

Socio-spatial Mobility and Residential Sorting: Evidence from a Large-scale Survey

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Abstract

This paper demonstrates that residential locations observed at one point in time influence socio-spatial mobility and hence neighbourhood outcomes arising from residential mobility. Using a unique survey of migration within New Zealand, it illustrates the classic result that repeated observations regress towards the mean. According to this statistical property, those leaving the most and least deprived areas are observed moving up and down towards the mean level of neighbourhood quality. After addressing this statistical effect, it is shown that those leaving very deprived areas are less likely to upgrade their neighbourhood, particularly if they also report relatively low incomes. By contrast, the downward adjustment observed by those leaving areas of low deprivation approximate those expected on the basis of regression towards the mean.

1. Introduction

The focus in this paper is the propensity of individuals to move geographically between different positions within the prevailing system of social stratification. There has been on-going interest in the dynamics of movement into and out of deprived areas at the same time as there has been an on-going enquiry into social mobility. This paper makes a connection between the two by exploring the differential ability of households to leave the most deprived areas of our cities and the possible consequences

such constraints may have for their social exclusion (Glennister, *Lupton et al.*, 1999; Townsend, 1999; Power and Wilson, 2000).

One of the main reasons for taking a geographical approach to social mobility is the widespread concern over the social mobility implications of place—the argument that, other things equal, the socioeconomic circumstances of the neighbourhood in which people live can affect their ability to enjoy equal rates of upward mobility. While the effects of place as spatial context can be

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positive or negative and operate with equal force at *both* ends of the social spectrum, the policy focus is clearly on those who begin their move from relatively deprived areas.

The paper reviews the literature on mobility and deprivation and the hypotheses raised about the relative influence of settlement geography on social mobility. This is followed by a discussion of our data. The Survey of Dynamics and Motivation for Migration in New Zealand allows us to construct an origin by destination mobility matrix connecting neighbourhoods across the full range of deprivation deciles recorded by the New Zealand Deprivation Index. The heart of the paper is our analysis of the patterns of people movement between neighbourhoods over a two-year time-interval. We demonstrate the influence of regression to the mean and use departures from the regression to identify the influence that neighbourhood deprivation can have on the magnitude and direction of mobility.

Our paper makes three contributions to the discussion and interpretation of neighbourhood mobility. First, we address the possibility of neighbourhood effects in full recognition of regression towards the mean effects. Secondly, we focus on neighbourhoods sorted on socio-economic or deprivation criteria only, a feature which sets the paper apart from much of the research based on residential change in the US and therefore on neighbourhoods differentiated by race. Thirdly, we treat the New Zealand data as an opportunity to re-examine generalisations about residential mobility drawn from the US as well as the UK and other European studies.

2. The Context of Previous Work on Deprivation and Residential Mobility

Recent work has drawn attention to the general importance of links between mobility

and neighbourhood effects (van Ham and Manley, 2010; Hedman, 2011), although public policy concern has focused primarily on movements in and out of poor neighbourhoods. There has therefore been a growing body of work which examines the transitions of people out of deprived neighbourhoods. That research can be categorised into: studies of the role of selective migration; differential choices by race and ethnicity; the role of explanatory factors especially education and income; and, the impact of neighbourhood type.

It has been argued—criticism of ‘area-based initiatives’ in the UK, for example—that selective migration processes constantly erode any gains made by public investment in place (Bailey and Livingston, 2008, p. 943). Nord (1998), Gramlich *et al.* (1992) and Andersson and Brama (2004) each show that, even though the poor as a whole are quite mobile, there is a tendency of people who move into deprived areas to be poorer than those on average, leading to increased neighbourhood deprivation (Andersson and Brama, 2004). Even though out-migration of the poor substantially exceeds in-migration, poverty rates are driven up by much higher net out-migration of the non-poor. Such a pattern, Nord suggests

is consistent with the hypothesis that the spatial concentration of poverty persists in association with, and as a result of, *long-term spatial unevenness in level and type of economic development*, and that differential migration of the poor and non-poor is one of the mechanisms linking the two phenomena (Nord, 1998, p. 349; emphasis added).

Nord finds that the poor as well as the non-poor move in response to real economic opportunity, but the migration patterns of the two groups differ because the opportunities that attract them differentially are mixed in varying proportions in different

places. Thus, net migration flows reflect residential sorting behaviour and thereby reinforce deprivation in such areas regardless of the macro-economic context.

Differential flows also exacerbate increases in neighbourhood deprivation when linked to ethnic outcomes (Bolt and van Kempen, 2003; Quillian, 2003; South and Crowder, 1997). South and Crowder show that Blacks are less likely than Whites to leave poor tracts and are more likely to move into them, and Quillian establishes that there are large racial disparities in the likelihood of Blacks having long residency in poor neighbourhoods. In the European context, Bolt and van Kempen show that native Dutch households (in contrast to ethnic minorities) are more likely to be able to leave poor neighbourhoods. The fact that out-migration of the non-poor renders poor areas even more disadvantaged tends to reinforce the relative ranking of neighbourhoods, perpetuating the socio-economic separation of neighbourhoods, particularly when the differences between them are marked to begin with. In other words, there is evidence that

net migration flows act to *maintain* the gap between deprived areas and the average and, as a result, work to undermine efforts to regenerate deprived neighbourhoods (Bailey and Livingston, 2008, p. 948; emphasis added).

