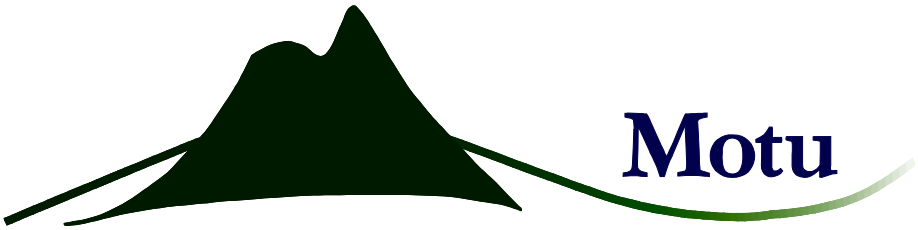

Does Selling State Silver Generate Private Gold? Determinants and Impacts of State House Sales and Acquisitions in New Zealand

Katy Bergstrom, Arthur Grimes, and Steve Stillman

Motu Working Paper 11-03
Motu Economic and Public Policy Research

Author contact details

Katy Bergstrom
Motu Economic & Public Policy Research, and University of Canterbury
katy.bergstrom@motu.org.nz

Arthur Grimes
Motu Economic & Public Policy Research, and University of Waikato
arthur.grimes@motu.org.nz

Steve Stillman
Motu Economic & Public Policy Research, and University of Otago
steve.stillman@motu.org.nz

Acknowledgements

We thank Housing New Zealand Corporation (HNZC) for access to data on state housing stocks and flows. We also thank the Marsden Fund of the Royal Society of New Zealand (grant: MEP 07-MEP-003, Homeownership) for providing financial assistance for Arthur Grimes and Steve Stillman, together with the Motu Education and Research Foundation that supported the work of Katy Bergstrom as a Motu intern. The authors alone are responsible for the analysis and views expressed.

Motu Economic and Public Policy Research

PO Box 24390
Wellington
New Zealand

Email info@motu.org.nz
Telephone +64 4 9394250
Website www.motu.org.nz

 ISSN 1176-2667 (Print), ISSN 1177-9047 (Online).

Abstract

New Zealand experienced two natural experiments with respect to state-provided social housing after 1990. First, while continuing to acquire new state houses, the National Government substantially reduced the overall state house stock by selling a greater number of houses either to existing tenants (through the Home Buy scheme) or, if the house was vacant, to other purchasers (vacant sales). From 1999, the Labour-led government ended homebuys, greatly reduced vacant sales and increased acquisitions, resulting in a major increase in the state house stock. We examine determinants of the spatial distribution of homebuys, vacant sales and acquisitions over the period 1991–2006, focusing on levels of, and changes in, local deprivation status and house prices as determinants. Having modelled the determinants of each category, we test whether homebuys, vacant sales, and acquisitions in an area over one five-year period had an effect on changes in local deprivation and house prices in the succeeding five-year period, after controlling for initial levels of, and prior changes in, deprivation and house prices. We find that state house acquisitions in an area led to a subsequent rise in local deprivation, consistent with the policy aim of providing housing to those most in need. While vacant sales had no material effects, a greater number of homebuys in an area led to increased local real house price appreciation over the subsequent five year period. This finding, based on the results of a politically-driven natural experiment, is consistent with the hypothesis that a scheme that transforms existing tenants into homeowners (at the same location) improves community outcomes for the surrounding neighbourhood.

JEL codes

H31, I38, R21, R28

Keywords

State house sales; homeownership

Contents

1. Introduction

During the 1990s and 2000s there were significant spatial changes in state housing density in New Zealand (Schrader, 2005). We use Housing New Zealand Corporation (HNZC) data, census data and Quotable Value New Zealand (QVNZ) housing data to investigate determinants and impacts of these spatial changes over 1991–2006. We investigate which area characteristics are systematically associated with sales and acquisitions of state houses, and whether HNZC sales and acquisitions led to subsequent changes in deprivation and house prices.

