Valuing cultural diversity of cities

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Disclaimer

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Abstract

This paper revisits whether cultural diversity is a source of local production and/or consumption amenities. We adapt the analytical framework of Roback (1982, 1988) and Chen & Rosenthal (2008) to estimate the impact of cultural diversity on city wage and rent premiums from hedonic regressions. We focus on New Zealand which – with high residential mobility and ease of setting up business – is particularly suited to this framework. Additionally, our estimates are based on a very large data set: complete unit record census data on individuals and dwellings in 110 urban areas spanning 32 years. Controlling for observed and unobserved city characteristics, and for the potential endogeneity of diversity, we find that cultural diversity serves as a local positive production amenity and a weakly negative consumption amenity. The results are mostly robust to measuring cultural diversity by birthplace, ethnicity or religion; and to using a range of measures of diversity. We conclude that the presence of people from different cultural backgrounds enhances the profitability of urban firms. In contrast, a city's population has a weak preference for living near others who are culturally similar to them. The effects are stronger in larger cities.

JEL codes

J31; R21; R23; R31

Keywords

Diversity; fractionalisation; local amenity; urban wages and rents; hedonic regression

Summary haiku

In diverse cities

Wages and rents are higher

Firms gain, folks less so

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1 Introduction

More than 40 percent of the population of New Zealand's largest city, Auckland, was born overseas, and only about half identifies as European, which is the largest ethnic group. Auckland's population mix makes it one of the most diverse cities in the world , with over 150 different ethnic identities and 120 languages reported in the 2006 census (Gilbertson & Meares, 2013). In this paper we examine the impact of such diversity on the attractiveness of cities to business and to residents. We follow the approach of Ottaviano & Peri (2005) in using cross-city variation in wages and rents to identify the economic value of cultural diversity. Our identification of whether diversity makes cities more attractive to firms is based on whether diversity is higher in cities with high wages and rents. If a firm can operate competitively in such a location despite the higher costs, we infer that diversity must confer a productivity advantage. Similarly, identifying whether workers value city diversity is based on observing whether diverse cities have low wages and high rents. We interpret such a pattern as meaning that workers find diversity attractive, since they are willing to 'pay' for it in the form of higher rents or accepting lower wages. Firms and workers put different weight on rent differences compared with wage differences because of the importance of each in firms' costs or workers' net expenditures. In spatial equilibrium, the value of diversity to both firms and workers will be reflected in local wage and rent premiums.

Section 2 summarises possible explanations for the economic impacts of diversity, and empirical evidence on the nature and strength of impacts. Section 3 outlines the theoretical framework that summarises these links and the empirical approach to estimating the value of diversity. The costs and benefits of diversity, and thus the impact of diversity on wages and rents may vary depending on city characteristics, such as size, on how diversity is measured and on the level of diversity. Section 4 documents the census data on wages, rents, and diversity across New Zealand urban areas, which we use in implementing the framework outlined in section 3. We also review a range of alternative measures of diversity that we implement in the empirical analysis. The resulting estimates are presented in section 5, followed by concluding remarks in section 6.

2 The value of diversity in consumption and production

Previous studies of the value of diversity have identified a range of explanations for why diversity might matter for firms or for workers. In the next two subsections, we summarise some of the key explanations, as well as the main approaches that have been taken to measuring whether local area diversity makes a difference for firms (section 2.1) or for resident workers (section 2.2). Section 2.3 outlines the spatial equilibrium approach that we adopt for examining these two effects jointly, an approach that is described in more detail in section 3.

2.1 Diversity as a local productive amenity

The impact of diversity on the productivity of teams, workplaces, cities, or economies could be positive or negative. Standard production theory suggests that diversity within a firm can raise productivity if different groups of workers are imperfect substitutes. Recent studies of diversity and productivity discuss a range of mechanisms that could generate such relationships, and which may operate not only within firms, but also at the level of cities and regions.

The literature has distinguished different forms of diversity that operate in distinct ways (Kemeny, 2017; Page, 2007). A key distinction is between cognitive diversity and identity diversity. Cognitive diversity includes the diversity of knowledge held by different members of a group. It also includes the diversity of cognitive function – the diverse ways that people perceive and solve problems. Diversity of knowledge or of cognitive function enables a group to be more effective at solving complex problems than a homogeneous group, and may make the diverse group even able to outperform a homogeneous group with high average ability (Cooke & Kemeny, 2017; Hong & Page, 2004). It also enables groups to outperform individuals in tasks involving prediction.

For the purpose of collective decision-making, however, the benefits of diversity are less clear-cut. Cognitive diversity may make decision-making more costly or difficult, due to the challenges of reaching agreement among people with different knowledge, cognitive functions, native language or preferences. When considering the contribution of preference diversity to decision-making, Page (2007) distinguishes fundamental preference diversity (pursuing different objectives) from instrumental preference diversity (preferring different means to a common end), noting that fundamental preference diversity may make collective decision-making more difficult. Another impact of diversity is that it may reduce the ease with which people interact, diminishing the potential benefits of diversity or magnifying the adverse impacts. Benefits of diversity may be easier to obtain when levels of institutional quality and social capital are high (Kemeny & Cooke, 2017).

Measures of diversity are typically based on the mix of observably different groups – differing in terms of characteristics such as gender, birthplace, ethnicity, language, religion, qualifications, etc. Although overall diversity is likely to be correlated with such observable differences, diversity will also exist within groups that may observationally appear rather homogeneous. Diversity is likely to reflect a mix of cognitive, identity, and preference diversity. Page (2007), for instance, characterises ethnic diversity as a source of cognitive diversity as well as diversity of preferences, which can confer benefits for decision-making and prediction.

Estimates of the net productivity impacts of diversity have been made using direct productivity estimation, or using wages as a proxy for productivity. Existing studies find weak or negative overall effects of firm-level diversity on productivity, but positive effects within some subsets of firms or between work teams within firms (Ozgen et al., 2014). Parrotta et al. (2014) consider both ethnic (language and nationality) and qualification diversity within firms and find that both are negatively related to a firm's total factor productivity (TFP). However, skill diversity among high skilled workers is found to increase productivity in at least some sectors. This finding is similar to that of Iranzo et al. (2008), who found that skill diversity within broadly defined occupations raises productivity even though they find that skill differences between production and non-production workers have a negative effect, suggesting gains from specialisation within broad skill groups may dominate diversity effects.

Möhlmann & Bakens (2015) report a positive cross-sectional relationship between birthplace diversity and TFP for Dutch firms, which is reversed when controls are introduced for firm size and exporting, and which disappears in the presence of firm fixed effects. They conclude that if there are productive advantages of diversity, they do not arise at the firm level. Ozgen et al. (2017) use Dutch longitudinal linked employer-employee data to estimate the effect of birthplace diversity on a firm's innovation. Similar to Möhlmann & Bakens (2015), Ozgen et al. (2017) find that the correlation between innovation and cultural diversity vanishes after introducing firm fixed effects.

Trax et al. (2015) consider the productivity impact of ethnic diversity, as captured by country of birth, at both the firm and regional levels. They find that the share of foreigners in the firm or in the region is not associated with differential productivity performance, but the diversity of foreigners enhances productivity for some firms. Diversity of foreigners within the firm is associated with higher productivity among manufacturing firms whereas diversity of foreigners at the regional level appears to benefit small plants and service sector firms. In the New Zealand context, Maré & Fabling (2013) find that the positive relationship between local workplace ethnic diversity and productivity is largely accounted for by associated differences in skill composition.

Estimates of the wage impacts of diversity also vary across studies and contexts. Ottaviano & Peri (2005) find a positive and significant effect of linguistic diversity on average wages across US cities, but a negative effect of skill diversity, measured across four qualification-based skill groups. Kemeny & Cooke (2018) find a robust positive wage effect of birthplace diversity within US cities and within firms on wages. Their use of linked employer-employee data on US firms allows them to control for firm, worker, and region-year variation. They find that a one standard deviation increase in city birthplace diversity is associated with an increase in wages of nearly 6 percent.

2.2 Diversity as a local consumption amenity

Local cultural diversity can also act as a local consumption amenity. As in the case of productive amenities, this effect could be positive or negative. Residents of an area may value local diversity because of the opportunities it provides for variety in consumption and social interaction (Lazear, 1999). Alternatively, they may prefer to live in more homogeneous communities that provide stronger opportunities to build bonding social capital – even if they value access to consumption diversity in nearby precincts. Bakens et al. (2018) find evidence for this in house prices in Amsterdam. On the one hand native-born residents value diversity in the form of easy access to a range of ethnic cuisines, but on the other hand they prefer to live in neighbourhoods in which they represent a relatively large proportion of the population. Card et al. (2012) interpret reported attitudes to diversity as a reflection of 'compositional amenities' – the value that people associate with being in a more or less diverse country. They report considerable variation in attitudes to immigration, and find that compositional amenities provide a stronger explanation of this variation than reported views on the economic, fiscal and labour market impacts of migration.

In New Zealand, there is strong support for multiculturalism, with 89 percent of people agreeing with the statement that "it is a good thing for a society to be made up of people from different races, religions, and cultures" (Ward & Masgoret, 2008). While this support may not be equally strong in all areas within New Zealand (Waikato Regional Council, 2019), it is nevertheless stronger support than is found in Australia or Europe, but less positive than in Canada. Similarly, Dixon and Poot (2017) report that New Zealanders are "on average relatively more tolerant, accepting, and generally more positive, towards immigration" than are people from Australia or the UK. The positive value placed on cultural diversity will make diverse cities more attractive, acting as a city-wide consumption amenity, although at a local scale diversity may be a disamenity, reflected in relatively lower land values, as people seek to live near similar others (Bakens et al., 2013).

2.3 Diversity and spatial equilibrium

Following Ottaviano & Peri (2006), a number of studies have identified the joint impact of diversity as both a production and consumption amenity, based on relative wages and rents across cities. As shown by Roback (1982), in a spatial equilibrium model, positive local production amenities are reflected in high relative wages and rents – firms locating in high-wage, high-rent areas can compete only if there are productive advantages of locating there. For workers, positive consumption amenities are reflected in low relative wages and high relative rents. They are willing to locate in high-amenity areas despite real earnings being low locally. A more formal exposition of this model is included in the next section.

Ottaviano & Peri (2006) document an economically significant and robust relationship between high birthplace diversity in US cities and higher levels of both wages and rents. This pattern is consistent with the dominant effect of diversity being to raise local productivity. Bellini et al. (2013) report similar findings across European NUTS regions, using local restaurant prices instead of rents as a proxy for local price effects, and GDP per capita as a wage measure.

Bakens et al. (2013) also document a positive relationship between local cultural diversity (based on parental birthplace) and both wages and rents across Dutch metropolitan areas. This finding is robust to controls for endogeneity, but not to controlling for selection. The selection patterns suggest that residents of diverse cities would earn high wages and pay high rents wherever they were to live. Adjusting for this, diversity is associated with lower rents, and generally no difference in wages, consistent with diversity acting as a negative consumption amenity. The authors show that the negative consumption amenity arises despite a positive contribution from quality of living advantages and the diversity of consumption, as proxied by restaurant variety, which is greater in more diverse cities. More recently, Bakens & de Graaff (2018) revisit the spatial equilibrium allocation of firms and households in the Netherlands by means of a Roback model in which there is heterogeneity among workers and firms with respect to the effects of diversity on productivity and utility respectively. The heterogeneity is identified empirically by means of a finite mixture model (FMM). Using cross-sectional data and allowing for commuting, Bakens & de Graaff (2018) find that diversity in terms the immigrant share of an area has a positive productivity effect, leading to higher wages and prices. There is also a positive amenity effect in terms of diversity of cuisines of restaurants for a small share of the population, but for about 70% of their sample there is no evidence of between-city spatial sorting based on utility effects of diversity.

3 Framework

Our analysis and estimation of the local impacts of diversity are built on a model of spatial equilibrium. We adopt the framework introduced by Roback (1982, 1988), which models optimal location choices of both workers and firms, and derives equilibrium wage and rent expressions as a function of local consumption and production amenities. In this context, diversity within a city is considered as a local amenity, which can potentially affect the attractiveness of the city for both consumption and production. The model we present here does not explicitly consider intra-city variation in diversity – and how firms and households react to that. Clearly, the opportunities for intra-city variation in diversity is greater in large cities. We will consider the potential implications of this in our empirical work. Our model may be considered particularly suitable in the context of New Zealand, which has relatively high geographical population mobility (Bell & Charles-Edwards, 2013) and which is ranked number one in the World Bank's global ease of doing business index.[1]

Workers and firms choose to locate in one of C different cities, indexed by c=1,…,C. Workers live and work in the same city, so the model abstracts from commuting behaviour.[2] All firms use (mobile) labour and (immobile) land inputs to produce a tradeable good (Y). All workers provide a constant amount of labour, earning a locally determined wage (w_c), which they spend on land for housing (H_c), or on consumption of Y. The price of land (r_c) is determined locally but the price of the tradeable output (p_c) is assumed to be constant across cities. Cities differ in their attractiveness to workers and firms through their different endowments of amenities (A_c) – characteristics that may have consumption value or disutility for workers, and that may raise or lower firm costs. Cultural diversity is considered as such an amenity.