The process of moving on, or being 'trapped', in poor neighbourhoods is clearly related to resources. Education, employment and training have the potential to stimulate mobility out of deprived areas. To the extent that they are successful, 'those who get on, get out' and this lowers rather than raises the average level of deprivation in the area being assisted (Cheshire *et al.*, 2003). Several studies have demonstrated empirically the influence of income

and socioeconomic status on movements in and out of deprived neighbourhoods (South *et al.*, 2005; South *et al.*, 2011; Bolt *et al.*, 2008). And, as Schaake *et al.* (2009) point out, people with higher income are more likely to move out of neighbourhoods through a sorting process which reinforces the concentrations of the have and have-nots into selected neighbourhoods. Recent research has shown that spatial sorting continues to operate even in communities where there is a strong policy interest in mixing—for example, in the Dutch context (van Ham and Feijten, 2008). This is partly because mobility decisions can be triggered by the presence of minority populations (Bolt *et al.*, 2008).

The creation of deprived neighbourhoods is therefore not a random process but is embedded in the preferences people reveal in their choice of area and their economic ability to affect those choices. The resulting sorting processes distribute the population across urban amenities. If the residential sorting process widens differences between neighbourhoods, some places will experience a more rapid descent socioeconomically and generate characteristics which may initiate threshold effects on the social behaviour of the associated residents. It is this recognition of threshold effects which has provided a conceptual basis for linking general 'place characteristics' to behavioural responses (Meen, 2006).

In light of this research, it is surprising to find so few attempts to track the movement of a cross-section of individuals across neighbourhoods. In part, this is because attention has been focused on ethnic rather than socioeconomic sorting notwithstanding the strong but far from complete overlap between the two. However, there is evidence that economic resources are becoming important when it comes to understanding patterns of residential sorting in contemporary urban contexts. The fact that Toronto's

neighbourhoods, for example, have become considerably more polarised by income over the past few decades reflects the increasing attention neighbourhood characteristics receive by those with the ability to choose (Hulchanski, 2007). And, as Hulchanski suggests, the greater the resources available to individuals, the greater the likelihood that neighbourhoods will polarise.

In summary, a considerable body of research exists which focuses on the consequences of patterns of mobility for the characteristics of neighbourhoods and the strong interconnections between different levels of the residential hierarchy. The better-off try and avoid or leave poor areas for other areas so that they can create positive externalities for themselves, but their absence in turn is keenly felt in poorer communities who are, as a result, subject to a range of negative externalities associated with a predominance of poor families. The extent to which these concentrations in turn retard the chances of the upward mobility of individuals caught in such areas remains an area of central concern.

If the connection between residential mobility and neighbourhood externalities is to be better understood then we need to focus on the *relationship* between living in deprived and relatively privileged neighbourhoods and subsequent mobility. In the New Zealand case study provided here, we estimate the relative importance of both the neighbourhood and the demographic and socioeconomic attributes of the movers in accounting for movement up and down the hierarchy of neighbourhoods. Such an approach requires a specialised survey.

3. The Survey of Dynamics and Motivation for Migration and the Deprivation Index

The Survey of Dynamics and Motivation for Migration is a Statistics New Zealand

initiative designed to investigate the motivations behind residential mobility. The survey was run as a supplement to the March 2007 New Zealand Household Labour Force Survey between 7 January and 7 April 2007.¹ This quarterly Labour Force Survey routinely collects basic demographic and employment information from around 30 000 individuals in 15 000 private households on a statistically representative basis from rural and urban areas throughout the country. In the March 2007 quarter, the sample of 26 756 respondents were given an opportunity to take part in the migration supplement leading to a total of 23 465 completed additional questions.² The migration survey separated the supplementary population sample into three mobility categories depending on whether they moved in the two years prior to the interview and whether they last moved *within* New Zealand or *to* New Zealand (including from Australia).³

Our aim in this paper is to examine the way these movers change the quality of their neighbourhood as measured by the rating the neighbourhood receives on the basis of the New Zealand Deprivation Index. The 2006 index (NZDep06) is the fourth iteration of the original developed for the 1991 census (Salmond and Crampton, 2001). Originally inspired by the census-based index applied in the UK (Townsend, 1979), the New Zealand index is constructed from a larger set of nine variables representing eight types of deprivation: two income measures, housing tenure, single-parenthood, unemployment, lack of qualifications, crowding, lack of access to a telephone and/or a car. In New Zealand, the index is widely known through the *Atlas of socioeconomic deprivation in New Zealand* (White *et al.*, 2008).

The deciles are constructed from the continuous form of the deprivation index, the scores. The scores themselves are obtained from the first principal component extracted from the intercorrelation of the nine variables

which are then scaled to have a mean of 1000 index points and standard deviation of 100 index points. The scores are therefore the weighted sums of the nine variables that account for most of the variation in socioeconomic deprivation level across the NZDep06 small areas. Our representation of the neighbourhood is the 'area unit', a Statistics New Zealand areal classification which, in contemporary urban contexts, contains an average of about 2200 people. These neighbourhoods correspond closely to recognised names and identities of suburbs, especially in the larger urban areas where statistical boundaries have been relatively stable over many decades. Each area unit is assigned a score which is then used to group neighbourhoods by decile. Those area units in decile 10 include the *most* deprived 10 per cent of the area units in the country and those in decile 1 include the 10 per cent of the *least* deprived area units. The same NZDep06 classification is applied to area units throughout the two-year migration window.

These NZDep2006 decile ratings of area units continue to serve as the primary statistical basis for redistributive funding in New Zealand. This funding takes several forms including early childhood and secondary school education as well as community health. The most deprived neighbourhoods (decile 10) receive the highest level of central government funding in recognition of the potential disadvantages of living in such areas. In this study, we use the deprivation index in a similar way, as a summary measure of the local socioeconomic circumstances that can impact on the individuals' propensity to progress in social mobility terms.