Our analysis exploits two natural experiments driven by differing political philosophies. The National government, elected in 1990, had a focus on state house sales. As a result, they substantially reduced the size of the state housing portfolio, whilst ensuring housing stock was located principally in areas of high demand. There were three types of sales that occurred. First, state houses could be sold to tenants at market value under the Home Buy scheme. Vacant state houses could also be sold privately as a vacant sale and, in a few instances, large numbers of vacant houses were sold to one owner as a community partner sale. The Labour government, elected in November 1999, changed the direction of state house policy. They increased acquisitions, removed the Home Buy scheme and greatly reduced the number of vacant sales.

We begin our analysis by examining the types of areas associated with differing levels of vacant sales, homebuys and acquisitions. Furthermore, we analyse determinants by house type: for example, comparing vacant sales of 1–2 bedroom state houses with vacant sales of 3+ bedroom state houses. We also explore the area characteristics associated with higher densities of state housing.

Initially, we run pooled OLS regressions for each category (vacant sales, homebuys, and acquisitions) across three inter-censal periods. However, the coefficients are not stable across the three periods, reflecting the changing state housing policies. This leads to our cross sectional analysis where we examine the effect of deprivation and housing affordability on sales and acquisitions in an area. We also examine the effect of prior changes in these area characteristics to control for whether an area was already "improving" or not. We hypothesise that prospective purchasers prefer to purchase a state house in "better" neighbourhoods or ones that are "up-and-coming" so as to preserve or enhance their investment. Thus we expect that both homebuys and vacant sales tended to occur in less deprived (and/or improving) areas. This tendency will be mediated by affordability issues, especially for existing state house tenants; thus we hypothesise that, ceteris paribus, a greater number of homebuys occurred in more affordable areas. Finally,

we expect acquisitions to have occurred predominantly in more deprived areas where house prices are relatively low, so enabling the state to offer social housing to those most in need.

Having determined the factors associated with vacant sales, homebuys and acquisitions we examine the impacts that HNZC sales and acquisitions had on the local area. First, we examine the effect that sales and acquisitions had on the subsequent change in deprivation level of an area. We then examine the effect that sales and acquisitions had on subsequent changes in local house prices. We expect areas which experience an increase in acquisitions to become more deprived and areas which experience a large percentage of homebuys to become less deprived. We also expect house prices to rise in areas which experience a large percentage of homebuys. This expectation reflects the hypothesis that a shift in the housing tenure status of an individual or household has an impact on those residents' attachment and commitment to the community (DiPasquale and Glaeser, 1999; Skilling, 2004 and 2005) and may lead to positive outcomes for issues such as crime (Sampson et al., 1997), immigration (Sinnings, 2010), outcomes for children (Green and White, 1997; Haurin et al., 2002; Mohantly and Raut, 2009), and general well-being (Cobb-Clark and Hildebrand, 2006). [1]

The Home Buy scheme is of particular use for examining whether a community experiences positive outcomes as a result of an exogenously sourced rise in the homeownership rate. By definition, the same residents remain in the house (at least initially) while their tenure status changes, since the Home Buy scheme was available only to a state house tenant who purchased the property in which they were already living. Our results for the impacts of the Home Buy scheme on the community therefore reflect a unique set of exogenous policy choices. Consistent with the literature on the hedonic pricing of houses, any impacts on the community of the scheme should be reflected in the area's house prices which summarise the broader amenity value of an area. Thus our test of the impacts of homebuys on subsequent house price appreciation (after controlling for other existing and prior factors) is of particular interest for understanding the impacts of tenure status on community outcomes.

Section 2 describes our datasets, their construction, application, and descriptive statistics. Section 3 describes the regression models used to examine the area characteristics associated with sales and acquisition patterns; section 4 presents and discusses the corresponding results; section 5 investigates whether HNZC sales and acquisitions led to subsequent changes in area outcomes; and Section 6 concludes.