Workers gain utility from their consumption of land (for housing) and consumption goods, and from local amenities. Hence, the utility of worker i in city c is assumed to be:

$$U_{ic} = f_u(A_c) H_{ic}^{\alpha} Y_{ic}^{1-\alpha} \tag{1}$$

Mobile workers choose to locate in the city that maximises their utility. Their expenditure (E_{ic}) is determined by city-specific wages. Without loss of generality we assume that workers supply one unit of labour. Hence $E_{ic} = w_c$ for all workers in city c. They allocate expenditure to land and goods consumption according to first order conditions:

$$H_{ic} = \frac{\alpha}{r_c} E_{ic}; \quad Y_{ic} = \frac{(1-\alpha)}{p_c} E_{ic} \tag{2}$$

giving them indirect utility of:

$$v_{ic} = \kappa_v f_u(A_c) \frac{E_{ic}}{r_c^{\alpha} p_c^{1-\alpha}} = \frac{\kappa_v f_u(A_c) w_c}{r_c^{\alpha} p_c^{1-\alpha}} \tag{3}$$

where $\kappa_v = \alpha^{\alpha}(1-\alpha)^{1-\alpha}$

Firm j produces Y_{jc} using land H_{jc} and labour L_{jc}, at prices of r_c and w_c respectively. The production function is assumed to be:

$$Y_{jc} = f_y(A_c) H_{jc}^{\gamma} L_{jc}^{1-\gamma} \tag{4}$$

Profit maximisation under perfect competition (implying zero profits) yields first order conditions for the use of land and labour, and a marginal cost function:

$$H_{jc} = \gamma \frac{p_c Y_{jc}}{r_c}; \quad L_{jc} = (1-\gamma) \frac{p_c Y_{jc}}{w_c} \tag{5}$$

[1] See, e.g., https://en.m.wikipedia.org/wiki/Ease_of_doing_business_index.
[2] The approximate equivalence of urban areas and local labour market areas in the case of our New Zealand data makes the application of this model especially appropriate for this empirical setting. In other contexts, such as The Netherlands in Bakens et al. (2013), commuting has to be explicitly accounted for.

$$p_c = \frac{r_c^{\gamma} w_c^{1-\gamma}}{\kappa_p \, f_y(A_c)} \tag{6}$$

where $\kappa_p = \gamma^{\gamma}(1-\gamma)^{1-\gamma}$.

The traded good sells at the same price everywhere, so its price is set as the numeraire ($p_c = 1$). Spatial equilibrium requires that indirect utility and marginal costs are equalised across cities. For firms, equation (6) implies that $r_c^{\gamma} w_c^{1-\gamma} = \kappa_p f_y(A_c)$. For workers, equation (3) implies that $r_c^{-\alpha} w_c = \bar{\bar{v}} / \left(\kappa_v f_u(A_c)\right)$, where $\bar{\bar{v}}$ is the equilibrium level of utility. Solving for rents and wages yields the following equilibrium conditions:

$$lnr_c = \left(\frac{1}{1-(1-\gamma)(1-\alpha)}\right)\left[ln\kappa_p + (1-\gamma)ln\left(\frac{\kappa_v}{\bar{\bar{v}}}\right) + lnf_y(A_c) + (1-\gamma)lnf_u(A_c)\right] \tag{7}$$

$$lnw_c = \left(\frac{1}{1-(1-\gamma)(1-\alpha)}\right)\left[\alpha ln\kappa_p - \gamma ln\left(\frac{\kappa_v}{\bar{\bar{v}}}\right) + \alpha lnf_y(A_c) - \gamma lnf_u(A_c)\right] \tag{8}$$

Although we cannot separately identify the effects of $f_y(A_c)$ and $f_u(A_c)$, we follow Roback (1982) and Chen and Rosenthal (2008) in interpreting the joint behaviour of $\frac{\partial lnr_c}{\partial lnA_c}$ and $\frac{\partial lnw_c}{\partial lnA_c}$ to identify the dominant impact of A_c as a positive or negative consumption or production amenity. All four cases are shown in Table 1.

To capture the valuation of A_c by workers and for firms, we derive quality of life (QL_c) and quality of business (QB_c) indexes. The QL_c index is derived from the position of iso-utility curves, capturing the tradeoff that workers are willing to make between wages and rents. For workers, the tradeoff depends on the expenditure share of rents $\left(\frac{\partial lnw_c}{\partial lnr_c}\Big|_{utility} = \alpha\right)$. The resulting index is thus $QL_c = \alpha lnr_c - lnw_c$. We use a value of $\alpha = 0.2$ to approximate the land (housing) share of expenditure in our main results.[3]

The QB_c index reflects the relative importance of labour and land expenditures in costs. The firm's iso-cost curve is given by $\left(\frac{\partial lnw_c}{\partial lnr_c}\Big|_{cost} = -\frac{\gamma}{1-\gamma}\right)$, implying an index of $QB_c = \frac{\gamma}{1-\gamma} lnr_c + lnw_c$. We use $\gamma = 0.1$ as an approximation of the cost share of land and buildings in our main results.[4]

[3] MBIE (2015) reports average household income and average weekly rental for each of 16 regions. The ratio of average annual rent to average income is 0.2 nationally and varies across regions from 0.12 in Southland to 0.24 in Auckland. The utility function specified in equation (1) implies an elasticity of substitution of one and cannot account for housing taking a larger share of expenditure in areas where prices and rents are high, which would imply a utility function with an elasticity of substitution less than one. Rather than increasing the mathematical complexity by introducing more flexible utility functions, we investigate the sensitivity of our findings to alternative values of α in section 5.1 and specifically in Table 8.

[4] Reliable estimates of the value of γ are not available. Fabling and Maré (2019) report aggregate Cobb Douglas production function estimates. Their estimates suggest that capital accounts for 14% of expenditure, labour 24% and intermediate purchases and taxes 62%. Hence the capital share of factor payments is 0.14/(0.14+0.24), i.e. 37%.

The impact of diversity on the quality of life and the quality of business are calculated as:

$$\begin{aligned}\frac{\partial QL_c}{\partial lnA_c} &= \frac{\partial QL_c}{\partial lnr_c}\frac{\partial lnr_c}{\partial lnA_c} + \frac{\partial QL_c}{\partial lnw_c}\frac{\partial lnw_c}{\partial lnA_c} \\ &= \alpha\frac{\partial lnr_c}{\partial lnA_c} - \frac{\partial lnw_c}{\partial lnA_c}\end{aligned} \tag{9}$$

and

$$\begin{aligned}\frac{\partial QB_c}{\partial lnA_c} &= \frac{\partial QB_c}{\partial lnr_c}\frac{\partial lnr_c}{\partial lnA_c} + \frac{\partial QB_c}{\partial lnw_c}\frac{\partial lnw_c}{\partial lnA_c} \\ &= \left(\frac{\gamma}{1-\gamma}\right)\frac{\partial lnr_c}{\partial lnA_c} + \frac{\partial lnw_c}{\partial lnA_c}\end{aligned} \tag{10}$$

where $\frac{\partial lnr_c}{\partial lnA_c}$ and $\frac{\partial lnw_c}{\partial lnA_c}$ are estimated from regressions as outlined in the following section.

3.1 Estimation

We estimate the relationship between local amenities (specifically, diversity) and local rents and wages respectively, as suggested by equations (9) and (10). We adopt a two-stage estimation procedure. In the first stage we estimate, by means of ordinary least squares (OLS), hedonic wage and rent equations that yield city-year wage and rent premiums respectively. Let lnw_{ict} and lnr_{jct} represent the log of wages of individual *i* and the log of rents of dwelling *j* respectively in city *c* in time period *t*, then

$$lnw_{ict} = X^W_{ict}\beta^W_{Xt} + a^W_{ct} + e^W_{ict} \tag{11}$$

and

$$lnr_{jct} = X^R_{jct}\beta^R_{Xt} + a^R_{ct} + e^R_{jct} \tag{12}$$

In equations (11) and (12), local wages and rents are determined by observed characteristics of individuals or dwellings. The hedonic person-level wage regression includes a range of controls $\left(X^W_{ict}\right)$ that are listed in Section 4.3. The hedonic property-level rent regression controls for differences in dwelling-level characteristics across cities $\left(X^R_{jct}\right)$. These controls are described in Section 4.2.

However, in our model land is the only variable capital input. Rental leasing and rates (RLR) account for around 30% of capital inputs, implying that γ is around 0.11 (=0.37*0.30). However, the RLR measure includes some but not all land-related costs, and excludes relevant costs for businesses that own their own land and buildings. A mean expenditure share derived from industry-specific weights used in the calculation of Statistics New Zealand's Producer Price Index (inputs) yields an estimate for γ of 0.16. We use a benchmark value of $\gamma = 0.1$ and discuss in section 5.1 the sensitivity of findings to this choice (see Table 8). The discussion of sensitivity will also shed light on the impact of spatially-varying elasticities of substitution. The choice of a production function with an elasticity of substitution between labour and land inputs of one (equation (4)) implies that the cost share of land and buildings is assumed constant across cities.

The components e_{ict}^{W} and e_{jct}^{R} represent error terms for the individual *i* and dwelling *j* respectively, but equations (11) and (12) also include city-year wage and rent premiums, a_{ct}^{W} and a_{ct}^{R} respectively, that represent the combined impact of city-level observable and unobserved externalities. Hence

$$a_{ct}^{W} = D_{ct}\,\eta_{D}^{W} + V_{ct}^{W}\,\eta_{V}^{W} + a_{c}^{W} + \tau_{t}^{W} + u_{ct}^{W} \qquad (13)$$

and

$$a_{ct}^{R} = D_{ct}\,\eta_{D}^{R} + V_{ct}^{R}\,\eta_{V}^{R} + a_{c}^{R} + \tau_{t}^{R} + u_{ct}^{R} \qquad (14)$$

The main covariate of interest is one observable city-level characteristic, the cultural diversity of the local population (D_{ct}). Our main focus is on birthplace diversity and on measuring diversity by fractionalisation, as defined below. However, we also show that the results are mostly robust to other dimensions of cultural diversity and other ways of measuring diversity. The coefficients on birthplace diversity (η_{D}^{W} and η_{D}^{R}) represent the partial derivatives $\frac{\partial lnw_c}{\partial D_c}$ and $\frac{\partial lnr_c}{\partial D_c}$ used in the calculation of $\frac{\partial QL_c}{\partial lnA_c}$ and $\frac{\partial QB_c}{\partial lnA_c}$, as shown in equations (9) and (10) with now $lnA_c = D_c$. In the second stage of our estimation procedure we also control for other factors that may vary between cities over time by means of city-time covariates (V_{ct}^{W} and V_{ct}^{R} respectively) as well as city and year fixed effects. u_{ct}^{W} and u_{ct}^{R} represent error terms in the measurement of city-time characteristics that affect wages and rents respectively, i.e. they include the impact of other time-city varying amenities, which are assumed uncorrelated with cultural diversity.

The city-year fixed effects a_{ct}^{W} and a_{ct}^{R} are regressed on local cultural diversity as well as other city-year variables. Regarding the latter, we control for the log of city population, and a proxy for expected employment growth, calculated as a lagged-share weighted average of industry growth rates, i.e. a Bartik index (Bartik, 1991).[5] Each of these measures is expected to have an impact on wages and rents, independent of the effect of diversity.[6] The second stage wage and rent regressions are jointly estimated as seemingly unrelated regressions (SUR), to facilitate calculating standard errors of $\frac{\partial QL_c}{\partial D_c}$ and $\frac{\partial QB_c}{\partial D_c}$, which are each a linear combination of

[5] $\widetilde{EmpGrowth}_{ct} = \left(\sum_{k=industry}\left(\frac{E_{kct-1}}{E_{ct-1}}\right)\left(\frac{\breve{E}_{kt}}{\breve{E}_{kt-1}}\right)\right) - 1$, where $\breve{E}_{kt}$ is employment in industry *k* at time *t* in cities other than *c*.

[6] In principle, it is possible to treat a_{ct}^{W} and a_{ct}^{R} as correlated random effects in equations (11) and (12) respectively, and include city-year means of the person level and dwelling level characteristics in the second stage regression. In practice, this raises the standard errors on η_{D}^{W} and η_{D}^{R} substantially and yields volatile and insignificant estimates of these parameters.

$\eta_D^W = \frac{\partial lnw_c}{\partial D_c}$ and $\eta_D^R = \frac{\partial lnr_c}{\partial D_c}$. However, given that we have taken the regressors to be identical in the two equations, SUR yields the same estimates as OLS. The regressions are estimated using weighted least squares (WLS) with weights equal to city population, to adjust for the greater variance of a_{ct}^W and a_{ct}^R estimates from smaller cities.[7]

For the wage equation, the observable attributes of individuals that are assumed linked to their cultural identity enter the estimation in two distinct ways. First, they are included in the vector X_{ict}^W, capturing their impact on an individual's local wage, using the estimated coefficients β_X^W. Second, the city-year means of the cultural variables which are included in X_{ict}^W enter in the estimation of the regression of a_{ct}^W in the form of a diversity measure, which is a non-linear function of those means.

4 Data

We use data from eight New Zealand Censuses of Population and Dwellings which span the years from 1976 to 2013.[8] Access to the individual census records used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975.

4.1 Identifying cities

Geographic areas are not consistently coded across all of the censuses. The authors have allocated individuals and dwellings to urban areas as defined in 2013, using the most detailed geographic coding available in each year.[9] Where a detailed area from an earlier census is associated with more than one 2013 urban area, the earlier census area is allocated to the urban area that contains the largest share of the 2013 population.