4. Mobility across the Socio-spatial Structure

Approximately one-quarter of the sampled population changed address at least once within New Zealand over the survey period,

although the chances of moving were not uniform across neighbourhoods. The proportion of people who moved between 2005 and 2007 rose at an increasing rate with the level of neighbourhood deprivation: from between 19 and 25 per cent among the three least deprived deciles to between 25 and 30 per cent in the three most deprived deciles. Turnover is therefore higher in the poorer neighbourhoods—a result that persists in all four 20-year age-groups except for those over 75 years of age.

Among movers, the most frequent practice was to move within the same broad socioeconomic band and almost 20 per cent of movers did not change their decile when they moved (18.7 per cent).⁴ If we add the 11.6 per cent who moved to a neighbourhood just one decile lower than the one they left and the 12.18 per cent who moved just one decile higher, then we cover 42.5 per cent of all movers. If we add in the further 8.57 per cent who moved one further decile down and the 9.67 per cent who moved another step further up, we embrace 60.7 per cent of all movers. This distribution of moves is shown in Figure 1.⁵

An inspection of Figure 1 shows that the distribution of interdecile moves is negatively skewed. Over the two-year mobility period, there was a tendency of movers to enter slightly more deprived neighbourhoods than the one they left. The mean *increase* in deprivation over the possible range of interdecile moves (from -9 to + 9) was 0.267 or just over one-quarter of a decile with a standard deviation of 3.14. As the numbers above the bars of Figure 1 show, the sum of one decile increases in deprivation exceeds those of one decile reductions, 601 and >575. This is also true of the two decile moves (477 and >423), three decile moves (365 and >297) and so on.

In summary, those who changed their residential address in New Zealand between 2005 and 2007 tended to move within the

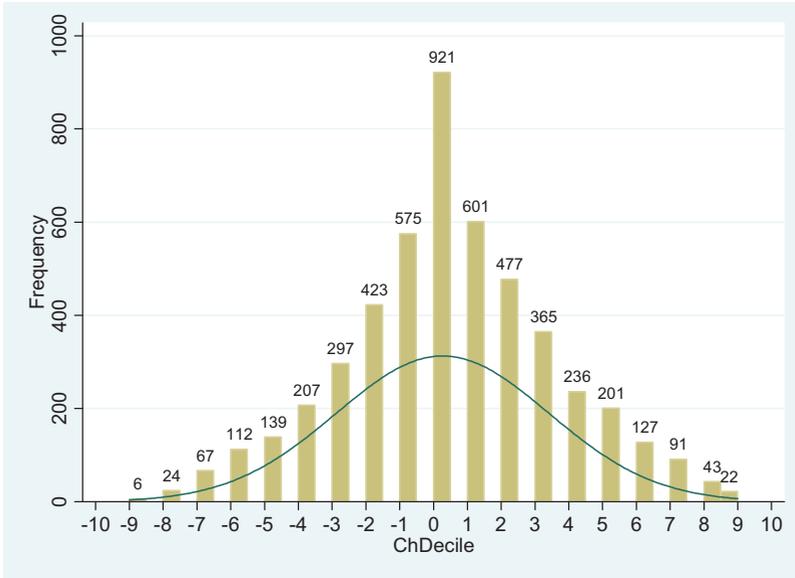


Figure 1. The distribution of changes in deprivation decile by movers within New Zealand between 2007 and 2008.

Note: ChDecile is the difference between the decile of destination and decile of origin, $\Delta D_{ji} = D_j - D_i$. For example, if someone moves from deprivation decile 5 to a *more* deprived area 6, then $\Delta D_{65} = D_6 - D_5 = 1$. If they move in the other direction, from decile 6 to a *less* deprived decile 5, then $\Delta D_{56} = D_5 - D_6 = -1$. Therefore, the changes in deciles occasioned by mobility run on the left from the most extensive *upgrading* (-10) to the most extensive *downgrading* possible (10) on the right.

Source: Statistics New Zealand, Survey of dynamics and motivation for migration in New Zealand, 2007.

same broad socioeconomic category that they left, although as a whole they experienced a mild downgrade in the socioeconomic ranking of their neighbourhood. In light of this general trend, we turn to our central question—namely, how these shifts varied according to the quality of the neighbourhood people left, after controlling for their personal characteristics.⁶

Mobility between Neighbourhoods

Movements between deprived and less deprived areas are tabulated along with their conditional transition probabilities in Tables 1 and 2. The numbers changing address within each deprivation decile appear in bold in the diagonal. Those moving into *more* deprived neighbourhoods appear *above*

the diagonal (the heavily shaded cells), and those moving into less deprived areas appear *below* the diagonal (the lightly shaded cells). The row and column marginals complete the table. The marked statistical departures from independence are apparent from the chi squared statistic and the strength of the relationship between the origin and destination in the Cramér’s V statistic.

Possibly the most striking feature of Table 1 is how extensively it is populated; movers are present in each of the 100 cells with the counts increasing in size closer to the diagonal. The transition probabilities in Table 2 serve to show how the probability of moving within and between neighbouring deciles increases among movers leaving more deprived areas, deciles 8, 9 and 10. Our central concern is the extent to which

Table 1. The origin by destination matrix of movers in New Zealand, 2005 and 2006, based on deciles of the 2006 New Zealand Deprivation Index: frequencies

Origin /Destination	1	2	3	4	5	6	7	8	9	10	
1	51	49	38	37	34	28	25	33	27	22	344
2	43	40	31	29	38	34	31	36	34	16	332
3	29	43	72	57	42	49	38	40	29	24	423
4	28	33	57	65	49	77	47	42	66	37	501
5	21	29	60	44	38	58	51	65	52	36	454
6	31	32	42	35	43	84	48	91	77	36	519
7	28	26	38	37	57	67	57	95	67	52	524
8	21	14	40	38	58	76	50	159	135	82	673
9	16	33	40	19	34	54	65	104	152	79	596
10	6	8	13	30	23	44	49	68	124	203	568
	274	307	431	391	416	571	461	733	763	587	4934

Notes: Pearson chi squared(81) = 979.5728; pr = 0.000. Cramér's V = 0.1485.