[1] Some other studies suggest that homeownership may also have negative individual effects; for instance Oswald (1996, 1999) finds an increase in homeownership rates is associated with an increase in unemployment, while Ellis (2006) suggests that homeowners who concentrate their wealth in housing face more investment risk.

2. Data Description

2.1. HNZC Data

The HNZC dataset that we use is described fully in Olssen et al. (2010). It contains information on 80,983 state houses over the period January 1936 to February 2010. We use data from 1993 onwards, following the date at which HNZC started actively managing the houses.

The dataset contains information regarding the acquisition dates of the properties and specific characteristics of the properties, such as the number of bedrooms and the type of property – for example whether the property was a single, double or multi unit building. The dataset also provides information on whether the properties were sold or destroyed, the sale prices and sale dates of the properties, and the type of sale. There were three sale types that occurred between 1993 and 2010. State houses could be sold to the current tenants under the Home Buy scheme, sold privately as a vacant sale, or sold to a community group as a Community Partner sale (Schrader, 2005; Olssen et al., 2010).

As at 1 March 1993, there were 69,267 state houses in this dataset. In this paper we are interested in the acquisitions, vacant sales, and homebuys of state houses over the three inter-censal periods: March 1991 to February 1996, March 1996 to February 2001, and March 2001 to February 2006. However, we do not have detailed data between 1991 and 1993. Given that there were very few sales and acquisitions between 1991 and 1993, the 1993 HNZC data is treated as if it corresponded to the 1991 census. Table 1 summarises the number of acquisitions, vacant sales, and homebuys for the three periods.[2] There were very few homebuys between 2001 and 2006, due to the Labour government terminating the Home Buy scheme when elected in late 1999.

2.2. Census Data

This paper uses data from the 1991, 1996, and 2001 censuses to calculate the total number of private dwellings in different geographical areas. Our analysis requires the calculation of each of the three categories – acquisitions, vacant sales, and homebuys – as a percentage of total private dwellings per geographical unit. The census data provides the number of private dwellings per meshblock and census area unit (CAU) for the corresponding year.[3] Using

[2] Table 4 contains further descriptive data on acquisitions, vacant sales, and homebuys.
[3] For example, the 1991 census provides data on 1991 CAUs and 1991 meshblocks.

concordance files, the number of private dwellings for each of the 1,860 2001 CAUs[4] is generated.[5] All descriptive statistics and results are presented at the CAU level.

2.3. Population Data

We use data from the 1986, 1991, 1996, 2001, and 2006 censuses to generate population characteristic variables for each area; the data are fully documented in Stillman and Maré (2008).[6] Population and migrant counts are calculated for the usually resident population aged 18 and over in each geographical area, excluding individuals with missing information. Included in the population and migrant counts are all non-institutionalised adults. Table 2 summarises the mean characteristics of the population over the five censuses.

These variables allow us to control for area characteristics as well as identifying what characteristics, if any, are systematically associated with higher or lower acquisitions, homebuys, and vacant sales. For instance, as discussed in the Introduction, three of the hypotheses of this project are that less deprived areas are associated with more vacant sales and more homebuys, while more deprived areas are associated with a greater number of acquisitions.

2.4. Housing Market Data

The house sale price data comes from QVNZ. QVNZ maintains a dataset of all property sales that have occurred from 1982 onwards and provides data for several categories of residential dwellings. QVNZ has matched this dataset to census meshblocks and has made it available at the meshblock level on an annual basis.

Stillman and Maré (2008)[7] use the QVNZ data to create average sale prices in each geographic area of residential dwellings[8] in each of the census years. They aggregate sales data in each meshblock up to census area units in two different ways. Firstly they weight by the population in each meshblock in that year, and secondly they weight by the number of sales in each meshblock in that year. We use the log of the median real sales price (in 1991 dollars)[9] aggregated to CAU level weighted by the number of sales in each meshblock.