4.2 Rent equation

The rent equation is estimated using information on weekly rents paid in non-owner-occupied private dwellings. Rental housing accounts for an increasing share of the New Zealand housing

[7] It is possible to reduce the two-stage estimation to a single stage by substituting equation (15) in (13) and (16) in (14). In this case the error terms are clustered by city-year. However, a difficulty then arises in calculating the standard errors of $\frac{\partial QL_c}{\partial D_c}$ and $\frac{\partial QB_c}{\partial D_c}$, which require calculation of the correlation between the estimates of η_D^W and η_D^R. In the single stage approach the cross-equation correlation cannot be calculated while the individual observations from the wage equation (which is estimated for fulltime employees) do not match the individual observations for the rent equation (which is estimated for renters of private non-owner-occupied dwellings).

[8] Estimation focuses on the seven census years of 1981, 1986, 1991, 1996, 2001, 2006 and 2013. Additionally, data from 1976 were used where lagged values of variables were required for the construction of instrumental variables for 1981.

[9]. Generally, this is a census meshblock, which is a geographic area containing on average around 100 people. For the 1976 census, meshblock codes were derived from undocumented administrative codes. For individuals who were away from home on census night in 1976, coding was available only at a more aggregated (area unit) level.

market (from 26% in 1986 to 35% in 2013). The user cost of owner occupied dwellings may be assumed to have changed proportional to rents (See Grimes and Hyland, 2013). Respondents report the dollar amount paid in rent, which is converted to an equivalent weekly rate. We exclude rental payments for non-private dwellings in order to more closely approximate a market price for local land and housing services.

As shown in equation (12), we regress (log) rents on available housing characteristics. Specifically, we account for the number of rooms, the number of bedrooms, the type of dwelling, and the number and types of heating fuel available. The number of rooms and bedrooms are included as sets of dummy variables for each distinct value, top-coded at 7. Dwelling type distinguishes detached houses from complexes of two or more connected dwellings, and further classifies these according to the number of storeys. The degree of detail and the classification schedule varies between censuses, with the number of categories varying from 3 to 8 categories. Mobile dwellings and campgrounds are excluded. Respondents can identify up to 8 heating fuels ever used in the dwelling. The classification of fuel types varies between censuses. Dummy variables are included for each of 6 to 8 categories, with a count of different fuels used being an additional variable. For each variable, we also include a residual category that combines non-responses with unidentifiable responses.

4.3 Wage equation

The Census does not collect information on wage or earnings levels. The wage equation is estimated based on the reported annual income of usually-resident adults aged 15 and over who were full-time employees in the week prior to the census. Regional variation in this measure is highly correlated with regional differences in mean quarterly earnings derived from administrative tax data (linked employer employee data), indicating that census annual income is for fulltime employees a good proxy of labour earnings.[10] We will therefore refer to census income as the wage in the discussion of the results of our estimations.

Census income information is collected in bands. This is converted to a specific dollar measure for each individual using the median income within bands provided by Statistics New Zealand.[11] The number of income bands varies across census years, from a low of 13 in 1991

[10] For the years 2001, 2006 and 2013, where both measures are available, a log-log regression of mean earnings by region yields coefficients of around one and R^2 of above 0.97 in each year.

[11] For 1976 and 1981, estimated medians within bands are not available. For these years, the midpoint is calculated as the average of the upper and lower bounds of each band, with the midpoint for the open-ended top band set at 1.4 times the lower-bound, consistent with assuming a Pareto distribution for the upper tail of incomes. Only around 0.5% of incomes are top-coded in these years.

and 1996, to a high of 24 in 1981.[12] The proportion of people with top-coded income ranges from 0.3% in 1981 to 3.3% in 2006.

In the wage equation, the log of annual income of full-time employees is regressed on a quartic in age, a gender dummy, and sets of dummy variables for categories of birthplace, ethnic identity, religion, qualification, and two-digit industry.

Birthplace coding is available for individual countries of birth, with additional codes for responses not corresponding to specific countries. The number of birthplace codes ranges from 194 in 1976 to 257 in 2013. As described below, diversity measures are based on this detailed coding. In contrast, the birthplace variables in the wage equation are based on an aggregated classification of countries. Each year-specific classification is derived by aggregating countries of birth that account for less than 0.2% of adults. Codes are initially aggregated from 4-digit country code to 2-digit code (region of birth). Aggregated groups that still account for less than 0.2% of adults are further aggregated to 1-digit codes and any remaining small groups are classified into a residual category. The resulting number of distinct categories ranges from 23 in 1981 to 38 in 2013. Ten categories of birthplace region are included as covariates in the wage-equation, representing the 9 largest categories, plus one remainder, which accounts for between 4 and 11 percent of the population (See Appendix Table 2).

Coding of ethnicity-related variables is extremely inconsistent across New Zealand censuses (Statistics New Zealand, 2004 - Appendix B). At different times, ethnicity-related questions have been framed in terms of descent, race, ethnic identity, and ethnic affiliation, with multiple responses allowed in some years. Notwithstanding the fact that questions and classifications in different years are fundamentally different, we have aligned all responses to the same coding schedule (Ethnicity New Zealand Standard Classification 2005 V2.0.0). Ethnicity groupings are constructed in two stages. First, groupings of prevalent ethnicity codes are created by combining five-digit ethnicity response codes that are reported by less than 0.2% of the adult population into their respective 4-digit codes. This aggregation is repeated combining 4-digit codes reported by less than 0.2% of the adult population into 3 digit codes, 3-digit into 2-digit and 2-digit into 1-digit. Any remaining 1-digit groups that fail to meet the 0.2% threshold are combined in a residual category. In the second stage, each combination of 'prevalent group' responses is then treated as a distinct 'ethnic' response, or grouped in a residual category if numbers are too small. Thus, the dual ethnicity of 'New Zealand European and Māori' is treated as distinct from 'New Zealand European' and from 'Māori'. This approach yields between 10 (in 1976) and 34 (in 2013) distinct groups. Wage equation indicator

[12] As an alternative to using estimated band medians, we tested the robustness of our findings by using simple range midpoints (combined with an estimated median for the top bracket) and also by using interval regression assuming a lognormal income distribution. Our findings are consistent across these specifications.

variables are included for the 9 largest of these, plus one combined residual group (See Appendix Table 3).

The construction of variables to capture religious affiliation follows the same patterns as for the construction of ethnicity measures. Detailed (level 2 Religious Affiliation 1999 V1.0.0) response codes are aggregated into sufficiently large categories – again 0.2% of the adult population, with smaller categories grouped at level one, or assigned to a residual group if still smaller than the size cutoff. In years where multiple responses are possible (from 2001), each combination of multiple responses is then treated as a distinct affiliation, being aggregated into residual categories where they fall below the size threshold. The number of distinct categories varies between 20 and 30 each year. The nine largest groups, plus one residual group, define the indicator variables used in the wage equation (See Appendix Table 4).

Levels of highest qualification are classified into 8 levels – no qualifications; 4 levels of school qualification, and 3 levels of tertiary qualification. An indicator variable is included for each level in the wage equation.

4.4 Diversity measurement

Cultural diversity, which is thought of here as an urban amenity, has been measured in the literature in many different ways: by ethnicity, race, descent, country of birth, religion, language, etc. In this paper we focus on primarily on birthplace diversity given its direct link with the growing share of foreign born residing in New Zealand. As noted earlier, the measurement of ethnicity has been modified in various censuses, rendering ethnic diversity a less suitable measure of cultural diversity for our analysis. However, in robustness checks we will compare results for birthplace diversity with those for our best estimates of ethnic diversity and religious diversity.

We capture birthplace diversity for each urban area *c* and period *t*. Our main diversity measure is the commonly used fractionalisation index (Nijkamp & Poot, 2015):

$$FR_{ct} = 1 - \sum_{g=1}^{G} \left(\frac{P_{gct}}{P_{ct}}\right)^2 \tag{15}$$

where P_{gct} is the population of group g in city c at time t and P_{ct} is the size of the total local population at time t. FR_{ct} has a simple interpretation: it measures the probability that in a meeting of two randomly selected individuals in the city the two belong to different groups. If we assume that the impact of this probability on utility and output is directly proportional to the respective levels, the probability enters equations (13) and (14) in logarithmic form, $D_{ct} = lnFR_{ct}$, in order to calculate the quality of life and quality of business effects as given in equations (9) and (10). However, theory is agnostic about the functional forms $f_u(A_c)$ and

$f_y(A_c)$ through which amenity A_c enters the utility and production functions respectively. We will therefore also consider the simple level effect of fractionalization FR_{ct} on wage and rent premiums.

We distinguish diversity that arises from the prevalence of minority groups and that arising from diversity among minority groups, using two components of the fractionalisation index, as in Alesina et al. (2016). The decomposition is shown as equation (16), with city and period subscripts suppressed and g=1 referring to the single group that accounts for the majority of the population. In the case of birthplace, this group represents those born in New Zealand while in the case of ethnicity it represents those identifying as 'New Zealand European'.[13]

$$\begin{aligned} FR &= \left[2\frac{P_1}{P}\left(1-\frac{P_1}{P}\right)\right] + \left[\left(1-\frac{P_1}{P}\right)^2 \sum_{g=2}^{G} \frac{P_g}{P-P_1}\left(1-\frac{P_g}{P-P_1}\right)\right] \\ &= [FR_1] + [FR_2] \end{aligned} \tag{16}$$

The fractionalisation indexes are calculated using groups defined by individual birthplace codes (194 to 257 distinct codes). Using the aggregated 23-38 categories, as described in section 4.3 above, yields almost identical index values.

As a robustness test for our main findings, we consider also three other indexes:[14] the Hoover index (HO), which calculates the proportion of the population that would have to have a different country of birth to make all groups of equal size; the Evenness index (EI), which is maximised when all groups are of equal size; and the Reynal-Querol polarisation index (RQ), which captures deviations from having two equal sized groups – a situation associated with maximal social conflict (Reynal-Querol, 2002):

$$HO = 0.5 \sum_{g=1}^{G} \left|\frac{P_g}{P} - \frac{1}{G}\right| \tag{17}$$

$$EI = 0.5 \sum_{g=1}^{G} \frac{P_g}{P}\left(1-\left(\frac{P_g}{P}\right)^2\right) \tag{18}$$

[13] Note that census respondents may identify with more than one ethnic group.
[14] Other measures (specifically, the Simpson Diversity Index and the modified FR) were also examined (see Nijkamp & Poot, 2015). These turned out to be highly correlated (ρ>0.99) with FR and produce estimates that are very similar to those obtained when using FR. Nijkamp & Poot (2015) also document entropy-based measures (Shannon-Wiener; Shannon Evenness), which were not considered in the current context.

$$RQ = 4\sum_{g=1}^{G}\left(\frac{P_g}{P}\right)^2\left(1-\frac{P_g}{P}\right) \tag{19}$$

4.5 Sample selection

There are 143 urban areas or zones defined in the official NZ urban area classification for 2013. We consolidate urban zones into their corresponding urban areas, which affects Auckland (4 zones), Hamilton (3 zones), Wellington (4 zones) and Napier-Hastings (2 zones). The first stage estimation of the year-specific wage equations uses information from all full-time employees with positive and non-missing income. The number of observations each year varies between 888,000 and 1,197,000. Rent equations use information on between 125,000 and 405,000 private non-owner-occupied rental dwellings each year. City-year fixed effects are recovered from each of the wage and rent regressions for 134 distinct areas (all 17 main, 14 secondary, and 103 minor urban areas, and for a single composite area capturing the remainder of New Zealand). The second stage regressions using city-year observations are generally restricted to the 110 urban areas that have a population of at least 1,000 in each of the 1981 to 2013 years. The restriction is imposed because population shares for particular birthplace groups, and therefore the associated measures of diversity, can be unstable for small urban areas. The hedonic returns are thus estimated from a broader set of cities than are used for the second stage regressions. Data for the 110 urban areas on population size, birthplace fractionalisation and wage and rent premiums derived from the first stage regressions are reported in Appendix Table 1.

5 Results

As outlined above, our approach to valuing cultural diversity relies on cross-city variation in diversity over time, and the pattern of covariation with wage and rent premiums. As noted previously, we present our main results for birthplace diversity which is measured unambiguously across the seven censuses of data. There is considerable variation across cities in both the level of birthplace diversity, and the size of changes over time. Birthplace diversity in New Zealand increased markedly between 1981 and 2013. The proportion of the adult population that was born overseas rose from 18.2% to 28.9%. The increase in the foreign-born adult population was particularly strong in larger urban areas. In Auckland, the foreign born population share rose from 28.3% in 1981 to 47.3% in 2013, and birthplace fractionalisation rose from 0.493 to 0.740.[15]

Table 2 summarises the variation in fractionalisation across cities and over time. The top panel reports weighted means and standard deviations of birthplace fractionalisation, with each city weighted by its census usually resident population (CURP). Weighted mean fractionalisation rose from 0.341 in 1981 to 0.555 in 2013. There was considerable variation across urban areas in both the level of fractionalisation (s.d. of 0.112 in 1981 and 0.156 in 2013) and in the change in fractionalisation (s.d. of 0.064). This was also true of each component of fractionalisation – majority fractionalisation and fractionalisation among minority groups.

The 1981-2013 pooled cross-sectional variation in birthplace fractionalisation (weighted standard deviation of 0.161 around a mean of 0.434) is dominated by variation in majority birthplace fractionalisation (FR1) (s.d. of 0.099 around a mean of 0.360), though with substantial variation also in the smaller FR2 component (s.d. of 0.067 with mean of 0.074). The growth in fractionalisation was due not only to the increase in majority fractionalisation (FR1 rose from 0.304 to 0.426), but also to increased birthplace diversity among the foreign born. Minority fractionalisation (FR2) rose from 0.036 in 1981 to 0.129 in 2013 (see the top panel of Table 2 and Figure 1).

