Motu

Amenities and the attractiveness of New Zealand cities

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Disclaimer

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Abstract

We analyse which factors attract people and firms (and hence jobs) to different settlements across New Zealand. Using theoretically consistent measures derived within the urban economics literature, we compile quality of life and quality of business indicators for 130 'cities' (settlements) from 1976 to 2013, using census rent and wage data. Our analyses both include and exclude the three largest cities (Auckland, Wellington, Christchurch). Places that are attractive to live in tend to be sunny, dry and near water (i.e. the sea or a lake). Since the mid-1990s, attractive places have also had relatively high shares of the workforce engaged in education and (to a lesser extent) health. Attractive places have high employment shares in the food, accommodation, arts and recreation service sectors; however (unlike for education and health) we find no evidence that quality of life is related to changes in employment share for these sectors. The quality of business is highest in larger cities, and this relationship is especially strong when the country's three largest cities are included in the analysis.

JEL codes

R11, R12, R23

Keywords

Amenities; quality of life; quality of business; rents; wages; New Zealand; settlements

Summary haiku

People like to be
dry and sunny, by the sea,
but firms like cities.

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1 Introduction

Which factors attract people (and jobs) to certain cities?[1,2] Not only is this question of relevance to local policy-makers and planners, but it is also important for households and individuals when choosing a place to live. To address this question, we derive theory-based measures of location-attractiveness of New Zealand cities from the perspectives of households and of firms, denoted in the literature as indicators of *quality of life* (QL) and *quality of business* (QB), respectively (Gabriel and Rosenthal 2004; Chen and Rosenthal 2008). We construct a panel of QL and QB measures using New Zealand census data from 1976-2013.[3] We then analyse the relationship between each of these measures and various local natural and social attributes. While our focus is on 127 'second-tier' and 'third-tier' settlements, excluding the three largest cities (Auckland, Wellington, and Christchurch), for completeness we also present results that include these three larger cities.

The QL and QB measures reflect the willingness to pay of workers and firms, respectively, for a city's local amenities. Equations for these measures are derived from economic models that invoke a spatial equilibrium condition (Roback 1982, 1988), which requires that, in the long-run, the indirect utility of (identical) workers and profits of (identical) firms are equalised across cities. If the spatial equilibrium condition did not hold, then workers or firms would be able to gain by relocating to a different city. One implication of these models is that workers will accept relatively high rents and low wages to live in relatively attractive places. Similarly, firms are prepared to pay higher costs—in terms of wages and rents—to operate in cities with a strong business environment. Accordingly, the implicit willingness to pay of workers and of firms (QL and QB) for a city's amenities can be derived as functions of the local wages and rents.

In practice, calculating QL and QB first requires that we estimate quality-adjusted measures of wages and rents for each city. We estimate these values using eight waves of New Zealand census data from 1976 to 2013. Specifically, we use predicted coefficients from city fixed effects in regressions of wages (controlling for observable employee characteristics) and rents (controlling for dwelling characteristics). These coefficients are identical to those in (Maré and Poot 2018). The estimated wage and rent premia for each city are subsequently substituted into the equations for QL and QB derived from an equilibrium model.

[1] We refer to our units of observation primarily as "cities", although many of these units are much smaller than city size. At times, we also use the terms "settlements" and "locations" to describe these units.
[2] Grimes et al., (2016) addressed this issue using a dataset of 56 New Zealand towns and cities from 1926 to 2006, finding that land-use capability, sunshine hours, human capital and proximity to Auckland were factors associated with long-run population increase. In this study, we use a greater number of settlements but over a shorter time period, and adopt a different analytical lens.
[3] Donovan (2011) calculated related measures for Territorial Local Authorities in New Zealand for 1996, 2001 and 2006.

We find that QL and QB for New Zealand cities are substantially negatively correlated, but there are some cities that are attractive to both workers and firms. We also observe that, in general, there is persistence in both QL and QB over the 37-year time period. However, many cities do experience increases or decreases in these measures over time, signalling that it is possible for locations with poor performance on these measures to improve, and vice versa.

To describe relationships between our constructed measures and specific amenities, we regress each of QL and QB on variables reflecting city attributes. The independent variables included in these regressions reflect the local climate, intensity of various industries, and population. Specifications are estimated separately across two time-periods, with and without city fixed effects. We focus on results from weighted-least-squares regressions with weights equal to population, in which we exclude the three biggest cities from the sample.

Results for QL regressions on local attributes reveal that consumers tend to prefer cities with sunnier and drier climates and that are by the coast or a lake. QL is higher in cities with a greater concentration of employment in the accommodation, food, and recreation services; healthcare services; and education services. Once we include city fixed effects in the specification, only education and health remain associated positively with QL within cities, and only in the second half of the time period. There is no evidence that increasing accommodation, food, arts, and recreation services within cities is significantly associated with changes in QL. We also find that city size is negatively associated with QL - at least in earlier years; a result that could indicate the impact of (broadly defined) congestion effects.

Differences in estimates from the QL regressions over time show that the importance to consumers of a sunny and dry climate has increased. This finding is consistent with a wider literature showing that a pleasant climate is a luxury good, becoming more important for consumers as their incomes rise (Glaeser, Kolko, and Saiz 2001; Rappaport 2007; Partridge 2010; Cheshire and Magrini 2006; Ferguson et al. 2007; Grimes et al. 2016). We observe the same pattern for the consumption value of accommodation, food, and recreation services as well as healthcare.

Our estimates indicate that cities with higher population are better places to do business. In several cases, the signs on coefficients of location attributes in QB regressions are opposite in sign to those in QL regressions. While some amenities may have positive value for consumers and negative value for firms or vice versa, the opposing signs across QL and QB may reflect the strong negative correlation between the two variables. If this is the case, the implication may be that QB is less well measured than is QL. One possible reason for this is that we use residential rents as the rental measure for both QL and QB but residential rents may not be a suitable proxy for commercial rents (either for CBD firms, whose rents may be higher than the average residential rents, or for industrial firms that may have lower rents). For this reason, we place greater emphasis on our QL results relative to those for QB.

2 Framework

Here we provide the intuition behind the measures of QL and QB that we construct for each settlement and time-period. For the full set of assumptions and mathematical derivations we refer the reader to (Maré and Poot 2018). We use the spatial equilibrium model of Roback (1982, 1988) in which workers and firms choose to locate in one of many cities which differ in their wages, rents, and amenities.

Workers derive utility from the consumption of (tradable) goods and (non-tradable) housing and from local amenities, and their consumption expenditure depends on local wages and rents. Firms earn profits equal to the price of the goods they produce less the cost of labour and land inputs (local wages and rents). Local amenities may raise or lower production costs (either through affecting productivity or by directly shifting input costs, given a certain level of productivity). A worker's optimal location choice is the city in which their utility is maximised given the local wages, rents, and amenities. For firms, the optimal location is the city in which their profit is maximised given those same factors.

In the long-run, spatial equilibrium requires that indirect utility of identical workers and marginal costs of identical firms are equalised across cities. Otherwise, workers could gain more utility or firms could increase profits by relocating to a different city. It follows that places with low wages and high rents must be attractive places to live, otherwise workers would not stay there. Similarly, cities with high wages and high rents must be productive places to do business to offset the high input costs to firms.

The value of local amenities in city c at time t to workers (QL_{ct}) and to firms (QB_{ct}) can be derived from the position of worker iso-utility curves and firm iso-cost curves, respectively. The value of local amenities for workers is given as $QL_{ct} = \alpha lnr_{ct} - lnw_{ct}$, where α is the expenditure share of rents and r_c and w_c are the quality-adjusted[4] rents and wages in city c, respectively (Roback 1982; Blomquist, Berger, and Hoehn 1988; Maré and Poot 2018).[5] This equation reflects the trade-off that workers are willing to make between wages and rents. The production value of local amenities, introduced by Gabriel and Rosenthal (2004), is equal to $QB_{ct} = \frac{\gamma}{1-\gamma} lnr_{ct} + lnw_{ct}$, where $\frac{\gamma}{1-\gamma}$ reflects the relative importance of the cost of land to the cost of labour.[6] Following Maré and Poot (2018), we let α=0.2 and γ=0.11.

Examples of worker iso-utility curves and firm iso-cost curves are plotted in Figure 1. Worker indifference curves are upward sloping, reflecting that to receive the same utility, workers must be compensated for higher rents by earning higher wages. Firm iso-cost curves are downward sloping, illustrating that a decrease in firm profits due to higher rents can be offset by lower wages.

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[4] Wages and rents are quality-adjusted so that they can be fairly compared across cities and over time.
[5] We follow Maré and Poot (2018) who derive all equations in terms of *log* wages and *log* rents.
[6] Specifically, γ reresents the cost share of land and 1- γ is the cost share of labour.

Workers are indifferent between wage and rent combinations on the same iso-utility curve and derive more utility from combinations that allow them to reach a higher curve. Places with lower wages net of rents must be offset with positive consumption amenities such that utility is equalised across all locations.

Firms are indifferent between wage and rent combinations on the same iso-cost curve and (in the absence of amenity effects) would prefer wage and rent combinations on lower curves. For spatial equilibrium to hold, cities on relatively high iso-cost curves must be offset by more productive amenities.

In Figure 1, we plot the wage and rent premia of the 31 largest New Zealand cities in 2013. The premia are a quality-adjusted measure of the wages and rents, such that they are comparable across cities (see Section 2.1 for a full discussion). Figure 2 shows the derived relationship between *QL* and *QB* for the same 31 cities.

Figure 1: Wage and Rent Premia (2013)

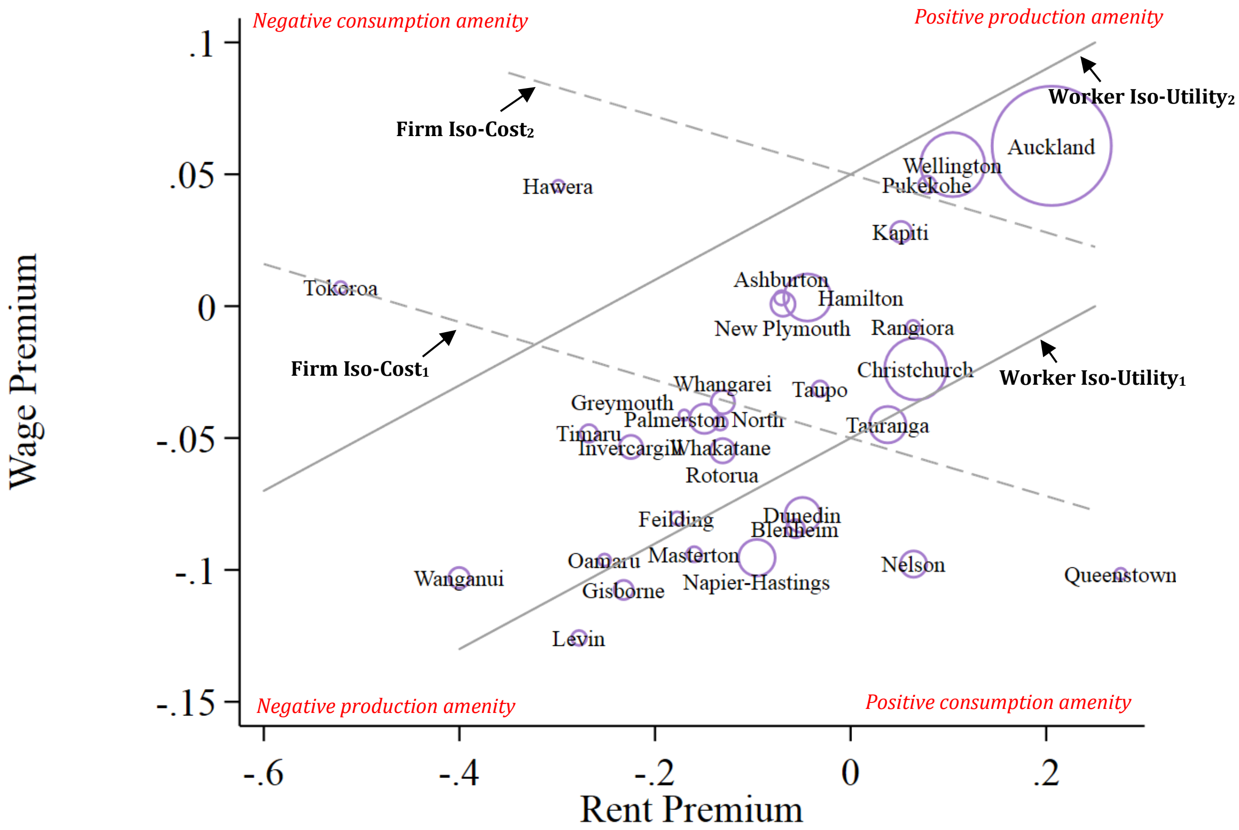
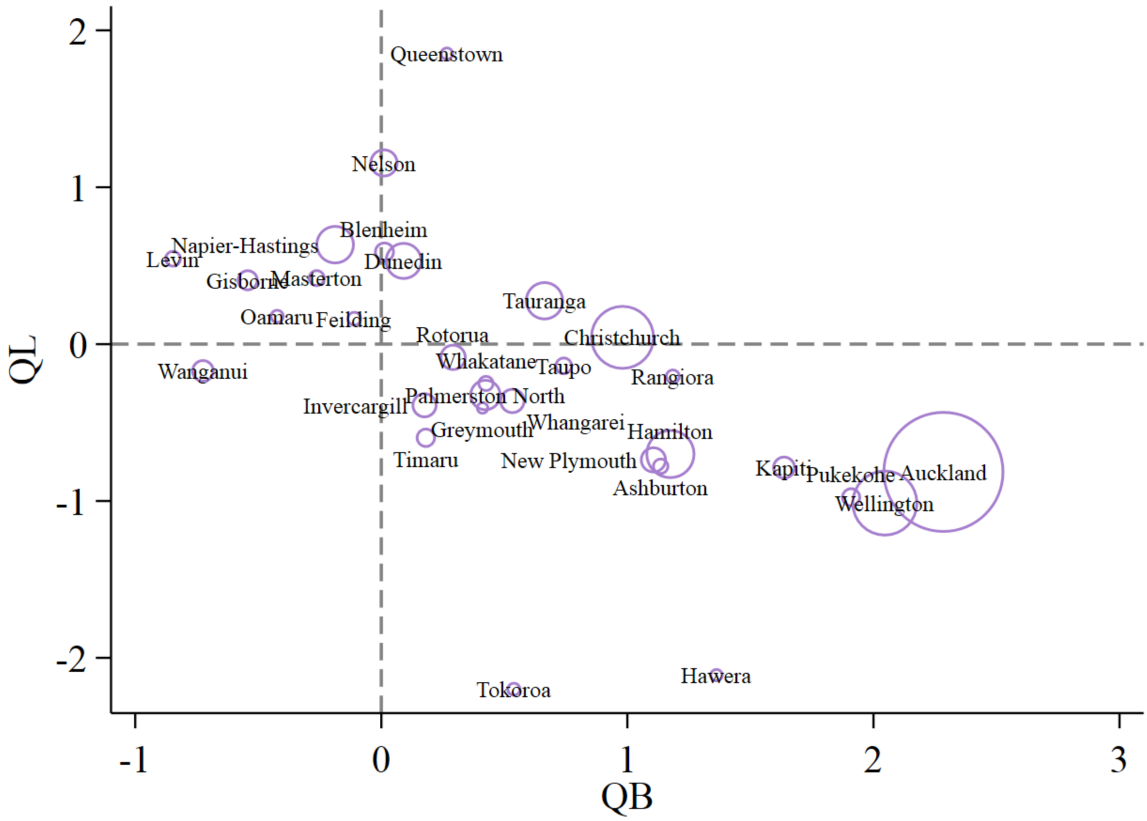


Figure 2: QL and QB (2013)



2.1 Estimation of QL and QB

To construct QL_{ct} and QB_{ct} we require quality-adjusted rents, r_{ct}, and quality-adjusted wages, w_{ct}, for each location and time-period. We adopt the estimates of Maré and Poot (2018). They estimate the location-specific rent (wage) component in each period by regressing log rents of individual rented houses (log wages of individuals) on characteristics of those houses (individuals), plus location-specific fixed effects.

We substitute the estimated values of the location fixed effects as the quality-adjusted wage, w_{ct}, and the quality-adjusted rent premium, r_{ct}, into the equations for QL_{ct} and QB_{ct} to construct a panel of these measures for all cities over time. For our analysis, we standardise QL_{ct} and QB_{ct} so that each has a mean of zero and standard deviation of one across the full sample.

2.2 Empirical relationship between QL, QB and amenities

We estimate weighted least squares regressions, with weights equal to city population, of QL_{ct} and QB_{ct} on several observable location-specific attributes. Letting Q_{ct} represent either QL_{ct} or QB_{ct} in each city c and time-period t, we estimate:

$$Q_{ct} = \alpha^Q + \boldsymbol{A}_{ct}^Q \boldsymbol{\beta}_A^Q + \tau_t^Q + l_c^Q + u_{ct}^Q \tag{1}$$

In equation 1, α^Q is a constant and $\boldsymbol{A}_{ct}^Q$ is a vector of attributes in each location and time-period with corresponding coefficients $\boldsymbol{\beta}_A^Q$ which are to be estimated. Year fixed effects τ_t^Q and city fixed effects l_c^Q are included in equation 1 to control for national trends and all fixed characteristics of cities. The final term u_{ct}^Q is a random error term.

In practice some of the amenities that we would like to include in the vector $\boldsymbol{A}_{ct}^Q$ are constant across time. These characteristics can only be included when we run specifications that supress the city fixed effects.

3 Data

We use data from the 1976 to 2013 New Zealand Censuses of Population and Dwellings.[7] Our sample covers the urban areas of New Zealand as defined by Statistics New Zealand using 2013 boundaries. We exclude three settlements from our dataset because they experience unusual population changes throughout the covered time period: Turangi, Twizel Community and Waiouru.[8] Where settlements are geographically contiguous, we combine them into a single urban area because of potentially shared labour and housing markets.[9] The resulting panel includes 130 settlements observed over eight time-periods from 1976-2013.[10]

We construct a panel of quality-adjusted rents and quality-adjusted wages, respectively, for each settlement and time-period. The data used to estimate these measures are described below. We subsequently derive measures of QL_{ct} and QB_{ct} for each time-period (as described above). The resulting panel is combined with local attributes as detailed below.

3.1 Rents and wages

To obtain quality-adjusted rents, we regress (log) rents on location fixed-effects, controlling for housing characteristics. Data for this estimation is at the dwelling level, and for the dependent variable we use information on weekly rents paid in non-owner-occupied private dwellings. Respondents report the dollar amount paid in rent, which is converted to a weekly equivalent rate. We exclude rental payments for non-private or owner-occupied dwellings to more closely approximate a market price for local land and housing services.

[7] Access to the data 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. The results presented in this study are the work of the authors, not Statistics NZ.

[8] Turangi and Twizel were developed as towns for the workers of nearby hydro-electric projects, and experienced significant population declines after the completion of these projects that occurred during the time-period studied. Waiouru is a town with a large military base that has seen large declines in population over the studied time-period due to operations leaving the area.

[9] Urban areas that we combine are Northern Auckland Zone, Western Auckland Zone, Central Auckland Zone, and Southern Auckland Zone (into Auckland); Wellington Zone, Lower Hutt Zone, Upper Hutt Zone, and Porirua Zone (into Wellington); Napier Zone and Hastings Zone (into Napier-Hastings); and Nelson and Brightwater (into Nelson).

[10] The New Zealand Census is held five-yearly, except in the case of 2013 which was 7 years after the 2006 census due to the 2011 Canterbury earthquake.

The controls included in the rent equation are number of rooms, the number of bedrooms, the type of dwelling, and the types of heating fuel available. The number of rooms and bedrooms are included as sets of dummy variables for each distinct value, top-coded so that the top-coded category contains at least five percent of observations. Dwelling type distinguishes detached houses from complexes of two or more connected dwellings, and further classifies these according to the number of storeys, giving a seven-way classification, each of which is included as a dummy variable. Mobile dwellings and campgrounds are excluded. Respondents can identify up to six heating fuels ever used in the dwelling, and can also report no heating fuels, or 'other'. Dummy variables are included for each of these eight categories, together with a count of different fuels used.[11]

To obtain quality-adjusted wages, the log of annual income is regressed on location fixed-effects and a vector of control variables. The Census does not collect information on wages, so annual income is used as a proxy for actual wage rates.[12] For this estimation we use data at the individual level, and the sample includes those usually resident who reported positive annual income, aged 15 and over, who were full-time employees in the week prior to the Census.

Income information is collected in bands. This is converted to a cardinal measure using the log of income midpoints provided by Statistics New Zealand based on estimated median income within each band.[13] Control variables include a quartic in age, a gender dummy, and a set of dummy variables for categories of ethnic identity and qualification.

3.2 Local Attributes

Local attributes included in the panel of settlements include natural characteristics that are time-invariant and time-varying features, as shown in Table 1 below. The time-invariant amenities include variables relating to the climate (*temp*, *rainfall*, *sunhours*, and *days33knots*) and the presence of coastline or a major lake[14] within or contiguous to the settlement boundary (*water*).

