more heterogeneous, then the effects of heterogeneity on volunteering will be exaggerated. As our second robustness check, we move to fixed effects analysis in an attempt to better control for unobserved characteristics that do not vary over time.

One problem with using fixed effects analysis here is that we are following *neighbourhoods* rather than *individuals* over time, and the latter are free to change where they live. Is there any reason to expect that unobserved characteristics like "attitude to volunteering" would remain constant over time for given neighbourhoods, even as the individuals in them come and go? One defence of this proposition could come from a Tiebout type argument that people will self-select to live in an area with others who share their preferences regarding the optimal trade-off between private consumption and public goods provision (Tiebout 1956). Individuals who come to differ with the local prevailing preferences would leave, and those who share those preferences would enter. But it remains the case that fixed effects analysis cannot eliminate endogeneity problems with neighbourhood data as well as it could with individual level data.

In any case, if the effects of heterogeneity vanish in fixed effects analysis, we may conclude either a) that the cross section effects of heterogeneity are spuriously caused by omitted variable bias, or b) that the lesser variation that exists within neighbourhoods over time than between them at one time is making it difficult for fixed effects to discern effects from heterogeneity that are there.

To proceed, we estimate the following volunteering equation using panel data on the meshblocks of New Zealand:

$$y_{ijt} = X'_{ijt}\beta + \alpha_{ij} + \varepsilon_{ijt}. \tag{10}$$

y_{ijt} is the volunteering rate in meshblock *i* within area unit *j* in year *t*, while X_{ijt} contains our set of heterogeneity measures and other control variables previously defined. The α_{ij} are unobservable meshblock-specific fixed effects (such as average neighbourhood attitude towards volunteering) which may be correlated with X_{ijt}, while ε_{ijt} is a pure random error term. To control for the potential correlation between α_{ij} and X_{ijt}, we will exploit the "within

neighbourhood" variation of our panel data over time. In particular, we control for each neighborhood's fixed effect by applying OLS to the mean-differenced equation

$$y_{ijt} - \overline{y_{ij}} = (X_{ijt} - \overline{X_{ij}})'\beta + \varepsilon_{ijt} - \overline{\varepsilon_{ij}}. \tag{11}$$

Here, for any variable Z, $\overline{Z_{ij}} = \sum_t Z_{ijt} / 3$.

Table 5 presents the estimated effect of each type of heterogeneity on volunteering using this form of fixed effects analysis. The control variables included are identical to the baseline covariates used in Table 3, and the effects are again presented using meshblock, area unit, and hybrid specifications. In general, evidence of an effect of heterogeneity on volunteering has decreased. As shown in columns (1) to (3), ethnic fragmentation retains its negative effect on volunteering rates, but the magnitude of the effect has fallen sharply. This suggests that neighbourhoods that experience an increase in ethnic heterogeneity also experience a decrease in volunteering rates on average, but it is very slight. From column (3), the lower and upper bound of the total effect are 0 and .3 percentage points, respectively, for a 10 percentage point increase in either between or within ethnic fragmentation. Language fragmentation has lost any significant negative effect on volunteering rates (column (6)), even though a negative effect might be suggested by analysis that used area units alone (column (5)). Birthplace fragmentation retains a negative effect, though the lower and upper bounds of the total effect are far apart at 0 and 3.4 percentage points, respectively (column (9)). Household nominal income fragmentation also retains a suggestively negative effect, with lower and upper bounds of a total effect of 0 and 1.2 percentage points, respectively (column (12)).

{Table 5 about here.}

IV. Summary

This paper has attempted to make two contributions to the growing empirical literature identifying a negative relationship between social diversity at the neighbourhood level and people's contributions of money or time towards public goods or trust in others. First, we noted that many of the existing studies finding a negative relationship are constrained to use cross sectional analysis (Vigdor 2004, Putnam 2007, Leigh 2006, Letki 2008, Alesina et al. 1999). It is widely recognized that cross sectional analysis cannot easily address the problem of omitted variable bias, where people's unobserved characteristics such as attitude to volunteering may be negatively correlated with heterogeneity. What has not been widely recognized is that *any* empirical attempt to estimate the effect of a concave neighbourhood characteristic (such as fragmentation or entropy) on people's behaviour may produce biased results if the researcher uses only one classification of neighbourhood. Using either smaller or larger neighbourhood boundaries alone omits the effect of heterogeneity between the small neighbourhood units. This can create biased estimates (up or down) of the effect of heterogeneity within small (or large) neighbourhood units even when the omitted "between heterogeneity" has zero economic effect on the behaviour of interest. We show that this problem can be addressed by regressing small neighbourhood outcomes of interest on the concave neighbourhood characteristic at both the small and corresponding large neighbourhoods levels simultaneously. Here, this results in an estimate of the effect on volunteering of heterogeneity within small neighbourhoods, and of heterogeneity between them. The two estimates provide an upper and lower bound for the total effect of heterogeneity on our outcome of interest.

The second contribution of the paper was to apply this idea as we test for a negative relationship between volunteering and heterogeneity (by ethnicity/race, language, birthplace, and household income), using three rounds of census data from New Zealand. The New Zealand census is unusual in asking all New Zealanders whether they have volunteered in the four weeks prior to the census, and thus provides an unusual opportunity to examine the effects of neighbourhood heterogeneity on volunteering rates both cross sectionally, and over time. This data is available at both the meshblock (≈ 100 people) and area unit (≈ 2000 people) levels.

Our baseline cross sectional analysis suggests that diversity indeed discourages volunteering. A ten percentage point increase in within- or between ethnic meshblock fragmentation has a lower and upper bound negative total effect on volunteering rates of .4 and 1.0 percentage points, respectively. The corresponding bounds for language, birthplace and household nominal income fragmentation are (.7, 2.3), (.5, .9) and (0, .7) percentage points, respectively. In some cases, these results differ dramatically from those obtained using only meshblock or only area unit neighbourhoods.