Weighting by population magnifies the higher level and growth of fractionalisation among larger urban areas. There are 17 main urban areas, which collectively account for between 82% and 85% of the urban population each year. The pattern of cross-city differences is, however, also evident across smaller urban areas. Mean fractionalisation among the smaller urban areas increased from 0.216 to 0.380 between 1981 and 2013 (not shown in the table). The second panel of Table 2 reports unweighted means across all 110 selected urban areas. These means reflect predominantly the experience of the smaller urban areas, which account for 93 of the 110 observations.

Table 2 also documents the variation in relative wages and rents across urban areas. These are reported as premiums, relative to overall weighted mean levels in each year.[16] Thus, by construction, the mean premium in the top panel is zero. The cross-city variation in rents is greater than the cross-city variation in wages (strictly, annual incomes of full-time employees), with the standard deviation in rent premiums a little over twice as great as the standard deviation of wage premiums. The unweighted mean premium is negative, reflecting the large number of small areas with relatively low wages and rents.

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[15] In 2013 Queenstown was the urban area with highest birthplace diversity (FR=0.77). Fifty-one percent of Queenstown's adult population was born overseas. The proportions overseas born are based on the 93% (in Auckland) or 91% (in Queenstown) of adults who stated a country of birth.

[16] The premiums are estimated using person and property level regressions from 134 urban areas (as specified in equations (11) and (12)) and are subsequently normalised to have a population-weighted mean of zero across the 110 urban areas used in the second stage regressions.

Estimating the value of birthplace diversity is based on the co-movements of diversity and wage/rent premiums. The nature of this relationship is sensitive to the way that diversity is scaled (as the level of FR or the logged level of FR), especially when using weighted measures. Table 2 shows that the weighted average 1981-2013 increase in birthplace fractionalisation FR was 0.187, which is *more* than the unweighted increase in FR (0.153). In contrast, the weighted increase in logged fractionalisation lnFR (0.452) is *less* than the unweighted increase (0.549). A big contributor to the difference between the unweighted and weighted increase is the large weight (1/3) that the largest city, Auckland, has in calculating the weighted average. Birthplace fractionalisation in Auckland rose, from 0.47 to 0.74 – an increase of 0.27, which is much larger than the average increase of 0.153 (see Table 2). The natural logarithm of fractionalisation in Auckland increased from -0.76 to -0.30 – a change of 0.46, which is less than the average increase of 0.549. The difference between the level and logged increase in diversity is due to the fact that Auckland started out with a much higher level of diversity than average. Because weighted regression is econometrically preferred when the large variation in city sizes introduces heteroscedasticity in the estimation of equations (13) and (14), we prefer to use the log of fractionalisation as the diversity measure, which reduces the influence of Auckland on the results. We note that Auckland had much faster than average growth in wages and rents. The Auckland wage premium rose 4 percentage points (see Appendix Table 1) compared with an average relative decline in the raw wage premium of 7.2 percentage points (Table 2). Similarly, the rent premium in Auckland rose 7 percentage points, compared with an average relative decline of 11.8 percentage points. Using lnFR as the diversity measure gives the strong coincidence of a large diversity increase and large increases in relative wages and rents in Auckland less weight in the estimation. Thus, to reduce the influence of Auckland on the overall results, our regression estimates will identify the effects of *proportional* changes in fractionalisation (i.e., the increase in logged fractionalisation). However, we also carry out analyses on subsets of cities to detect heterogeneous patterns, as well as estimate the impact of fractionalisation measured in level form.

5.1 Regression estimates

The first column of Table 3 summarises the bivariate relationship between raw wage premiums and logged diversity, and between raw rent premiums and logged diversity, based on pooled data from the seven successive censuses between 1981 and 2013. We control only for year effects, through the inclusion of separate intercepts. We also standardise the logged value of the fractionalisation index to a measure with zero mean and a standard deviation of one. This is used in all the regression estimates that follow, and allows the coefficient on fractionalisation to be interpreted as the effect of a one standard deviation proportional change in fractionalisation.

A one standard deviation proportional change in birthplace diversity is associated with a 7.4% higher raw wage premium and a 21.5% higher raw rent premium. Within the local amenity framework outlined in section 3, the higher wages and rent premiums suggest that birthplace diversity is a local productive amenity (raises QB, see also Table 1). Whether birthplace diversity raises or lowers QL depends on the relative size of the wage and rent increases, in accordance with equations (9) and (10). The bolded rows in Table 3 report the implied impact of birthplace diversity on QL and QB. Using our chosen benchmark values for expenditure and cost shares (α=0.2 and γ=0.1), these are calculated as $\frac{\partial QL_c}{\partial(std.\ lnFR_c)}$ = 0.2 * 0.215 - 0.074 = -0.031 (see equation (9)); and $\frac{\partial QB_c}{\partial(std.\ lnFR_c)}$ = 0.1/(1-0.1) * 0.215 + 0.074 = 0.097 (see equation (10)). Based on the raw relationships alone, we would conclude that a one standard deviation increase in local birthplace diversity (defined by the natural logarithm of the fractionalisation index) raises QB by 0.097, and reduces QL by 0.031.

The second column of Table 3 uses the residual estimates of wage and rent premiums obtained from first stage regressions in the place of raw premiums, controlling for cross-city differences in observable characteristics of workers and rental dwellings. The estimated impacts of diversity on QL and QB are slightly reduced, but qualitatively similar.

The inclusion of additional covariates to control for other determinants of wage and rent variation that may be correlated with diversity results in broadly similar estimated impacts of diversity on QL and QB. Column (3) shows the effect of adding city size (as captured by the log of population) and an expected employment growth variable based on local industry composition, as described in footnote 6 above. The estimate of the positive effect of diversity on QB is reduced to 0.072 and the size of the negative effect on QL is raised slightly, to -0.029. The further addition of urban area fixed effects in column (4) results in a further reduction in the positive QB effect, to 0.049, and a reduction in the strength of the negative effect on QL (-0.005).

The impact of including city fixed effects is particularly pronounced in the wage equation, significantly lowering the coefficient on birthplace diversity. This suggests that diverse cities have relatively high average wages for reasons other than their diversity, and that the relationship over time between diversity and wages is weaker than the cross-sectional variation suggests. Given that the most birthplace diverse cities are the metropolitan areas, it is plausible that the high wages in those cities are due to agglomeration externalities (see, e.g. de Groot et al. 2016) that are not adequately captured by population size.

Our preferred specification, in column (5) of Table 3, includes both city fixed effects and time-varying covariates, but additionally controls for the potential endogeneity of diversity. Such endogeneity may arise if the location choices of birthplace groups are influenced by changes in the relative wages and/or by changes in rents between cities. To control for possible reverse causality of this sorting, we use an instrumental variables strategy. We instrument for birthplace diversity using an instrument constructed from prior birthplace shares in each city and growth elsewhere in the number of residents from each birthplace. The instrument for fractionalisation is based on the following (with FR_{ct}^{IV} suitably logged and transformed):[17]

$$FR_{ct}^{IV} = 1 - \sum_{g=1}^{G} \left(\frac{\tilde{P}_{gct}}{\tilde{P}_{ct}} \right)^2 \tag{20}$$

where $\tilde{P}_{gct}$ is the predicted number of city residents from country-g based on the number of country–g residents in the city in the previous census, and the growth (in all other urban areas combined) in the number of country-g residents; and $\tilde{P}_{ct}$ is the predicted number of city residents from all countries:

$$\begin{gathered} \tilde{P}_{gct} = P_{gct-1} * \left(\frac{P_{gt} - P_{gct}}{P_{gt-1} - P_{gct-1}} \right) \\ \tilde{P}_{ct} = \sum_{g} \tilde{P}_{gct} \end{gathered} \tag{21}$$

Instrumenting for diversity in the wage equation has a small impact on the estimates. A formal test of the endogeneity of birthplace fractionalisation in the wage equation (shown at the bottom of Table 3) fails to reject the null hypothesis of exogeneity (p=0.29). Similarly, we cannot reject the exogeneity of birthplace fractionalisation in the rent equation (p=0.62). However, because the null hypothesis of exogeneity is rejected in some of extensive range of robustness checks that we report on below, IV regression has been applied to all regressions in the subsequent tables. The chosen instrument passes tests of instrument strength, as shown by the under-identification and weak instrument tests reported in Table 3. Because the same covariates are included in the wage and rent equations, the same test statistics apply to both equations.

Controlling for the endogeneity of birthplace fractionalisation in the rent equation leads to a smaller estimated effect of diversity on rent and a slightly larger estimated effect on wages. The overall conclusion that birthplace diversity is a positive productive amenity and a weak negative consumption amenity is maintained. A one standard deviation proportionally higher level of diversity is associated with a 0.055 higher quality of business, and a 0.013 lower quality of living. Overall, the positive effect on QB more than balances the weak negative effect on QL, implying that diversity has a net positive effect on welfare, as long as the weight that we assign to QB-related welfare change is at least 24 percent of the weight that we assign to QL-related welfare change. (0.055*24% - 0.013 ≅ 0)

[17] Because we are instrumenting for the diversity of the population rather than for the size of the population, our use of this shift-share instrument is less subject to the biases addressed by Jaeger et al (2018).

The estimated wage impact of diversity is for 4.0% higher wages in response to diversity that is one standard deviation higher. This is quite comparable but slightly weaker than the 6% impact reported by Kemeny and Cooke (2018). The magnitude of the diversity effects on QB and QL are substantial. A one standard deviation higher level of diversity has the same effect on QB as a 47% increase in population.[18] The negative effect on QL of a one standard deviation difference in diversity is relatively small – commensurate with a 14% increase in population.

Figure 2 illustrates the estimated impact of a one standard deviation increase in diversity on local wage and rent premiums, showing also the cross-city premiums in 2013. Business (iso-cost) and worker (indirect utility) indifference curves are plotted, each passing through the average (zero) rent and wage premiums. The impact of diversity is shown as the upward dotted arrow. The shaded ellipse around the arrow head indicates the 95 percent confidence bounds for estimated wage and rent effects. The arrow head is above the reference indirect utility curve, indicating that diversity acts as a negative consumption amenity. It is also above the dashed iso-cost curve, indicating a positive productive effect.

The inference that birthplace diversity is a negative consumption amenity depends crucially on the parameter α in equation (1) – which is the imposed consumer expenditure share accounted for by housing. As documented in section 3, our main estimates impose a value of α=0.2. Table 8 shows the sensitivity of the estimated effect of diversity on QL to alternative values of α. A higher value of α implies a steeper slope for the upward sloping indirect utility curve in Figure 2. For a housing expenditure share of 30 percent, the indirect utility curve would have the same slope as the birthplace diversity effect, implying that diversity had no effect on quality of life. Given that housing accounts for a higher share of expenditure in Auckland than elsewhere, our main estimates, although already small, probably overstate the negative consumption amenity effect of diversity there. Conversely, in areas where housing costs are low relative to incomes, we are probably understating the negative effect. As shown in Table 8, if housing costs were only 15 percent of expenditure, our estimated wage and rent effects would imply a negative consumption amenity effect of 0.020.

In contrast, the estimated impact of birthplace diversity as a production amenity is positive for all plausible values of γ (the share of land use costs in total costs) - see Table 8. At the imposed value of γ=0.1, the effect of diversity on QB is 0.055 (as in Table 3, column (5)). Even if γ were as low as 5 percent, the implied effect of diversity on QB would be 0.047. Visually, the steepness of the downward sloping iso-cost curve in Figure 2 does not alter the

[18] $\frac{\partial QB}{\partial lnPop} = 0.11 * \frac{\partial lnR}{\partial lnPop} + \frac{\partial lnW}{\partial lnPop} = 0.143$; $\frac{\partial QB}{\partial std.lnFR} = 0.055 = 0.143 * dlnPop => dlnPop = \frac{0.055}{0.143} = 0.384 =>$ $\%change\ in\ pop = (e^{0.384} - 1) * 100\% = 47\%$.

conclusion that diversity raises quality of business due to its positive effects on both wages and rents.

5.2 Different effects by city size

The estimates in Table 3 reflect the average effect of diversity across 110 urban areas, weighted by population. Table 4 reports analogous estimates for different subsets of urban areas, to examine whether the strength of production and consumption amenity effects varies by city size. It appears that the impacts are strongest in the three largest cities – Auckland, Wellington and Christchurch (see column (2)). In these cities, diversity raises QB by 0.096, which is 1.75 times as large as the estimated impact overall. In contrast, the negative impact on QL of -0.009 is only slightly weaker than the overall effect of -0.013 (see column (1)). In the 14 other, smaller main urban areas (see column (3)), the effects on QB are less positive and the effects on QL are more negative. The estimated impact on the quality of business is about the same as the overall effect, at 0.053. The negative effect on quality of life is somewhat more pronounced in main urban areas other than Auckland Wellington and Christchurch (-0.069).