---

[4] I.e. for CAUs defined consistently according to 2001 boundaries.
[5] We also considered analysis at the 58 and 140 labour market area (LMA) level (Newell and Papps, 2001). However, once further analysis was undertaken, both the LMA definitions were discarded as data is too aggregated to examine the determinants of the stock of state houses over time. A similar problem would result from using Territorial Local Authority or Regional Council boundaries, so we do not consider these spatial aggregations.
[6] See section 3.1, "Population Data".
[7] See section 3.2, "Housing Market Data".
[8] We have used residential dwellings defined as dwellings of a fully detached or semi-detached style on their own clearly defined piece of land.
[9] All variables that are expressed in 1991 dollars are deflated by the Consumer Price Index.

2.5. Deprivation Index

The deprivation index compiled by Salmond et al. (2002) is calculated for each census year using a combination of census variables that reflect aspects of material and social deprivation. The deprivation index allocates each meshblock in New Zealand a deprivation score. The deprivation index is provided in two forms: the deprivation interval variable and the deprivation ordinal scale. The deprivation interval variable is the first principal component score, scaled to have a mean of 1000 index points and standard deviation of 100 index points. The ordinal scale, derived from the first principal component score, ranges from 1 to 10, where 1 represents not deprived and 10 represents highly deprived.

We are interested in examining the relationship between sales and acquisitions and the level of deprivation in an area. The Salmond et al. deprivation index is given at meshblock and CAU level for the corresponding census year but aggregation of this index to 2001 CAUs on a consistent basis is problematic. Since this is a generated index, we have conducted our own principal component analysis on a large number of census variables,[10] and use the first principal component score to generate our own measure of deprivation. Our generated deprivation score and the Salmond et al. deprivation interval variable ("NZDep 2001") are highly correlated with a significant correlation coefficient of 0.818 in 2001. Figure 1 illustrates this strong positive correlation.

Table 3 summarises the correlations between the deprivation interval variable, our generated deprivation score, and the different area characteristics for 2001. While there are some area characteristics, such as the log of real income, that are highly correlated with the deprivation interval variable (and so could possibly be used as proxies for deprivation), if we were to use one of these variables as a proxy for deprivation, we would not be able to control for other area characteristics due to the presence of strong multicollinearity amongst the variables. Hence we use the generated deprivation score as our measure of CAU deprivation.

2.6. Data Creation

This project requires the merging of the HNZC data, QVNZ data and census data, in order to model each sales/acquisitions category between each census as a percentage of initial

[10] These variables include, for the local population: mean age, percent aged 65+ (omitted percent aged 18–64), percent female, percent with school qualifications, with post-school qualifications, with degree qualifications and with missing qualifications (omitted percent with no qualifications), percent unemployed or not in the labour force, percent married, in a de facto relationship, divorced/separated, widowed, and missing marital status (omitted non-family), mean number of 0–4-, 5–12-, 13–17-, 18–24-, 25–64-, and 65+-year-olds in private dwellings, percent with zero or negative income, percent with missing income, percent European, percent Maori, percent Asian, percent Pacific Island, percent other ethnicity and the percent of migrants.

private dwellings.[11] Vacant sales and homebuys are also calculated as a percentage of the initial state housing stock.[12] The HNZC dataset has information for 1,136 of the 2001 CAUs, whereas the census data contains information for all 1,859 CAUs. The 723 missing CAUs from the HNZC data is due to there being no state houses in these areas in 1993 and no state houses acquired in the areas after 1993.

Our analysis examines the determinants of the spatial changes in state housing density by splitting the sales and acquisition categories into different house types. The house type categories include 1–2 bedroom state houses, 3+ bedroom state houses, single unit state houses and state houses of other property types.[13] Table 4 summarises the mean state housing characteristics over the three census periods.[14] We split each category to examine the area characteristics associated with higher or lower sales/acquisitions of state houses of different sizes and styles.