[11] For each variable, we also include a residual category that combines non-responses with unidentifiable responses.
[12] The income question in the Census asks respondents to include income from all sources (including benefits) rather than wages, which may be a source of error for both *QL* and *QB*. The income reported is before tax.
[13] In 2006, there were 12 bands for positive income, with a top-code of $100,001. In 2013, there were 14 positive income bands top-coded at $150,001. As an alternative to using estimated band medians, we tested the robustness of our findings to using range midpoints (with the estimated median for the top bracket) and also to using interval regression assuming a lognormal income distribution. Our findings are consistent across these specifications.
[14] Cities in our dataset defined as on a lake are Cromwell, Queenstown, Rotorua, Taupo, Te Anau, Te Kauwhata, and Wanaka.

Table 1: Definitions and Summary Statistics of Independent Variables

	Definition	Obs	Mean	SD	Min	Max
Time-invariant Amenities						
temp	Mean (monthly mean air temperature (degrees Celsius))	130	12.90	1.57	9.70	15.82
rainfall	Mean (total monthly rainfall (mm))	130	101.70	37.28	30.09	241.90
sunhours	Mean (monthly total sunshine hours)	130	165.53	15.30	137.02	210.31
days_33knots	Mean (days per month of wind gusts ≥33 knots)	130	3.88	2.99	0.00	16.23
water	Dummy variable = 1 if coastline or major lake present	130	0.45	0.50	0.00	1.00
Time-variant Amenities						
AccomFoodRec	Employment share in accommodation, food, art & recreation services	1,040	0.10	0.08	0.00	0.63
Education	Employment share in education & training	1,040	0.09	0.05	0.00	0.45
Health	Employment share in healthcare & social assistance	1,040	0.09	0.06	0.00	0.76
LandTransport	Employment share in land & water transport	1,040	0.04	0.03	0.00	0.24
AirTransport	Dummy variable = 1 if number employed in air & space transport > 0	1040	0.17	0.38	0.00	1.00
lnpop	ln(usually resident population)	1040	8.45	1.41	5.09	14.08

The climate variables are based on yearly averages of monthly observations from 1965-2017 at weather stations throughout New Zealand, reported in NIWA's CliFlo National Climate Database.[15] Each city is matched to this yearly weather data of the stations within their geographic boundaries.[16] We then take the average of all station-year observations falling within a settlement. Where data are missing for a particular weather variable within a settlement's boundaries, we add data from stations falling within 10km of the settlement's boundaries, repeating this process in 10km increments until the data is complete.[17]

The water indicator variable was constructed manually according to the settlement's geographic boundaries. A value of 1 is used for a city with a boundary contiguous to the coastline, or with a lake either inside or contiguous to the boundary. The smallest lake included is Dunstan (for settlement Cromwell).

Time-variant amenities are all generated from Statistics New Zealand Census data,[18] and comprise the (logarithm of) usually resident population plus employment shares in specific industries. These employment shares are generated from counts of Census respondents

[15] The database is available at https://cliflo.niwa.co.nz. Specifically, we take monthly data from the "Monthly and Annual Stats Combined" tables. We exclude observations based on fewer than three months of data.
[16] NIWA provides the geographic coordinates of each station which we overlaid in a map of the urban area boundaries using software QGIS.
[17] A list of weather stations used for each settlement is available from the authors. For all settlements, weather data was obtained from stations no further than 50km from their boundaries. We assessed the averaged weather variables by settlement for surprising results, leading us to remove two weather stations (located more than 900m above sea level) that were driving results for two settlements. We also dropped stations for a settlement where the station was on the other side of a mountain range. We obtained more climate variables than those shown in Table 1, but many were highly correlated. We have selected those that capture the most variation across settlements without being closely correlated to each other.
[18] Specifically, we used data created by Dave Maré and Ben Davies under microdata access agreement MAA2003/18.

employed in each industry, recoded to align with ANZSIC06 industries.[19] The industry employment shares proxy the intensity of certain services in each city. We use a dummy variable for employment in air transport because places with small airports, not necessarily offering scheduled flights, tend to have relatively high shares of employment in this industry.

We initially grouped accommodation and food industries separately from recreation and arts industries, but the two employment shares were moderately positively correlated (r = 0.32) resulting in our decision to combine the two groupings. The set of employees included in this variable overlaps with those defined by Florida (2002) as members of the "creative class", however the two definitions are not the same.[20] A subset of this group of employment reflects the tourism sector, and so we expect this variable to capture natural and cultural amenities both within a city and in their surrounding regions.

In the regressions we employ standardised values of all independent variables, except *water* and *AirTransport* dummies and *lnpop*, so that these variables have zero mean and a standard deviation of one.

4 QL and QB in New Zealand Settlements

QL and QB are shown for the top 10 and bottom 10 ranked cities in 2013 according to each measure in Table 2. The full set of QL and QB measures for each settlement over time are displayed in Appendix Tables 1 and 2, respectively. Recall that the QL and QB measures are standardised meaning they each have mean 0 and standard deviation of 1.

The locations in Table 2 with the highest QL tend to be coastal or on a lake and many are known for having a warm climate and/or attractive scenery.[21] Most of the locations with the highest QB are in or near New Zealand's largest cities (Auckland, Wellington, and Christchurch) or lie within relatively close proximity to a large city.[22] The locations in Table 2 with the lowest QL and QB are all small rural towns, most of which are inland and many of which are located in the North Island.

[19] We aggregated Statistics New Zealand ANZSIC06 industry codes into groupings that best reflect the industries described in Table 1.

[20] For example, our variable does not include some workers in science, technology, engineering, and mathematics (STEM) which Florida includes in the creative class, and we include employees such as cleaners in hotels, which Florida does not.

[21] The only settlement in this group that does not touch the coast or a lake, Moerewa, is a short drive from the coast.

[22] The exceptions are Te Kauwhata (which is 80 kms from Auckland and 50 kms from Hamilton, New Zealand's fourth largest city), Arrowtown (which has an economy driven largely by tourism), and Hawera (situated near one of the world's largest dairy factories).

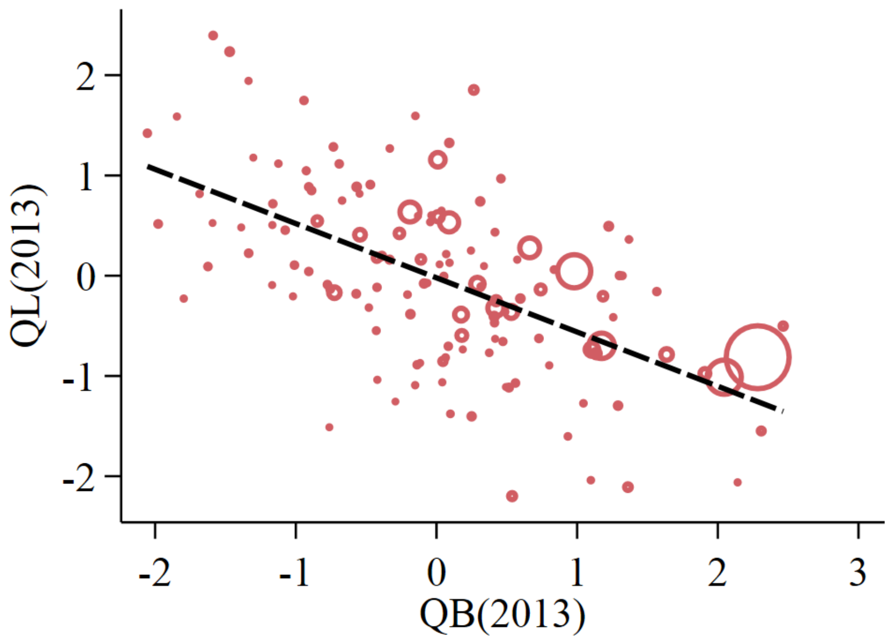
Table 2: 2013 Top and Bottom Ranked Settlements by QL and QB

Top 10 Settlements by QL	QL rank	QL	QB rank	QB	Top 10 Settlements by QB	QL rank	QL	QB rank	QB
Whitianga	1	2.40	123	-1.59	Rolleston	92	-0.50	1	2.46
Motueka	2	2.24	122	-1.47	Waiuku	125	-1.55	2	2.31
Coromandel	3	1.94	120	-1.34	Auckland	105	-0.81	3	2.28
Queenstown	4	1.85	50	0.27	Te Kauwhata	128	-2.06	4	2.14
Katikati Community	5	1.75	110	-0.94	Wellington	112	-1.01	5	2.05
Mapua	6	1.59	78	-0.15	Pukekohe	111	-0.97	6	1.91
Moerewa	7	1.59	128	-1.85	Kapiti	104	-0.79	7	1.64
Opotiki	8	1.42	130	-2.06	Lincoln	74	-0.16	8	1.57
Wanaka	9	1.33	58	0.09	Arrowtown	44	0.36	9	1.37
Cromwell	10	1.29	101	-0.73	Hawera	129	-2.11	10	1.36
Bottom 10 Settlements by QL	**QL rank**	**QL**	**QB rank**	**QB**	**Bottom 10 Settlements by QB**	**QL rank**	**QL**	**QB rank**	**QB**
Tokoroa	130	-2.20	32	0.54	Opotiki	8	1.42	130	-2.06
Hawera	129	-2.11	10	1.36	Taumarunui	36	0.52	129	-1.98
Te Kauwhata	128	-2.06	4	2.14	Moerewa	7	1.59	128	-1.85
Eltham	127	-2.04	20	1.10	Murupara	81	-0.23	127	-1.80
Winton	126	-1.60	23	0.93	Waipawa	23	0.82	126	-1.68
Waiuku	125	-1.55	2	2.31	Wairoa	58	0.09	125	-1.62
Patea	124	-1.51	103	-0.76	Raetihi	35	0.53	124	-1.59
Kawerau	123	-1.40	51	0.25	Whitianga	1	2.40	123	-1.59
Pahiatua	122	-1.38	56	0.10	Motueka	2	2.24	122	-1.47
Morrinsville	121	-1.30	13	1.29	Kawakawa	39	0.48	121	-1.39

In Appendix Table 1 we provide charts displaying QL and QB over time for every settlement. Places often have relatively high QL and low QB (e.g. Whitianga) or low QL and high QB (e.g. Hawera). The tendency for households and firms to prefer different locations is consistent with analysis by Chen and Rosenthal (2008) of cities in the United States. It is less common for settlements to have above-average QL and QB at the same time. Only Christchurch, Tauranga and Queenstown achieve this in all periods, and only 18% of settlement-year observations do so overall. No settlement exhibits below-average QL and QB in all years, while just 14% of observations do so in at least some periods (e.g. Milton).

An increase from one time-period to the next in QL often corresponds with a decrease in QB, and vice-versa. The scatterplot in Figure 3 shows the relationship between QL and QB across towns more generally for 2013. This scatter is equivalent to Figure 2 but includes the full sample of settlements in our dataset. We find QL and QB are negatively correlated (the correlation coefficient for the whole period is -0.57), but the loose distribution around the fitted line shows there is considerable variation across observations. The negative correlation of QL and QB does raise the concern that they are, in part, capturing the same information.[23] One possible concern with our QB measure is that it uses the same (residential) rent data as does QL. If commercial rents are not closely approximated by residential rents then there will be an element of noise introduced to QB. QL does not suffer from this source of inaccuracy. One other assumption that affects both QL and QB is that the measures are aggregate statistics for each city; it is likely that different household types and different business types will face different wages and rents within a city (Roback 1988). Hence these measures should be treated in the same way as all aggregate measures, i.e. as averages for each city rather than being specific to particular agents.

Figure 3: QL and QB of New Zealand Settlements in 2013



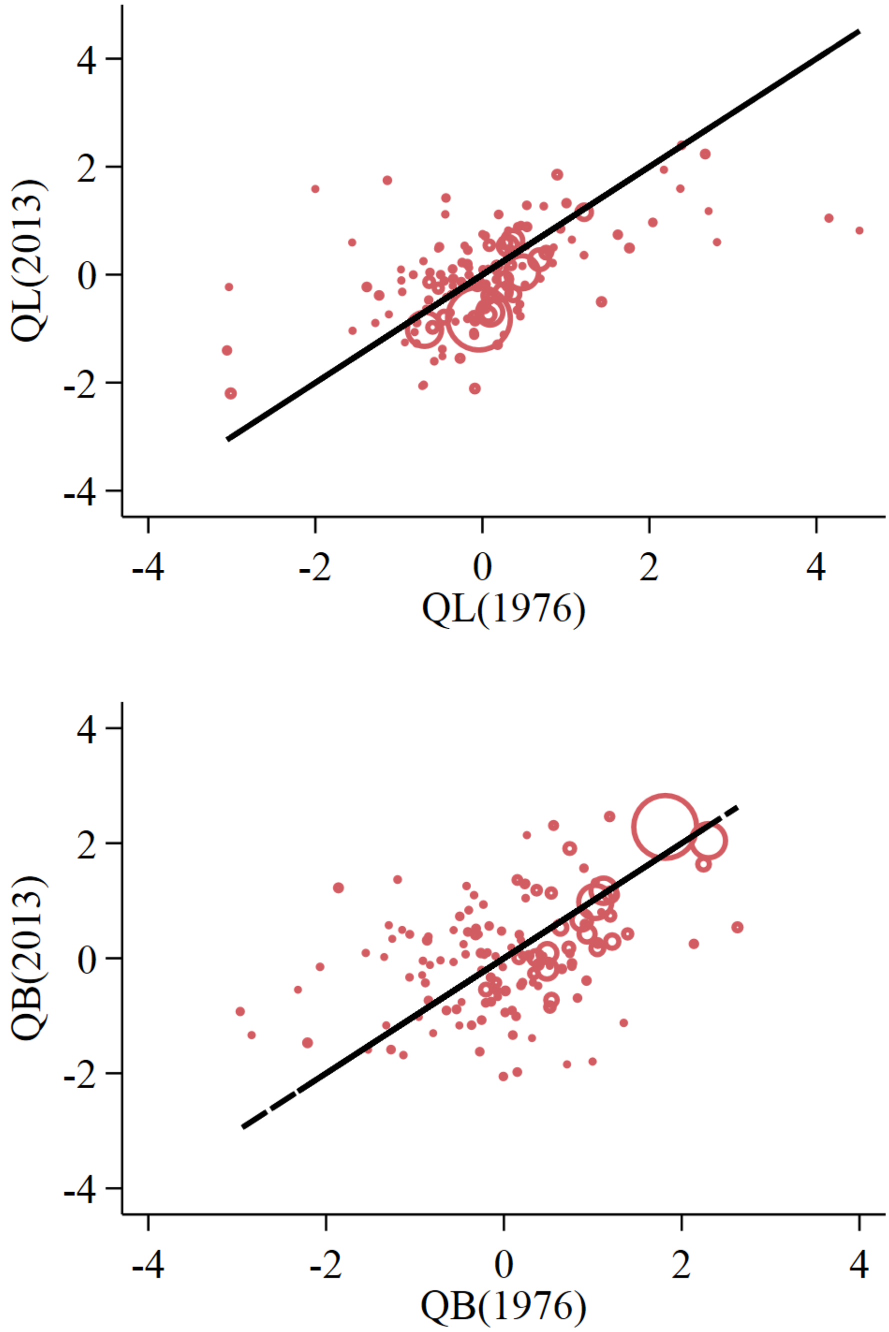
Notes: Settlements are weighted by 2013 population

In addition to considering the contemporaneous relationship between QL and QB, it is interesting to consider their persistence over time. The top and bottom panels of Figure 4 show 1976 and 2013 values for QL and QB, respectively. The upward sloping trend lines on each figure indicate the set of points that correspond to zero change in QL or QB between 1976 and 2013. The plot suggests that there has been considerable variation in the degree of persistence of QL and QB across locations over the 37-year time-period. From a policy viewpoint, this ability to shift upwards (and downwards) in terms of relative quality of life and quality for business indicates that local place-based policy initiatives may have material effects on local conditions.

[23] Chen and Rosenthal (2008) highlight that if wages are large enough relative to rents, then both QL and QB will approximate wages but with different signs. While arithmetically there is an inverse relationship between QL and QB, this doesn't necessarily result in QL and QB moving in opposite directions for a given city over time (i.e. if rent movements are large enough relative to wage movements, QL and QB move in the same direction). For example, see the first four instances of QL and QB for Balclutha in Appendix Figure 1. However, to the extent that there is noise in wages, this will show up as movements of QL and QB in the opposite direction. Similarly, any noise in rents will present as movements of the two variables in the same direction.

The urban areas which have experienced the largest changes in QL or QB in the 37-year period are relatively small in population, which could indicate that these apparent changes are driven by noise in the estimates of QL and QB. Nonetheless, even in a sample limited to cities with a population greater than 5,000 in all periods, we see changes as large as two standard deviations (relative to the full sample).[24]

Figure 4: Persistence of QL and QB of Settlements from 1976 to 2013



Notes: Settlements are weighted by 2013 population

[24] Of cities with a population of at least 5000 in all periods, the largest change in QL is for Hawera, which fell by 2.02(SD). The largest change in QB is for Tokoroa, which fell by 2.09(SD). We also see increases in QL of up to 1.65 (SD) (for Kawerau) and up to 1.2 (SD) for QB (for Hawera).

5 Regression results

We begin our discussion by focusing on estimates of the relationship of *QL* and then *QB* with location attributes, separately estimated across two time-periods: 1976-1991 and 1996-2013. The separation of the sample over two time-periods allows us to observe changes in the nature of the relationship between different amenities and each of our *QL* and *QB* measures. The first time-period includes data for years leading up to and including a period of major economic reform in New Zealand (1984-1991) (Evans et al. 1996). The second time-period covers a more stable set of economic conditions and policies. Major changes enacted over the reform period, such as removal of agricultural subsidies, impacted differently across cities and regions, so results for the latter period are likely to be more relevant to today's policy-makers.

We focus on estimates in which the samples are weighted by population, to correct for heteroskedasticity[25] as well as to put more emphasis on where most people live.[26] We exclude Auckland, Wellington, and Christchurch from the main estimates since our prime focus is on second-tier and third-tier settlements. In addition, the three large cities have particularly high leverage due to their large weighting. All specifications include year fixed effects while in each case we run the regressions with and without city fixed effects.[27] Inclusion of city fixed effects accounts for the impact of all unchanging city-specific characteristics.

Recall that all independent variables except *water* and *AirTransport* dummies and *lnpop* are standardised so that they have zero mean and a standard deviation of one. As a result, coefficients on these variables can be interpreted as the effect of a one standard deviation change in the variable on *QL* or *QB*.

5.1 *QL* and location amenities

Table 3 summarises the main estimates of *QL* regressions, with results for the first time-period (1976-1991) in the left panel and for the second time-period (1996-2013) in the right panel. Within each panel, the first column does not include city fixed effects which are added in the second column.

[25] We can expect estimates of *QL* and *QB* to be noisier for smaller cities because they are based on smaller numbers of people or dwellings.
[26] Specifically, cities are weighted by the mean population over the full period of data.
[27] Given that our equations for *QL* and *QB* describe a simple spatial general equilibrium, we also estimated our main specifications simultaneously (for both time periods, with and without city fixed effects). The standard errors on our estimated coefficients were almost unchanged. In addition, we tested for correlation between the errors across the *QL* and *QB* estimations, finding the error terms are significantly negatively correlated. To the extent that the errors reflect measurement error, this finding suggests that the measurement error is predominantly in wages rather than rents. The negative correlation was statistically different from zero (by a Breusch Pagan test) in all specifications, but the coefficients were much smaller for specifications with city fixed effects, indicating that the fixed effects specifications are preferred to those without fixed effects.

Table 3: Weighted regressions of *QL* on location attributes, excluding large cities

Dep var: QL	**1976-1991**		**1996-2013**	
	(1)	**(2)**	**(3)**	**(4)**
temp	0.035		-0.123	
	(0.105)		(0.105)	
rainfall	-0.162**		-0.268**	
	(0.081)		(0.104)	
sunhours	0.110		0.212***	
	(0.079)		(0.075)	
days_33knots	-0.136		-0.148	
	(0.128)		(0.109)	
water	0.359***		0.371**	
	(0.135)		(0.172)	
AccomFoodRec	0.255**	0.062	0.449***	0.059
	(0.097)	(0.111)	(0.098)	(0.110)
Education	0.194**	0.019	0.005	0.274***
	(0.081)	(0.071)	(0.110)	(0.066)
Health	0.223*	0.078	0.449***	0.162*
	(0.127)	(0.104)	(0.155)	(0.083)
LandTransport	0.035	-0.043	-0.085	0.073
	(0.077)	(0.040)	(0.121)	(0.070)
AirTransport	0.417*	-0.124	0.009	-0.062
	(0.223)	(0.076)	(0.244)	(0.113)
lnpop	-0.095	-0.943***	0.002	-0.415
	(0.077)	(0.257)	(0.093)	(0.253)
Fixed Effects	Year	Year, City	Year	Year, City
No. of cities	127	127	127	127
No. of obs.	508	508	508	508
R-squared	0.279	0.105	0.377	0.128

Notes: Standard errors in parentheses are clustered at the city level. Stars denote: *** p<0.01, ** p<0.05, * p<0.1. R-squared in columns (2) and (4) is R-squared-within. All specifications include a constant which is omitted from the table. Samples are weighted by mean population across all periods. Large cities (Auckland, Wellington, and Christchurch) are not included in these regressions.