In smaller urban areas, the estimated impacts of birthplace fractionalisation look very different. As shown in column (4) of Table 4, there are 93 secondary and minor urban areas with minimum population above 1,000. They range in size from around 1,000 up to around 20,000, with an average of over 5,000 (see also Appendix Table 1). These areas have lower levels of diversity than the main urban areas. They also have lower levels of rents and, to a lesser extent, lower wage levels. For these urban areas, birthplace fractionalisation is unrelated to wage levels, but does have a positive effect on rents. The estimates imply that for smaller, less diverse areas, higher diversity is a consumption amenity, raising QL by 0.010.[19] In contrast, the beneficial impact on the quality of business that is evident for larger cities becomes only weakly significant, and small (0.015), suggesting that the business benefits of birthplace diversity are primarily a large-city phenomenon. The results with respect to the quality of life impact suggests a nonlinear effect of diversity in relation to city size: the effect on QL is approximately zero in metropolitan and small urban areas, but negative in intermediate-sized urban areas. [20]

[19] The differences by city size in the strength of the QL effect is larger than can be accounted for by differences in expenditure shares, as shown in Table 8.
[20] Ward et al. (2011) find a nonlinear relationship between immigrant density (share) in urban areas and attitudes towards immigrants. New Zealanders tend to value immigrants more as their numbers increase, but further increases in large cities are associated with more negative attitudes. The evidence reported in Tables 4 and 5 is consistent with that.

5.3 Different effects over time

The second half of the 1980s in New Zealand saw marked changes in the structure of the economy, associated with widespread and well-documented market liberalisation (Evans et al. 1996). There was also a pronounced slowdown in growth, associated with a contraction in employment. It took ten years for employment to regain levels attained in early 1986, having declined by over 10% in the intervening period. Furthermore, the pattern of adjustment was spatially very uneven, with many smaller urban areas being particularly hard hit. Table 5 reports estimates separately for two time periods – 1981 to 1996, which includes the reform period, and 2001-2013, which was a period of overall growth, albeit with a sharp contraction around the global financial crisis in 2008-09. Each sub-period contains significant variation in migration flows, and hence in overall birthplace diversity. Annual net migration added more than 0.5% to the population in 1983, in 1994-96 and in 2003. In contrast, there was net annual emigration in 9 years between 1981 and 2013 (in 1981, 1985, 1986, 1988, 1989, 1999-2001 and in 2012) (Statistics New Zealand, n.d.).

Across all 110 urban areas, the effect of diversity on the local quality of business is positive in both periods, as shown in columns (1) and (4) of Table 5. The apparent strengthening of the effect from 0.113 to 0.139 is not, however, statistically significant. In contrast, the effect on quality of life becomes significantly more negative, dropping from 0.015 in 1981-1996, to -0.095 in 2001-2013. The remaining columns of the table show differences between main urban areas and other urban areas, in both the size of effects, and the changes over time.

In each sub-period, the QB effect of diversity is more strongly positive in main urban areas than in other urban areas. The estimated effect for main urban areas is 0.252 in the earlier period and 0.182 in the later period, although the change is not statistically significant. In smaller urban areas, the effects on QB are relatively small (-0.023 and 0.043). Whereas the positive QB effect of birthplace diversity was more strongly felt in the main urban areas than elsewhere, main urban areas experienced a stronger negative effect of birthplace diversity on the quality of life. The negative QL effect in main urban areas contrasts with the effect in other urban areas, which was positive and significant at the 1 percent level in 1981-96 (0.062) and negative, but insignificant at the 5 percent level, in 2001-2013.

The patterns are suggestive of decreasing productive returns to diversity over time – with smaller effects in the later period (when diversity is higher) in the main urban areas. The pattern of declining marginal consumption benefits of diversity are more consistent across time and cross-sectionally. Consumption disamenities become less positive, or more negative, over time, with the overall change being statistically significant, and the effects on QL are more strongly negative in larger cities, where diversity is higher.

5.4 Alternative diversity measures

Fractionalisation is only one of many plausible measures of birthplace diversity that could be used to estimate the impacts of diversity on local quality of life and quality of business. In practice, different measures show broadly similar patterns. Table 6 presents estimates using a range of alternative diversity measures. Column (1) reproduces our benchmark results of Table 3, column (5).

Column (2) of Table 6 examines whether the two components of birthplace fractionalisation (FR1: Majority share; and FR2: diversity among minority groups) have different effects on the quality of life and quality of business. This is achieved by including a second diversity measure in addition to the log of fractionalisation – namely, the proportion of fractionalisation that is due to diversity among minority groups (FR2/FR).[21] The added variable is treated as endogenous, and an instrument is constructed based on a decomposition of the FR instrument described in equation (16) into majority and minority components. The coefficients on this ratio show that the positive productive amenity effect and negative consumption amenity effect of birthplace diversity are each more pronounced when diversity within minority groups is a large component of diversity.

The third column of Table 6 presents estimates using the level of fractionalisation (FR) rather than its natural logarithm (lnFR) to capture birthplace diversity. The estimated effect on QL is more strongly negative (-0.052) and the effect on QB is insignificantly smaller (0.046) than in the preferred specification shown in the first column. This pattern reflects the fact that larger cities, and Auckland in particular, had greater numerical than proportional variation in diversity, as discussed at the beginning of this section.

The logged Hoover and Evenness indexes of diversity, as shown in equations (17) and (18) are highly correlated with fractionalisation (ρ of 0.959 and 0.999 respectively). Perhaps not surprisingly then, these indexes yield estimates of diversity impacts that are similar to those obtained from the fractionalisation index. These measures of diversity are negatively associated with QL, and positively associated with QB.

The Reynal-Querol index of polarisation (equation 19) captures an aspect of diversity different from that captured by the indexes in the first five columns of Table 6. The polarisation index is maximised when there are two equally-sized dominant groups. Overall, the RQ index is negatively correlated with fractionalisation (ρ=-0.856) since high fractionalisation reduces the likelihood of two large groups occurring. Polarisation has negative but relatively small impacts on both QL and QB, consistent with the interpretation of the RQ index as a measure of potential conflict, which lowers the attractiveness of an urban area to both businesses and residents.

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[21]. Two observations are lost because the largest birthplace group accounts for less than 50% of the population. The two observations are for Auckland and Queenstown in 2013.

5.5 Comparison with other dimensions of diversity

Our focus on birthplace diversity as the primary measure of local diversity is a pragmatic choice driven mainly by the greater consistency of birthplace coding in the census data we use. Another commonly used measure of local population diversity is based on diversity of ethnicities present in an area. As discussed in section 4.3, and shown in Figure 1, the variation in aggregate ethnic diversity measures over time in New Zealand is strongly affected by changes in concepts, questions, and definitions. Birthplace diversity and ethnic diversity are positively related (ρ=0.71) but capture different dimensions of diversity. Importantly, ethnic diversity captures diversity within the New Zealand-born population, in which Maori only and dual Maori/NZ European ethnicity account for 4.2 to 8.1 percent and 1.9 to 5 percent respectively (see Appendix Table 3). Additionally, second and third generation immigrants from non-traditional source countries are a growing component of the New Zealand born population. These ethnic diversity changes are not reflected in birthplace diversity measures.

Nevertheless, when measuring ethnic diversity in each urban area relative to the national average in each year, the estimated impact of ethnic diversity on QB is qualitatively similar to that of birthplace diversity. Table 7 reports a positive effect of ethnic diversity on QB (0.023 in column (2), compared with our benchmark birthplace diversity estimate of 0.055). The effect on QL (0.005) is, like the benchmark estimate of -0.013, very small but positive in the case of ethnic diversity.

A final measure of cultural diversity is religion. Column (3) of Table 7 presents the estimates of how religious diversity affect the local quality of life and quality of business. Religious diversity has a small effect on QL that is similar to that of ethnic diversity (but of opposite sign). The effect of religious diversity on the quality of business index is approximately zero. These findings may partly reflect the nature of measured religious diversity. Most of the variation is due to differences in the shares of mainstream Christian religious groups and those stating no religious affiliation, as shown in Appendix Table 4. In the New Zealand context, the range of diversity between these groups is limited.

6 Concluding remarks

We have estimated the impact that local cultural diversity has on the attractiveness of cities to businesses and to workers. The identification of impacts is based on the link between local diversity and the relative wage and rent premiums that exist between cities, as in Roback (1982) and Ottaviano & Peri (2006). More diverse cities have relative high wages and rents, so we infer that such cities must offer productivity advantages to firms, enabling them to be competitive despite the higher costs. For workers, the fact that the benefit of higher wage premiums in diverse cities slightly outweighs the higher rental costs implies that workers have a slight preference for more homogeneous cities. This finding is, however, weaker than the finding of productive effects, and is sensitive to the rental share of income that we assume.

Local population diversity thus affects the relative attractiveness of urban areas to business and to residents. Using birthplace fractionalisation as our main measure of cultural diversity, we have found that cultural diversity serves as a positive productive amenity, as reflected in firms' ability to pay higher wages and rents in more diverse areas. This finding echoes the findings of Ottaviano & Peri (2006, p.39) that "a more multicultural urban environment makes US-born citizens more productive". For residents, diversity acts as a negative consumption amenity, compensated for by higher wages and lower rents. The magnitude of estimated effects is substantial. A one standard deviation proportional rise in birthplace fractionalisation raises the attractiveness of an area to businesses by 0.055 – an impact comparable to increasing city size by 47%. The impact of diversity on attractiveness to residents (QL) is a decrease of -0.013, comparable to the impact of a 14% increase in city size. We conclude that diversity has a net positive effect on economic welfare, as long as QB is given at least 24 percent as much weight as QL.

The overall amenity effects of birthplace diversity on quality of life and quality of business are driven largely by the strength of effects in larger urban areas. The effects of diversity on both wages and rents are stronger in the three largest urban areas of Auckland, Wellington, and Christchurch. This finding is similar to that of Bakens et al. (2013) who find more pronounced impacts of diversity among the 25 largest cities in the Netherlands – all of which have populations in excess of 100,000. Only six New Zealand cities have mean population (1981-2013) larger than 100,000 (Appendix Table 1). Combining these wage and rent effects to estimate the effect of QL and QB, we find – as was shown in Table 4 – that birthplace diversity has its strongest positive productive amenity effect in larger cities (0.096), with a smaller positive effect in other main urban areas (0.053). Outside the main urban areas, there is only weak evidence of a positive productive effect of diversity (0.015). The difference in effects between larger and smaller urban areas are suggestive of increasing productive returns to diversity in relation to city size. However, the weakening of positive productive effects over time suggests decreasing marginal productive returns to diversity levels.

In contrast, birthplace diversity has its strongest effect as a negative consumption amenity in main urban areas outside of Auckland, Wellington, and Christchurch. In the largest cities, where diversity is highest, it is estimated to be only a weak negative consumption amenity, with the size of the effect small enough to be more than fully accounted for by cross-city differences in the housing expenditure share. In the largest and most diverse cities, the residents may locate where they can combine the consumptive benefits of cultural diversity in terms of goods and services in shopping precincts with the perceived cost of greater difficulty of interacting with those of their own background in their residential neighbourhood. Outside the main urban areas, the estimated impact of diversity on QL is small and positive (0.010, as shown in Table 4). Smaller urban areas have on average lower levels of birthplace diversity.

Both the positive production and negative consumption amenity effects are larger where diversity reflects birthplace diversity among minority groups rather than a low proportion of foreign-born residents *per se.* When minority fractionalisation is accounted for, overall fractionalisation has a small positive impact on the quality of life index and a larger positive impact on quality of business (Table 6). Diversity among minority groups (measured by the FR2/FR ratio) amplifies the impact on the quality of business index, but leads to a notable negative impact on the quality of life index.

There are various lines of inquiry along which the research reported in this paper can be developed further. Firstly, the simple Roback framework of spatial equilibrium was estimated under the assumption of homogeneity of the returns to human capital and housing attributes that determine the urban wage and rent premiums. If such returns vary spatially, the estimated premiums may be affected. There is also the possibility that there is heterogeneity in the weight that different population groups attach to urban amenities. For example, those with higher levels of education may value cultural diversity more than those with less education. Such effects lead to sorting of firms and residents across urban areas in a way that has not been accounted for in our estimates. However, Bakens & de Graaff (2018) find that – after accounting for heterogeneity of the population in the Netherlands – there is little evidence of spatial sorting across municipalities in terms of being influenced by immigrant share, immigrant diversity and the diversity of ethnic cuisine, at least for the majority of the population. Instead, the work by Bakens et al. (2018, 2013) suggests that locational choice *within* the city may be affected by cultural diversity in different ways. On the one hand individuals may value the consumptive benefit of diversity in goods and services generated by a culturally diversity population. On the other hand, the effects estimated in this paper suggest that they seek a residential location where their own group is relatively well represented among the population. Consequently, there is much scope for extending the present analysis by focussing on location within the larger, and therefore more culturally diverse, cities. In addition to dealing with heterogeneity and sorting effects, such an intra-urban location analysis of equilibrium wage and rent premiums would also need to take the impact of commuting behaviour into account.