Table 4 shows the large increase in both vacant sales and homebuys between 1996 and 200,1 and the large decrease in each sales category between 2001 and 2006. These two periods pick up the effect of firstly the National government's state housing policy followed by the change in state housing policy adopted by the Labour government. When looking at each category, the percentages relative to total private dwellings are very small, especially when each category is split into different house types. However, as a proportion of the initial state housing stock, some of the sales proportions are material. For instance, over 1996–2001, almost 16% of initial state houses were sold as vacant sales and a further 4% as homebuys.

Table 4 also shows the number of sales of each sub-category expressed as a percentage of initial state housing stock of that sub-category.[15] For the period 1996–2001, nearly one fifth of single unit state houses were sold as vacant sales and a further 6% as homebuys, whereas only 9% of other property type state houses were sold as vacant sales and only a further 1.5% as homebuys. Also a greater proportion of larger state houses (3+ bedrooms) were sold than smaller state houses (1–2 bedrooms). From 1996 to 2001, 17% of 3+ bedroom houses were sold as vacant sales and a further 6% as homebuys, compared with 15% of 1-2 bedroom houses sold

[11] Private dwellings include any permanent or temporary dwelling that is occupied by a private household. It includes privately owned and state owned houses and flats, but excludes institutional dwellings.
[12] We do not calculate acquisitions as a percentage of initial state housing stock as these percentages would be misleading for those area units which began with few or no state houses.
[13] Other property type includes state houses that are double unit, multi unit, bedsitter, complex, duplex unit and star flat.
[14] The means presented in table 4 are weighted by the total number of private dwellings in each geographical area unit. 45% of vacant sales were 1–2 bedroom state houses (55% were 3+ bedroom); 71% of vacant sales were single unit state houses (29% were other property type). 28% of homebuys were 1–2 bedroom state houses; 90% of homebuys were single unit state houses. 43% of acquisitions were 1–2 bedroom state houses; 59 % of acquisitions were single unit state houses.
[15] E.g. the number of 1–2 bedroom vacant sales over 1996–2001 as a percentage of the number of 1–2 bedroom state houses in 1996.

as vacant sales and 2.5% as homebuys. These figures imply that prospective purchasers of state houses may have preferred to purchase larger, standalone houses; alternatively these houses may have been located in more affordable or more desirable areas. Our statistical analysis sheds light on competing reasons for the differing sale propensities.

3. Determinants of Sales, Acquisitions and State Housing Stock

In this section, we summarise our models for the determinants of the spatial distribution of vacant sales, homebuys, and acquisitions. Discussion of results follows in section 4.

We carry out panel regressions across areas and across censuses as a function of area characteristics, testing for varying coefficients across time. We then carry out cross sectional regressions for the three periods, determining whether the effects of area characteristics differ over time and the extent to which they do.

We model each sales/acquisition category in a number of different ways for areas defined according to 2001 CAU boundaries. First, we model the sales/acquisition category between each census as a percentage of the initial total private dwellings.[16] We then model the sales categories (vacant sales and homebuys) between each census as a percentage of the initial state housing stock.[17] We also model the spatial characteristics of the state housing stock itself.

3.1. Panel Data Regressions

We initially run panel regressions to examine the effect that the different area characteristics[18] have on the sales and acquisitions of state houses over the census periods. We test whether the effect of each area characteristic is stable over time. Equations (1) and (2) illustrate the first set of panel regressions and the subsequent statistical tests undertaken. We have allowed for area and time fixed effects and clustered the standard errors on CAUs.

$$\textit{(Acquisitions as \% of total private dwellings)}_{CAU,((t+5)-t)} = a + \beta_t(\textit{State Housing Stock as \% of total private dwellings})_{CAU,t} + \theta_t(\textit{area characteristics})_{CAU,t} + e_{CAU,t} \quad (1)$$

$$\textit{Where } e_{CAU,t} = \mu_{CAU} + \tau_t + \varepsilon_{CAU,t} \quad , t = 1991, 1996, 2001$$

Wald test:

$$H_0: \theta_t = \theta \text{ , for } t = 1991, 1996, 2001$$

[16] For example, sales/acquisition category as a percentage of 1996 total private dwellings for the 1996–2001 sales/acquisitions.
[17] For example, 1991–1996 vacant sales as a percentage of the 1991 stock of state houses.
[18] The area characteristics are the same as the census area characteristics used in the principal component analysis plus the log of median real house sale prices.