Recognizing that our baseline cross section regressions may be suffering from omitted variable bias, we first repeat the analysis adding additional groups of control variables relating to religious affiliation, deprivation, employment and education, as well as including the four types of heterogeneity simultaneously. Including all heterogeneity dimensions simultaneously checks whether the apparent effect of one heterogeneity is really reflecting the effect of another, but collinearity between heterogeneity measures can also mask marginal effects that are actually present. Extending our cross section covariates does not affect our negative findings for ethnic fragmentation, but weakens slightly the effect of language and birthplace heterogeneity, for example by reducing slightly the lower bound of their (negative) effects, even to zero in the case where all types of heterogeneity are included at once. For

household income fragmentation, which already had a lower bound of zero effect in the baseline specification, extending the covariates did not reduce its upper bound. The exception was when all types of heterogeneity were entered simultaneously, in which case the lower *and* upper bound of income fragmentation's effect on volunteering fell to zero.

Since even expanded cross sectional analysis still omits unobserved variables that may be correlated to heterogeneity, such as attitude to volunteering, we second repeat our baseline cross sectional analysis using fixed effects analysis that follows meshblocks or area units over time. Similar to extended cross section analysis, fixed effects commonly reduces the lower bound of the estimated effects of heterogeneity on volunteering, while not necessarily reducing the upper bound. The lower and upper bounds of heterogeneity's total (negative) effect on volunteering are, respectively, (0, .3) percentage points for ethnicity, (0, 0) percentage points for language, (0, 3.4) percentage points for birthplace, and (0, 1.2) percentage points for income, for a ten percentage point increase in within- or between neighbourhood fragmentation.

Comparing across our three estimation strategies, the effect of ethnic fragmentation is equally strong in baseline or extended cross section analysis, but weaker in fixed effects. The effect of language fragmentation is strongest in the baseline regression, weaker in extended cross section analysis, and non existent in fixed effects. The lower bound of the effect of birthplace fragmentation is strongest in the baseline or extended cross section regressions excluding other types of heterogeneity. It falls to zero with all types of heterogeneity entered simultaneously, or in fixed effects. The upper bound of the effect of birthplace fragmentation is actually strongest in fixed effects, and similar across cross section strategies. Finally, the negative effect of income fragmentation on volunteering has a lower bound of zero across all approaches, but an upper bound that is strongest in fixed effects, intermediate in the baseline

or most extended cross section regressions, but zero when all types of heterogeneity were entered simultaneously.

To the extent that fixed effects analysis does not find effects from heterogeneity when cross section analysis does, such as for language, it is unclear whether this is due to fixed effects' better ability to control for unobserved variables, or to a smaller degree of variation over time from which it can identify such effects.

Taken together, the evidence from New Zealand is that ethnic heterogeneity has a negative effect on the proportion who volunteer, as this is found to a greater or lesser extent across all estimation strategies. Birthplace heterogeneity may also have a negative effect, though the lower bound of its effect is zero when all heterogeneity is considered at once, or in fixed effects analysis. Language and nominal household income heterogeneity may also have a negative effect, but they are found to have no effect either when all heterogeneity is considered at once (income), or in fixed effects analysis (language). We are left with fairly conclusive evidence that racial/ethnic heterogeneity depresses volunteering rates in New Zealand, suggestive evidence that birthplace heterogeneity may do the same, and inconclusive evidence regarding heterogeneity by language or income.

Table 1. Population Weighted Means and Standard Deviations of Key Variables Over Time at the Meshblock Level, Using a Common Sample

Census Year	*Variable*				
	Volunteering Rate Mean (St. Dev	Ethnic/Racial Fragmentation Mean (St. Dev)	Language Fragmentation Mean (St. Dev)	Birthplace Fragmentation Mean (St. Dev)	Household Income Fragmentation Mean (St. Dev)
1996 N=11662	.183 (.064)	.347 (.185)	.246 (.136)	.293 (.126)	.747 (.072)
2001 N=18578	.156 (.064)	.352 (.191)	.255 (.141)	.300 (.132)	.757 (.067)
2006 N=19372	.147 (.060)	.378 (.192)	.275 (.143)	.330 (.129)	.767 (.065)

Table 2. Population Weighted Means and Standard Deviations of Heterogeneity Variables at the Meshblock and Area Unit Levels, Using a Common Pooled Sample.

Neighbor-hood Size	*Variable*			
	Ethnic/Racial Fragmentation Mean (St. Dev)	Language Fragmentation Mean (St. Dev)	Birthplace Fragmentation Mean (St. Dev)	Household Income Fragmentation Mean (St. Dev)
Small (Meshblock) N=49612	.361 (.190)	.261 (.141)	.310 (.130)	.758 (.068)
Large (Area Unit) N=3507	.402 (.176)	.283 (.127)	.318 (.120)	.797 (.035)