The results for variables relating to climate show that consumers prefer to live in places with sunnier and drier weather, and the implicit price (reflected in rents and wages) of these factors has increased over time. For the period from 1996 to 2013, we find that a city with one SD higher rainfall can be expected to have 0.27 SD lower *QL*, while a city with one SD more hours of sunshine per month can be expected to have 0.21 SD greater *QL*. These findings are statistically significant at the 5% level. The apparent increase in the importance of these climate-related variables over time is consistent with international evidence that a pleasant climate is a luxury good, becoming more valued as incomes increase.[28] We find no statistically significant relationship between *QL* and either temperature or wind.

The coefficients on the dummy variable for being on the coast or a lake (*water*) are strongly positive and statistically significant at the 5% level in both periods. Cities by the water can be expected to have a higher *QL* measure by about 0.36 SD in both time periods.

When city fixed effects are not included, the employment share in accommodation, food, arts, and recreation (*AccomFoodRec*) has strongly positive coefficients and these have become stronger over time. A one SD increase in the share of employment in these industries is associated with a 0.26 SD higher *QL* in the first time period, and a 0.45 SD higher *QL* in the second period. However, adding fixed effects in columns (2) and (4) show that the importance of changes in this variable within cities is estimated to be small and not statistically significant. This finding likely reflects that accommodation, food, arts, and recreational services often cater to tourism demand which is higher in attractive cities, but changes in the provision of these services by itself does not correspond with statistically significant *QL* improvements.[29]

With the inclusion of city fixed effects, we find no relationship between education and *QL* in the first period but a positive and highly significant relationship in the second period: a one SD increase in education is associated with a 0.27 SD increase in *QL*. This could reflect the increasing importance of tertiary education, particularly university education, as a drawcard for cities over time (Apatov and Grimes, forthcoming).

Similarly, with the inclusion of city fixed effects, we find an increasing importance of the employment share in healthcare services over time, albeit with this effect being only weakly significant in the second period (and not significant in the first period). The findings for education and health provide evidence that not only do cities with more employment in education and health tend to have higher *QL*, but also that changing provision of these services over time has been valued by consumers.

By contrast, with fixed effects, we find no evidence that employment in land and water transport or in air transport is related to *QL*.

Concentrating again on specifications with city fixed effects included, we find that the coefficient on *lnpop* is negative and significant in the first period but its impact drops away for the second period. Its coefficient for the 1976-1991 sample implies that population growth of 10% was associated with a 0.09 SD decrease in *QL*, consistent with congestion being negatively valued by city residents. In the second period, the point estimate is nearly halved and it is not precisely estimated. However, if we include the three large cities (Auckland, Wellington, and Christchurch), the relationship between *lnpop* and *QL* becomes more clearly negative, even

[28] See relevant citations in the Introduction.
[29] It is possible that this could be due to offsetting effects, e.g. an increase in amenities such as restaurants and recreation services may raise quality of living but this then attracts greater numbers of residents and tourists with resulting congestion impacts.

without city fixed effects, driven by relatively low QL in Auckland and Wellington (see Appendix Table 5).

Appendix Table 3 summarises estimates of the relationship between the amenity variables and QL separately for each year in our sample. These specifications provide a more detailed insight of the changing nature of consumer preferences for amenities over time (albeit with a loss of degrees of freedom). Findings are generally consistent with the pooled regressions in Table 3.

5.2 QB and location amenities

Results from regressions of QB across the two time-periods are reported in Table 4 in the same format as the table for QL above. Population has a positive relationship with QB in both periods, with the relationship being especially strong when fixed effects are included. The estimates in columns (2) and (4) show that within-city population size is strongly related to QB. Experiencing a 10% increase in population is associated with an increase of QB by approximately 0.1 SD in both periods, with statistical significance at the 1% level. It is important to note that we cannot determine the direction of this relationship. Population growth may drive improved business quality, or business quality may drive population growth, or there may be bi-directional causality. Nevertheless, the association that we observe is consistent with the literature on the productivity benefits of agglomeration (D. C. Maré and Graham 2013).

Turning to the fixed location-specific variables reported in columns (1) and (3), and concentrating only on variables significant at the 5% level, we find that the coefficients on rainfall are positive and statistically significant in both periods, while the coefficient on sunshine hours is negative in the second period. In both periods, we estimate that cities on the coast or beside a lake have lower QB by approximately one third of a SD.

While we find no statistically significant effect of the employment share of accommodation, food, art, and recreation services on QB, we do find negative relationships of QB with both health and education employment shares. Again, we cannot draw causal conclusions here; for instance, government may choose to place tertiary education and health facilities in locations that otherwise have a poor business environment. Apatov and Grimes (forthcoming), for example, show that while polytechnics are situated in a number of regional cities, they do not appear to assist the growth of those cities.

Table 4: Weighted regressions of *QB* on location attributes, excluding large cities

Dep var: QB	**1976-1991**		**1996-2013**	
	(1)	**(2)**	**(3)**	**(4)**
temp	0.061		0.159*	
	(0.088)		(0.087)	
rainfall	0.213**		0.242***	
	(0.088)		(0.090)	
sunhours	-0.058		-0.113**	
	(0.059)		(0.056)	
days_33knots	0.128		0.038	
	(0.112)		(0.082)	
water	-0.279**		-0.370**	
	(0.132)		(0.163)	
AccomFoodRec	0.131	-0.080	-0.046	0.022
	(0.110)	(0.095)	(0.108)	(0.152)
Education	-0.139	-0.149**	-0.122	-0.427***
	(0.098)	(0.065)	(0.097)	(0.086)
Health	-0.211*	-0.202*	-0.493***	-0.371***
	(0.111)	(0.109)	(0.150)	(0.111)
LandTransport	-0.141*	-0.077*	0.004	-0.035
	(0.075)	(0.046)	(0.108)	(0.070)
AirTransport	-0.054	-0.052	0.446*	0.043
	(0.234)	(0.046)	(0.240)	(0.127)
lnpop	0.332***	1.374***	0.135	1.067***
	(0.084)	(0.373)	(0.091)	(0.300)
Fixed Effects	Year	Year, City	Year	Year, City
No. of cities	127	127	127	127
No. of obs.	508	508	508	508
R-squared	0.379	0.206	0.403	0.308

Notes: Standard errors in parentheses are clustered at the city level. Stars denote: *** p<0.01, ** p<0.05, * p<0.1. R-squared in columns (2) and (4) is R-squared-within. All specifications include a constant which is omitted from the table. Samples are weighted by mean population across all periods. Large cities (Auckland, Wellington, and Christchurch) are not included in these regressions.

Neither land and water transport nor air transport are associated significantly with *QB* (at the 5% level) with or without fixed effects included. The air transport impact is, however, particularly difficult to model since airports tend to be located in cities with relatively large populations (the correlation coefficient between the airport variable and population is 0.72).[30]

[30] We present results from QB regressions estimated separately for each year in Appendix Table 4

This observation leads us back to the dominant finding in relation to *QB* which is that population size is strongly related to our measure of quality for business. Even though the latter is probably imperfectly measured, the strong raw correlation coefficient between *QB* and *lnpop* across census waves, illustrated in Table 5, indicates the importance of city population size for firms. We see that in unweighted samples the raw relationship between *QB* and *lnpop* has been weakening since the 1986 census, whether or not large cities are included in the sample. When the samples are weighted, there is again a weakening relationship over time when the large cities are excluded. However, with the three large cities included (column 2), there is no apparent trend, and the relationship between *QB* and *lnpop* remains very strong throughout the 37 year period. Given that these estimates include New Zealand's major business cities, this raw relationship indicates that city size is an important productivity-related drawcard for firms.

Table 5: Correlation Coefficients of *QB* and *lnpop* across census waves

	Including large cities		**Excluding large cities**	
	Unweighted	**Weighted**	**Unweighted**	**Weighted**
1976	0.60	0.76	0.56	0.49
1981	0.50	0.66	0.47	0.41
1986	0.60	0.80	0.55	0.53
1991	0.58	0.82	0.50	0.48
1996	0.51	0.81	0.42	0.39
2001	0.43	0.81	0.31	0.36
2006	0.39	0.83	0.28	0.42
2013	0.36	0.82	0.26	0.37

Notes: Large cities are Auckland, Wellington, and Christchurch. Weighted samples are weighted by mean population across all periods.

5.3 Including large cities

We present results for regressions that include Auckland, Wellington, and Christchurch, (previously excluded from the samples) in Appendix Table 5 for *QL* and Appendix Table 6 for *QB*. In these tables, the left panel contains output from regressions weighted by mean population, and the right panel shows results from unweighted regressions.

The reason for leaving out large cities in our main analysis was due to concern that they would considerably alter results because each of them has special characteristics that could mean they are outliers - Auckland is by far New Zealand's largest city; Wellington the capital;

. As was the case for QL, these results are largely consistent with those aggregated into the two pools.

and Christchurch was strongly affected by a series of earthquakes at the end of the sample. Given the relatively large populations of these cities in comparison to other cities in our dataset, they have a large effect on results in weighted regressions. Nonetheless, given the share of New Zealand's population living in these cities, it is worthwhile to understand the importance for *QL* and *QB* of different amenities when these cities are included. We also estimate unweighted regressions using the full sample to show general patterns across cities without the focus on where people are concentrated. Such results may be strongly affected by outliers - small towns with particularly high employment in some of the industries captured in the regressors.

We find the results are sensitive to adding Auckland, Wellington, and Christchurch and respond differently again to the unweighted specification. A key point, for both *QL* and *QB*, is that variables relating to climate are more important when adding the large cities in weighted regressions. On the other hand, they tend to have smaller and less significant coefficients in unweighted regressions.

Compared to the main *QL* results, a key difference in the left panel of Appendix Table 5 is that we find a strongly positive and statistically significant relationship between *QL* and accommodation, food, and recreational services (when fixed effects are included) in the later time-period. This result is consistent with Florida's (2002) contention that additional hotels, restaurants, recreational services etc. are associated positively with *QL*. We also find that the negative relationship between *lnpop* and *QL* is stronger when including the large cities (both with and without city fixed effects), consistent with rising congestion effects as settlements increase in size. Again, however, we cannot attribute causality to these results.

While we found no significant relationship between *AccomFoodRec* and *QB* in the main results, in Appendix Table 6 the coefficients on this variable are statistically significant in some columns. However, the sign of the coefficients varies across specifications. Another important difference in Appendix Table 6 is, in weighted regressions, the negative coefficients on health and education are stronger than in the main results, while coefficients on land and water transport are no longer statistically significant.

6 Discussion

Our analysis points to the conclusion that households and firms prefer different amenities and hence prefer different locations. For instance, households appear to prefer sunny, dry locations near water, while firms appear to prefer to locate in larger cities.

In many cases, amenities that are positively associated with *QL* are estimated to be negatively associated with *QB*, and vice versa. It is possible that the strong negative correlation between *QL* and *QB* makes it difficult to distinguish between consumption and production amenities in the regressions. For example, while we might not have any reason to expect sunshine to be negatively associated with *QB*, the explanation for why it appears to in the regression results could be because it has a positive relationship (as expected) with QL. Indeed, while our results for the relationship of amenities to QL is largely in accordance with intuition, this is less so for the QB results – other than the strong positive relationship between QB and population size.

It is possible that our derived QB variable is not a very accurate measure of the implicit willingness to pay by (at least some) firms for local amenities. A potential source of measurement error in QB is that it is calculated using quality-adjusted residential rents rather than commercial rents. In particular, the fact that many firms operate in the central business district within a city or in distinct industrially-zoned districts, could mean that the rents firms pay are poorly measured. Secondly, it could be that the production value of particular amenities is very specific to individual company needs. Both our QB and QL variables are average measures for a location that do not distinguish between households or firms having differing tastes or production needs relative to the average. An additional source of error for both QL and QB is that wages are proxied by income. Measurement error in this variable will cause imperfections in either or both of our QL and QB measures.

Our estimates show that QL tends to be higher in coastal and lakeside cities, and in places with less rain and more sun. Of the industry measures, only education and health have any impact on QL *within* cities, and only in more recent years. When city fixed effects are included, we find no evidence that increasing accommodation, food, arts, and recreational services is associated with an increase in QL in our main results (that exclude the large cities). Nor is there evidence of a positive effect of the share of employment in land and water transport or having employment in the air travel industry. It seems that places that are nice to live in are generally rich in these amenities, but intensifying those industries in any given city does not necessarily improve QL. However, we do detect a positive and statistically significant relationship between QL and the employment share in accommodation, food, arts, and recreational services when we include the major cities of Auckland, Wellington, and Christchurch over the more recent years (1996-2013).

Finally, we see a negative relationship between QL and (log) population when city fixed effects are included (both with the inclusion and exclusion of Auckland, Wellington, and Christchurch). Thus, there is evidence that population growth *within* cities is negatively associated with QL. One possible explanation for this result is that the congestion and crowding that comes with growth are viewed by consumers as disamenities. This finding serves as a warning that investment in improving local consumption amenities may be partially offset by population increases if raising QL attracts new residents. The result reflects an assumption often made in the broader urban economics literature (e.g. Glaeser et al. 2014), though it is notable in our results (with and without the larger cities) that this effect is smaller in the second than the first half of our sample. Perhaps New Zealand's cities are becoming more cosmopolitan and perhaps also people are valuing these aspects more, so that cities are seen as increasingly attractive places to live. Another possibility is that urban infrastructure (including communications technology) has been effective in ameliorating congestion and/or that certain negative aspects of cities (such as crime rates or pollution) have reduced over time.

All our results should be interpreted as associations rather than indicating causal relationships, although the regressions with fixed effects at least control for fixed unobserved characteristics of each place. We expect that local policy-makers may be particularly interested in the relationship between consumption and production amenities and population size. The results of our study suggest that population size is positively associated with QB and negatively with QL (though the latter is less strong over time). Future work will study the link between QB and QL with people's location choices (and hence population size) using data on individuals within a location choice framework.

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Appendix Tables

Appendix Table 1: *QL* for all settlements and time periods

	QL over time for each city							
Settlement	**1976**	**1981**	**1986**	**1991**	**1996**	**2001**	**2006**	**2013**
Alexandra	0.46	0.35	0.22	0.78	0.58	0.88	0.46	0.91
Amberley	-0.71	0.40	0.52	0.66	-0.31	0.50	0.28	0.25
Arrowtown	1.22	0.43	0.80	0.57	-0.41	0.29	-0.51	0.36
Ashburton	-0.10	-0.16	0.25	-0.19	-0.17	-0.43	-0.42	-0.78
Auckland	-0.04	-0.12	-0.01	-0.38	-0.60	-1.27	-1.24	-0.81
Balclutha	-0.39	-0.46	-0.57	-0.90	-0.90	-0.11	-0.47	-0.70
Blenheim	0.28	0.88	1.24	0.95	1.26	1.07	0.96	0.59
Bluff	-0.09	-0.95	-0.73	0.09	0.33	-0.32	-0.21	-1.09
Bulls	-0.81	-0.80	-0.78	-1.06	-2.17	-0.89	-1.51	-1.06
Carterton	0.94	0.55	0.14	0.20	0.90	0.32	0.54	0.85
Christchurch	0.47	0.06	0.38	0.27	0.17	0.12	0.14	0.04
Coromandel	2.17	1.70	1.46	1.19	1.94	1.39	0.60	1.94
Cromwell	0.53	-1.31	-2.24	-1.14	2.42	0.83	0.86	1.29
Dannevirke	-0.25	-0.84	-1.05	-0.90	-1.19	-0.55	-0.06	-0.13
Darfield	-0.43	-0.08	-1.11	-1.10	-1.20	0.25	-0.23	-0.41
Dargaville	-0.17	0.30	0.60	-0.07	0.25	0.93	0.28	0.45
Dunedin	0.31	0.06	0.17	0.70	0.81	0.72	0.74	0.53
Edgecumbe	-1.28	-1.67	-1.54	-1.16	-1.86	-1.75	-1.18	-0.89
Eltham	-0.70	-1.27	-1.47	-1.38	-1.29	-1.58	-1.91	-2.04
Featherston	0.51	-0.12	-0.17	-0.48	-0.23	-0.16	0.39	-0.19
Feilding	0.17	-0.63	0.08	-0.16	-0.17	-0.17	-0.16	0.16
Foxton Community	0.17	0.46	-0.97	-0.83	0.01	0.10	-0.40	-0.09
Geraldine	0.45	0.20	-0.08	-0.70	0.26	0.17	-0.82	-0.77
Gisborne	0.76	0.28	0.71	0.75	1.04	0.42	0.04	0.41
Gore	-0.09	-0.95	-0.43	0.06	0.06	-0.42	-0.27	-0.85
Greymouth	0.10	0.64	-0.31	0.31	0.25	0.14	0.21	-0.41
Greytown	-0.79	0.27	-0.44	0.19	-0.05	-0.41	-0.48	-1.27
Hamilton	0.09	0.00	0.03	-0.38	-0.22	-0.53	-0.66	-0.70
Hawera	-0.09	-0.69	-0.89	-1.60	-1.28	-1.97	-1.91	-2.11
Helensville	0.17	1.69	0.51	0.50	0.23	-0.86	-0.69	0.06
Hokitika	0.42	-0.45	0.00	0.15	0.25	-0.03	0.08	-0.66
Huntly	-1.24	-1.58	-1.02	-0.98	-0.89	-0.60	-0.96	-0.38
Inglewood	-0.16	-0.91	-0.43	-0.81	0.08	-0.40	0.10	-0.01
Invercargill	0.08	-0.39	-0.21	-0.65	-0.91	-0.59	-0.23	-0.39
Kaikohe	-0.63	0.18	0.30	0.15	1.50	0.00	0.51	0.04
Kaikoura	0.00	0.10	0.26	0.64	0.30	1.11	1.41	0.75
Kaitaia	0.04	0.28	0.77	0.12	0.06	0.28	-0.27	-0.18
Kapiti	-0.46	-0.43	-0.71	-1.03	-0.99	-0.85	-0.52	-0.79
Katikati Community	-1.14	0.32	0.61	1.55	1.71	1.72	2.06	1.75
Kawakawa	-0.53	0.13	0.23	0.85	0.82	-0.12	-1.25	0.48
Kawerau	-3.06	-4.21	-2.46	-3.21	-2.76	-2.30	-1.75	-1.40
Kerikeri	1.62	1.79	1.97	1.49	0.86	1.19	0.86	0.74

Leeston	0.48	-0.59	-0.13	-0.73	0.27	-0.71	-0.44	0.16
Levin	0.08	-0.26	-0.35	0.05	0.05	0.11	0.16	0.55
Lincoln	-0.06	0.66	0.72	0.45	0.95	0.70	0.88	-0.16
Mangawhai Heads	4.52	1.17	1.97	1.92	3.76	1.08	1.00	0.82
Mapua	2.37	3.96	2.62	2.29	2.68	2.69	2.58	1.59
Martinborough	-0.38	-0.19	0.10	0.49	0.13	0.51	-0.60	-0.36
Marton	-0.24	-0.40	-0.53	-0.72	-0.06	-0.27	0.42	0.22
Masterton	0.35	-0.06	-0.10	0.01	-0.15	0.05	0.33	0.42
Matamata	-1.38	-0.27	-0.33	-0.44	-1.23	-0.51	-0.63	-0.23
Methven	-0.16	0.09	0.48	-0.58	-1.44	-0.36	0.75	0.13
Milton	-0.96	-0.31	-1.23	-0.22	-1.64	-0.54	-0.07	-0.32
Moerewa	-2.00	-0.02	-0.28	0.54	1.75	0.89	0.88	1.59
Morrinsville	0.18	-0.37	-0.60	-0.77	-1.08	-1.09	-1.74	-1.30
Motueka	2.67	3.22	1.73	2.53	2.24	2.57	2.12	2.24
Murupara	-3.03	-2.35	-1.83	-0.67	-1.10	-1.24	-1.26	-0.23
Napier-Hastings	0.36	0.11	0.20	0.48	0.99	0.63	0.47	0.64
Nelson	1.22	1.11	1.03	1.14	1.03	1.17	0.93	1.16
New Plymouth	0.07	0.09	-0.10	-0.29	-0.41	-0.65	-0.58	-0.74
Ngatea	-1.12	-0.62	0.12	-1.29	-0.93	-0.15	-0.97	-0.74
Ngunguru	1.07	2.78	0.42	0.14	-0.51	-0.81	-0.46	0.65
Oamaru	0.34	0.03	-0.18	0.07	0.27	0.30	0.27	0.18
Ohakune	-0.93	-0.80	-1.11	-0.76	-1.22	-2.03	-1.57	-1.25
Opotiki	-0.44	0.16	0.44	0.75	0.84	1.17	0.80	1.42
Opunake	-0.32	-0.59	-1.69	-0.19	-0.66	-1.70	-0.04	-0.87
Otaki	0.19	0.55	-0.49	-0.04	-0.73	0.07	0.55	0.16
Otorohanga	-0.18	0.43	-0.14	-0.52	-0.68	-1.02	-0.80	-0.82
Oxford	-0.21	0.25	0.17	0.12	-0.69	0.48	0.40	0.54
Paeroa	-0.46	-0.61	-0.51	-0.59	0.72	0.18	0.32	-0.12
Pahiatua	-0.48	-1.13	-1.19	-2.06	-1.77	-0.87	-1.18	-1.38
Paihia	2.81	2.37	1.56	1.58	2.86	1.42	0.74	0.60
Palmerston North	0.25	0.23	0.18	0.21	-0.33	-0.33	-0.52	-0.32
Patea	-0.48	0.17	0.79	-0.89	0.27	-0.49	-0.62	-1.51
Picton	0.19	0.55	1.14	0.95	1.65	2.25	1.77	1.12
Pleasant Point	-0.68	-0.40	-1.02	-0.60	-0.64	-1.08	-0.94	-0.63
Pukekohe	-0.60	-0.15	-0.41	-0.63	-0.57	-0.71	-1.17	-0.97
Putaruru	-0.79	-0.98	-1.28	-1.43	-1.25	-1.48	-1.32	-0.89
Queenstown	0.90	1.48	1.20	0.79	0.73	0.78	0.84	1.85
Raetihi	0.53	-1.33	-0.87	0.44	-0.32	-0.35	-0.73	0.53
Raglan	0.81	1.88	2.14	1.11	0.53	0.36	0.40	0.43
Rakaia	-0.97	1.33	-0.33	1.11	-0.03	0.93	0.37	0.10
Rangiora	0.30	-0.07	0.69	0.34	-0.12	-0.20	0.36	-0.20
Reefton	0.07	-0.17	-0.59	0.03	0.16	0.49	0.09	0.11
Riverton	0.85	0.49	0.15	0.75	-0.45	0.15	0.60	0.51
Rolleston	1.43	1.82	0.32	-0.59	0.47	0.14	-0.15	-0.50
Rotorua	0.27	-0.32	0.11	-0.37	-0.25	-0.38	-0.40	-0.08
Shannon	-0.10	-0.45	-0.28	-1.43	-0.63	-0.57	0.50	-0.09
Snells Beach	2.04	1.81	1.14	0.91	0.86	0.64	0.88	0.97
Stratford	-0.10	-0.13	-0.47	-0.60	-0.41	-1.10	-0.46	-1.12