Source: Statistics New Zealand, Survey of dynamics and motivation for migration in New Zealand, 2007.

Table 2. The origin by destination matrix of movers in New Zealand, 2005 and 2006, based on deciles of the 2006 New Zealand Deprivation Index: conditional (row) probabilities

Origin/Destination	1	2	3	4	5	6	7	8	9	10	
1	0.148	0.142	0.110	0.108	0.099	0.081	0.073	0.096	0.078	0.064	1
2	0.130	0.120	0.093	0.087	0.114	0.102	0.093	0.108	0.102	0.048	1
3	0.069	0.102	0.170	0.135	0.099	0.116	0.090	0.095	0.069	0.057	1
4	0.056	0.066	0.114	0.130	0.098	0.154	0.094	0.084	0.132	0.074	1
5	0.046	0.064	0.132	0.097	0.084	0.128	0.112	0.143	0.115	0.079	1
6	0.060	0.062	0.081	0.067	0.083	0.162	0.092	0.175	0.148	0.069	1
7	0.053	0.050	0.073	0.071	0.109	0.128	0.109	0.181	0.128	0.099	1
8	0.031	0.021	0.059	0.056	0.086	0.113	0.074	0.236	0.201	0.122	1
9	0.027	0.055	0.067	0.032	0.057	0.091	0.109	0.174	0.255	0.133	1
10	0.011	0.014	0.023	0.053	0.040	0.077	0.086	0.120	0.218	0.357	1
	0.63	0.696	0.923	0.836	0.869	1.152	0.933	1.413	1.446	1.102	10

Source: Statistics New Zealand, Survey of dynamics and motivation for migration in New Zealand, 2007.

social mobility can be inferred from such a transition matrix and in particular whether upward mobility is retarded by prior residence in highly deprived neighbourhoods. Before taking that analytical step, we need to address patterns of mobility that occur randomly—that is, by chance alone. This we do in section 5, after which we address the attributes of movers and the way they condition moves within the neighbourhood hierarchy.

5. Regression towards the Mean

Our concern with the role that starting conditions might have on subsequent behaviour is shared by other disciplines. For example, educationalists ask if students who do poorly in one test improve in the next (with or without additional coaching). Exercise physiologists ask whether those who are less physically fit improve their level of fitness

following an exercise regime. Medical researchers ask whether anti-hypertensive drugs have a more positive effect on patients with high blood pressure. Urban geographers in turn ask whether residence in deprived areas lowers the propensity of movers to upgrade their neighbourhood. In addressing the respective evidence, each profession encounters random patterns linking initial conditions to behaviour in a statistical phenomenon known as ‘regression towards the mean’.⁷

The motivation for the urban geographer’s question reflects a concern for the social mobility consequences of neighbourhood externalities, both positive and negative. Positive externalities associated with the spatial clustering of privileged households enhances opportunities for social mobility due to the presence of useful contacts (weak ties), positive peer effects and enhanced learning environments which can condition the future social mobility of their children (Devine, 2004). By the same phenomenon, negative externalities can often (but not always) accompany relative lack of access to beneficial networks, enhanced chances of encountering negative peer effects and relatively lower access to positive learning environments, which collectively can lower the social mobility of their residents (Lareau, 2003). Both sets of externalities are argued to exist over and above the ascribed and achieved abilities of individuals themselves.

Notwithstanding the theory, the evidence demonstrating the effect of either positive or negative externalities of neighbourhoods has been difficult to establish empirically and this has limited the use of the neighbourhood, and spatial context more generally, as an instrument in promoting social mobility. When areas of high deprivation do receive special attention, there is a real possibility that subsequent patterns of geographical and social mobility get misinterpreted

In general, when observing repeated measurements in the same subject, relatively high (or relative low) observations are likely to be followed by less extreme ones nearer the subject’s true mean. ... The practical problem caused by regression towards the mean is the need to distinguish a real change from this expected change due to the natural variation (Barnett *et al.*, 2005, p. 215).⁸

Borjas noted this phenomenon in his study of the social mobility of immigrants, as a tendency for extremes, rich and poor alike, to regress towards the mean creating the appearance of more equality regardless of where the parents start out (Borjas, 2006).

Turning to the New Zealand example, since regression towards the mean tends to be accentuated when data are grouped (as in the construction of deciles from the baseline scores as in the case of NZDep06), there is an advantage in using the unbounded deprivation scores themselves. There is a further justification in our case because of the uneven way the scores are distributed across the most deprived decile (10). As Figure 2 shows, over most of their range there is a close relationship between the deprivation scores assigned to neighbourhoods and the deciles into which they have been placed. While the median scores for area units rise from decile 1 to 10 in the case of the last two deciles, there is not only a more rapid rise in the median but a much wider dispersion of scores as well. In fact, the distribution of scores within decile 10 is wider than the range of median scores across *all* the other deciles. Using deciles alone can disguise the mobility that takes place *within* the most deprived 10 per cent of the country’s neighbourhoods, a particularly important point given the financial attention these neighbourhoods receive in New Zealand.