Table 3. Determinants of Volunteering Rates: Baseline Cross Section Regression (Pooled OLS, Area Unit N =3507, Meshblock N = 49,612)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Ethnic Fragment Meshblock	Ethnic Fragment Area Unit	Ethnic Fragment Hybrid	Language Fragment Meshblock	Language Fragment Area Unit	Language Fragment Hybrid
Intercept	.204	.013	.205	.313	.291	.345
	(.018)***	(.019)	(.018)***	(.022)***	(.013)***	(.022)***
Fragmentation: Meshblock	-.127		-.102	-.267		-.234
	(.004)***		(.004)***	(.015)***		(.015)***
Fragmentation: Area Unit		-.136	-.041		-.380	-.074
		(.002)***	(.003)***		(.009)***	(.004)***
Asian Ethnic Share	-.062	.077	-.051			
	(.017)***	(.018)***	(.016)***			
Pacific Ethnic Share	-.048	.075	-.040			
	(.016)***	(.017)***	(.016)**			
Maori Ethnic Share	.170	.337	.175			
	(.016)***	(.017)***	(.016)***			
European Ethnic Share	-.074	.019	-.072			
	(.017)***	(.018)	(.017)***			
English Language Share				-.203	-.351	-.229
				(.020)***	(.011)***	(.020)***
Maori Language Share				.600	.816	.575
				(.009)***	(.006)***	(.009)***
Samoan Language Share				.079	.237	.081
				(.008)***	(.005)***	(.008)***
Female Share	-.002	-.061	.001	.005	.056	.009
	(.007)	(.010)***	(.007)	(.007)	(.010)***	(.007)
Median Age	.000	.001	.000	.000	.001	.000
	(.000)***	(.000)***	(.000)***	(.000)***	(.000)***	(.000)***
Household Size	-.007	-.009	-.007	-.004	-.007	-.003
	(.001)***	(.000)***	(.001)***	(.001)***	(.000)***	(.001)***
Marriage Share	.110	.036	.106	.116	.037	.107
	(.003)***	(.003)***	(.003)***	(.003)***	(.003)***	(.003)***
Share of Families that are "Couple with Kids"	.037	.169	.038	.041	.222	.042
	(.004)***	(.005)***	(.004)***	(.004)***	(.005)***	(.004)***
Share of Families "Couple with No Kids"	.014	.122	.015	.024	.170	.023
	(.003)***	(.004)***	(.003)***	(.003)***	(.003)***	(.003)***
Year 2001	-.025	-.000	-.026	-.025	.000	-.026
	(.001)***	(.000)	(.001)***	(.001)***	(.000)	(.001)***
Year 2006	-.029	-.000	-.031	-.028	-.000	-.031
	(.001)***	(.000)	(.001)***	(.001)***	(.000)	(.001)***
R^2	.263	.590	.266	.258	.611	.263

Note: ***,**,* represent the levels of statistical significance of 1%, 5%, and 10% respectively. Run on Stata 9.2. Robust standard errors in parentheses.

Table 3 Cont'd. Determinants of Volunteering Rates: Baseline Cross Section Regression (Pooled OLS, Area Unit N =3507, Meshblock N = 49,612)

	(7)	(8)	(9)	(10)	(11)	(12)
Variable	Birthplace Fragment Meshblock	Birthplace Fragment Area Unit	Birthplace Fragment Hybrid	H Income Fragment Meshblock	H Income Fragment Area Unit	H Income Fragment Hybrid
Intercept	.064	-.372	.078	-.033	-.374	.013
	(.017)***	(.018)***	(.017)***	(.017)**	(.018)***	(.018)
Fragmentation: Meshblock	-.103		-.045	-.019		-.003
	(.005)***		(.006)***	(.004)***		(.005)
Fragmentation: Area Unit		-.034	-.094		-.108	-.073
		(.004)***	(.005)***		(.004)***	(.010)***
Born in NZ Share	-.021	.071	-.022			
	(.007)***	(.004)***	(.007)***			
Real Median HH Income				-.000	-.000	-.000
				(.000)***	(.000)***	(.000)***
Asian Ethnic Share	-.016	.234	-.006	.021	.234	.019
	(.016)	(.018)***	(.016)	(.017)	(.018)***	(.016)
Pacific Ethnic Share	.038	.267	.040	.075	.309	.075
	(.016)**	(.017)***	(.016)**	(.016)***	(.017)***	(.016)***
Maori Ethnic Share	.187	.436	.173	.278	.528	.274
	(.017)***	(.018)***	(.016)***	(.016)***	(.017)***	(.016)***
European Ethnic Share	.054	.227	.049	.131	.307	.128
	(.016)***	(.018)***	(.016)***	(.016)***	(.017)***	(.016)***
Female Share	.007	-.003	.010	-.005	.032	-.006
	(.007)	(.011)	(.007)	(.007)	(.011)***	(.007)
Median Age	.001	.002	.001	.000	.001	.001
	(.000)***	(.000)***	(.000)***	(.000)***	(.000)***	(.000)***
Household Size	-.003	-.005	-.002	-.001	-.003	-.001
	(.001)***	(.000)***	(.001)***	(.001)*	(.000)***	(.001)
Marriage Share	.113	.033	.106	.125	.019	.126
	(.003)***	(.004)***	(.003)***	(.003)***	(.004)***	(.003)***
Share of Families that are "Couple with Kids"	.045	.235	.048	.051	.381	.052
	(.004)***	(.006)***	(.004)***	(.004)***	(.007)***	(.004)***
Share of Families "Couple with No Kids"	.026	.185	.026	.029	.264	.030
	(.004)***	(.004)***	(.003)***	(.004)***	(.004)***	(.004)***
Year 2001	-.025	.001	-.025	-.023	.001	-.022
	(.001)***	(.000)**	(.001)***	(.001)***	(.000)***	(.001)***
Year 2006	-.029	.001	-.028	-.025	.002	-.024
	(.001)***	(.000)***	(.001)***	(.001)***	(.000)***	(.001)***
R^2	.248	.557	.254	.239	.581	.240

Note: ***,**,* represent the levels of statistical significance of 1%, 5%, and 10% respectively. Run on Stata 9.2. Robust standard errors in parentheses.