Taihape	-1.55	-0.85	-1.57	-1.06	-0.19	-0.17	-0.33	-1.04
Taipa Bay-Mangonui	0.69	1.14	2.62	1.07	0.80	-0.31	0.80	-0.07
Tairua	2.71	0.75	1.66	2.25	1.28	1.21	1.74	1.18
Takaka	-1.56	-0.14	0.66	1.03	-0.72	1.21	0.34	0.60
Taumarunui	-0.52	-0.49	-1.01	-0.34	-0.60	-0.22	0.03	0.52
Taupo	-0.64	-0.81	-0.33	-0.20	-0.46	0.02	-0.20	-0.14
Tauranga	0.68	0.60	0.57	0.32	0.39	0.35	0.33	0.28
Te Anau	-0.44	0.19	-0.34	-0.22	-0.14	-0.58	-0.04	1.12
Te Aroha	-0.64	-0.46	-0.17	-0.89	-1.09	-1.22	-0.67	-0.47
Te Kauwhata	-0.72	-0.15	-1.45	-1.28	-1.38	-1.19	-1.87	-2.06
Te Kuiti	-0.36	-0.86	-0.03	-0.76	-0.35	-0.65	-0.98	0.11
Te Puke Community	0.53	-0.24	-0.21	0.25	0.55	0.83	0.55	0.89
Temuka	-0.10	-0.36	-0.44	0.22	-0.93	-0.57	-0.76	-1.07
Thames	-0.35	0.19	-0.26	0.06	-0.08	-0.02	0.02	-0.08
Timaru	0.02	-0.08	0.25	0.17	-0.16	-0.43	-0.29	-0.60
Tokoroa	-3.01	-2.09	-1.95	-2.85	-2.76	-2.80	-1.97	-2.20
Waiheke Island	1.76	2.20	1.54	1.17	0.84	0.51	0.08	0.49
Waihi	0.42	0.79	0.83	0.39	0.45	1.22	1.40	0.89
Waihi Beach	0.84	1.31	0.10	-0.24	0.85	0.71	0.92	0.22
Waikouaiti	0.25	-1.25	-0.30	-1.11	-0.66	0.48	0.20	-1.11
Waimate	0.45	-0.54	-0.89	-0.11	0.80	-0.22	0.93	-0.55
Waipawa	0.31	0.29	-0.22	-0.13	1.02	-0.15	1.13	0.82
Waipukurau	0.03	-0.57	0.53	-0.04	0.57	-0.09	0.19	0.72
Wairoa	0.01	-0.74	-0.36	-0.71	-0.53	-0.07	-0.41	0.09
Waitara	-0.18	-0.34	-0.37	-0.45	0.17	0.55	0.38	0.20
Waiuku	-0.27	-1.08	-0.57	-0.84	-1.88	-1.23	-2.07	-1.55
Wakefield	0.73	0.50	0.44	0.06	0.67	1.19	1.54	1.27
Wanaka	1.01	1.07	0.57	1.32	2.12	2.21	1.32	1.33
Wanganui	-0.06	-0.38	0.00	-0.33	-0.24	-0.21	-0.12	-0.17
Warkworth	-0.50	-0.51	0.74	0.85	0.15	0.50	0.05	0.00
Wellington	-0.69	-0.98	-0.49	-0.79	-1.32	-1.51	-1.42	-1.01
Wellsford	-0.97	-0.41	0.48	-0.44	-0.30	-0.24	0.06	-0.11
Westport	0.03	0.49	0.03	0.52	0.54	0.35	0.26	-0.63
Whakatane	-0.53	-0.31	-0.40	-0.55	-0.28	-0.76	-0.58	-0.25
Whangamata	4.15	2.71	1.71	2.52	1.13	1.50	1.34	1.05
Whangarei	0.37	0.14	-0.55	-0.30	0.01	-0.36	-0.65	-0.36
Whitianga	2.39	2.86	2.13	2.05	1.58	1.99	1.19	2.40
Winton	-0.58	-0.28	0.59	-0.06	-1.01	-1.62	-1.16	-1.60
Woodend	-0.83	-0.35	-0.78	-0.23	0.03	-0.62	0.38	0.00
Woodville	-0.35	-0.30	-1.14	-1.26	-1.43	0.34	-0.14	-0.21

Appendix Table 2: *QB* for all settlements and time periods

	QB over time for each city							
Settlement	**1976**	**1981**	**1986**	**1991**	**1996**	**2001**	**2006**	**2013**
Alexandra	0.19	0.20	0.46	-0.25	-0.35	-1.01	0.14	-0.47
Amberley	-0.45	-0.56	-1.39	-0.61	0.12	-0.38	-0.07	0.25
Arrowtown	-1.20	-0.99	0.42	-0.33	1.37	0.79	2.46	1.37
Ashburton	0.53	0.00	-0.21	-0.11	0.07	0.02	0.45	1.13
Auckland	1.81	1.38	2.31	3.00	2.87	3.10	2.83	2.28
Balclutha	0.74	0.55	0.09	-0.11	0.23	-0.68	-0.27	0.08
Blenheim	0.17	-0.46	-0.09	-0.14	-0.67	-0.46	-0.13	0.01
Bluff	-0.01	1.03	-0.18	-1.02	-1.37	-0.95	-0.99	-0.15
Bulls	0.44	0.57	0.47	0.58	-0.01	-0.23	-0.04	0.04
Carterton	-0.53	-0.55	-0.67	-0.53	-1.05	-0.46	-0.65	-0.89
Christchurch	1.03	0.48	0.94	1.12	1.12	0.88	0.88	0.98
Coromandel	-2.84	-1.48	-1.36	-1.02	-1.62	-0.86	-0.36	-1.34
Cromwell	-0.85	0.87	2.33	0.45	-2.12	-0.86	0.25	-0.73
Dannevirke	-0.14	0.16	0.39	0.21	0.55	-0.21	-0.51	-0.76
Darfield	-0.42	0.05	-0.51	0.49	0.34	0.14	0.33	1.26
Dargaville	-0.25	-0.30	-0.56	-0.12	-0.36	-1.18	-0.96	-1.08
Dunedin	0.49	0.45	0.59	0.60	0.24	-0.03	0.07	0.09
Edgecumbe	1.10	2.05	0.88	1.67	1.47	1.78	1.12	0.80
Eltham	-0.34	0.03	0.11	-0.07	-0.28	0.17	0.55	1.10
Featherston	-0.25	-0.26	-0.95	0.02	-0.26	-0.15	-0.82	-0.21
Feilding	0.39	0.76	0.47	0.79	0.58	0.16	0.03	-0.11
Foxton Community	-0.20	-0.56	-0.16	0.40	-0.26	-0.59	-0.27	-0.78
Geraldine	-0.85	-1.06	-1.00	-0.80	-1.07	-0.83	0.29	0.38
Gisborne	-0.20	0.03	-0.01	-0.19	-0.19	-0.47	-0.29	-0.54
Gore	0.28	0.87	0.15	-0.93	-0.68	-0.54	-0.77	0.05
Greymouth	-0.32	-0.04	0.09	-0.08	0.09	-0.19	-0.29	0.41
Greytown	0.24	-0.82	-0.41	-0.51	-0.74	0.22	0.42	1.04
Hamilton	1.12	0.87	1.16	1.38	1.21	1.32	1.31	1.17
Hawera	0.15	0.46	0.56	0.68	1.04	1.30	1.07	1.36
Helensville	-0.40	-1.12	-0.34	0.61	0.70	1.76	1.67	0.84
Hokitika	-0.03	0.43	-0.10	0.41	0.10	-0.35	-0.43	0.47
Huntly	0.65	1.02	0.88	0.28	0.35	-0.03	0.29	-0.19
Inglewood	0.21	0.32	1.00	0.39	-0.28	-0.16	-0.53	0.05
Invercargill	1.05	1.29	0.88	0.45	0.75	0.05	0.10	0.17
Kaikohe	0.09	-0.36	-0.22	-0.31	-1.24	-0.28	-0.97	-0.91
Kaikoura	-0.07	-0.01	-0.48	-0.55	-0.40	-0.75	-0.66	-0.67
Kaitaia	-0.08	0.03	0.27	0.43	0.30	-0.46	-0.22	-0.57
Kapiti	2.25	1.32	1.56	2.44	1.97	2.16	1.42	1.64
Katikati Community	0.01	-0.19	-0.53	-0.97	-1.03	-1.02	-1.30	-0.94
Kawakawa	0.32	0.08	-0.16	-0.64	-0.62	-0.24	0.29	-1.39
Kawerau	2.14	3.64	2.51	2.83	2.35	1.61	0.73	0.25
Kerikeri	-0.86	-0.07	-0.53	-0.52	0.24	0.17	0.57	0.31
Leeston	-1.30	-0.33	-0.32	-0.74	-0.12	-0.15	0.40	0.57
Levin	0.52	0.34	0.62	0.52	0.06	-0.21	-0.58	-0.85

Lincoln	0.90	0.12	-0.12	0.43	0.09	0.89	0.59	1.57
Mangawhai Heads	-2.32	-2.42	-1.78	-2.32	-3.32	-0.53	-0.01	-0.55
Mapua	-2.07	-3.50	-3.42	-2.42	-2.20	-1.54	-1.14	-0.15
Martinborough	-0.57	-0.69	-1.90	-0.33	-0.73	-0.71	-0.03	0.49
Marton	0.10	-0.02	0.41	0.22	-0.09	-0.49	-1.41	-1.34
Masterton	0.34	0.20	0.13	0.00	-0.02	-0.06	-0.36	-0.26
Matamata	0.91	0.11	0.71	0.71	1.28	0.73	0.81	0.60
Methven	-1.55	-1.28	-1.26	-0.21	0.19	-0.07	-0.57	0.09
Milton	0.38	-0.04	-0.24	-1.18	0.25	-0.51	-0.60	-0.48
Moerewa	0.71	-0.51	-0.29	-1.04	-2.04	-0.99	-1.34	-1.85
Morrinsville	0.23	0.42	0.71	0.99	1.13	0.97	1.46	1.29
Motueka	-2.21	-2.40	-1.18	-1.98	-1.19	-1.65	-1.22	-1.47
Murupara	1.00	0.96	-0.20	-0.93	-0.70	-0.59	-0.71	-1.80
Napier-Hastings	0.48	0.35	0.75	0.29	-0.06	-0.10	0.04	-0.19
Nelson	0.36	-0.09	0.35	0.29	0.45	0.11	0.25	0.01
New Plymouth	1.20	0.38	1.40	1.14	1.07	0.63	0.75	1.10
Ngatea	0.08	0.75	-0.54	0.45	0.26	-0.09	0.56	0.19
Ngunguru	-0.09	-1.76	0.60	0.40	1.15	1.55	1.38	0.04
Oamaru	-0.09	-0.14	-0.23	-0.42	-0.49	-0.86	-0.79	-0.42
Ohakune	-0.92	0.67	0.51	0.40	0.07	0.85	-0.01	-0.29
Opotiki	-0.01	-0.37	-0.45	-1.01	-0.79	-1.40	-1.50	-2.06
Opunake	-0.83	-0.19	0.34	-1.43	-1.32	-0.22	-1.46	-0.12
Otaki	-0.15	-0.40	0.25	0.55	1.00	-0.04	-0.70	-0.33
Otorohanga	-0.22	-0.73	-0.70	-0.33	0.10	0.28	-0.03	0.06
Oxford	-0.91	-1.30	-1.73	-0.36	0.22	-0.16	0.04	-0.04
Paeroa	0.21	0.43	0.20	0.16	-0.42	-0.09	-0.66	-0.42
Pahiatua	-0.19	0.19	0.01	1.14	0.97	-0.05	-0.12	0.10
Paihia	-0.71	-0.19	0.39	-0.45	-1.59	0.14	-0.02	-0.04
Palmerston North	0.94	0.68	1.21	1.33	1.28	0.79	0.65	0.42
Patea	-0.48	-0.69	-2.72	-2.01	-2.46	-1.95	-2.01	-0.76
Picton	0.83	0.21	-0.51	-0.07	-0.62	-1.51	-0.95	-0.69
Pleasant Point	-0.28	-0.72	-0.38	-0.46	-0.45	0.04	0.07	0.42
Pukekohe	0.74	0.26	0.78	1.43	1.58	1.82	2.17	1.91
Putaruru	0.76	0.60	1.01	0.95	0.93	0.99	0.50	-0.14
Queenstown	1.06	0.67	1.40	0.56	1.61	1.29	1.67	0.27
Raetihi	-1.53	0.89	-0.28	-1.10	-0.56	-0.73	-0.45	-1.59
Raglan	-1.06	-1.95	-2.41	-0.98	-0.44	0.25	0.35	0.42
Rakaia	-1.26	-1.86	-1.24	-2.12	-1.45	-1.31	-0.48	0.34
Rangiora	0.37	0.01	-0.09	0.26	0.65	0.89	0.58	1.18
Reefton	-1.35	-0.73	-0.56	-0.86	-0.86	-1.99	-0.90	0.02
Riverton	-1.32	-0.09	-1.51	-2.33	-1.16	-1.54	-1.39	-1.17
Rolleston	1.19	-0.89	0.75	0.82	0.47	1.53	1.99	2.46
Rotorua	1.22	1.23	1.36	1.31	1.16	1.14	0.78	0.29
Shannon	-0.50	-0.70	-1.06	0.27	-0.49	-0.92	-1.77	-1.17
Snells Beach	-0.41	-0.87	-0.11	-0.03	0.24	0.80	0.61	0.46
Stratford	-0.31	-0.37	-0.22	-0.48	-0.30	0.08	-0.56	0.52
Taihape	0.33	0.55	0.36	-0.61	-1.29	-1.18	-1.16	-0.42
Taipa Bay-Mangonui	-0.57	-0.29	-1.84	-0.37	-0.41	0.94	-0.75	-0.07

Tairua	-0.80	0.73	-1.21	-2.05	-0.71	-0.91	-1.28	-1.30
Takaka	0.52	0.10	-0.44	-1.50	-0.02	-1.09	-0.11	-0.13
Taumarunui	0.15	0.21	0.32	-0.13	-0.13	-0.93	-1.47	-1.98
Taupo	1.20	1.57	1.46	1.25	1.21	0.98	1.01	0.74
Tauranga	0.88	0.48	0.77	0.90	0.92	0.84	0.80	0.66
Te Anau	1.35	0.97	0.64	-0.46	-0.14	0.30	0.31	-1.12
Te Aroha	0.17	-0.08	-0.18	0.64	0.90	0.83	0.32	0.41
Te Kauwhata	0.26	-0.99	0.29	0.09	0.49	0.89	1.77	2.14
Te Kuiti	0.14	0.58	-0.25	-0.02	-0.14	0.02	-0.01	-1.01
Te Puke Community	0.02	0.56	0.65	-0.03	0.04	-0.26	-0.17	-0.57
Temuka	-0.17	-0.16	-0.20	-0.60	0.06	-0.17	0.20	0.56
Thames	0.77	0.40	0.74	0.72	0.88	0.35	0.06	-0.09
Timaru	0.73	0.24	0.28	-0.08	0.11	-0.04	-0.18	0.18
Tokoroa	2.63	2.17	2.43	2.56	2.13	1.98	0.58	0.54
Waiheke Island	-1.86	-2.18	-1.53	-0.31	0.21	1.22	1.64	1.22
Waihi	-0.65	-0.86	-1.03	-0.34	-0.26	-1.12	-1.37	-0.91
Waihi Beach	-0.43	-1.32	-0.53	0.40	-0.44	-0.25	-0.38	0.07
Waikouaiti	-1.14	0.51	-1.19	-0.72	0.72	-0.71	-0.28	0.49
Waimate	-0.88	-0.83	-1.05	-1.45	-2.11	-1.14	-2.11	-0.43
Waipawa	-1.13	-0.89	-0.44	-0.48	-1.44	-0.23	-1.28	-1.68
Waipukurau	-0.36	0.21	0.05	-0.10	-0.64	-0.12	-0.51	-1.16
Wairoa	-0.27	0.49	-0.18	-0.12	-0.17	-0.96	-1.00	-1.62
Waitara	0.93	0.38	1.22	0.46	-0.26	-0.89	-0.85	-0.39
Waiuku	0.56	1.15	1.69	2.22	2.67	2.30	2.79	2.31
Wakefield	-1.06	-0.67	-0.20	-0.36	-0.43	-0.08	-0.36	-0.33
Wanaka	-0.26	-0.23	0.22	-0.82	-1.33	-0.96	0.48	0.09
Wanganui	0.54	0.55	0.71	0.62	0.34	-0.32	-0.65	-0.73
Warkworth	0.24	0.71	0.05	0.16	0.79	0.80	1.43	1.30
Wellington	2.30	1.90	2.42	3.20	2.88	2.84	2.32	2.05
Wellsford	0.19	-0.49	-0.92	0.58	0.64	1.29	0.92	0.31
Westport	-0.50	-0.63	-0.54	-0.80	-0.46	-1.04	-0.84	0.73
Whakatane	1.39	0.83	1.19	1.16	0.87	1.09	0.90	0.42
Whangamata	-2.97	-2.02	-1.91	-1.99	-0.93	-0.94	-0.93	-0.93
Whangarei	0.63	0.54	2.01	1.02	0.75	0.68	0.82	0.53
Whitianga	-1.27	-2.05	-2.01	-1.46	-0.82	-1.19	-0.14	-1.59
Winton	-0.23	0.05	-0.85	-0.99	-0.29	0.34	0.49	0.93
Woodend	1.03	0.57	0.72	1.05	1.24	1.39	1.06	1.32
Woodville	-0.96	-0.68	-0.05	0.41	0.34	-0.99	-1.05	-1.02

Appendix Table 3: Weighted regressions of *QL* on location attributes for settlements by year, excluding large cities

Dep var: QL	**1976**	**1981**	**1986**	**1991**	**1996**	**2001**	**2006**	**2013**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
temp	0.014	0.079	0.095	-0.033	-0.071	-0.092	-0.195**	-0.133
	(0.096)	(0.095)	(0.083)	(0.100)	(0.105)	(0.098)	(0.088)	(0.093)
rainfall	-0.138*	-0.090	-0.155**	-0.275***	-0.297***	-0.272***	-0.214***	-0.292***
	(0.081)	(0.083)	(0.070)	(0.086)	(0.088)	(0.083)	(0.074)	(0.075)
sunhours	0.041	0.157**	0.130**	0.101	0.242***	0.189***	0.216***	0.211***
	(0.064)	(0.064)	(0.056)	(0.066)	(0.070)	(0.064)	(0.056)	(0.059)
days_33knots	-0.219**	-0.095	-0.059	-0.159*	-0.226**	-0.148*	-0.043	-0.178**
	(0.085)	(0.086)	(0.071)	(0.084)	(0.088)	(0.084)	(0.075)	(0.074)
water	0.504***	0.307**	0.182	0.426***	0.438***	0.353**	0.307**	0.380***
	(0.137)	(0.135)	(0.115)	(0.137)	(0.152)	(0.141)	(0.123)	(0.124)
AccomFoodRec	0.157	0.368***	0.318***	0.203	0.419***	0.417***	0.429***	0.572***
	(0.149)	(0.132)	(0.121)	(0.135)	(0.140)	(0.127)	(0.123)	(0.130)
Education	0.073	0.372***	0.208*	0.154	0.152	-0.028	-0.132	0.024
	(0.140)	(0.125)	(0.125)	(0.114)	(0.145)	(0.127)	(0.120)	(0.115)
Health	0.237*	0.258**	0.227**	0.184	0.343*	0.430**	0.585***	0.457***
	(0.120)	(0.116)	(0.104)	(0.126)	(0.196)	(0.167)	(0.169)	(0.160)
LandTransport	-0.022	0.131	0.042	-0.053	0.002	-0.163	-0.055	-0.123
	(0.078)	(0.085)	(0.115)	(0.181)	(0.207)	(0.178)	(0.147)	(0.151)
AirTransport	0.458**	0.189	0.515***	0.545**	-0.226	0.095	-0.011	0.098
	(0.212)	(0.219)	(0.172)	(0.225)	(0.254)	(0.236)	(0.213)	(0.201)
lnpop	-0.125	-0.051	-0.087	-0.139	0.120	-0.029	-0.017	-0.039
	(0.080)	(0.081)	(0.068)	(0.092)	(0.091)	(0.084)	(0.077)	(0.074)
No. of obs.	127	127	127	127	127	127	127	127
R-squared	0.289	0.299	0.341	0.307	0.375	0.375	0.408	0.433

Notes: Standard errors in parentheses. Stars denote: *** p<0.01, ** p<0.05, * p<0.1. All specifications include a constant which is omitted from the table. Samples are weighted by mean population across all periods. Large cities (Auckland, Wellington, and Christchurch) are not included in these regressions.