H_A: θ_t *is not constant overtime*

$$(\text{Sales as \% of total private dwellings})_{CAU,((t+5)-t)} = a + \beta_t(\text{State Housing Stock as \% of total private dwellings})_{CAU,t} + \theta_t(\text{area characteristics})_{CAU,t} + e_{CAU,t} \quad (2)$$

$$\text{Where } e_{CAU,t} = \mu_{CAU} + \tau_t + \varepsilon_{CAU,t}, \; t = 1991, 1996, 2001$$

Wald test:

H_0: $\theta_t = \theta$, *for* $t = 1991, 1996, 2001$

H_A: θ_t *is not constant over time*

Equation (2) is run separately for vacant sales and homebuys. Due to the small percentage of sales occurring between 2001 and 2006, we have run panel regressions for homebuys and vacant sales between just 1991 and 2001. Similarly, we have run a panel regression for acquisitions only considering the period 1996–2006.

Finally we run similar regressions for each sales category defined as a percentage of initial state housing stock, where we do not include the percentage of initial state housing stock as an explanatory variable. Equation (3) represents this specification. We also run Equation (3) just for t = 1991, 1996.

$$(\text{Sales as \% of initial state housing stock})_{CAU,((t+5)-t)} = a + \theta_t(\text{area characteristics})_{CAU,t} + e_{CAU,t} \quad (3)$$

$$\text{Where } e_{CAU,t} = \mu_{CAU} + \tau_t + \varepsilon_{CAU,t}, \; t = 1991, 1996, 2001$$

Wald test:

H_0: $\theta_t = \theta$, *for* $t = 1991, 1996, 2001$

H_A: θ_t *is not constant over time*

In all of the panel regressions covering all three periods we reject the null hypothesis of constant coefficients across time. When we run regressions covering just two periods, we cannot reject the null hypothesis for four of the regressions but do reject stable coefficients for one of the regressions. [19] The rejections of constant coefficients across the three periods reflect the

[19] The exception is vacant sales defined as a percentage of total private dwellings over 1991–2001, where we can reject stable coefficients across the two periods.

different policies adopted by the National and Labour governments during this time. The absence of stable coefficients over time leads to our cross sectional analysis, examining the models for each census period individually.

3.2. Cross Sectional Regressions

We analyse the determinants of each of the sales/acquisition categories over each of the census periods separately using cross sectional regressions. In contrast to the panel regressions, we do not include the individual census area characteristics as left hand side variables. Instead we use our generated deprivation score, and by doing so, eliminate the problems associated with multicollinearity existing between the census variables.

Our first cross sectional regressions investigate the effect that deprivation has on the sales and acquisitions for each census period. Each regression is a function of our generated deprivation score, the initial state housing stock (as a proportion of total dwellings) and the change in the deprivation score between the prior two censuses.[20] We include the change in deprivation to get a measure of whether the area was already 'improving' or not. This specification is shown in Equation (4).

$$(Sales\ or\ Acquisitions\ as\ \%\ of\ total\ private\ dwellings)_{CAU,\,(t+5)-t} = a + \beta(State\ Housing\ Stock)_{CAU,\,t} + \lambda(Dep\_Score)_{CAU,\,t} + \delta(\Delta Dep\_Score)_{CAU,\,t} + e_{CAU,\,t} \quad (4)$$