Table 4. Adding Covariates as a Robustness Check on the Effect of Heterogeneity on Volunteering Rates (Pooled OLS, Area Unit N = 3507, Meshblock N = 49,612)

Specification	(1)	(2)	(3)	(4)	(5)	(6)
	Ethnic Fragment Meshblock	Ethnic Fragment Area Unit	Ethnic Fragment Hybrid	Language Fragment Meshblock	Language Fragment Area Unit	Language Fragment Hybrid
Basic (Same as Table 2) Meshblock	-.127 (.004)***		-.102 (.004)***	-.267 (.015)***		-.234 (.015)***
Basic (Same as Table 2) Area Unit		-.136 (.002)***	-.041 (.003)***		-.380 (.009)***	-.074 (.004)***
Basic + Religious Affiliation (ChrSh, OthSh) Meshblock	-.108 (.004)***		-.081 (.004)***	-.231 (.015)***		-.189 (.016)***
Basic + Religious Affiliation (ChrSh, OthSh) Area Unit		-.110 (.002)***	-.044 (.003)***		-.319 (.008)***	-.078 (.004)***
Basic + Deprivation (OwnHmSh, MedBedrm, Crime)[a] Meshblock	-.125 (.004)***		-.100 (.005)***	-.247 (.017)***		-.221 (.017)***
Basic + Deprivation (OwnHmSh, MedBedrm, Crime)[a] Area Unit		-.138 (.002)***	-.042 (.003)***		-.378 (.010)***	-.069 (.005)***
Basic + Employment (UnempSh, EmpFTSh, NotLFSh) Meshblock	-.118 (.004)***		-.098 (.004)***	-.260 (.015)***		-.234 (.016)***
Basic + Employment (UnempSh, EmpFTSh, NotLFSh) Area Unit		-.088 (.003)***	-.034 (.003)***		-.244 (.010)***	-.060 (.004)***
Basic + Education Levels (NoQualSh, BHSh) Meshblock	-.123 (.004)***		-.096 (.004)***	-.344 (.015)***		-.309 (.015)***
Basic + Education Levels (NoQualSh, BHSh) Area Unit		-.132 (.002)***	-.045 (.003)***		-.436 (.009)***	-.087 (.004)***
Basic + All Fragment + Underlying Shares Meshblock	-.087 (.005)***		-.047 (.006)***	-.195 (.026)***		-.173 (.026)***
Basic + All Fragment + Underlying Shares Area Unit		-.079 (.004)***	-.078 (.005)***		-.186 (.022)***	.120 (.010)***

Note: ***,**,* represent the levels of statistical significance of 1%, 5%, and 10% respectively.

Robust standard errors in parentheses.

[a] Obs.=37,950 Meshblocks and 2384 Area Units, as the Crime variable is available only for 2001 and 2006.

Table 4 (Cont'd). Adding Covariates as a Robustness Check on the Effect of Heterogeneity on Volunteering Rates (Pooled OLS, Area Unit N = 3507, Meshblock N = 49,612)

Specification	(7)	(8)	(9)	(10)	(11)	(12)
	Birthplace Fragment Meshblock	Birthplace Fragment Area Unit	Birthplace Fragment Hybrid	H Income Fragment Meshblock	H Income Fragment Area Unit	H Income Fragment Hybrid
Basic (Same as Table 2) Meshblock	-.103 (.005)***		-.045 (.006)***	-.019 (.004)***		-.003 (.005)
Basic (Same as Table 2) Area Unit		-.034 (.004)***	-.094 (.005)***		-.108 (.004)***	-.073 (.010)***
Basic + Religious Affiliation (ChrSh, OthSh) Meshblock	-.087 (.005)***		-.041 (.006)***	-.009 (.004)**		.003 (.005)
Basic + Religious Affiliation (ChrSh, OthSh) Area Unit		-.027 (.004)***	-.075 (.005)***		-.063 (.004)***	-.056 (.010)***
Basic + Deprivation (OwnHmSh, MedBedrm, Crime)[a] Meshblock	-.093 (.004)***		-.040 (.007)***	-.042 (.005)***		-.024 (.006)***
Basic + Deprivation (OwnHmSh, MedBedrm, Crime)[a] Area Unit		-.038 (.004)***	-.086 (.006)***		-.137 (.005)***	-.086 (.012)***
Basic + Employment (UnempSh, EmpFTSh, NotLFSh) Meshblock	-.093 (.006)***		-.041 (.006)***	-.012 (.005)**		.001 (.005)
Basic + Employment (UnempSh, EmpFTSh, NotLFSh) Area Unit		-.007 (.004)**	-.085 (.005)***		-.069 (.004)***	-.064 (.010)***
Basic + Education Levels (NoQualSh, BHSh) Meshblock	-.159 (.006)***		-.064 (.006)***	-.028 (.004)***		-.009 (.005)*
Basic + Education Levels (NoQualSh, BHSh) Area Unit		-.081 (.004)***	-.172 (.005)***		-.114 (.004)***	-.091 (.010)***
Basic + All Fragment + Underlying Shares Meshblock	.030 (.008)***		.054 (.008)***	.009 (.004)**		.016 (.005)***
Basic + All Fragment + Underlying Shares Area Unit		.087 (.005)***	-.111 (.007)***		-.049 (.004)***	-.010 (.010)

Note: ***,**,* represent the levels of statistical significance of 1%, 5%, and 10% respectively.

Robust standard errors in parentheses.

[a] Obs.=37,950 Meshblocks and 2384 Area Units, as the Crime variable is available only for 2001 and 2006.

Table 5. Fixed Effects Baseline Estimation, Effects of Fragmentation on Volunteering Rate (Area Unit N = 3507, Meshblock N = 49,612)

Specification (Basic)	(1)	(2)	(3)	(4)	(5)	(6)
	Ethnic Fragment Meshblock	Ethnic Fragment Area Unit	Ethnic Fragment Hybrid	Language Fragment Meshblock	Language Fragment Area Unit	Language Fragment Hybrid
Fragmentation Meshblock	-.034		-.034	.052		.052
	(.007)***		(.010)***	(.021)**		(.031)*
Fragmentation Area Unit		-.112	-.013		-.211	-.016
		(.004)***	(.019)		(.013)***	(.025)

Specification (Basic)	(7)	(8)	(9)	(10)	(11)	(12)
	Birthplace Fragment Meshblock	Birthplace Fragment Area Unit	Birthplace Fragment Hybrid	HH Income Fragment Meshblock	HH Income Fragment Area Unit	HH Income Fragment Hybrid
Fragmentation Meshblock	-.049		.001	-.030		.003
	(.010)***		(.015)	(.005)***		(.009)
Fragmentation Area Unit		.000	-.341		-.001	-.121
		(.001)	(.017)***		(.001)	(.016)***

Note: ***,**,* represent the levels of statistical significance of 1%, 5%, and 10% respectively.