Appendix Table 4: Weighted regressions of QB on location attributes for settlements by year, excluding large cities

Dep var: QB	**1976**	**1981**	**1986**	**1991**	**1996**	**2001**	**2006**	**2013**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
temp	-0.018	-0.046	0.053	0.231**	0.197**	0.200**	0.161*	0.120
	(0.088)	(0.085)	(0.088)	(0.096)	(0.097)	(0.099)	(0.091)	(0.092)
rainfall	0.204***	0.204***	0.222***	0.219***	0.279***	0.251***	0.178**	0.253***
	(0.075)	(0.073)	(0.074)	(0.083)	(0.081)	(0.084)	(0.076)	(0.075)
sunhours	0.037	-0.116**	-0.036	-0.097	-0.166**	-0.101	-0.079	-0.118**
	(0.059)	(0.057)	(0.059)	(0.064)	(0.065)	(0.065)	(0.057)	(0.059)
days_33knots	0.153*	0.098	0.096	0.156*	0.154*	0.057	-0.079	0.039
	(0.079)	(0.077)	(0.075)	(0.082)	(0.081)	(0.085)	(0.077)	(0.073)
water	-0.339***	-0.218*	-0.216*	-0.375***	-0.348**	-0.459***	-0.333***	-0.360***
	(0.126)	(0.119)	(0.122)	(0.132)	(0.140)	(0.143)	(0.127)	(0.124)
AccomFoodRec	0.178	0.007	0.247*	0.101	-0.059	0.066	0.039	-0.247*
	(0.137)	(0.117)	(0.129)	(0.131)	(0.129)	(0.128)	(0.127)	(0.130)
Education	-0.053	-0.244**	-0.176	-0.089	-0.234*	-0.049	-0.051	-0.153
	(0.128)	(0.111)	(0.133)	(0.111)	(0.134)	(0.128)	(0.124)	(0.114)
Health	-0.227**	-0.238**	-0.259**	-0.120	-0.236	-0.386**	-0.682***	-0.668***
	(0.111)	(0.103)	(0.111)	(0.122)	(0.180)	(0.169)	(0.174)	(0.159)
LandTransport	-0.131*	-0.157**	-0.221*	0.037	0.042	0.065	-0.033	-0.128
	(0.072)	(0.075)	(0.122)	(0.175)	(0.191)	(0.180)	(0.151)	(0.150)
AirTransport	-0.019	0.122	-0.322*	-0.029	0.479**	0.350	0.379*	0.644***
	(0.195)	(0.194)	(0.183)	(0.217)	(0.234)	(0.239)	(0.219)	(0.200)
lnpop	0.327***	0.223***	0.447***	0.355***	0.138	0.180**	0.163**	0.021
	(0.073)	(0.072)	(0.073)	(0.089)	(0.084)	(0.085)	(0.079)	(0.073)
No. of obs.	127	127	127	127	127	127	127	127
R-squared	0.377	0.365	0.459	0.414	0.395	0.393	0.451	0.455

Notes: Standard errors in parentheses. Stars denote: *** p<0.01, ** p<0.05, * p<0.1. All specifications include a constant which is omitted from the table. Samples are weighted by mean population across all periods. Large cities (Auckland, Wellington, and Christchurch) are not included in these regressions.

Appendix Table 5: Weighted and unweighted regressions of *QL* on location attributes for settlements, including large cities

Dep var: QL	**Weighted**				**Unweighted**			
	1976-1991		**1996-2013**		**1976-1991**		**1996-2013**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
temp	0.008		-0.176*		0.153*		-0.032	
	(0.080)		(0.091)		(0.086)		(0.079)	
rainfall	-0.170**		-0.268**		-0.083		-0.058	
	(0.080)		(0.104)		(0.060)		(0.061)	
sunhours	0.117*		0.215***		0.079		0.263***	
	(0.066)		(0.077)		(0.088)		(0.074)	
days_33knots	-0.185***		-0.212***		-0.021		-0.153**	
	(0.038)		(0.037)		(0.093)		(0.067)	
water	0.377***		0.303**		0.699***		0.516***	
	(0.119)		(0.141)		(0.193)		(0.176)	
AccomFoodRec	0.239***	0.060	0.413***	0.528**	0.166**	0.048	0.220***	0.066
	(0.087)	(0.115)	(0.099)	(0.228)	(0.078)	(0.113)	(0.078)	(0.119)
Education	0.209**	0.046	-0.013	0.241***	-0.011	-0.004	-0.134	0.285***
	(0.082)	(0.077)	(0.115)	(0.092)	(0.066)	(0.064)	(0.082)	(0.072)
Health	0.227*	0.075	0.595***	0.226*	-0.006	-0.059	0.164*	0.052
	(0.121)	(0.104)	(0.141)	(0.133)	(0.070)	(0.118)	(0.093)	(0.078)
LandTransport	0.022	-0.059	-0.158	-0.010	-0.101**	-0.032	-0.164**	0.045
	(0.078)	(0.044)	(0.126)	(0.095)	(0.047)	(0.044)	(0.078)	(0.078)
AirTransport	0.442**	-0.122	0.350*	-0.046	0.364	-0.013	-0.023	-0.007
	(0.175)	(0.086)	(0.178)	(0.128)	(0.286)	(0.117)	(0.191)	(0.104)
lnpop	-0.109**	-1.092***	-0.161***	-0.460*	-0.229***	-0.856***	-0.137*	-0.249
	(0.047)	(0.227)	(0.052)	(0.239)	(0.087)	(0.299)	(0.074)	(0.215)
Fixed Effects	Year	Year, City	Year	Year, City	Year	Year, City	Year	Year, City
No. of cities	130	130	130	130	130	130	130	130
No. of obs.	520	520	520	520	520	520	520	520
R-squared	0.451	0.242	0.677	0.335	0.283	0.062	0.300	0.085

Notes: Standard errors in parentheses are clustered at the city level. Stars denote: *** p<0.01, ** p<0.05, * p<0.1. R-squared in columns (2), (4), (6) and (8) is R-squared-within. All specifications include a constant which is omitted from the table. In weighted regressions samples are weighted by mean population across all periods. The full sample of cities is included in all specifications.

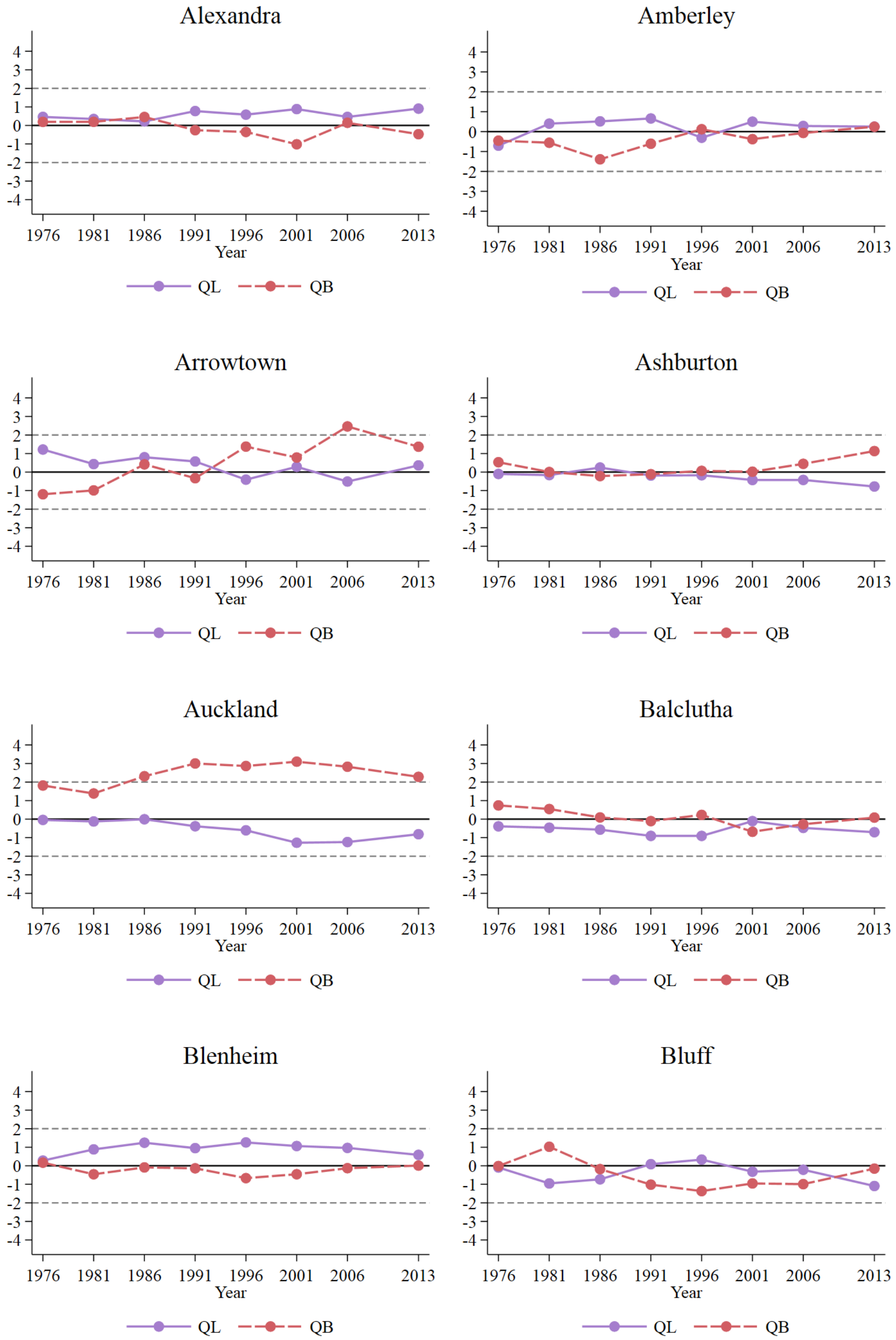
Appendix Table 6: Weighted and unweighted regressions of *QB* on location attributes for settlements, including large cities

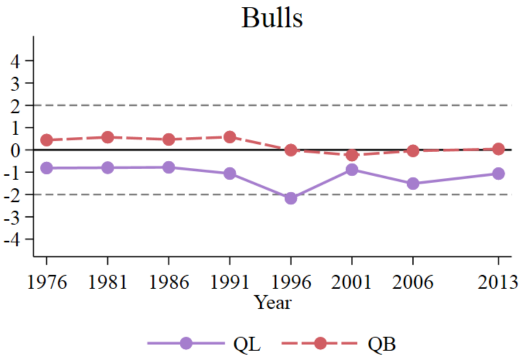
Dep var: QB	**Weighted**				**Unweighted**			
	1976-1991		**1996-2013**		**1976-1991**		**1996-2013**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
temp	0.182**		0.331***		0.010		0.202**	
	(0.082)		(0.094)		(0.078)		(0.085)	
rainfall	0.235**		0.258**		0.058		-0.052	
	(0.091)		(0.114)		(0.058)		(0.061)	
sunhours	-0.101*		-0.149***		0.032		-0.089	
	(0.052)		(0.052)		(0.077)		(0.070)	
days_33knots	0.273***		0.212***		0.054		0.101	
	(0.040)		(0.039)		(0.078)		(0.067)	
water	-0.339***		-0.260*		-0.477***		-0.367*	
	(0.114)		(0.135)		(0.166)		(0.188)	
AccomFoodRec	0.207*	0.352	0.040	-0.661**	0.131*	-0.172**	0.002	-0.044
	(0.111)	(0.271)	(0.126)	(0.294)	(0.070)	(0.082)	(0.089)	(0.121)
Education	-0.247*	-0.542***	-0.144	-0.568***	0.015	-0.105**	-0.046	-0.354***
	(0.132)	(0.175)	(0.102)	(0.091)	(0.059)	(0.048)	(0.085)	(0.078)
Health	-0.261**	-0.485**	-0.767***	-0.396***	-0.026	-0.042	-0.106	-0.174**
	(0.112)	(0.192)	(0.140)	(0.138)	(0.053)	(0.115)	(0.098)	(0.077)
LandTransport	-0.087	-0.004	0.139	0.010	-0.019	-0.077	0.098	-0.023
	(0.083)	(0.106)	(0.124)	(0.116)	(0.045)	(0.057)	(0.088)	(0.066)
AirTransport	-0.162	-0.012	-0.217	0.073	-0.009	0.050	0.522**	0.031
	(0.205)	(0.154)	(0.209)	(0.117)	(0.250)	(0.156)	(0.243)	(0.156)
lnpop	0.404***	1.822**	0.448***	0.140	0.467***	1.198***	0.222**	1.092***
	(0.064)	(0.902)	(0.073)	(0.488)	(0.071)	(0.305)	(0.086)	(0.265)
Fixed Effects	Year	Year, City	Year	Year, City	Year	Year, City	Year	Year, City
No. of cities	130	130	130	130	130	130	130	130
No. of obs.	520	520	520	520	520	520	520	520
R-squared	0.782	0.569	0.854	0.431	0.370	0.116	0.247	0.208

Notes: Standard errors in parentheses are clustered at the city level. Stars denote: *** p<0.01, ** p<0.05, * p<0.1. R-squared in columns (2), (4), (6) and (8) is R-squared-within. All specifications include a constant which is omitted from the table. In weighted regressions samples are weighted by mean population across all periods. The full sample of cities is included in all specifications.

Appendix Figures

Appendix Figure 1*: QL* and *QB* over time for all settlements

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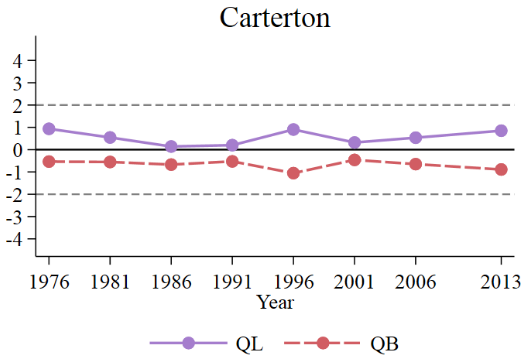
1976 1981 1986 1991 1996 2001 2006 2013
Year
QL
QB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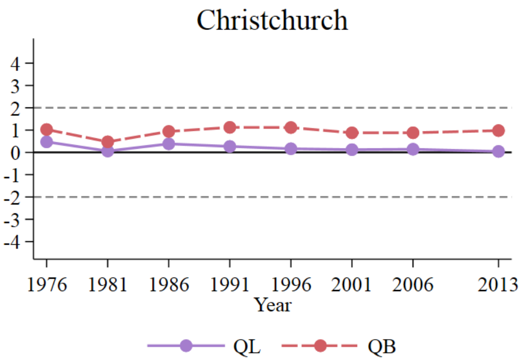
1976 1981 1986 1991 1996 2001 2006 2013
Year
QL
QB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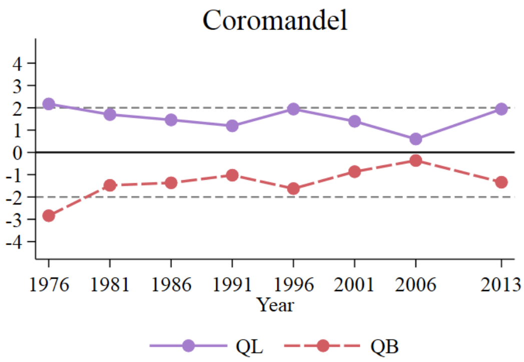
1976 1981 1986 1991 1996 2001 2006 2013
Year
QL
QB


Coromandel
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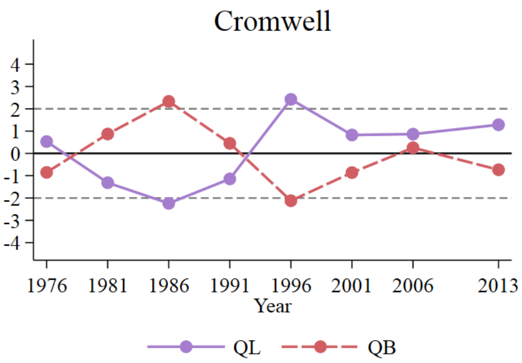
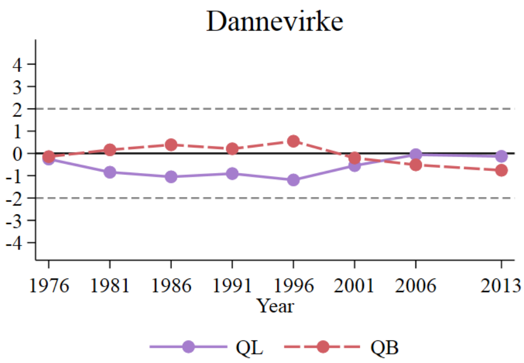
1976 1981 1986 1991 1996 2001 2006 2013
Year
QL
QB


Cromwell
4 3 2 1 0 -1 -2 -3 -4
1976 1981 1986 1991 1996 2001 2006 2013
Year
QL
QB


Dannevirke
4 3 2 1 0 -1 -2 -3 -4
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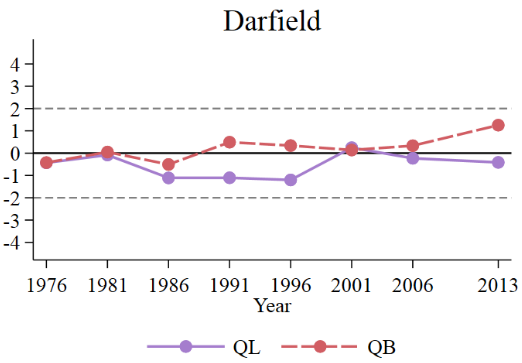
Year
QL
QB


Darfield
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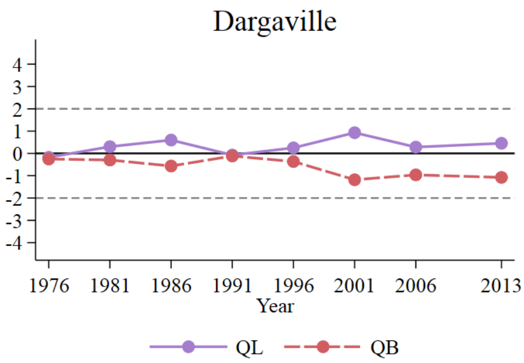
1976 1981 1986 1991 1996 2001 2006 2013
Year
QL
QB