Two questions follow. First, do the repeated measures present in the New

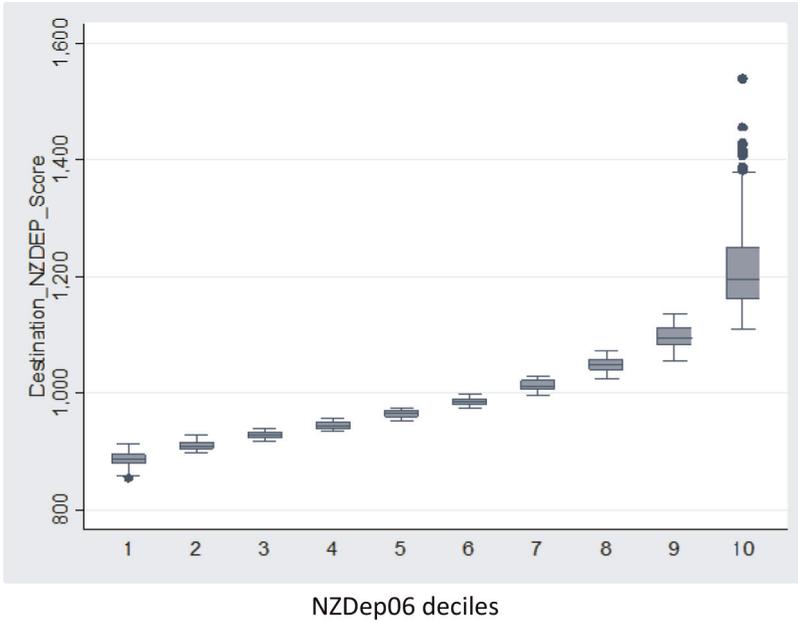


Figure 2. Boxplot of New Zealand area unit deprivation scores by decile, 2006. *Source:* Statistics New Zealand, Survey of dynamics and motivation for migration in New Zealand, 2007.

Zealand mobility data generate patterns consistent with a regression to the mean effect? Secondly, can observed departures from such an effect be used to identify the presence of systematic processes within the country? Much as Barnett *et al.* have done, we begin our analysis by constructing a scatter plot of the change against baseline measurements (see Barnett *et al.*, 2005, Fig. 3, p. 218).⁹

Drawing on the formulation of economic growth models, we use the difference between the deprivation scores at origin and destination divided by the score at origin to generate a deprivation growth rate

$$\Delta S_{ji}/S_i \quad (1)$$

where, ΔS_{ji} is the deprivation score of the destination neighbourhood (j) minus the score of the neighbourhood of origin (i).

Accordingly, negative growth in deprivation indicates an upgrading of the neighbourhood

and positive growth represents a downgrading. Recall that high scores are negative. The median increase in neighbourhood deprivation over the sample of movers as a whole was 5.1 per cent and the mean increase was 15.2 per cent.

As an example of the application of equation (1), consider the following two examples taken from the survey. A person begins with a neighbourhood of origin deprivation score of 1049 then moves within the two-year period to a neighbourhood with a deprivation score of 969. The reduction in the deprivation score is -80 corresponding to a 7.6 per cent upgrade in the quality of the neighbourhood. In the second case, a mover ends up in a neighbourhood with the same deprivation score 969, but begins their move from a neighbourhood with a lower score of 916. The result is a slight increase in deprivation of 0.058 or a reduction in neighbourhood quality of 5.8 per cent.

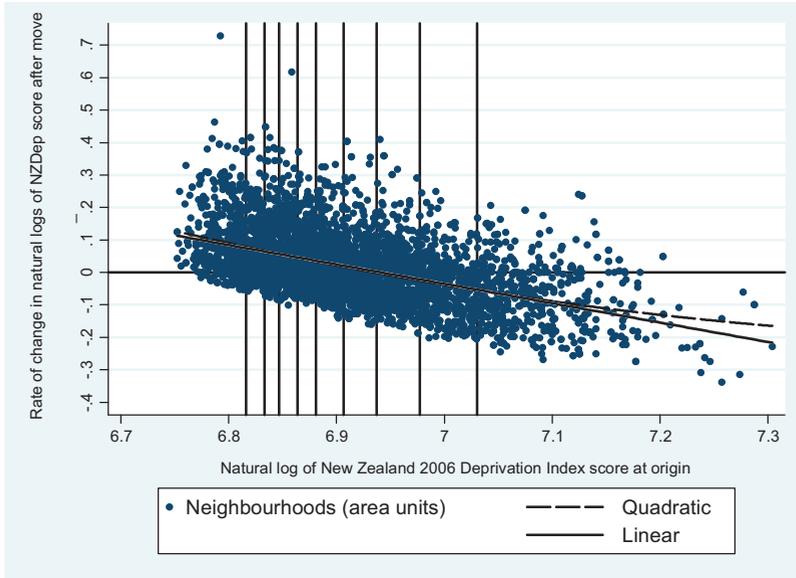


Figure 3. The growth rate in neighbourhood deprivation scores by the natural log of NZDep06 score of the neighbourhood of origin, New Zealand, 2005–06.

Notes: 1. $\Delta S_{ji}/S_i = 4.46(23.97) - 0.644(-24.05)\ln(S_i)$; $R^2 = 0.283$; $N = 4934$

2. $\Delta S_{ji}/S_i = 25.70(2.87) - 6.759(-2.63)\ln(S_i) + 0.440(-2.38)\ln(S_i^2)$; $R^2 = 0.285$; $N = 4934$
The t-statistics in parentheses (and take into account the survey sample design effects).