Robust standard errors in parentheses.

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Appendix I: Description of Variables

Variable	Description
Volunteering	
Volunteering *VolNarr06* *VolNarr01* *VolNarrAAlt96*	2006, 2001 Proportion of meshblock reporting "Other Helping or Voluntary Work For or Through any Organisation, Group or Marae" in the previous four weeks. Excludes following unpaid activities outside the household: caring for a child or someone who is ill, elderly, or disabled. Construction: "Other Helping…."/(Total – Not Stated) Assumes: "Not Stated" identical in likelihood of volunteering as those who state. 1996 Proportion of meshblock reporting "Attended Committee Meeting etc Unpaid for Group, Church or Marae" in the previous four weeks. Construction: "Attended…"/(Total – Not Specified) Assumes: "Not Specified" identical in likelihood of volunteering as those who state. Excludes the non mutually exclusive categories of "Did Unpaid Training, Coaching, Teaching etc." and "Did Fundraising, Selling etc Unpaid for Group, Church or Marae" and "Did Other Unpaid Work". This was because the latter categories had massive censoring, and had such overlap with the included category that retaining them would have resulted in implausibly high volunteering rates in comparison to 2001 and 2006.
Heterogeneity Measures	
Ethnic/Racial Fragmentation *EthFrag06* *EthFrag01* *EthFrag96*	2006,2001,1996. A fragmentation index for each meshblock, where the five possible ethnic shares s_i are "European", "Maori", "Pacific Peoples", "Asian", and "Middle Eastern/Latin American/African". Individuals could select more than one ethnicity, so the ethnic share is calculated from a baseline of total ethnic affiliations rather than total people. Construction: $1-\sum_{i=1}^{5} s_i^2$ See construction of ethnic shares

Appendix I (Cont'd): Description of Variables

Variable	Description
Heterogeneity Measures (Cont'd)	
Language Fragmentation *LanFrag06* *LanFrag01* *LanFrag96*	2006, 2001, 1996. A fragmentation index for each meshblock, where the four possible language shares s_i are "English", "Maori", "Samoan" and "Other". Individuals could select more than one language spoken, so the language share is calculated from a baseline of total language responses rather than total people. Construction: $1-\sum_{i=1}^{4} s_i^2$ See construction of language shares.
Birthplace Fragmentation *BornFrag06* *BornFrag01* *BornFrag96*	2006, 2001, 1996. A fragmentation index for each meshblock's usually resident population, where the two possible shares s_i of each meshblock are "Born in New Zealand" and "Born Overseas". Construction: $1-\sum_{i=1}^{2} s_i^2$ See construction of birthplace shares.
Household Income Fragmentation *HHIncFrag06* *HHIncFrag01* *HHIncFrag96*	2006, 2001, 1996. A fragmentation index constructed over the shares s_i of a neighbourhood's households with income from all sources in one of six nominal income bands. The bands are not adjusted for inflation, and are \$0-\$20,000; \$20,001 - \$30,000; \$30,001 - \$50,000; \$50,001 - \$70,000; \$70,000 - \$100,000; \$100,001 and greater. Construction: $1-\sum_{i=1}^{6} s_i^2$ Shares constructed from the frequency of households reporting total income within a band, divided by all households for whom total income was available.

Appendix I (Cont'd): Description of Variables

Variable	Description
Control Variables	
Ethnic Shares *EthEurSh06,01,96* *EthMaoSh06,01,96* *EthPacSh06,01,96* *EthAsnSh06,01,96* *EthMELAA06,01,96*	2006,2001,1996. The proportion of meshblock usual residents reporting one of five ethnic identifications: European, Maori, Pacific, Asian, and Middle Eastern/Latin American/African. Individuals could select more than one ethnicity, so each ethnic share is calculated from a base of the total ethnic affiliations across these five categories rather than total people. Construction: frequencies were summed across the five categories to create a base of total ethnic affiliations from which shares were calculated. For 1996 and 2001, the very small fraction of individuals with "other" ethnicities, such as North American Inuit or Indian, Mauritian, etc. are excluded from the baseline. Statistics NZ assigned the small fraction answering "New Zealander" in 1996 and 2001 as European. For 2006, a much larger proportion of respondents replied "New Zealander", and though 90% of these are thought to be European, they were classified by Statistics NZ under "other." Because "New Zealander" responses made up over 99% of "other" in 2006, we assigned the "other" category as European for that year.
Language Shares *EngLanSh06,01,96* *MaoLanSh06,01,96* *SamLanSh06,01,96* *OthLanSh06,01,96*	2006, 2001, 1996. The proportion of meshblock usual residents indicating they spoke one of four language classifications: English, Maori, Samoan and Other. Individuals could select more than one language (or none), so the language share is calculated from a baseline of total languages spoken rather than total people. Construction: frequencies were summed across the four language categories, omitting "None" or "Not Elsewhere Included", to create a base of total meshblock languages spoken from which shares were calculated.
Birthplace Shares *NZBornSh06* *NZBornSh01* *NZBornSh96*	2006, 2001, 1996. The proportion of meshblock usual residents born in New Zealand vs. born overseas. Construction: frequences were summied across the two birthplace categories, excluding those "Not Elsewhere Specified". Assumed: that those who did not answer this question were as likely to be born overseas as those who did answer.