Dargaville
4 3 2 1 0 -1 -2 -3 -4
1976 1981 1986 1991 1996 2001 2006 2013
Year
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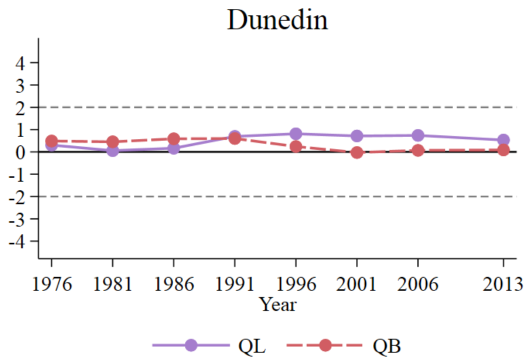
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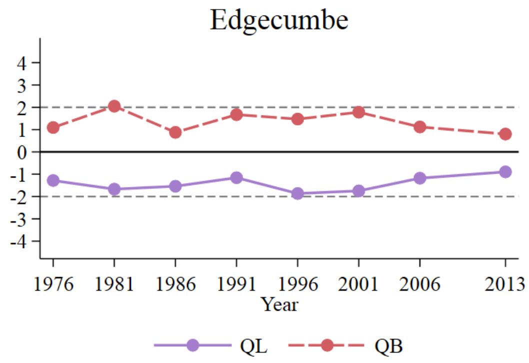
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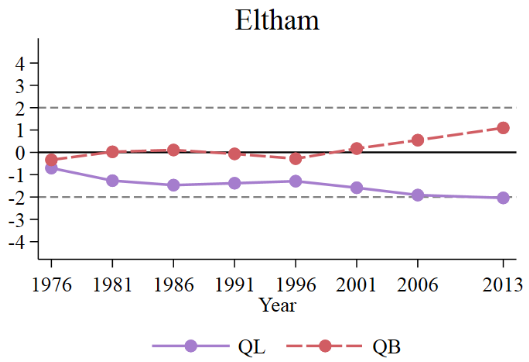
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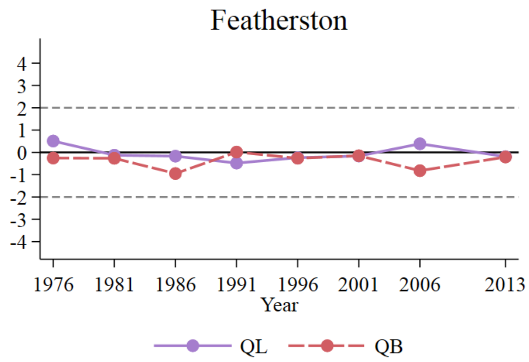
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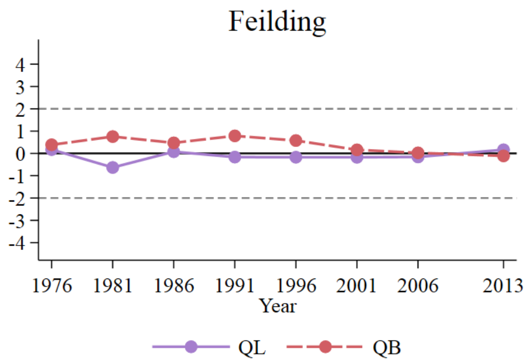
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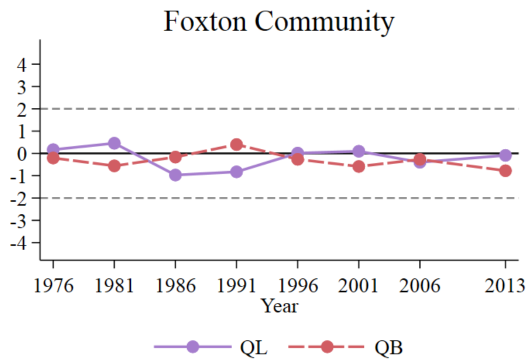
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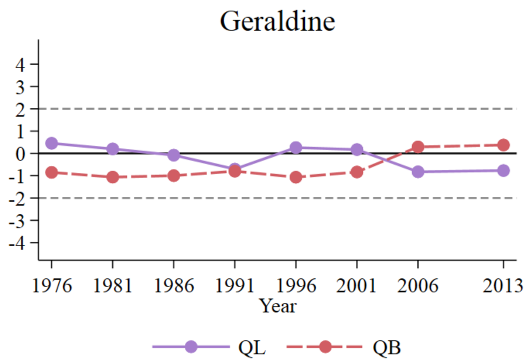
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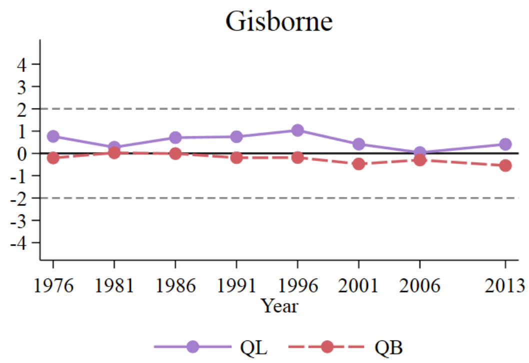
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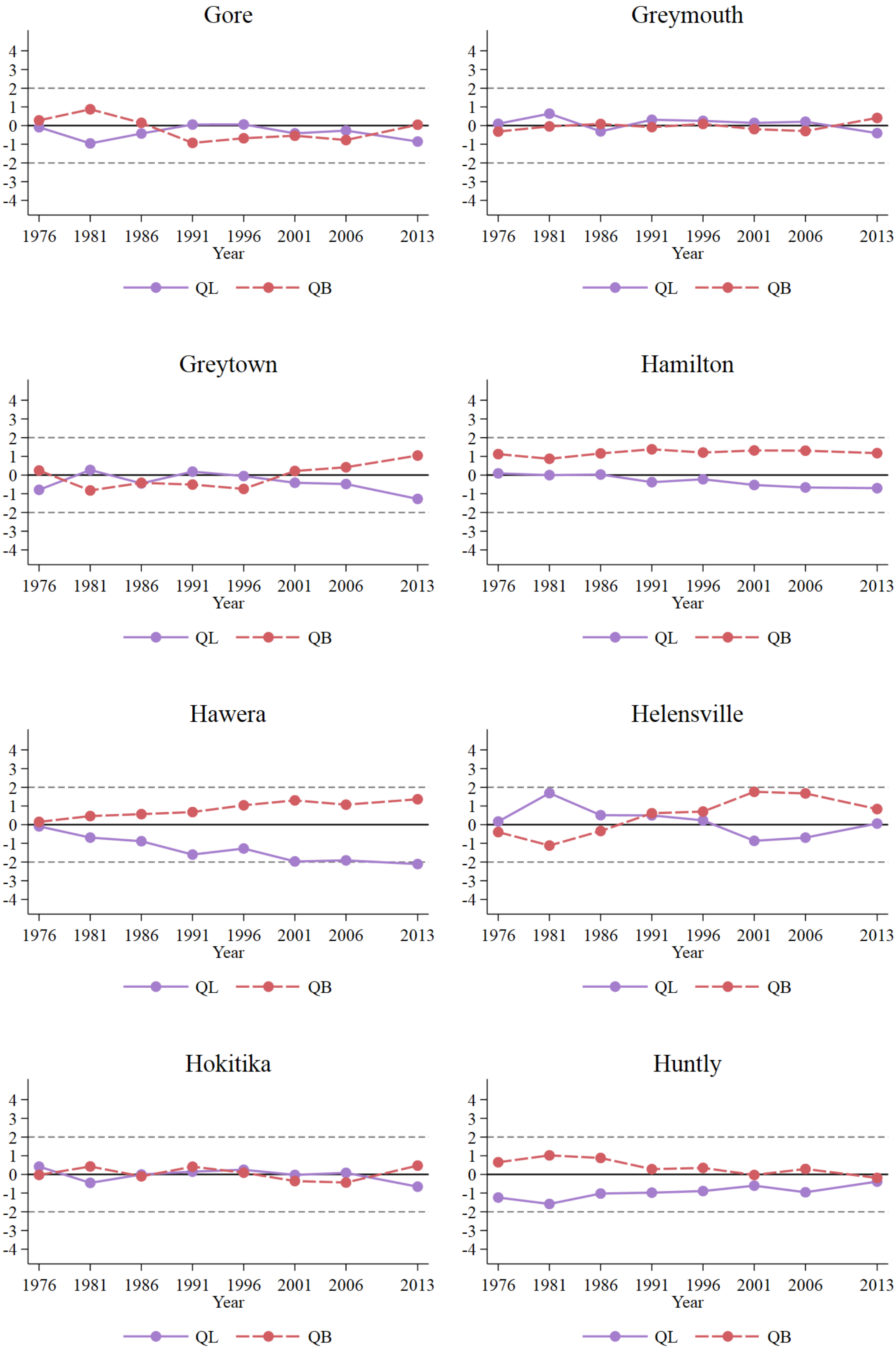
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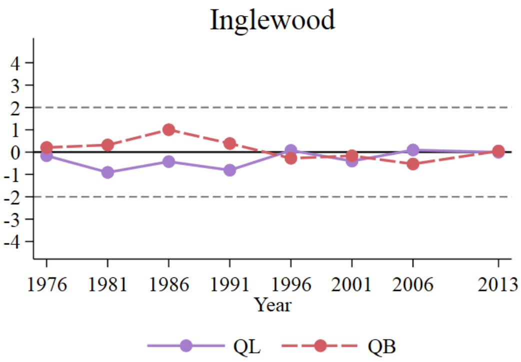
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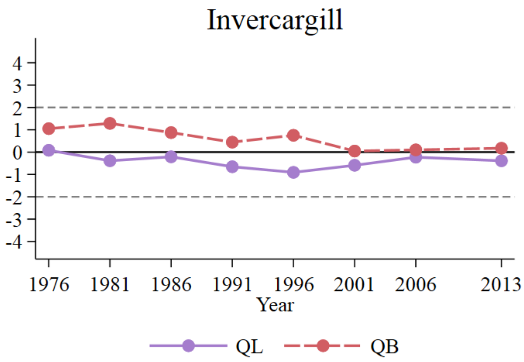
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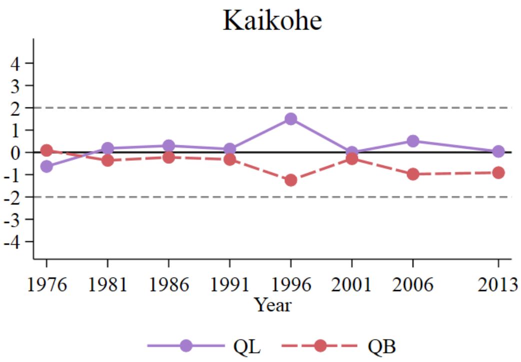
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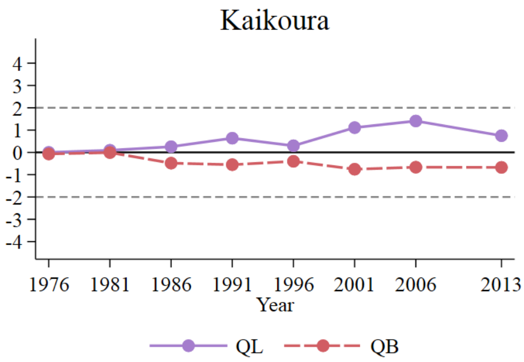
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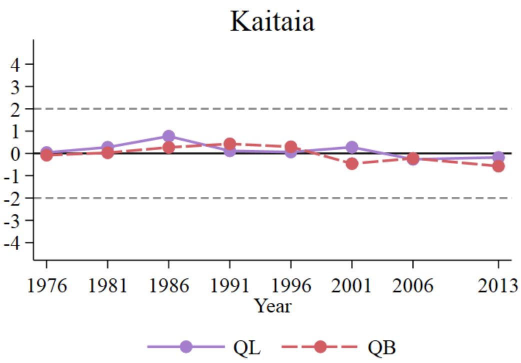
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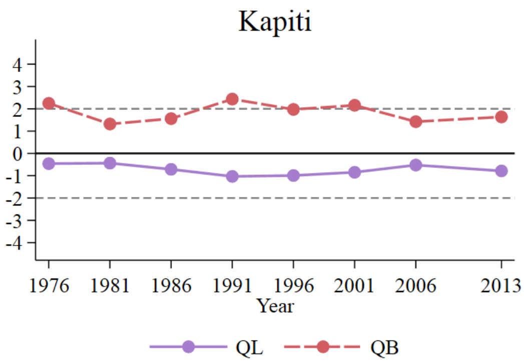
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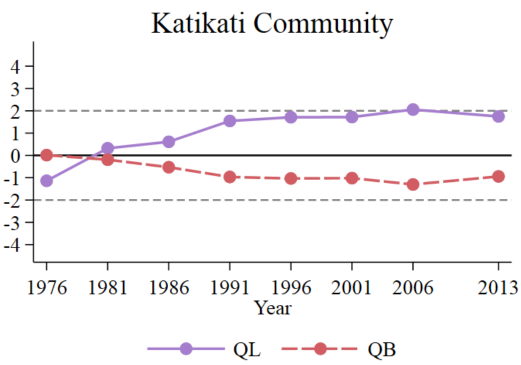
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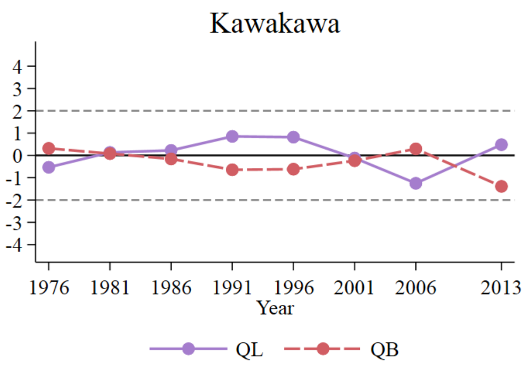
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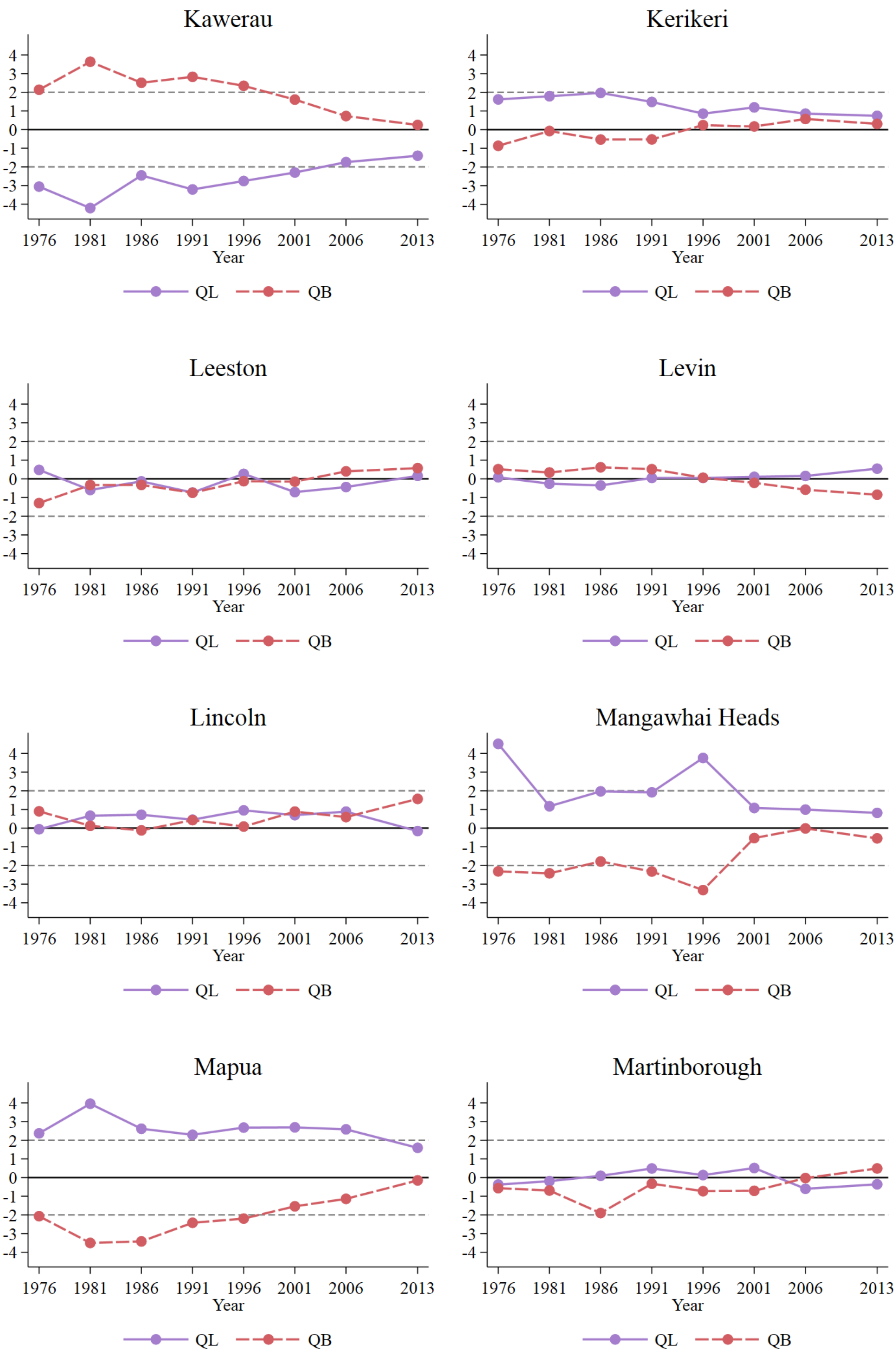
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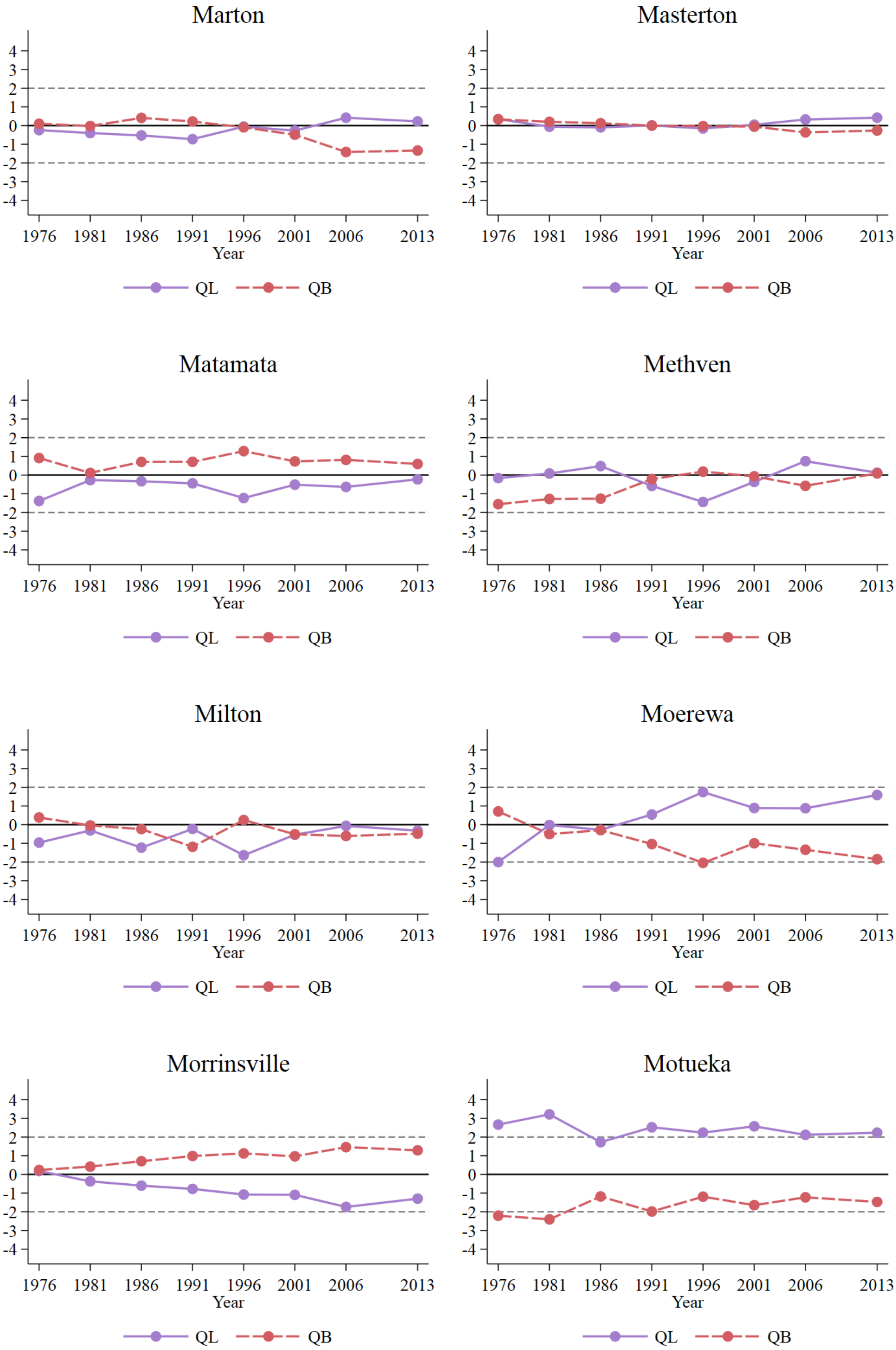
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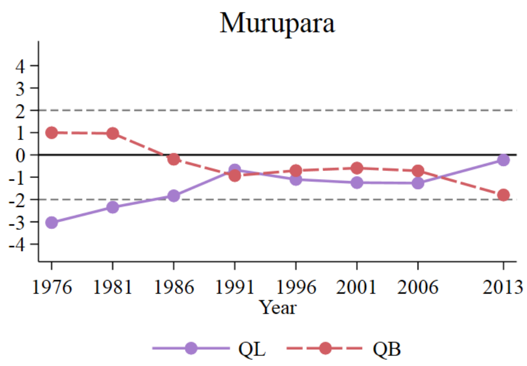
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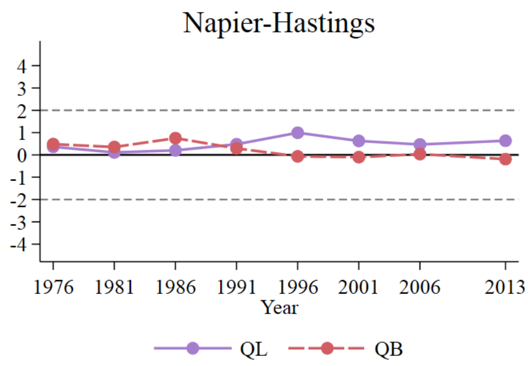
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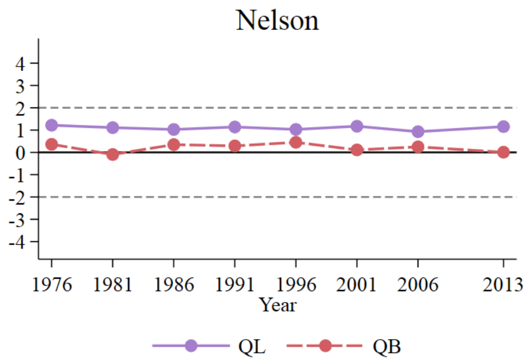
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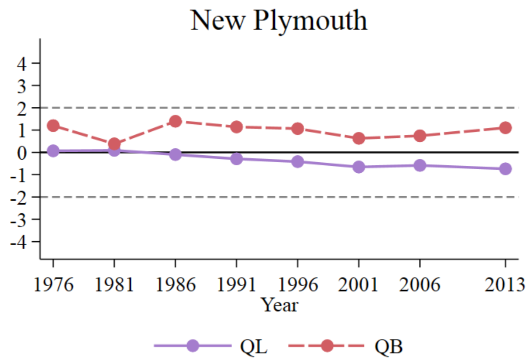
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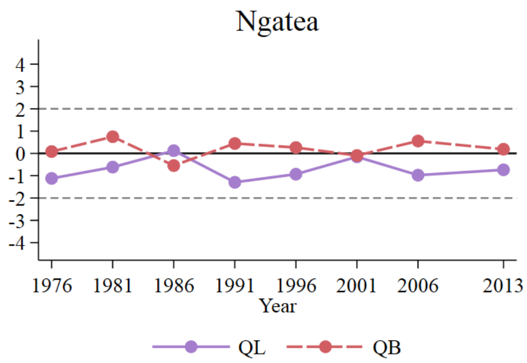
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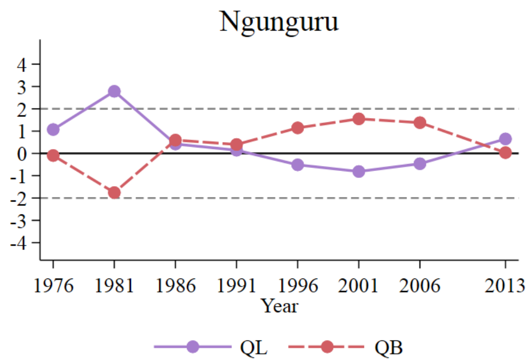
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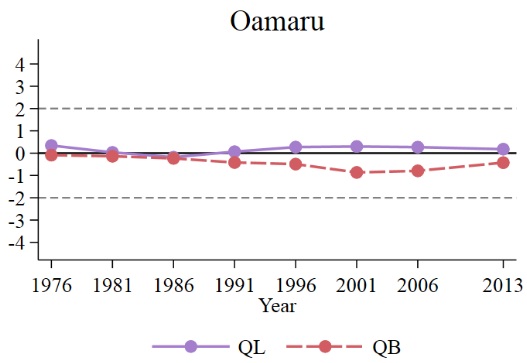