Secondly, we are interested in determining if there exists a relationship between the median house price in an area and the number of sales and acquisitions in that area. We do this in two ways. Firstly, we supplement Equation (4) with the inclusion of the log of real median house price and the prior change in the log of real median house price. In some circumstances, the change in house price over the previous five years may be a better indicator of whether house prices are seen to be "expensive" for the area, since this variable abstracts from the influence of unchanging natural amenities, such as views, coastal location or proximity to the city. This specification is shown in Equation (5).

$$(Sales\ or\ Acquisitions\ as\ \%\ of\ total\ private\ dwellings)_{CAU,\,(t+5)-t} = a + \beta(State\ Housing\ Stock)_{CAU,t} + \lambda(Dep\_Score)_{CAU,\,t} + \delta(\Delta Dep\_Score)_{CAU,\,t} + \theta ln(houseprice)_{CAU,\,t} + \varphi\,(\Delta ln(houseprice))_{CAU,\,t} + e_{CAU,\,t} \quad (5)$$

Alternatively, instead of using the log of real median house prices, we use the log of the ratio of real median house prices to real income in an area to examine the effect that house price

[20] Thus $\Delta Dep\_Score_{CAU,t} \equiv Dep\_Score_{CAU,t} - Dep\_Score_{CAU,t-5}$ where t is measured in years.

affordability (relative to local incomes) has on sales and acquisitions. Given spatial differences in both house prices and incomes across the country (with both variables generally being higher in Auckland and Wellington than other parts of New Zealand), we place most emphasis on the results of Equation (6), which includes house prices in a manner that accounts for differences in incomes across areas.

$$(Sales\ or\ Acquisitions\ as\ \%\ of\ total\ private\ dwellings)_{CAU,\,(t+5)\,-\,t} = a + \beta(State\ Housing\ Stock)_{CAU,\,t} + \lambda(Dep\_Score)_{CAU,\,t} + \delta(\Delta Dep\_Score)_{CAU,\,t} + \theta ln(houseprice/income)_{CAU,\,t} + \varphi\,(\Delta ln(houseprice/income))_{CAU,\,t} + e_{CAU,\,t} \quad (6)$$

Finally we run each of the cross sectional regressions for the two sales categories. However, this time each category is defined as the percentage of the initial state housing stock and we do not include the initial level of state housing stock as a right hand side variable. These specifications are shown in Equations (7), (8), and (9).

$$(Sales\ as\ \%\ of\ state\ housing\ stock)_{CAU,\,(t+5)\,-\,t} = a + \lambda(Dep\_Score)_{CAU,\,t} + \delta(\Delta Dep\_Score)_{CAU,\,t} + e_{CAU,\,t} \quad (7)$$

$$(Sales\ as\ \%\ of\ state\ housing\ stock)_{CAU,\,(t+5)\,-\,t} = a + \lambda(Dep\_Score)_{CAU,\,t} + \delta(\Delta Dep\_Score)_{CAU,\,t} + \theta ln(houseprice)_{CAU,\,t} + \varphi\,(\Delta ln(houseprice))_{CAU,\,t} + e_{CAU,\,t} \quad (8)$$

$$(Sales\ as\ \%\ of\ state\ housing\ stock)_{CAU,\,(t+5)\,-\,t} = a + \lambda(Dep\_Score)_{CAU,\,t} + \delta(\Delta Dep\_Score)_{CAU,\,t} + \theta ln(houseprice/income)_{CAU,\,t} + \varphi\,(\Delta ln(houseprice/income))_{CAU,\,t} + e_{CAU,\,t} \quad (9)$$

Again we place most emphasis on the results from Equation (9) where we control for house prices relative to local incomes. If we are interested primarily in the determinants of the likelihood of a sale within a given set of state houses, we consider the results from Equation (9), whereas the results from Equation (6) are more useful if we are primarily interested in the type of area in which state houses are sold or acquired.