Appendix I (Cont'd): Description of Variables

Variable	Description
Control Variables (Cont'd)	
Real Median Household Income *RHHIncMed06* *RHHIncMed01* *RHHIncMed96*	2006, 2001, 1996. The median household income from all sources for usual residents of meshblock aged 15 or older. Provided by Statistics New Zealand. Deflated by GDP deflator (1995 = 1000) of 1996 (1016.00), 2001 (1103.50) and 2006 (1224.50).
Female *FemaleSh06* *FemaleSh01* *FemaleSh96*	2006, 2001, 1996. The proportion of a meshblock's usually resident population that is female. Construction: frequencies were summed across the two categories of "Male" and "Female" to create a base from which shares were calculated. Assumes: sex frequencies are more reliable than the "totals" with rounding provided by Stats NZ.
Number of Residents *UsRes06,01,96*	2006, 2001, 1996. Size of meshblock in terms of usually resident population. Only needed if we try weighted least squares to weight meshblock observations by population size.
Population Density *PopDens06*	2006 only. Census meshblock usually resident population divided by meshblock square kilometers.
Median Age *AgeMed06,01,96*	2006, 2001, 1996. Median age of meshblock usually resident population.
Marital Status *MarrSh06* *MarrSh01* *MarrSh96*	2006, 2001, 1996. The share of each meshblock's usually resident population 15 and over who were currently married, as opposed to 1) never married or 2) separated/ divorced/widowed or 3) who did not answer the question. Construction: the four categories were summed to calculate the base. This assumes that all non-responders are not married

Appendix I (Cont'd): Description of Variables

Variable	Description
Control Variables (Cont'd)	
Crime *Crime06* *Crime01*	2006, 2001. The number of recorded offences per capita for each of the 43 Police Areas in New Zealand. Construction: Statistics New Zealand map all meshblocks into one of 43 Police Areas for which per capita offences data is released.
Family Type *CoupNKSh06,01,96* *CoupKSh06,01,96* *SinParSh06,01,96*	2006, 2001, 1996. The share of meshblock families in private dwellings of three possible types: couples without children, couples with children, and single parent families. Construction: frequencies were summed across the three possible categories to provide a baseline.
Religious Affiliation *ChrSh06,01,96* *NoRel06,01,96* *OthRSh06,01,96*	2006, 2001, 1996. The share of each meshblock's usually resident population identifying with one of three categories: Christian, No Religion and Other Religion. For 2001 and 2006 individuals could identify with more than one religion, so that the base is calculated from total religious affiliations, rather than total people. Construction: Other Religion summed frequencies across Buddhist, Hindu, Islam/Muslim, Judaism, Maori Christian, Spiritualist/New Age and Other Religions. "Not Elsewhere Included" are excluded from the base, which assumes that non-responders are similar to responders.
Education High *BHSh06* *BHSh01* *BHSh96*	2006, 2001, 1996. The share of each meshblock's usually resident population 15 or over whose highest degree is a bachelor's or honours degree. Construction: summed frequencies of "Bachelor's Degree or Level 7 Qualification" and "Postgraduate and Honours Degrees" (which excludes masters and PhD degrees), and divided by total people. This assumes that all "Not Elsewhere Included" individuals do not have a bachelor's or honour's degree.

Appendix I (Cont'd): Description of Variables

Variable	Description
Control Variables (Cont'd)	
Education Low *NoQualSh06* *NoQualSh01* *NoQualSh96*	2006, 2001, 1996. The share of each meshblock's usually resident population 15 or over who left high school without any (even minimum) qualification. Construction: "No Qualification" divided by total people. This assumes that all "Not Elsewhere Included" individuals had one of the other eight sub-university or four university level degrees.
Mean Household Size *HHSize06* *HHSize01* *HHSize96*	2006, 2001, 1996. The average number of usually resident people per household in the meshblock. Used as a proxy for household crowding and neighbourhood deprivation. Construction: provided directly from Statistics New Zealand to zero decimal places.
Labour Force Status *EmpFTSh06,01,96* *EmpPTSh06,01,96* *UnempSh06,01,96* *NotLFSh06,01,96*	2006, 2001, 1996. The share of the usually resident population in each meshblock aged 15 or over in one of four possible categories of labour force status: employed full time, employed part-time, unemployed, or not in labour force. Construction: frequencies for four categories summed to provide a baseline from which shares calculated. "Status Unidentifiable" were excluded, which assumes that those who did not disclose their labour force status were similar to those who did.
Number of Bedrooms *MedBedrms06* *MedBedrms01* *MedBedrms96*	2006, 2001, 1996. Median number of bedrooms in privately occupied dwellings in meshblock. Another proxy for neighbourhood deprivation. Construction: provided directly by Statistics New Zealand.

Appendix I (Cont'd): Description of Variables

Variable	Description
Control Variables (Cont'd)	
Home Ownership Status *OwnHmSh01* *OwnHmSh96*	2001, 1996. The share of dwellings owned or partially owned by their usual residents. Excludes from consideration residents who owned or partially owned their own homes via family trusts. Construction: frequencies for dwellings 1) owned/partially owned by residents, and 2) not owned by residents summed to provide a base from which the share of owner occupied dwellings calculated. Excludes "Dwellings Held in a Family Trust" and "Not Elsewhere Included"
Home Ownership Status *AltOwnHmSh06*	2006 only. The share of dwellings owned or partially owned by their usual residents, or held in a family trust. Dwellings held in a family trust are treated as owned/partially owned. Construction: frequencies for dwellings 1) owned/partially owned by residents, 2) not owned by residents and 3) held in family trusts, summed to provide a base from which the share of owner/trust occupied dwellings calculated. Excludes "Not Elsewhere Included", which assumes non responders are similar in distribution to responders.
Receiving Domestic Purposes Benefit *DomBenSh06* *DomBenSh01* *DomBenSh96*	2006, 2001, 1996. Share of meshblock individuals aged 15 or over receiving the Domestic Purposes Benefit (a welfare programme for single parents). Another proxy for neighbourhood deprivation. Construction: frequency of individuals 15 or over receiving income from the domestic purposes benefit in meshblock divided by the total number of people who disclosed their sources of income. This assumes that the distribution of Benefit recipients similar among those who did and did not disclose their sources of personal income.