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Table 1: Dominant amenity impact

	$\frac{\partial lnw_c}{\partial lnA_c} < 0$	$\frac{\partial lnw_c}{\partial lnA_c} > 0$
$\frac{\partial lnr_c}{\partial lnA_c} < 0$	Negative production amenity	Negative consumption amenity
$\frac{\partial lnr_c}{\partial lnA_c} > 0$	Positive consumption amenity	Positive production amenity

Table 2: Population and birthplace diversity variation across urban areas

	Pooled	**1981**	**2013**	**1981-2013 change**
		Weighted means		
Birthplace fractionalisation (FR)	0.434	0.341	0.555	0.187
	(0.161)	(0.112)	(0.156)	(0.064)
Majority fractionalisation (FR1)	0.360	0.304	0.426	0.108
	(0.099)	(0.088)	(0.071)	(0.032)
Minority fractionalisation (FR2)	0.074	0.036	0.129	0.078
	(0.067)	(0.025)	(0.088)	(0.063)
Ln(Birthplace fract.) (lnFR)	-0.908	-1.137	-0.631	0.452
	(0.397)	(0.360)	(0.298)	(0.134)
Raw wage premium	0.000	0.000	0.000	-0.009
	(0.093)	(0.066)	(0.092)	(0.071)
Raw rent premium	0.000	0.000	0.000	-0.041
	(0.208)	(0.140)	(0.197)	(0.139)
Population (000)	440.2	319.2	580.5	0.354
	(447.2)	(309.5)	(564.4)	(0.359)
		Unweighted means		
Birthplace fractionalisation (FR)	0.279	0.223	0.377	0.153
	(0.107)	(0.084)	(0.102)	(0.070)
Majority fractionalisation (FR1)	0.255	0.210	0.333	0.123
	(0.084)	(0.071)	(0.068)	(0.053)
Minority fractionalisation (FR2)	0.024	0.014	0.044	0.030
	(0.026)	(0.014)	(0.039)	(0.031)
Ln(Birthplace fract.) (lnFR)	-1.346	-1.560	-1.011	0.549
	(0.379)	(0.346)	(0.264)	(0.242)
Raw wage premium	-0.114	-0.057	-0.129	-0.072
	(0.107)	(0.101)	(0.112)	(0.121)
Raw rent premium	-0.295	-0.176	-0.293	-0.118
	(0.224)	(0.196)	(0.223)	(0.207)
Population (000)	28.0	24.2	32.8	0.235
	(107.5)	(84.9)	(134.6)	(0.657)

Note: Sample restricted to 110 urban areas within minimum population>1,000. Weighted estimates are weighted by the usually resident population in a city-year (weighted change measures are weighted by 1981 population). Population means are based on counts that are randomly rounded to base 3. Changes in population and premiums are measured as percentage changes. Fractionalisation change is measured as a difference. Standard deviations are given in parentheses.

Table 3: Regression estimates of the wage and rent impacts of diversity

	Raw wages and rents (OLS)	Residual wages and rents (OLS)	Residual wages and rents (OLS)	Residual wages and rents with city FE (OLS)	**Residual wages and rents with city FE (IV)**
	(1)	(2)	(3)	(4)	**(5)**
			(a) Wage Equations		
Birthpl. fract. (std. lnFR)	0.074***	0.064***	0.057***	0.033***	0.040***
	(0.003)	(0.002)	(0.003)	(0.005)	(0.007)
Ln(population)			0.006***	0.129***	0.127***
			(0.002)	(0.008)	(0.008)
Employment growth			-0.292***	-0.112**	-0.121***
			(0.074)	(0.044)	(0.045)
R^2 wage equations	0.489	0.661	0.672	0.920	0.920
			(b) Rent Equations		
Birthpl. fract. (std. lnFR)	0.215***	0.208***	0.139***	0.143***	0.134***
	(0.004)	(0.004)	(0.006)	(0.014)	(0.021)
Ln(population)			0.037***	0.141***	0.143***
			(0.003)	(0.024)	(0.025)
Employment growth			0.712***	0.027	0.039
			(0.146)	(0.132)	(0.133)
R^2 rent equations	0.825	0.815	0.851	0.919	0.919
Observations	770	770	770	770	770
Change in QL	**-0.031*** **	**-0.022*** **	**-0.029*** **	**-0.005* **	**-0.013*** **
	(0.003)	**(0.002)**	**(0.003)**	**(0.004)**	**(0.007)**
Change in QB	**0.097*** **	**0.087*** **	**0.072*** **	**0.049*** **	**0.055*** **
	(0.003)	**(0.002)**	**(0.003)**	**(0.006)**	**(0.008)**
Fixed effects	Year	Year	Year	City, year	City, year
UnderID					42.1
UnderID_p					0.00
WeakID					239.0
W: Endogeneity (p-val)					0.29
R: Endogeneity (p-val)					0.62

Notes: Each column contains weighted regression estimates from jointly estimated second stage wage and rent regressions. Changes in QL and QB resulting from a one standard deviation increase in the natural logarithm of birthplace fractionalisation are estimated as linear combinations of coefficients, as in equations (9) and (10). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Sample restricted to 110 urban areas within minimum population>1,000. The instrument in the IV regression in column (5) is based on FR_{ct}^{IV} as defined in equation (20). Underidentification test uses the Kleibergen-Paap LM test statistic. The weak identification test uses the Kleibergen-Paap F statistic. Endogeneity tests are based on the difference between two Sargan-Hansen statistics.

Table 4: Differences between urban areas in the wage and rent impacts of diversity

	Urban areas with min(pop)> 1,000	Akld, Wgtn, Chch only	Main urban areas excl Akld, Wgtn, Chch	Excluding Main urban areas
	(n=110)	(n=3)	(n=14)	(n=93)
	(1)	(2)	(3)	(4)
		(a) Wage Equations		
Birthpl. fract. (std. lnFR)	0.040***	0.065**	0.058***	0.006
	(0.007)	(0.028)	(0.017)	(0.008)
Ln(population)	0.127***	0.067	0.104***	0.113***
	(0.008)	(0.045)	(0.014)	(0.010)
Employment growth	-0.121***	-0.177	0.269**	-0.061
	(0.045)	(0.251)	(0.118)	(0.040)
R^2 wage equations	0.920	0.954	0.920	0.789
		(b) Rent Equations		
Birthpl. fract. (std. lnFR)	0.134***	0.280***	-0.051	0.079***
	(0.021)	(0.045)	(0.071)	(0.019)
Ln(population)	0.143***	-0.255***	0.267***	0.281***
	(0.025)	(0.072)	(0.059)	(0.023)
Employment growth	0.039	0.366	0.254	0.613***
	(0.133)	(0.398)	(0.487)	(0.092)
R^2 rent equations	0.919	0.981	0.762	0.850
Observations	770	21	98	651
Change in QL	**-0.013*** **	**-0.009***	**-0.069*** **	**0.010***
	(0.007)	**(0.028)**	**(0.021)**	**(0.008)**
Change in QB	**0.055*** **	**0.096*** **	**0.053*** **	**0.015***
	(0.008)	**(0.030)**	**(0.020)**	**(0.009)**
Fixed effects	City, year	City, year	City, year	City, year
UnderID	42.1	5.3	16.4	85.0
UnderID_p	0.00	0.02	0.00	0.00
WeakID	239.0	62.8	49.2	162.1
W: Endogeneity (p-val)	0.29	0.51	0.65	0.43
R: Endogeneity (p-val)	0.62	0.30	0.03	0.85

Note: Each column contains weighted regression estimates from jointly estimated second stage wage and rent regressions. Changes in QL and QB resulting from a one standard deviation increase in the natural logarithm of birthplace fractionalisation are estimated as linear combinations of coefficients, as in equations (9) and (10). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Sample restricted to 110 urban areas within minimum population>1,000. Column (1) reproduces the IV results of Table 3, column (5). All other regressions are also by means of IV, using the instrument based on FR_{ct}^{IV} as defined in equation (20). Underidentification test uses the Kleibergen-Paap LM test statistic. The weak identification test uses the Kleibergen-Paap F statistic. Endogeneity tests are based on the difference between two Sargan-Hansen statistics.

Table 5: Period differences in the wage and rent impacts of diversity – by type of urban area

	Urban areas with min(pop)> 1,000 (n=110)	Main urban areas (n=17)	Excluding Main urban areas (n=93)	Urban areas with min(pop)> 1,000 (n=110))	Main urban areas (n=17)	Excluding Main urban areas (n=93)
		1981-1996			2001-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
				(a) Wage Equations		
Birthpl. Fr. (std. lnFR)	0.067***	0.180***	-0.037	0.124***	0.167***	0.032
	(0.023)	(0.068)	(0.023)	(0.014)	(0.024)	(0.027)
Ln(population)	0.205***	0.241***	0.153***	-0.016	-0.058	0.087***
	(0.017)	(0.057)	(0.017)	(0.022)	(0.044)	(0.021)
Employment growth	-0.213***	-0.542**	-0.044	0.177**	-0.093	0.521***
	(0.054)	(0.211)	(0.046)	(0.085)	(0.147)	(0.103)
R^2 wage equations	0.915	0.912	0.848	0.973	0.989	0.904
				(b) Rent Equations		
Birthpl. Fr. (std. lnFR)	0.414***	0.657***	0.126**	0.143***	0.134**	0.097**
	(0.080)	(0.210)	(0.056)	(0.027)	(0.057)	(0.049)
Ln(population)	0.324***	0.489***	0.145***	-0.098**	-0.295***	0.205***
	(0.060)	(0.176)	(0.042)	(0.041)	(0.102)	(0.038)
Employment growth	-0.472**	-1.746***	0.347***	0.132	-0.287	0.952***
	(0.189)	(0.651)	(0.113)	(0.158)	(0.344)	(0.189)
R^2 rent equations	0.911	0.902	0.850	0.985	0.987	0.966
Observations	440	68	372	330	51	279
Change in QL	**0.015***	**-0.048***	**0.062*****	**-0.095*****	**-0.140*****	**-0.013***
	(0.019)	**(0.052)**	**(0.024)**	**(0.013)**	**(0.024)**	**(0.023)**
Change in QB	**0.113*****	**0.252*****	**-0.023***	**0.139*****	**0.182*****	**0.043***
	(0.029)	**(0.085)**	**(0.024)**	**(0.016)**	**(0.027)**	**(0.030)**
Fixed effects	City, year	City, year	City, year	City, year	City, year	City, year
UnderID	26.4	8.4	17.1	17.8	8.0	11.2
UnderID_p	0.00	0.00	0.00	0.00	0.00	0.00
WeakID	34.7	11.5	17.6	35.3	19.5	8.8
W: Endogeneity (p-val)	0.20	0.05	0.08	0.00	0.00	0.93
R: Endogeneity (p-val)	0.02	0.06	0.36	0.79	0.28	0.89

Note: Each column contains weighted regression estimates from jointly estimated second stage wage and rent regressions. Changes in QL and QB resulting from a one standard deviation increase in the natural logarithm of birthplace fractionalisation are estimated as linear combinations of coefficients, as in equations (9) and (10). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Sample restricted to 110 urban areas within minimum population>1,000. All regressions are IV, using the instrument based on FR_{ct}^{IV} as defined in equation (20). Underidentification test uses the Kleibergen-Paap LM test statistic. The weak identification test uses the Kleibergen-Paap F statistic. Endogeneity tests are based on the difference between two Sargan-Hansen statistics.

Table 6: Regression estimates of the wage and rent impacts of diversity – alternative diversity measures

	Std. Log Fractiona-lisation Index (std.lnFR)	Overall & Minority Fractiona-lisation (std.lnFR& (std. FR2/FR)	Fractiona-lisation Index (std.FR)	Log Hoover Index (std.lnHO)	Log Evenness Index (std.lnEI)	Log Polarisa-tion index (std.lnRQ)
	(1)	(2)	(3)	(4)	(5)	(6)
			(a) Wage Equations			
Diversity Index	0.040***	0.018***	0.048***	0.039***	0.029***	-0.002
	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.002)
Minority (FR2 / FR)		0.538***				
		(0.047)				
Ln(population)	0.127***	0.077***	0.074***	0.109***	0.137***	0.139***
	(0.008)	(0.010)	(0.012)	(0.009)	(0.008)	(0.010)
Employment growth	-0.121***	-0.209***	-0.106**	-0.093**	-0.110**	-0.072
	(0.045)	(0.041)	(0.043)	(0.044)	(0.045)	(0.045)
R^2 wage equations	0.920	0.933	0.923	0.923	0.919	0.915
			(b) Rent Equations			
Diversity Index	0.134***	0.144***	-0.019	0.105***	0.135***	-0.049***
	(0.021)	(0.021)	(0.021)	(0.019)	(0.018)	(0.005)
Minority (FR2 / FR)		-0.460***				
		(0.153)				
Ln(population)	0.143***	0.257***	0.191***	0.097***	0.181***	0.289***
	(0.025)	(0.034)	(0.037)	(0.027)	(0.024)	(0.028)
Employment growth	0.039	-0.037	0.228	0.150	0.023	0.145
	(0.133)	(0.132)	(0.140)	(0.130)	(0.132)	(0.131)
R^2 rent equations	0.919	0.919	0.907	0.920	0.920	0.919
Observations	770	768	770	770	770	770
		ln(FR)				
Change in QL	**-0.013*** **	**0.011** **	**-0.052*** **	**-0.018*** **	**-0.002* **	**-0.008*** **
	(0.007)	**(0.006)**	**(0.006)**	**(0.006)**	**(0.006)**	**(0.002)**
Change in QB	**0.055*** **	**0.034*** **	**0.046*** **	**0.051*** **	**0.044*** **	**-0.007*** **
	(0.008)	**(0.008)**	**(0.008)**	**(0.007)**	**(0.007)**	**(0.002)**
		ln(FR2/FR)				
Change in QL		**-0.630*** **				
		(0.043)				
Change in QB		**0.486*** **				
		(0.057)				
Fixed effects	City, year	City, year	City, year	City, year	City, year	City, year
UnderID	42.1	40.5	33.5	46.6	46.9	20.0
UnderID_p	0.00	0.00	0.00	0.00	0.00	0.00
WeakID	239.0	113.0	233.6	253.2	279.5	1869.0
W: Endog (p-val)	0.29	0.66	0.88	0.87	0.46	0.85
R: Endog (p-val)	0.62	0.20	0.01	0.08	0.97	0.48

Note: Each column contains weighted regression estimates from jointly estimated second stage wage and rent regressions. Changes in QL and QB resulting from a one standard deviation increase in the diversity measure are estimated as linear combinations of coefficients, as in equations (9) and (10). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Sample restricted to 110 urban areas within minimum population>1,000. Column (1) reproduces the IV results of Table 3, column (5). All regressions are IV using the instrument based on FR_{ct}^{IV} as defined in equation (20). Underidentification test uses the Kleibergen-Paap LM test statistic. The weak identification test uses the Kleibergen-Paap F statistic. Endogeneity tests are based on the difference between two Sargan-Hansen statistics.