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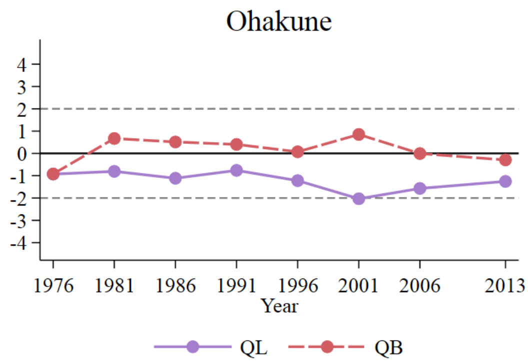
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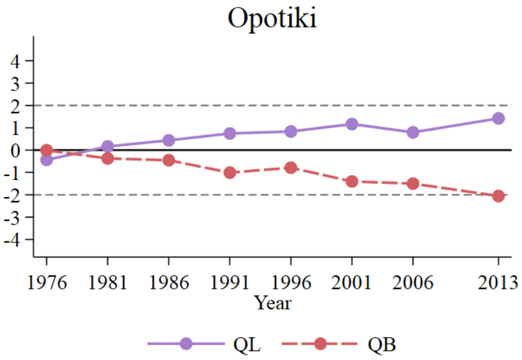
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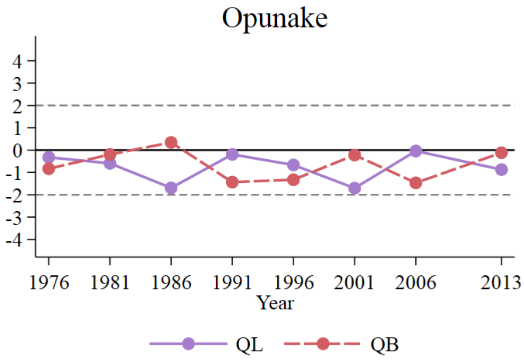
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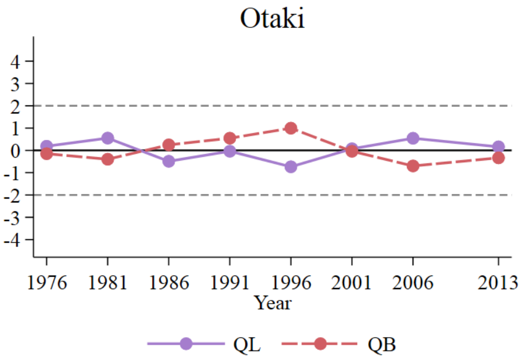
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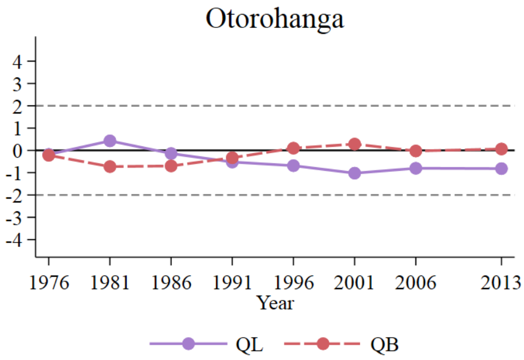
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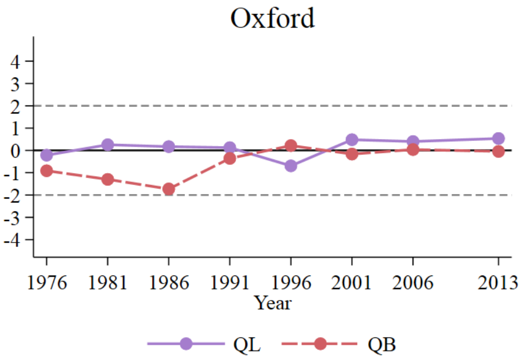
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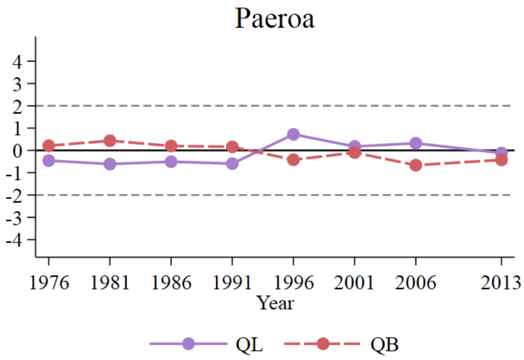
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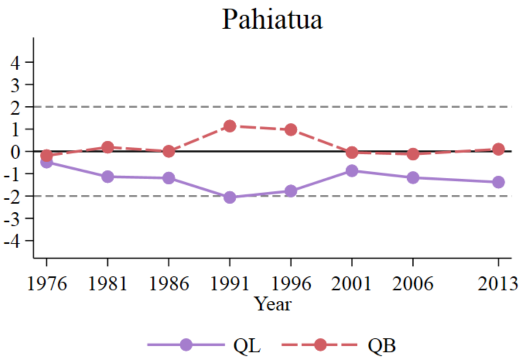
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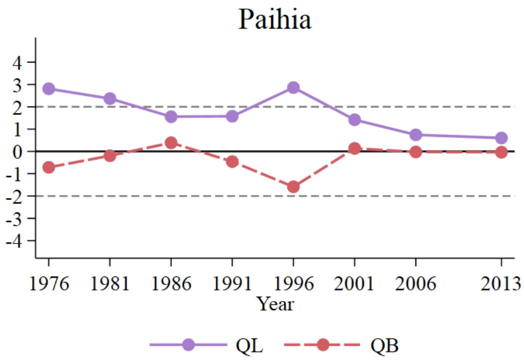
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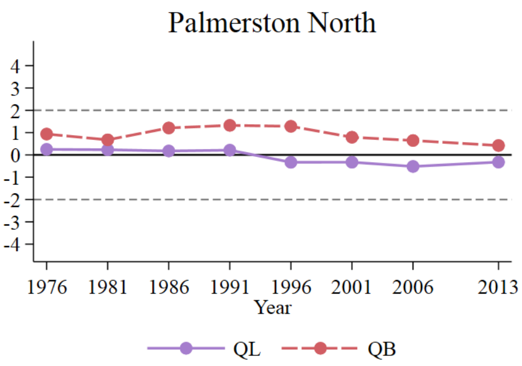
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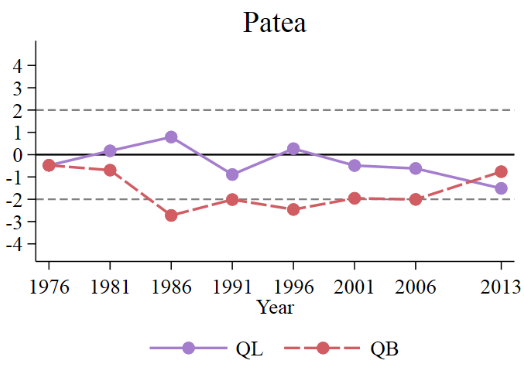
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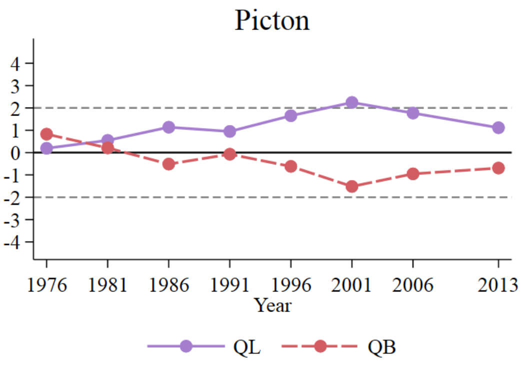
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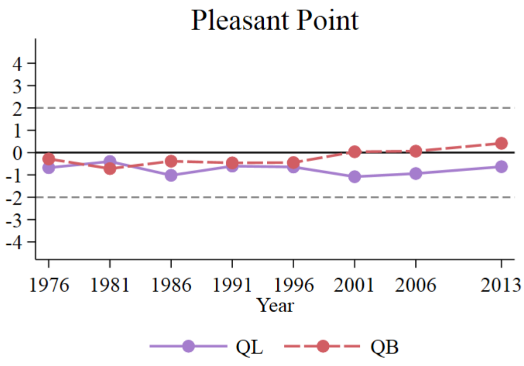
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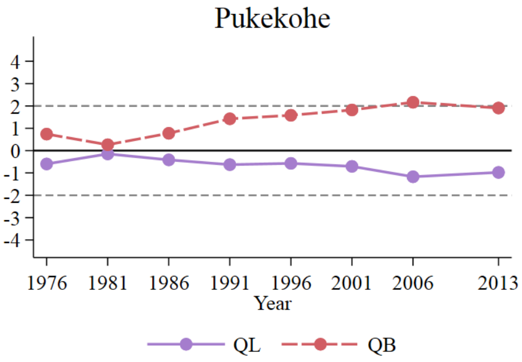
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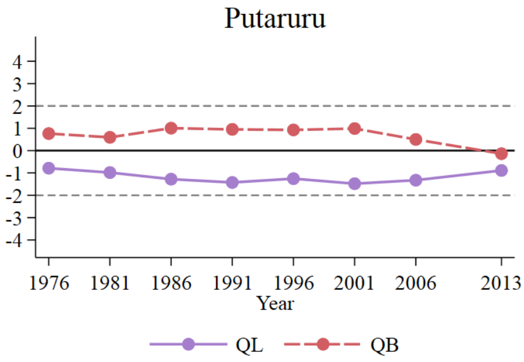
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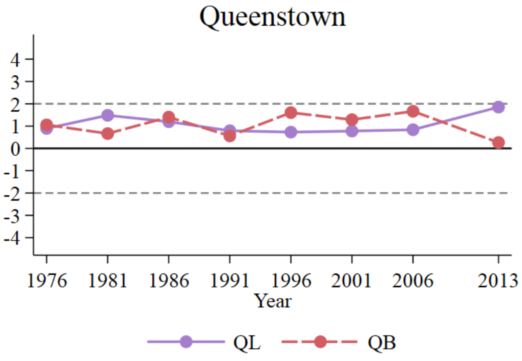
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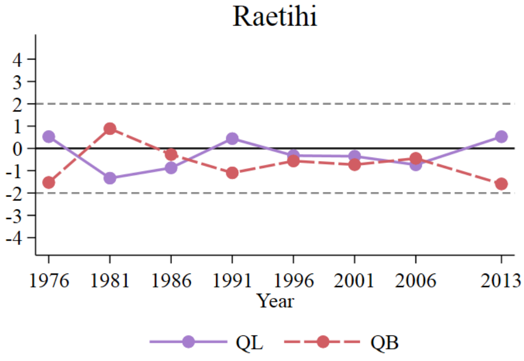
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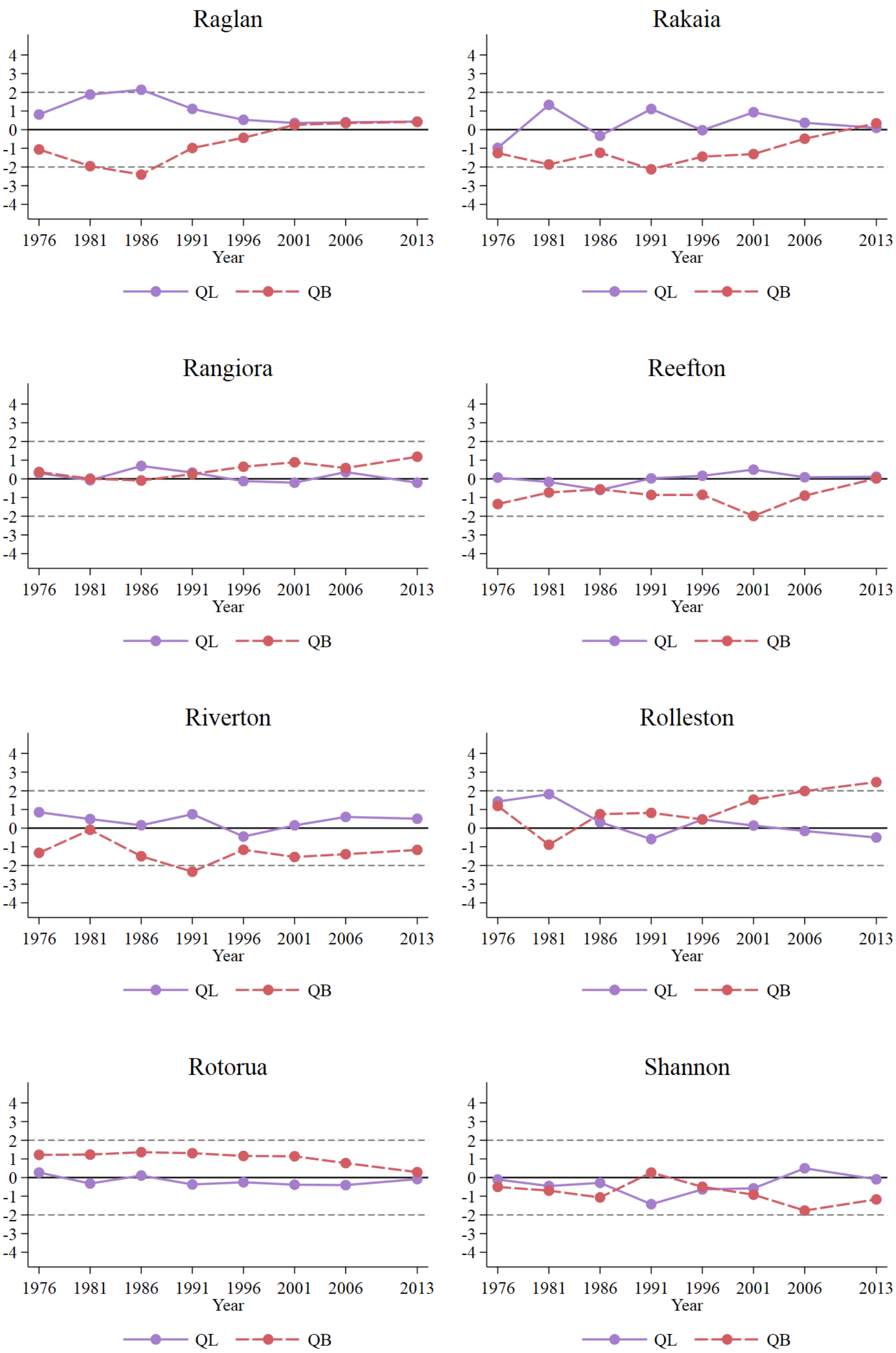
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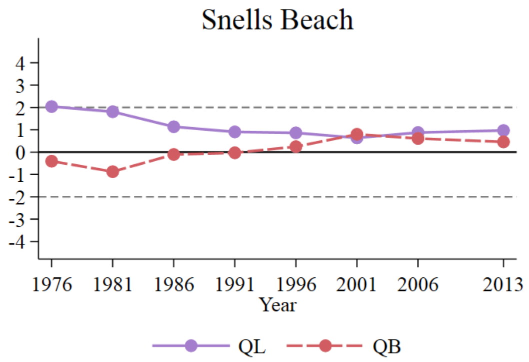
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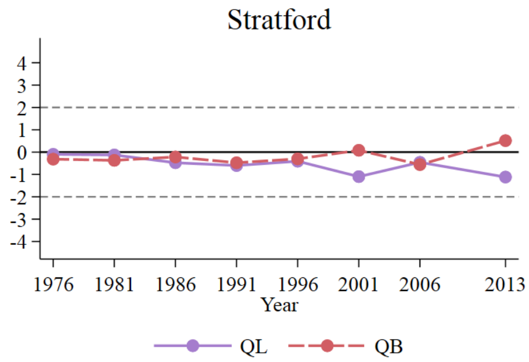
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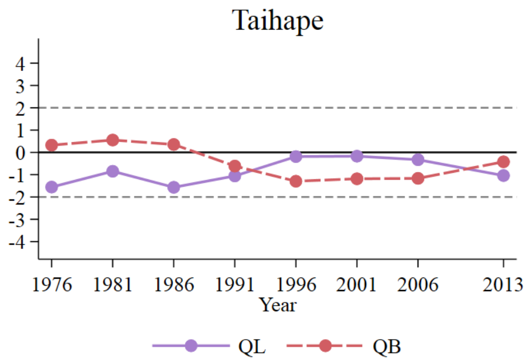
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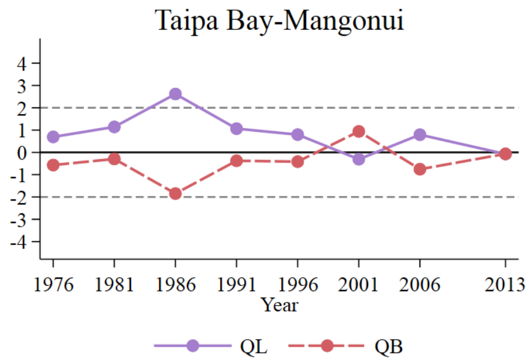
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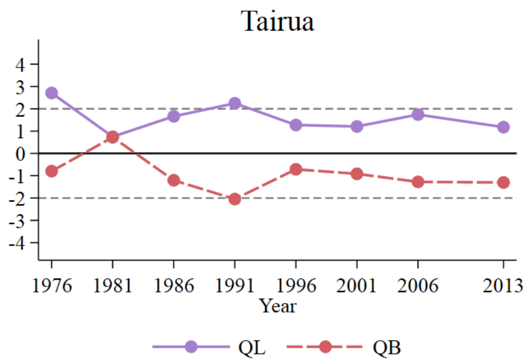
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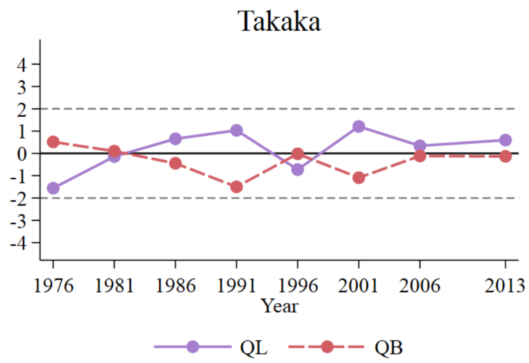
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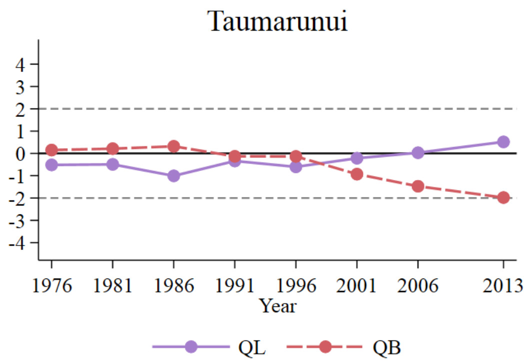
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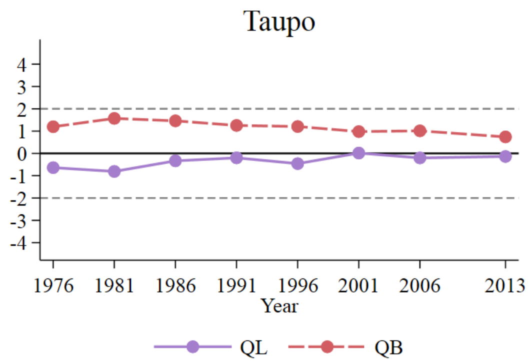
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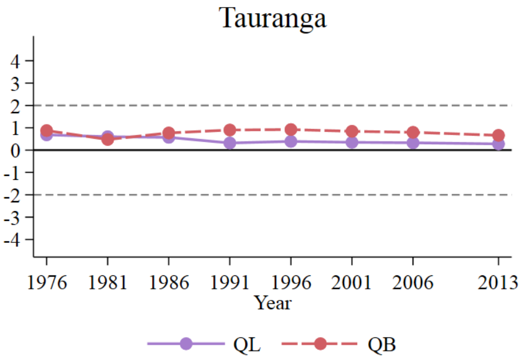