Source: Statistics New Zealand. Survey of dynamics and motivation for migration in New Zealand, 2007.

When plotted against their starting value, growth equations typically exhibit heteroscedasticity because the growth rate tends to widen the larger the deprivation score. In order more closely to approximate the distributional assumptions of ordinary least squares, we therefore take the natural log of the deprivation score which also allows us to interpret unit changes in neighbourhood deprivation in proportionate terms.

With these points in mind, we regress the change in deprivation against the natural log of the deprivation score of the mover's neighbourhood of origin as in equation (2).

$$\Delta S_{ji}/S_i = \alpha + \beta \ln S_i + \varepsilon \quad (2)$$

The predictions from equation (2) are then plotted as the diagonal line running down through the scatter in Figure 3 (the fitted

parameters are given in the equations below the figure).

We have added four lines to the scatter plot in Figure 3. The first is the horizontal line (0 on the Y axis) separating those who moved to more rather than less deprived areas. The second addition is the vertical lines which delimit each of the boundaries of the deciles into which the scores have been grouped, a step which serves again to highlight the wide distribution of scores within decile 10. The third, solid diagonal line through the points in Figure 3 is the estimated regression line (the first equation in the Notes to Figure 3). The negative slope of the regression line is typical of regression towards the mean. On the face of it, therefore, those moving out of poor neighbourhoods appear to be upgrading. However, as the regression towards the mean literature

clearly demonstrates, such upgrading is to be expected of those who start from the most deprived extremes of a distribution—simply as a matter of chance. For the same reason, those who begin with a low score, those in less deprived neighbourhoods, are more likely to move down towards the mean of the neighbourhood quality distribution. Neither of these apparent adjustments in neighbourhood condition can be interpreted as reflecting substantive *urban* process. In this sense, therefore, the negative slope we see in Figure 3 is simply a regression artefact.

In order to identify a process that could be associated with neighbourhood externalities, for example, we have to identify *departures* from such a regression to the mean. Specifically, we need to be able to identify whether those leaving the more highly deprived areas exhibit a *lower* than average likelihood of upgrading their neighbourhood and, to a lesser degree, whether those beginning in the least deprived areas are *less* likely to move down than the regression artefact might imply. We have chosen to test such hypotheses by re-estimating equation (2) as a quadratic, the results of which we report as the second equation in the Notes to Figure 3.

The positive and statistically significant coefficient on the squared term of the quadratic suggests that there *is* a tendency for those leaving the most deprived neighbourhoods to exhibit a *lower* chance of upgrading. The median spline fitted to the quadratic and plotted in Figure 3 as a dashed line suggests that those moving from more deprived areas, especially those within decile 10, exhibit lower rates of upward mobility than the remaining sample of movers. Those moving down from areas of very low deprivation, however, simply regress towards the mean as expected (raising questions perhaps about the positive returns to living in more

favourable neighbourhood environments). In any case, the immediate issue is whether the reduced level of upward mobility apparent in those moving out of highly deprived areas merely reflects the attributes of movers in these areas or whether the characteristics of the areas remain influential after imposing such controls.

6. The Attributes of Movers

Both the linear and quadratic regression models were fitted through the scatter in Figure 3 without including any information on the movers themselves. We now link the demographic and socioeconomic data to the deprivation score of the neighbourhood of origin and destination.¹⁰ The relevant characteristics are given in Table 3 along with summaries of the dependent variable, the deprivation growth rate (equation (1)) and the natural log of the deprivation scores and its quadratic. We learn that the average age of movers was 36.8 years and that men made up less than half of the total. Three-quarters of the sample were born in New Zealand (77.2 per cent) and just under three-quarters (73.2 per cent) were of European origin. Of those identifying with non-European ethnic groups, over 15.5 per cent identified as Māori and 5.5 per cent with Pacific.¹¹ Just over 3 per cent identified as Chinese or Indian each, leaving 11.5 per cent classified as Other. Over half of all movers were members of couple households (55.6 per cent), a further 12.6 per cent were one-parent households, 9.2 per cent were one-person households with the rest being members of other types of household, mainly unrelated individuals living together and extended families. In terms of education, two-thirds of movers had at least some school qualifications (66.2 per cent) and over half (53.6 per cent) had post-school qualifications. Those

Table 3. Characteristics of movers, New Zealand, 2007

<i>Variable</i>	<i>Mean</i>	<i>S.D.</i>	<i>Minimum</i>	<i>Maximum</i>
Deprivation gth rate	0.0152	0.104	-0.337	0.728
Ln of dep. at origin	6.915	.088	6.752	7.30
Ln of dep. at origin ²	47.835	1.234	45.593	53.346
Age	36.849	15.104	15	90
Male	0.434	0.495	0	1
Born NZ	0.772	0.418	0	1
European	0.732	0.442	0	1
Māori	0.155	0.362	0	1
Pacific	0.055	0.228	0	1
Chinese	0.032	0.178	0	1
Indian	0.033	0.179	0	1
Other	0.114	0.318	0	1
Couple household	0.556	0.496	0	1
One-parent household	0.125	0.331	0	1
One-person household	0.092	0.289	0	1
Other households	0.225	0.417	0	1
Any school quals	0.661	0.473	0	1
Post-school quals	0.535	0.498	0	1
Not employed	0.318	0.465	0	1
Income <\$1	0.058	0.234	0	1
Income \$1–20 000	0.307	0.461	0	1
Income \$20 000–40 000	0.303	0.459	0	1
Income \$40 000–70 000	0.213	0.410	0	1
Income \$70–\$100 000	0.061	0.240	0	1
Income >\$100 000	0.054	0.226	0	1

Source: Statistics New Zealand, Survey of dynamics and motivation for migration in New Zealand, 2007.

not working for pay or profit made up 31.8 per cent of movers. When it comes to income, two-thirds of the sample earned under \$40 000 before tax and a further 14 per cent earned \$70 000; therefore, movers were more likely to be drawn from the middle income range.