Table 7: Regression estimates of the wage and rent impacts of diversity – birthplace, ethnic and religious diversity

	Birthplace Diversity (1)	Ethnic Diversity (2)	Religious Diversity (3)
		(a) Wage Equations	
Standardized lnFR	0.040***	0.013***	0.002
	(0.007)	(0.004)	(0.003)
Ln(population)	0.127***	0.131***	0.135***
	(0.008)	(0.008)	(0.008)
Employment growth	-0.121***	-0.078*	-0.068
	(0.045)	(0.045)	(0.046)
R^2 wage equations	0.920	0.917	0.915
		(b) Rent Equations	
Standardized lnFR	0.134***	0.088***	-0.022***
	(0.021)	(0.011)	(0.008)
Ln(population)	0.143***	0.140***	0.165***
	(0.025)	(0.025)	(0.026)
Employment growth	0.039	0.157	0.203
	(0.133)	(0.134)	(0.139)
R^2 rent equations	0.919	0.914	0.908
Observations	770	770	770
Change in QL	**-0.013*** **	**0.005***	**-0.006*** **
	(0.007)	**(0.003)**	**(0.002)**
Change in QB	**0.055*** **	**0.023*** **	**0.000**
	(0.008)	**(0.004)**	**(0.003)**
Fixed effects	City, year	City, year	City, year
UnderID	42.1	49.9	36.4
UnderID_p	0.00	0.00	0.00
WeakID	239.0	446.8	165.0
W: Endogeneity (p-val)	0.29	0.56	0.14
R: Endogeneity (p-val)	0.62	0.04	0.19

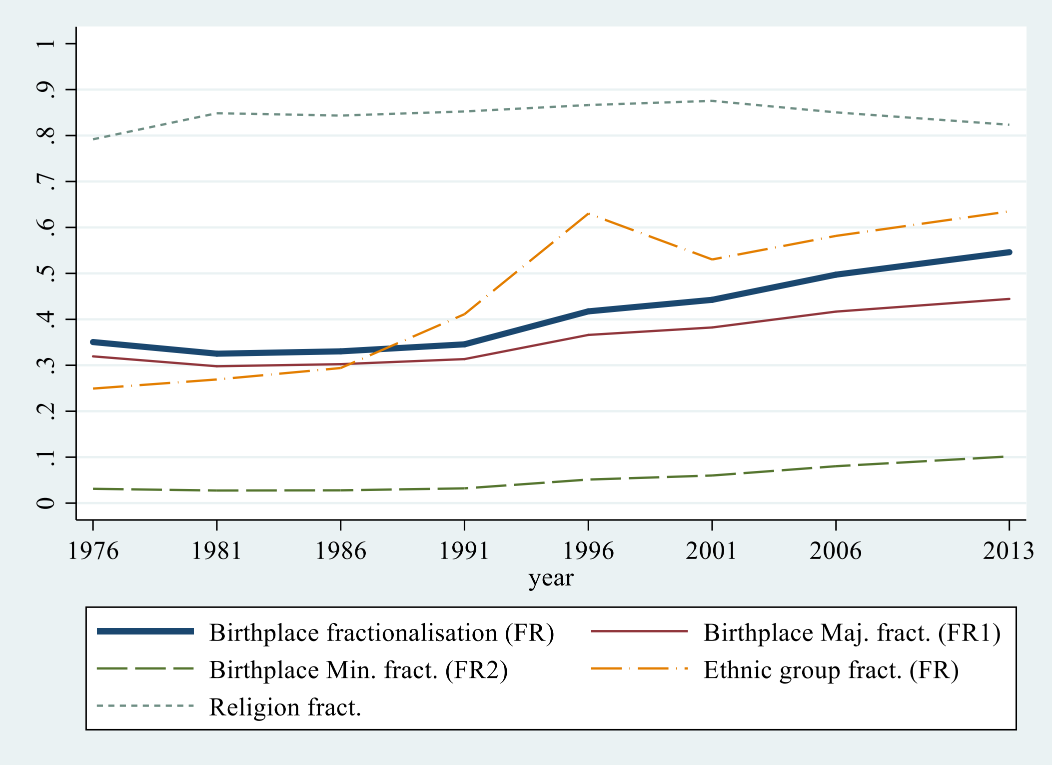
Note: Each column contains weighted regression estimates from jointly estimated second stage wage and rent regressions. Changes in QL and QB resulting from a one standard deviation increase in the diversity measure are estimated as linear combinations of coefficients, as in equations (9) and (10). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Sample restricted to 110 urban areas within minimum population>1,000. Column (1) reproduces the IV results of Table 3, column (5). All regressions are IV using the instrument based on FR_{ct}^{IV} as defined in equation (20). Underidentification test uses the Kleibergen-Paap LM test statistic. The weak identification test uses the Kleibergen-Paap F statistic. Endogeneity tests are based on the difference between two Sargan-Hansen statistics.

Table 8: Sensitivity of estimates to choice of cost and expenditure share parameters (γ and α)

Parameter choice	Change in QL(choice of α)	Change in QB(choice of γ)
0.05	-0.033***	0.047***
	(0.007)	(0.008)
0.10	-0.027***	**0.055*** **
	(0.006)	**(0.008)**
0.15	-0.020***	0.064***
	(0.006)	(0.009)
0.20	**-0.013*** **	0.074***
	(0.007)	(0.010)
0.25	-0.006*	0.085***
	(0.007)	(0.012)
0.30	0.000*	0.098***
	(0.007)	(0.013)
0.35	0.007*	0.112***
	(0.008)	(0.015)
0.40	0.014*	0.130***
	(0.008)	(0.018)

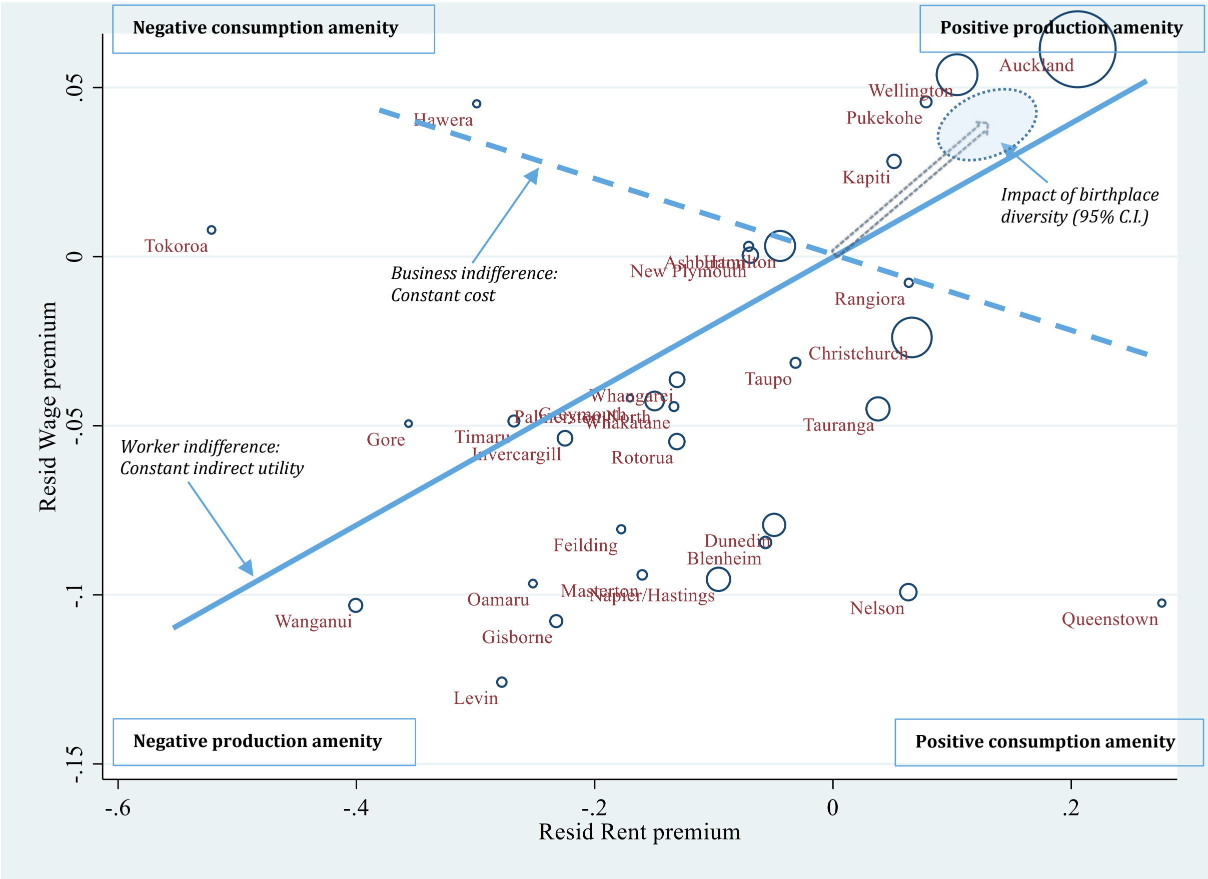
Note: these estimates of the effects of cultural diversity on QL and QB are based on the IV regressions reported in Table 3, column (5). The change in QL for a one standard deviation increase in lnFR is calculated as (0.134α – 0.040) and the change in QB for a one standard deviation increase in lnFR is calculated as ($0.134 \frac{\gamma}{1-\gamma}$ + 0.040).

Figure 1: National changes in cultural diversity



Note: The displayed national measures of fractionalisation are population-weighted averages across 110 urban areas.

Figure 2: Wage and rent premiums (2013)



Note: The figure shows only a subset of the 110 urban areas used for estimation – namely, the 28 urban areas that ever had population greater than 10,000 between 1981 and 2013. The size of the circles are proportional to the urban areas' population. The figure displays demeaned a^W_{c2013} and a^R_{c2013}, as calculated in the first stage regressions of individual wages and dwelling rents, specified in equations (11) and (12) respectively. The worker indifference (i.e. constant indirect utility) line is lnw = 0.2 lnr, i.e. QL=0. The business indifference (i.e. constant cost) line is lnw = –0.11 lnr, i.e. QB=0. The dashed arrow shows the impact of diversity, based on the lnFR coefficients from our preferred specification (Table 3, Column (5)).

Appendix

Appendix Table 1: Descriptive statistics by urban area (110 urban areas with min(pop)>1000)

Urban area	Mean (1981-2013)				Change between 1981 and 2013			
	Pop. (000)	FR	Wage prem	Rent prem	Pop growth	FR change	Wprem change	Rprem change
Auckland	1,013.0	0.600	0.065	0.249	69%	0.27	0.04	0.07
Wellington	339.4	0.486	0.075	0.158	17%	0.13	-0.02	0.02
Christchurch	321.6	0.365	-0.032	0.038	22%	0.18	0.00	0.11
Hamilton	161.1	0.361	-0.006	-0.009	54%	0.22	0.01	-0.08
Napier/Hastings	112.3	0.316	-0.075	-0.085	14%	0.14	-0.06	-0.03
Dunedin	109.5	0.320	-0.068	-0.051	5%	0.16	-0.06	0.00
Tauranga	88.0	0.348	-0.046	0.047	116%	0.16	-0.01	-0.03
Palmerston North	71.2	0.332	-0.026	-0.033	19%	0.18	-0.03	-0.19
Rotorua	50.6	0.341	-0.017	-0.017	15%	0.20	-0.08	-0.19
Invercargill	50.3	0.211	-0.032	-0.170	-11%	0.10	-0.08	-0.28
Nelson	50.2	0.336	-0.088	0.053	43%	0.14	-0.02	0.02
New Plymouth	47.7	0.299	-0.017	-0.071	20%	0.16	0.03	-0.01
Whangarei	45.0	0.338	-0.024	-0.069	22%	0.16	-0.01	-0.12
Wanganui	39.7	0.276	-0.061	-0.242	-3%	0.11	-0.09	-0.28
Gisborne	32.1	0.264	-0.096	-0.176	2%	0.15	-0.06	-0.12
Kapiti	30.6	0.440	0.033	0.060	94%	0.06	0.00	-0.01
Timaru	27.9	0.205	-0.060	-0.224	-8%	0.12	-0.02	-0.13
Blenheim	25.3	0.255	-0.106	-0.095	33%	0.18	0.00	0.04
Masterton	19.7	0.246	-0.075	-0.214	3%	0.11	-0.06	-0.02
Levin	19.0	0.318	-0.071	-0.214	6%	0.13	-0.10	-0.13
Pukekohe	18.7	0.361	0.015	-0.021	97%	0.26	0.07	0.22
Taupo	18.7	0.341	-0.010	-0.019	48%	0.14	-0.08	-0.07
Whakatane	16.7	0.324	-0.015	-0.095	20%	0.14	-0.05	-0.10
Tokoroa	16.7	0.421	0.085	-0.275	-35%	0.01	-0.10	-0.44
Ashburton	16.1	0.201	-0.053	-0.227	20%	0.18	0.04	0.14
Oamaru	13.5	0.217	-0.096	-0.306	-8%	0.20	-0.04	-0.05
Feilding	13.4	0.222	-0.052	-0.167	21%	0.10	-0.09	-0.05
Hawera	11.3	0.218	-0.001	-0.312	-3%	0.09	0.05	-0.09
Gore	10.8	0.159	-0.071	-0.354	-20%	0.11	-0.07	-0.19
Rangiora	10.6	0.252	-0.048	-0.071	94%	0.18	0.04	0.25
Greymouth	10.4	0.200	-0.076	-0.221	-13%	0.15	0.02	-0.12
Queenstown	8.1	0.541	-0.049	0.270	278%	0.41	-0.06	-0.03
Kawerau	7.8	0.346	0.097	-0.296	-28%	0.02	-0.26	-0.25
Huntly	7.0	0.309	-0.029	-0.339	-3%	0.08	-0.11	-0.05
Thames	6.6	0.270	-0.047	-0.132	4%	0.17	-0.04	-0.19
Motueka	6.5	0.298	-0.210	-0.126	38%	0.17	0.04	0.01
Waitara	6.5	0.187	-0.068	-0.217	5%	0.12	-0.08	-0.08
Te Puke Community	6.3	0.305	-0.084	-0.146	43%	0.32	-0.11	-0.05
Waiheke Island	6.3	0.542	-0.082	0.016	167%	0.06	0.18	0.47
Waiuku	6.2	0.428	0.061	0.011	115%	0.14	0.04	0.18
Morrinsville	6.0	0.260	-0.006	-0.195	30%	0.13	0.04	0.01
Matamata	6.0	0.265	-0.022	-0.184	31%	0.17	0.00	0.12