Appendix II: Descriptive Statistics (At Meshblock Level, Maximum Sample)

Variable	Obs	Simple Mean	Weighted Mean	Simple Std. Dev.	Min	Max
Volunteering						
VolNarrAAlt96	16712	.1943	.1889	.0702	.0195	.75
VolNarr01	32888	.1682	.1625	.0796	0	1
VolNarr06	34710	.1621	.1540	.0819	0	1
Heterogeneity						
Ethnicity/Race Fragmentation (5 categories)						
EthFrag96	34563	.2955	.3179	.1877	0	.7778
EthFrag01	35150	.3115	.3367	.1932	0	.7951
EthFrag06	34089	.3393	.3629	.1916	0	.7937
Language Fragmentation (4 categories)						
LanFrag96	34791	.2044	.2213	.1414	0	.685
LanFrag01	35323	.2209	.2406	.1449	0	.72
LanFrag06	35975	.2353	.2587	.1467	0	.6837
Birthplace Fragmentation (2 categories)						
BornFrag96	36533	.2389	.2634	.1424	0	.5
BornFrag01	37057	.2509	.2797	.1463	0	.5
BornFrag06	37637	.2754	.3089	.1474	0	.5
Household Income Fragmentation (6 categories)						
HHIncFrag96	25582	.7346	.7421	.0809	0	.8333
HHIncFrag01	26534	.7478	.7556	.0744	0	.8333
HHIncFrag06	27576	.7589	.7652	.0714	0	.8333
Controls for Neighbourhood Characteristics						
Ethnic Shares						
EthEurSh96	34563	.7803	.7643	.1976	0	1
EthEurSh01	35150	.7615	.7423	.2108	0	1
EthEurSh06	34089	.7362	.7148	.2180	0	1
EthMaoSh96	34563	.1323	.1333	.1438	0	1
EthMaoSh01	35150	.1327	.1313	.1466	0	1
EthMaoSh06	34089	.1337	.1292	.1420	0	1

Appendix II: Descriptive Statistics (Cont'd)

Variable	Obs	Simple Mean	Weighted Mean	Simple Std. Dev.	Min	Max
Controls for Neighbourhood Characteristics (Cont'd)						
Ethnic Shares (Cont'd)						
EthPacSh96	34563	.0438	.0521	.0992	0	1
EthPacSh01	35150	.0489	.0583	.1105	0	1
EthPacSh06	34089	.0533	.0622	.1140	0	1
EthAsnSh96	34563	.0399	.0462	.0695	0	.8857
EthAsnSh01	35150	.0517	.0619	.0865	0	1
EthAsnSh06	34089	.0697	.0855	.1100	0	.925
EthMELAASh96	34563	.0036	.0040	.0143	0	.8
EthMELAASh01	35150	.0052	.0062	.0174	0	.52
EthMELAASh06	34089	.0071	.0083	.0198	0	.52
Language Shares						
EngLanSh96	34791	.8772	.8675	.0976	.2857	1
EngLanSh01	35323	.8658	.8537	.1016	.2222	1
EngLanSh06	35975	.8549	.8393	.1055	.4	1
MaoLanSh96	34791	.0387	.0385	.0595	0	.5714
MaoLanSh01	35323	.0391	.0382	.0579	0	.5172
MaoLanSh06	35975	.0369	.0347	.0571	0	.5
SamLanSh96	34791	.0138	.0168	.0401	0	.5
SamLanSh01	35323	.0147	.0179	.0406	0	.4444
SamLanSh06	35975	.0143	.0174	.0395	0	.4444
OthLanSh96	34791	.0703	.0772	.0690	0	.5714
OthLanSh01	35323	.0803	.0903	.0769	0	.7778
OthLanSh06	35975	.0939	.1086	.0866	0	.6
Born in New Zealand Shares						
NZBornSh96	36533	.8402	.8243	.1218	0	1
NZBornSh01	37057	.8260	.8050	.1353	0	1
NZBornSh06	37637	.7998	.7703	.1498	0	1

Appendix II: Descriptive Statistics (Cont'd)

Variable	Obs	Simple Mean	Weighted Mean	Simple Std. Dev.	Min	Max
Controls for Neighbourhood Characteristics (Cont'd)						
Real Median Household Meshblock Income (1995 New Zealand Dollars)						
RHHIncMed96	25587	37307	37768	14760.5	0	98425
RHHIncMed01	26534	38767	39328	15965.8	7250	90621
RHHIncMed06	27576	44333	45276	17038.2	2858	81666
Sex						
FemaleSh96	37103	.5015	.5088	.0781	0	1
FemaleSh01	37544	.5051	.5123	.0770	0	1
FemaleSh06	38090	.5052	.5121	.0741	0	1
Population Density of Meshblock 2006						
PopDens06	41362	1783.5	2503.3	2595.6	0	143775
Median Age						
AgeMed96	31903	33.65	33.44	8.0842	10	86
AgeMed01	32471	35.42	35.16	8.3549	11	88
AgeMed06	33210	36.60	36.22	8.7959	13	88
Share Married (Of Age 15 or Older)						
MarrSh96	35542	.4936	.4858	.1649	0	1
MarrSh01	36068	.4707	.4654	.1633	0	1
MarrSh06	36812	.4513	.4879	.1627	0	1
Per Capital Recorded Offences						
Crime01	41376	.1115	.1099	.0699	.0689	.7073
Crime06	41376	.1009	.1012	.0436	.0641	.4178
Family Type Shares						
CoupleNKSh96	32340	.3757	.3680	.1631	0	1
CoupleNKSh01	32875	.3924	.3833	.1663	0	1
CoupleNKSh06	33660	.4034	.3931	.1698	0	1