The results of adding the independent variables in Table 3 to the right-hand side of equation (2) are shown in Table 4 and we find that controlling for the attributes of movers has very little effect on how the deprivation scores of the neighbourhood of origin are associated with mobility. The intercept drops very slightly from 25.66 to 24.66, as does the slope, from -6.79 to -6.37

and the adjusted R^2 rises with the addition of new arguments from 0.26 to 0.33.

As might be expected, it is the younger movers who are more likely to move into more deprived neighbourhoods (row 3, Table 4), moving out of the family home into cheaper rented accommodation for example. Over and above the age effect, male movers were more likely to move to more deprived neighbourhoods. So too were ethnic minorities. The large positive and highly significant coefficients associated with self-identification as Māori or Pacific ethnicity, for example, suggest that both groups were much more likely than Europeans to experience increased

Table 4. The estimated effect of neighbourhood deprivation on the deprivation growth rate, controlling for demographic and socioeconomic attributes of movers, New Zealand, 2005–07

<i>Variable</i>	<i>Coefficient</i>	<i>S.E.</i>	<i>t</i>	<i>P > t </i>
Ln of dep.at origin	-6.374	1.629	-3.91	0.000
Ln of dep.at origin ²	0.406	0.117	3.47	0.001
Age	-0.0005	0.00008	-5.99	0.000
Male	0.005	0.002	2.23	0.026
Born NZ	-0.006	0.003	-1.73	0.084
Māori	0.035	0.003	9.63	0.000
Pacific	0.055	0.005	9.57	0.000
Chinese	0.031	0.008	3.60	0.000
Indian	0.045	0.008	5.26	0.000
Other	-0.003	0.006	-0.56	0.576
Base: European				
One-parent household	0.014	0.004	3.70	0.000
One-person household	0.035	0.004	8.11	0.000
Other households	0.009	0.003	2.84	0.004
Base: Couples + children				
Any school quals	-0.009	0.002	-3.30	0.001
Post-sch quals	-0.002	0.002	-0.87	0.384
Base: No school quals				
Not employed	0.015	0.003	4.68	0.000
Income <\$1	-0.013	0.006	-2.22	0.026
Income \$1 000–20 000	0.008	0.003	2.31	0.021
Income \$40 000–70 000	-0.014	0.003	-4.13	0.000
Income \$70 000–\$100,000	-0.029	0.005	-5.29	0.000
Income >\$100 000	-0.003	0.005	-0.66	0.511
Base: Income \$20 000–40 000				
Constant	24.666	5.660	4.36	0.000

Adjusted $R^2 = 0.33$; $N = 4865$.

Source: Statistics New Zealand, Survey of dynamics and motivation for migration in New Zealand, 2007.

deprivation when they moved (even after controlling for the fact that both have a younger population and lower incomes, lower levels of education and higher levels of unemployment than Europeans).¹² As expected, those designated as ‘Other’ behave like Europeans. Being born in New Zealand increases the likelihood of upgrading (but is significant at only $p < 0.10$). Surprisingly, given the popular perception in New Zealand of the socially upward mobility of Asians, Chinese and Indian movers were more likely than European to

experience movement into more deprived neighbourhoods over this period almost to the same degree as Māori and Pacific.

However, we are not surprised to learn from Table 4 that one-parent households are more likely to move to lower-quality neighbourhoods (relative to couples with children), a trend which highlights concerns over the long-term impact of raising children in poor neighbourhoods. One-person households along with ‘other’ households are also relatively more likely to experience downgrading of their neighbourhood when

they move (compared with couples with children, the base).¹³

Education and income also matter. Gaining at least some school qualifications raises the chances of upward mobility, but having post-school qualifications appears to have little additional (cross-sectional) effect on downward mobility. As expected, movers *not* in gainful employment are considerably more likely to move into more deprived neighbourhoods and to a greater degree than movers simply with low annual incomes (between \$1 and \$20 000).¹⁴ As incomes rise, so the chances of upward mobility increase as shown by the negative sign on the step increments of the \$40 000–\$70 000 and \$70 000–\$100 000 categories. Income returns of above \$100 000 per annum, however, have no additional effect once age and education are controlled for. Such results for income are consistent with what we know about the positive income elasticity of demand for neighbourhood quality (for example, Williams, 1979). Of particular interest in light of these results is the possibility that low-income households might be more sensitive to the deprivation level of the neighbourhood when they move, in ways that further reduce their ability to upgrade. Adding an interaction term to the right-hand side, low income (below \$20 000 per annum) x deprivation score, does indeed yield a positive coefficient of 0.118 (and a significant t-statistic of 2.15) suggesting that the combination of limited resources and deprivation together increases the chance of movers downgrading their neighbourhood.

In summary, when it comes to social mobility as represented by movement up and down a scale of neighbourhood deprivation, regression towards the mean effects dominates and, unless recognised, such random patterns will distort the identification of substantive processes. Those movers who begin in more deprived neighbourhoods appear

slightly *less* likely to upgrade their neighbourhood over and above the statistical tendency for those movers beginning at the extremes to adjustment towards the mean. Controlling for the attributes of movers does little to mitigate this result, leaving us with the conclusion that starting off in very deprived neighbourhoods may indeed condition social mobility in geographical terms, especially if movers also have relatively low incomes.