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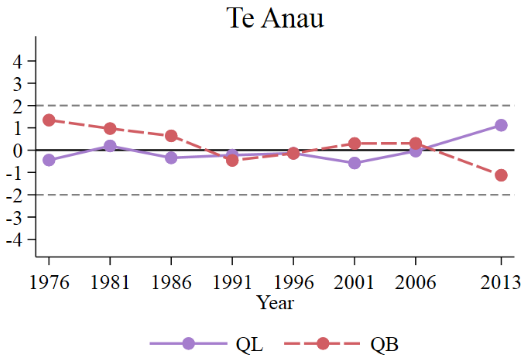
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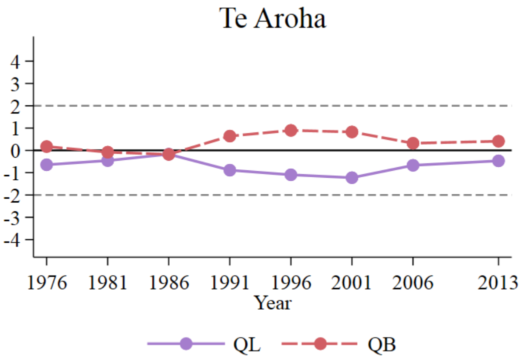
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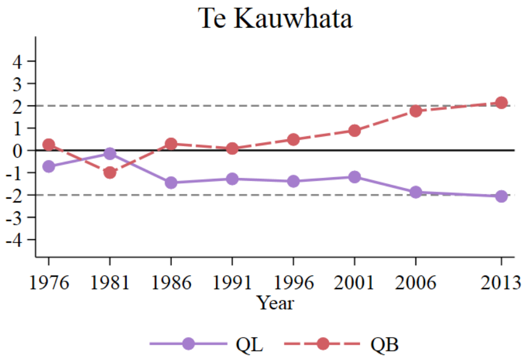
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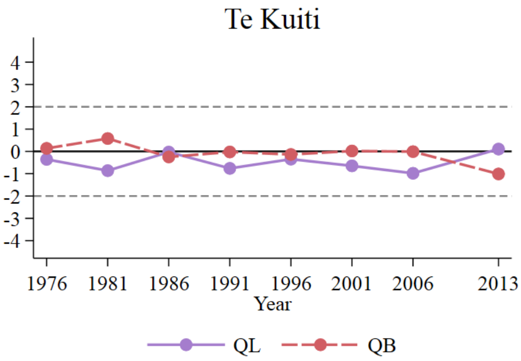
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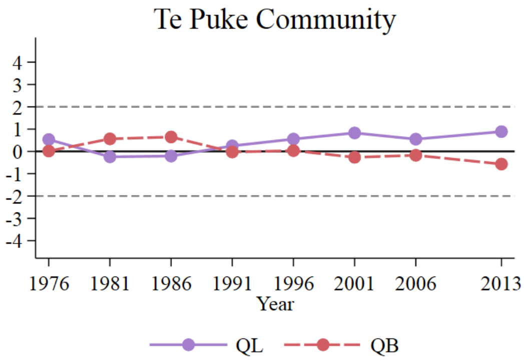
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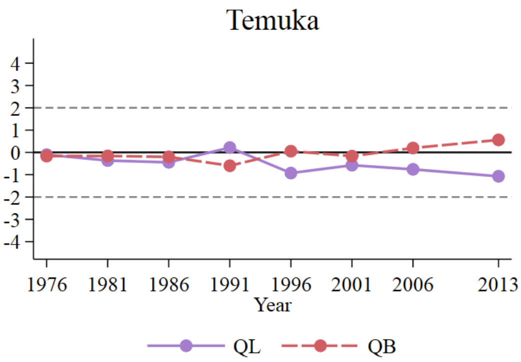
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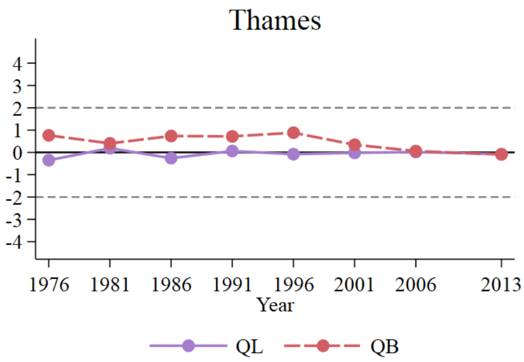
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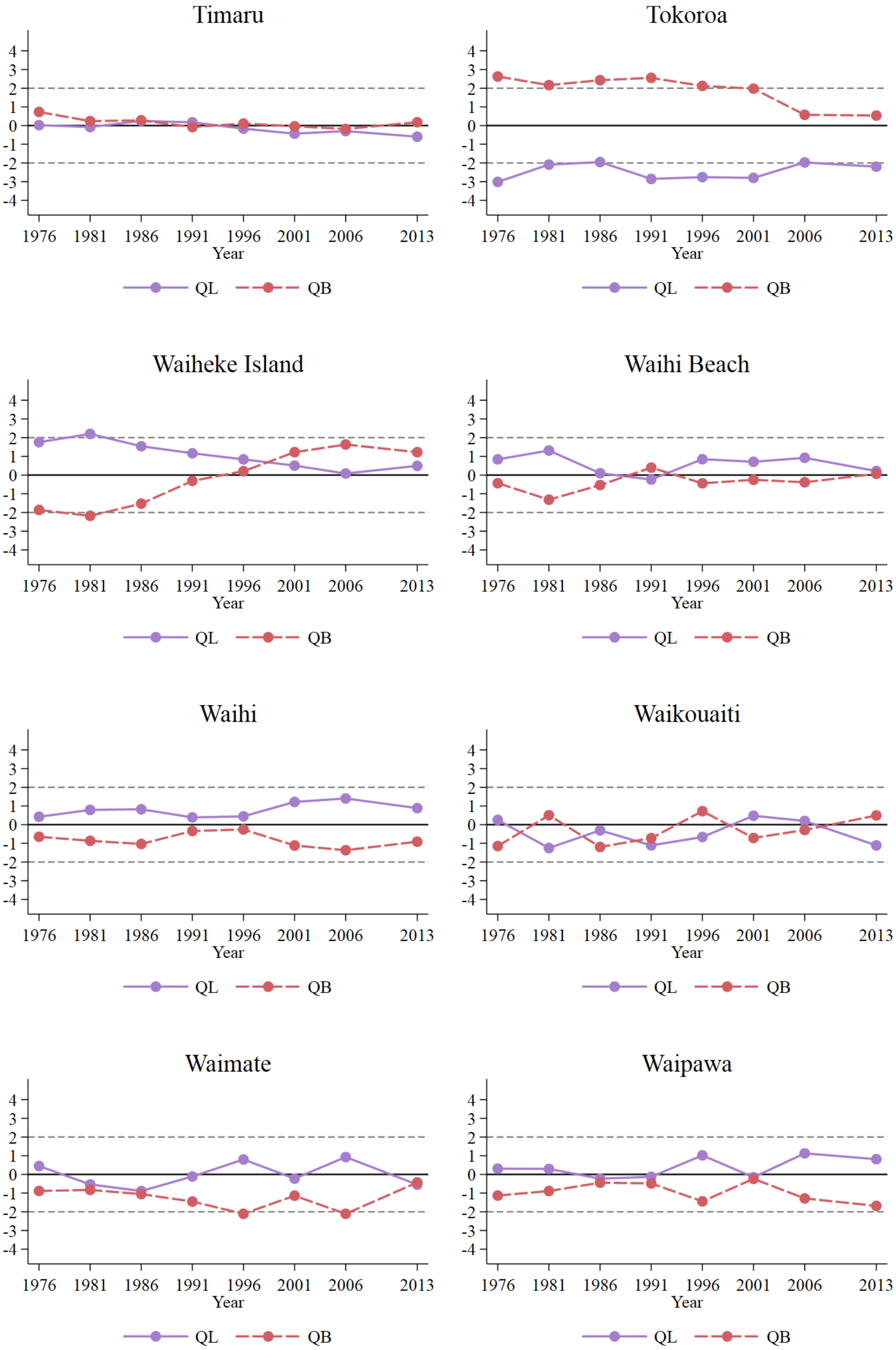
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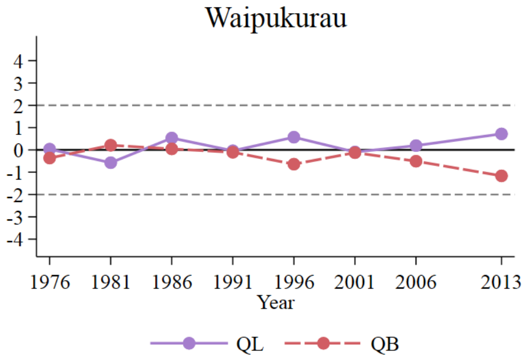
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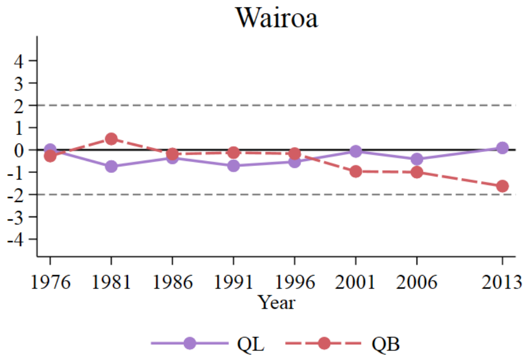
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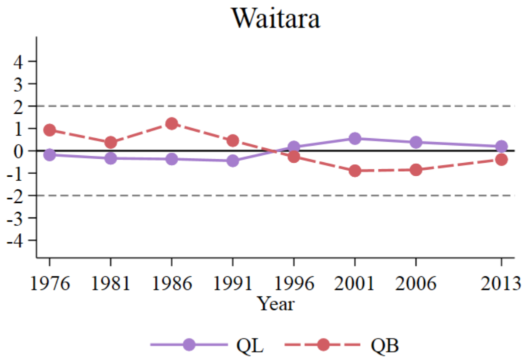
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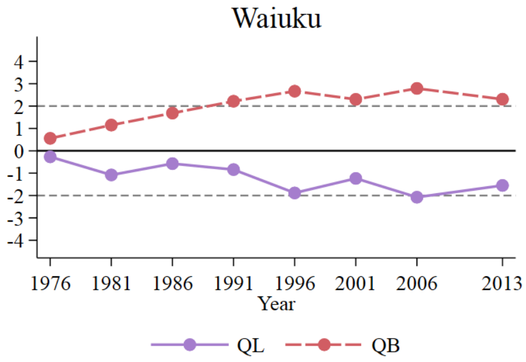
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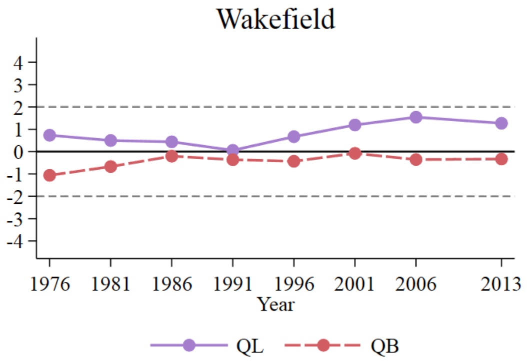
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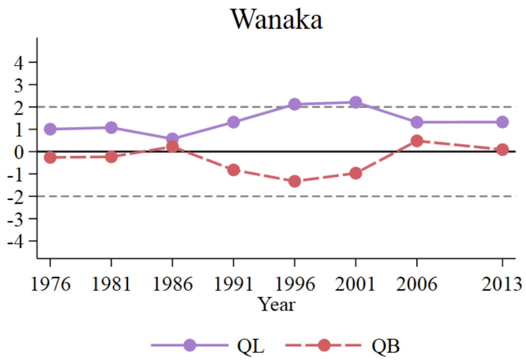
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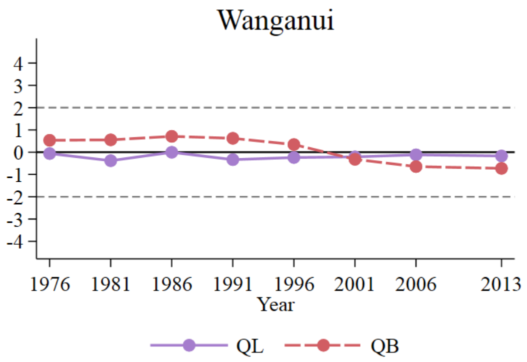
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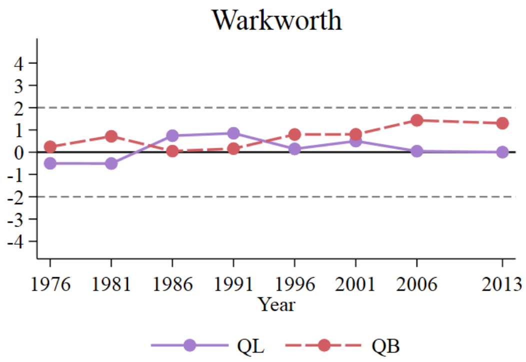
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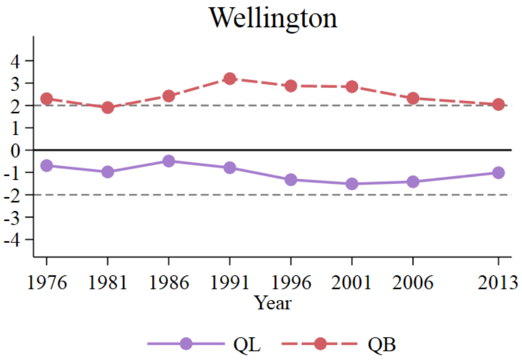
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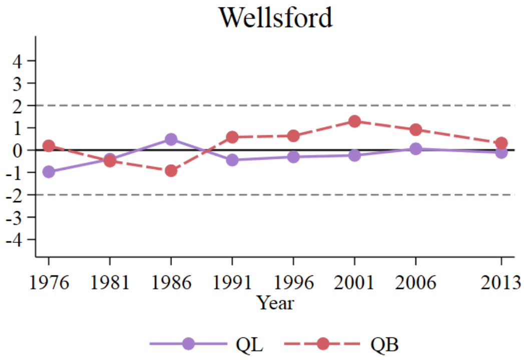
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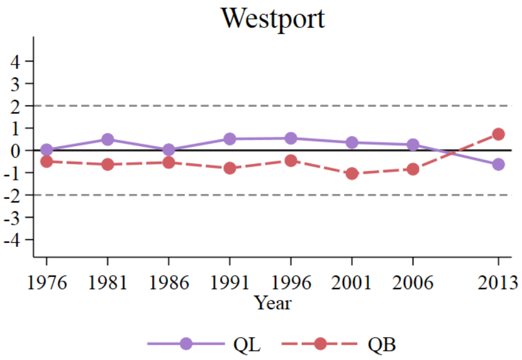
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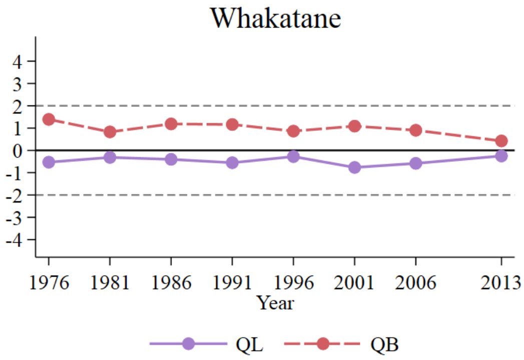
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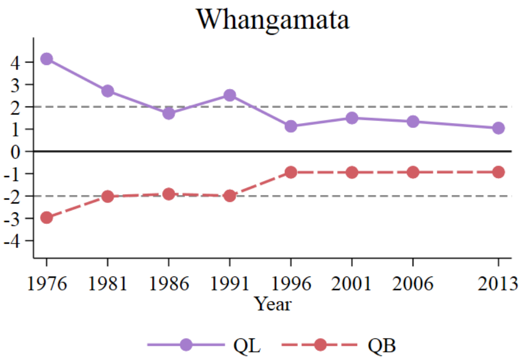
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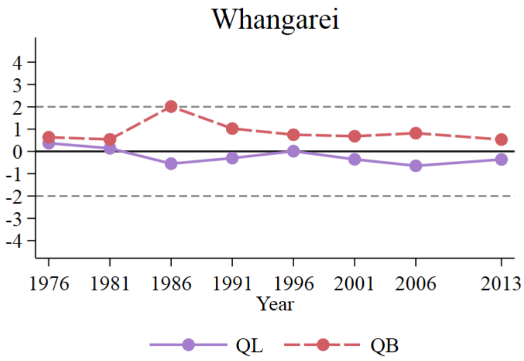
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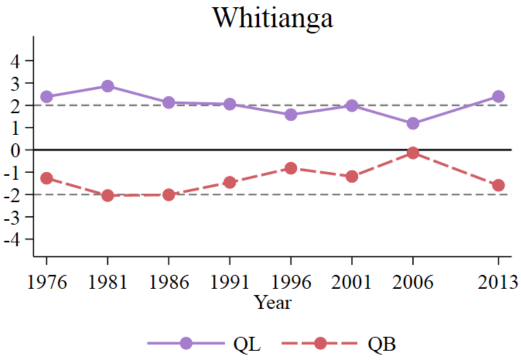
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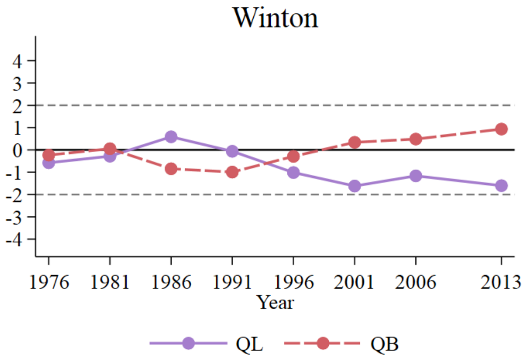
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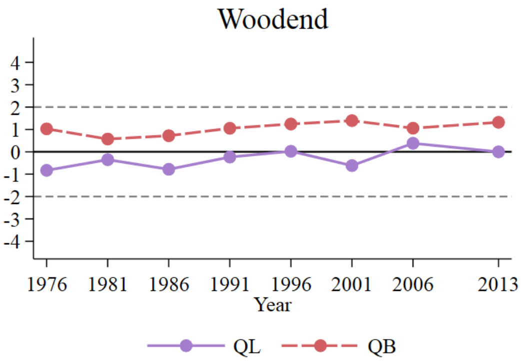
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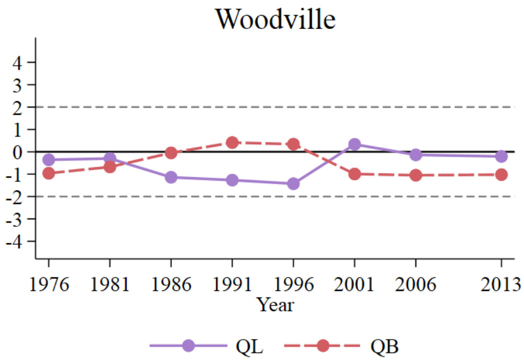
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