Urban area	Mean (1981-2013) Pop. (000)	FR	Wage prem	Rent prem	Change between 1981 and 2013 Pop growth	FR change	Wprem change	Rprem change
Taumarunui	5.9	0.206	-0.082	-0.415	-31%	0.12	-0.16	-0.34
Dannevirke	5.6	0.203	-0.058	-0.378	-12%	0.12	-0.09	-0.08
Stratford	5.5	0.205	-0.069	-0.403	-4%	0.14	0.04	0.00
Otaki	5.2	0.348	-0.072	-0.223	29%	0.14	-0.01	-0.08
Marton	5.1	0.253	-0.081	-0.354	-13%	0.15	-0.11	-0.20
Wairoa	4.9	0.198	-0.083	-0.416	-26%	0.09	-0.15	-0.35
Kaitaia	4.9	0.300	-0.078	-0.218	9%	0.25	-0.05	-0.25
Te Kuiti	4.6	0.226	-0.064	-0.359	-13%	0.16	-0.13	-0.20
Kerikeri	4.6	0.505	-0.100	0.034	150%	0.15	0.02	-0.14
Dargaville	4.5	0.251	-0.109	-0.315	-9%	0.19	-0.07	-0.17
Alexandra	4.5	0.179	-0.093	-0.147	13%	0.10	-0.07	-0.05
Westport	4.4	0.202	-0.101	-0.319	-13%	0.13	0.07	0.09
Balclutha	4.4	0.200	-0.053	-0.329	-17%	0.09	-0.04	-0.18
Waihi	4.4	0.316	-0.132	-0.266	18%	0.10	-0.03	0.00
Foxton Community	4.3	0.263	-0.083	-0.355	11%	0.05	-0.02	-0.18
Turangi	4.2	0.278	-0.021	-0.552	-46%	0.08	-0.34	-0.22
Carterton	4.2	0.253	-0.118	-0.281	15%	0.16	-0.05	-0.03
Putaruru	4.1	0.275	-0.009	-0.311	-13%	0.10	-0.06	-0.17
Wanaka	4.0	0.374	-0.122	0.029	414%	0.28	-0.02	0.12
Kaikohe	4.0	0.261	-0.105	-0.311	3%	0.23	-0.05	-0.18
Paeroa	4.0	0.229	-0.073	-0.283	-1%	0.13	-0.08	-0.12
Opotiki	4.0	0.243	-0.137	-0.335	8%	0.19	-0.14	-0.16
Temuka	3.9	0.181	-0.063	-0.358	6%	0.09	0.03	0.02
Waipukurau	3.9	0.199	-0.092	-0.281	-1%	0.08	-0.12	-0.07
Te Aroha	3.7	0.282	-0.037	-0.292	9%	0.19	0.00	0.11
Picton	3.7	0.297	-0.125	-0.084	26%	0.20	-0.08	-0.11
Hokitika	3.7	0.172	-0.068	-0.226	-11%	0.14	-0.02	-0.04
Twizel Community	3.3	0.261	0.042	-1.043	-73%	0.23	-0.33	1.15
Whangamata	3.2	0.327	-0.184	-0.205	128%	0.03	0.07	-0.09
Waimate	3.1	0.178	-0.131	-0.548	-19%	0.17	-0.01	0.09
Cromwell	3.1	0.224	-0.077	-0.197	79%	0.18	-0.17	0.15
Inglewood	3.1	0.224	-0.059	-0.272	13%	0.13	-0.06	0.12
Whitianga	3.1	0.365	-0.182	-0.108	157%	0.12	0.01	0.00
Katikati Community	2.9	0.407	-0.149	-0.157	138%	0.29	-0.10	0.11
Warkworth	2.7	0.391	-0.039	0.004	119%	0.24	-0.01	0.24
Pahiatua	2.7	0.186	-0.029	-0.441	-15%	0.16	-0.02	-0.08
Otorohanga	2.6	0.208	-0.071	-0.384	-6%	0.15	0.04	-0.08
Lincoln	2.5	0.471	-0.053	0.040	183%	0.04	0.06	0.17
Featherston	2.4	0.334	-0.088	-0.338	-11%	0.13	-0.02	-0.01
Murupara	2.4	0.143	-0.042	-0.632	-45%	0.21	-0.21	-0.24
Bluff	2.4	0.199	-0.079	-0.407	-37%	0.09	-0.08	-0.33
Raglan	2.3	0.358	-0.121	-0.187	93%	0.19	0.12	0.27
Taihape	2.2	0.188	-0.064	-0.510	-42%	0.11	-0.07	-0.29
Eltham	2.2	0.191	-0.031	-0.509	-19%	0.15	0.04	0.09
Geraldine	2.2	0.217	-0.098	-0.421	8%	0.22	0.07	0.14

Urban area	Mean (1981-2013) Pop. (000)	FR	Wage prem	Rent prem	Change between 1981 and 2013 Pop growth	FR change	Wprem change	Rprem change
Winton	2.1	0.147	-0.059	-0.406	6%	0.12	0.05	-0.07
Kaikoura	2.1	0.239	-0.108	-0.225	-5%	0.22	-0.07	-0.03
Milton	2.1	0.169	-0.070	-0.451	-15%	0.07	-0.05	-0.12
Helensville	2.1	0.358	-0.045	-0.053	70%	0.21	0.11	0.13
Greytown	2.0	0.307	-0.065	-0.329	17%	0.10	0.10	0.12
Waipawa	1.9	0.227	-0.128	-0.388	10%	0.16	-0.08	-0.09
Moerewa	1.8	0.191	-0.119	-0.378	-31%	0.32	-0.13	0.00
Bulls	1.8	0.267	-0.033	-0.419	-20%	0.04	-0.05	-0.20
Edgecumbe	1.8	0.240	0.030	-0.202	-17%	0.06	-0.11	-0.15
Waihi Beach	1.7	0.273	-0.103	-0.195	43%	0.06	0.07	0.10
Te Anau	1.7	0.313	-0.063	-0.197	24%	0.18	-0.15	-0.33
Riverton	1.7	0.167	-0.146	-0.485	-19%	0.09	-0.08	-0.27
Wellsford	1.7	0.262	-0.050	-0.208	3%	0.26	0.01	0.25
Opunake	1.6	0.192	-0.085	-0.559	-25%	0.13	-0.02	-0.05
Patea	1.6	0.190	-0.140	-0.680	-45%	0.20	0.01	-0.39
Paihia	1.6	0.468	-0.130	0.040	53%	0.30	0.02	-0.35
Woodville	1.5	0.205	-0.081	-0.479	-15%	0.20	-0.05	-0.07
Shannon	1.5	0.220	-0.100	-0.512	-17%	0.14	-0.06	-0.05
Kawakawa	1.5	0.263	-0.086	-0.286	-22%	0.23	-0.11	-0.30
Martinborough	1.4	0.277	-0.099	-0.381	7%	0.21	0.04	0.25
Darfield	1.4	0.241	-0.046	-0.265	67%	0.14	0.04	0.22
Takaka	1.2	0.255	-0.094	-0.280	2%	0.24	-0.06	0.09
Raetihi	1.2	0.145	-0.096	-0.456	-20%	0.03	-0.19	-0.22

Note: Wage and rent premiums are city-year fixed effects estimates obtained from a first-stage regression: (a_{ct}^{W} and a_{ct}^{R} as shown in equations 11 and 12).

Appendix Table 2: Broad country of birth groupings

	1981	1986	1991	1996	2001	2006	2013
New Zealand	80.4%	80.1%	79.2%	74.5%	72.7%	68.5%	64.6%
England	7.5%	8.1%	7.3%	6.4%	6.0%	5.9%	5.8%
China, People's Republic				0.7%	1.4%	2.7%	3.0%
India						1.4%	2.2%
Scotland	1.8%	1.6%	1.4%	1.1%	1.0%	0.9%	
Samoa	1.1%	1.4%	1.7%	1.6%	1.7%	1.7%	1.6%
Fiji	0.0%	0.0%	0.6%	0.7%	0.9%	1.2%	1.7%
Australia	1.6%	1.5%	1.4%	1.4%	1.5%	1.6%	1.4%
South Africa					0.8%	1.2%	1.5%
United Kingdom (nfd)	1.1%						
Philippines							1.0%
Netherlands	0.9%	0.9%	0.9%	0.8%	0.7%		
Cook Islands	0.6%	0.6%	0.6%				
North-West Europe (nfd)		0.4%					
Remainder	4.6%	4.6%	5.9%	8.0%	9.4%	10.4%	11.1%
Not Stated	0.5%	0.7%	1.0%	4.6%	3.9%	4.5%	6.2%

Note: ordered by maximal share

Appendix Table 3: Broad ethnicity groupings

	1981	1986	1991	1996	2001	2006	2013
New Zealand European	85.0%	83.3%	75.2%	58.2%	66.3%	61.8%	56.9%
Māori	4.2%	7.6%	8.1%	6.4%	6.9%	6.6%	6.0%
Other single ethnicity	1.2%	1.2%	2.4%	8.0%	3.6%	4.4%	3.7%
Dual: NZEur/Maori	5.0%	1.9%	1.8%	3.0%	3.5%	3.8%	4.5%
English			1.8%	5.0%	0.9%	1.0%	0.9%
Chinese nfd	0.6%	0.7%	1.3%	2.0%	2.9%	3.9%	4.2%
Indian nfd	0.3%	0.4%	0.8%		1.6%	2.5%	3.6%
Samoan	1.0%	1.5%	2.0%	1.8%	2.2%	2.3%	2.3%
Dual: NZ Eur/English				1.9%			
Scottish				0.9%			
Other European			0.4%		0.5%	0.7%	0.8%
Cook Islands Maori nfd	0.6%	0.8%					
New Zealander		0.6%					
European nfd					0.5%	0.5%	0.6%
Other European			0.4%		0.3%	0.3%	0.3%
Tongan		0.3%					
Other Ethnicity nec	0.3%						
Chinese						0.2%	0.2%
Not Stated	1.3%	1.2%	0.8%	4.2%	3.9%	3.9%	5.3%
Remainder	0.5%	0.5%	4.9%	8.6%	7.0%	8.0%	10.7%

Note: ordered by maximal share

Appendix Table 4: Broad religion groupings

	1981	1986	1991	1996	2001	2006	2013
No religion	13.4%	21.7%	25.4%	30.0%	36.3%	39.4%	45.7%
Anglican	26.6%	25.4%	22.8%	18.5%	15.9%	14.0%	11.2%
Presbyt, Congreg & Reform	16.6%	18.7%	17.0%	13.7%	11.6%	10.1%	8.1%
Catholic	14.0%	15.3%	14.9%	13.3%	12.7%	12.5%	11.6%
Methodist	4.9%	5.1%	4.5%	3.7%	3.2%	3.0%	2.5%
Christian nfd		1.1%		4.8%	4.0%	4.0%	4.6%
Other Christian	3.1%						
Other single religion					2.8%	2.5%	1.8%
Jehovah's Witnesses			2.6%				
Hindu						1.8%	2.4%
Baptist	1.7%	2.2%	2.2%	1.5%			
Pentecostal		1.2%		1.8%	1.7%	1.9%	1.8%
Latter-day Saints			1.3%				
Don't Know	1.1%						
Object to answering	15.0%	7.8%	7.6%	7.2%	6.3%	0.0%	0.0%
Not Stated	3.6%	1.6%	1.6%	5.6%	5.5%	10.8%	10.2%

Note: ordered by maximal share

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