7. Conclusions

Our principal focus in this paper has been on the relationship between people's prior location decisions and their subsequent spatio-social mobility. Using a unique survey administered by Statistics New Zealand to residential movers in New Zealand over the two-year period 2005–07, we have identified two important patterns. The first concerns the role of chance alone, the statistical tendency for those starting in at the extremes of the distribution to gravitate towards the sample mean. As is well documented in the statistical literature, such evidence can lead the unwary into misinterpreting the upgrading propensity of those leaving deprived areas. Our mobility data, however, suggest that mobility is much *less* marked than the random patterns would suggest. Compared with the majority of movers, even after controlling for their personal characteristics, we find that those leaving very deprived areas are less likely to upgrade, particularly if they also have lower incomes. While increasing age, formal education, being employed and returning an above-average income accelerate the upward mobility in spatio-social terms, identifying with non-European and low income is associated with downward mobility in neighbourhood terms.

At the same time, the strong tendency of both Māori and Pacific to move less often

underscores the point that social mobility is not simply a people or place question. Moving can mean leaving communities and such costs need to be weighed against material improvements in the neighbourhood. Joint investments in both people *and* places rather than people or places separately are likely to be necessary in evening out the chances of social mobility and thereby reducing levels of inequality. This is a particularly salient issue in countries where the otherwise high levels of ethnic concentration (in both urban and rural areas) are intimately associated with the spatial properties of community itself.

Notes

1. The period covered by the migration survey was a relatively buoyant period in which the demand for labour was high and unemployment rates relatively low, both historically since the 1990s and in comparison with other OECD countries. This interval in the business cycle may have the effect of raising the upward mobility chances of those living in deprived neighbourhoods.
2. The population for the migration survey is a representative survey of the usually resident, civilian population of New Zealand aged 15 years and over and living in occupied private dwellings.
3. A full set of tabulated results from this survey are downloadable from the Statistics New Zealand website: <http://www.stats.govt.nz/>. Search on: Survey of Dynamics and Motivations for Migration in New Zealand.
4. It is important to recognise that our mobility window is only a two-year period and that this reduces the scope for changes in individual characteristics to influence the outcome.
5. One might want to argue that most tend to remain in the same socio-economic decile *because* they do not move very far geographically. The median move in New Zealand over this 2005–07 period was only 4.3 km albeit over a wide interquartile, skewed range of 15.9 km. The actual distance moved has little influence as an explanatory variable in accounting for changes in the quality of the neighbourhood. Those ending up in higher socio-economic areas (the least deprived three deciles) only moved 1 km further on average than those ending up in one of the three *most* deprived deciles. Whether people are moving next door or the length of the country, they tend to remain within narrow bounds.
6. It is important to note that our study is not a study of neighbourhood change. It is a study of what happens to individuals, specifically those who move. What is going on in the neighbourhood with changes in the incomes of those there does not directly affect those who are moving.
7. As originally established by Francis Galton with respect to children's heights in relation to those of their parents (Galton, 1886), "the average regression of the offspring is a constant fraction of their respective mid-parental deviations", meaning that the difference between a child and its parents for some characteristic is proportional to its parents' deviation from typical people in the population. So if its parents are each two inches taller than the averages for men and women, on average the child will be shorter than its parents by some factor (one minus the regression coefficient) times two inches.
8. Regression towards the mean can be defined for any bivariate distribution with identical marginal distributions and, while the marginal distributions of our sample are not identical, there is an almost 90 per cent correlation between the row and column marginals in Tables 1 and 2.
9. In the standard regression toward the mean, the destination score would be regressed against the score of origin. Since those beginning from neighbourhoods with low (high) deprivation will be more likely to experience an increase (decrease) in deprivation, the regression line will not reproduce the 'true' or 'functional relationship' of unity but will take a slope of less than unity (Bland and Altman, 1994a, 1994b). If we redefine the Y axis the difference between destination and origin, the 'true'

relationship becomes the horizontal line and the estimated slope runs through it from above. The relationship continues to hold in the slightly modified case of (2) plotted in Figure 3.

10. Not all moves could be attached to NZDep2006 measures both at the origin and destination and, as a result, there is a loss of 678/5616 or just under one-eighth of the original sample. This reduces the number of moves available for the following analysis from 5616 to 4938. The sample size is further reduced to 4865 as a result of the missing values present in some of the variables used in the multivariate regressions.
11. The term 'Pacific' is the term officially used to cover those identifying with Pacific Island ethnicity regardless of whether the person was born overseas or in New Zealand. Māori are the indigenous people of New Zealand. The term 'Other' includes mainly those declaring their ethnicity as 'New Zealander' (a local alternative to 'European').
12. Unlike the US and UK cases, discrimination plays a minor role in the New Zealand context. What is much more relevant in New Zealand is self-discrimination, by which we mean the strong preferences Pacific and Māori have to reside within their own urban spatial communities. Now this could indeed constrain movement and there is some evidence that Māori are reluctant to move out of established communities. Therefore, although we find a tendency for Pacific and Māori to exhibit less upward mobility in neighbourhood terms, it would be wrong to attribute any significant proportion of that to 'social' or housing market discrimination. By the same argument, however, one would expect to see higher *in situ* (within) neighbourhood mobility than might ordinarily prevail among Europeans, a feature that would have to be tested outside this project.
13. These results are quite consistent with the differential ability of these different types of household to enter homeownership (Morrison, 2005).

14. Less clear-cut is the result for those returning a negative income. The fact that the net losses in any year can disguise higher average incomes may account for the upward mobility inferred from this negative coefficient.

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