Appendix II: Descriptive Statistics (Cont'd)

Variable	Obs	Simple Mean	Weighted Mean	Simple Std. Dev.	Min	Max
Controls for Neighbourhood Characteristics (Cont'd)						
Family Type Shares (Cont'd)						
CoupleKSh96	32340	.4507	.4505	.1586	0	1
CoupleKSh01	32875	.4202	.4225	.1552	0	1
CoupleKSh06	33660	.4157	.4204	.1542	0	1
SingleParSh96	32340	.1736	.1815	.1433	0	1
SingleParSh01	32875	.1874	.1942	.1440	0	1
SingleParSh06	33660	.1808	.1865	.1423	0	1
Religious Affiliation Shares						
ChrisSh96	33546	.6826	.6794	.1243	0	1
ChrisSh01	34123	.6251	.6215	.1278	0	1
ChrisSh06	34763	.5664	.5634	.1304	0	1
NoRelSh96	33546	.2760	.2761	.1139	0	1
NoRelSh01	34123	.3150	.3140	.1177	0	1
NoRelSh06	34763	.3651	.3613	.1262	0	1
OthRSh96	33546	.0415	.0445	.0630	0	.9565
OthRSh01	34123	.0599	.0644	.0752	0	1
OthRSh06	34763	.0685	.0753	.0842	0	.9583
Education Shares High or Low						
Bach/HonsSh96	31128	.0777	.0784	.0861	0	.7778
Bach/HonsSh01	31824	.0974	.0990	.0967	0	.75
Bach/HonsSh06	31646	.1134	.1162	.0913	0	.7
NoQualSh96	31128	.3301	.3265	.1384	0	.9512
NoQualSh01	31824	.2455	.2405	.1158	0	.96
NoQualSh06	31646	.2335	.2264	.1157	0	.8313
Average Household Size						
HHSize96	27936	3.0056	2.8102	2.4534	1	35
HHSize01	28824	2.9295	2.7418	2.4105	1	37
HHSize06	29807	2.9289	2.7613	2.3576	1	39

Appendix II: Descriptive Statistics (Cont'd)

Variable	Obs	Simple Mean	Weighted Mean	Simple Std. Dev.	Min	Max
Controls for Neighbourhood Characteristics (Cont'd)						
Labour Market Shares						
EmplFTSh96	34989	.4741	.4640	.14007	0	1
EmplFTSh01	35559	.4847	.4747	.13909	0	1
EmplFTSh06	36263	.5113	.5023	.13149	0	1
EmplPTSh96	34989	.1419	.1398	.0671	0	1
EmplPTSh01	35559	.1444	.1424	.0652	0	.6667
EmplPTSh06	36263	.1504	.1486	.0652	0	1
UnempSh96	34989	.0498	.0521	.0520	0	.5
UnempSh01	35559	.0492	.0513	.0504	0	.5
UnempSh06	36263	.0339	.0357	.0403	0	1
NotLFSh96	34989	.3342	.3441	.1414	0	1
NotLFSh01	35559	.3218	.3315	.1370	0	1
NotLFSh06	36263	.3044	.3134	.1304	0	1
Median Number of Bedrooms						
MedBedrms96	26867	2.9106	2.913	.4489	0	6
MedBedrms01	27868	2.9693	2.974	.4742	1	6
MedBedrms06	28885	3.0010	3.010	.5031	1	6
Share Owning or Partially Owning Own Home						
OwnHmSh96	33809	.7002	.7049	.2100	0	1
OwnHmSh01	34511	.6796	.6754	.2025	0	1
AltOwnHmSh06	34106	.6619	.6624	.2046	0	1
Share Receiving Domestic Purposes Benefit						
DomBenSh96	29504	.0416	.0427	.0472	0	.4545
DomBenSh01	30153	.0414	.0423	.0453	0	.4286
DomBenSh06	31110	.0339	.0342	.0407	0	.4444

Appendix III. Population Weighted Means and Standard Deviations of Key Variables Over Time (NZ Census, 1996, 2001, 2006), at the Meshblock and Area Unit Levels, using Maximum Sample.

Variable	*Neighbor-hood Size*	*Census Year*					
		1996		2001		2006	
		Mean (St. Dev)	N	Mean (St. Dev)	N	Mean (St. Dev)	N
Volunteering Rate	Meshblock	.189 (.066)	16712	.163 (.069)	32888	.154 (.068)	34710
	Area Unit	.193 (.044)	1757	.163 (.042)	1779	.154 (.039)	1780
Ethnic/Racial Fragmentation	Meshblock	.318 (.184)	34563	.337 (.190)	35150	.363 (.190)	34089
	Area Unit	.342 (.161)	1786	.362 (.170)	1781	.387 (.173)	1772
Language Fragmentation	Meshblock	.221 (.137)	34791	.241 (.140)	35323	.259 (.143)	35975
	Area Unit	.231 (.114)	1791	.250 (.120)	1784	.268 (.124)	1787
Birthplace Fragmentation	Meshblock	.263 (.130)	36533	.280 (.134)	37057	.309 (.132)	37637
	Area Unit	.271 (.112)	1806	.289 (.118)	1798	.319 (.117)	1803
Household Income Fragmentation	Meshblock	.742 (.075)	25582	.756 (.069)	26534	.765 (.067)	27576
	Area Unit	.782 (.039)	1748	.796 (.033)	1755	.805 (.033)	1753