3.3. Determinants of Sales by House Type

We examine the spatial distribution of vacant sales and homebuys by house type. For each vacant sale and homebuy type (defined as a percentage of state housing stock of that type) we run two regressions, estimated using seemingly unrelated regressions (SURs). The first set of SURs separates vacant sales and homebuys into 1–2 bedroom state houses and 3+ bedroom state houses. The second set of SURs separates the two sales categories into single unit state houses and other property type state houses. Each SUR is a function of the deprivation level, the change in the deprivation level between the prior two censuses, real house prices relative to income, and the change in real house prices relative to income between the two prior censuses.

These specifications are shown in Equations (10) and (11). Each SUR is run for the period 1996–2001 as it is in these periods when the majority of sales of each sub-category occurred.

SUR 1:

$$(\textit{Sales of 1-2 bedroom state houses as \% of stock of 1-2 bedroom state houses})_{CAU,\,(t+5)-t} = a_1 + \beta_1(Dep\_Score)_{CAU,\,t} + \delta_1(\Delta Dep\_Score)_{CAU,\,t} + \theta_1 ln(houseprice/income)_{CAU,\,t} + \varphi_1(\Delta ln(houseprice/income))_{CAU,\,t} + e_{CAU,\,t}$$

$$(\textit{Sales of 3+ bedroom state houses as \% of stock of 3+ bedroom state houses})_{CAU,\,(t+5)-t} = a_2 + \beta_2(Dep\_Score)_{CAU,\,t} + \delta_2(\Delta Dep\_Score)_{CAU,\,t} + \theta_2 ln(houseprice/income)_{CAU,\,t} + \varphi_2(\Delta ln(houseprice/income))_{CAU,\,t} + e_{CAU,\,t} \quad (10)$$

SUR 2:

$$(\textit{Sales of single unit state houses as \% of stock of single unit state houses})_{CAU,\,(t+5)-t} = a_1 + \beta_1 Dep\_Score)_{CAU,\,t} + \delta_1(\Delta Dep\_Score)_{CAU,\,t} + \theta_1 ln(houseprice/income)_{CAU,\,t} + \varphi_1(\Delta ln(houseprice/income))_{CAU,\,t} + e_{CAU,\,t}$$

$$(\textit{Sales of other state houses as \% of stock of other state houses})_{CAU,\,t} = a_2 + \beta_2(Dep\_Score)_{CAU,\,t} + \delta_2(\Delta Dep\_Score)_{CAU,\,t} + \theta_2 ln(houseprice/income)_{CAU,\,t} + \varphi_2(\Delta ln(houseprice/income))_{CAU,\,t} + e_{CAU,\,t} \quad (11)$$

For each set of SURs, we conduct two Wald tests shown below. The first test determines whether the effect of each explanatory variable, other than the constant, is the same for each sub-category. The second test determines whether the underlying propensity to purchase a state house, given by the constant term, is different for each sub-category given the other determinants.

Wald Tests:

1) H_0: $\beta_1 - \beta_2 = 0$; $\delta_1 - \delta_2 = 0$; $\theta_1 - \theta_2 = 0$; $\varphi_1 - \varphi_2 = 0$ — H_A: *the coefficients are not constant across sub-categories*

2) H_0: $a_1 - a_2 = 0$; $\beta_1 - \beta_2 = 0$; $\delta_1 - \delta_2 = 0$; $\theta_1 - \theta_2 = 0$; $\varphi_1 - \varphi_2 = 0$ — H_A: *the coefficients are not constant across sub-categories*

3.4. Determinants of the State Housing Stock

Finally, we examine the area characteristics of the stock of state houses over time. We model the stock of state houses as a proportion of total private dwellings,[21] carrying out both panel regressions and cross sectional regressions over the three census periods.

Firstly we run a panel regression exploring the determinants of the stock of state houses over time. We test for area and time fixed effects and clustered the standard errors on CAUs. Equation (12) illustrates this regression and the statistical tests undertaken.

$$\begin{aligned} &(\text{State housing stock as \% of total private dwellings})_{CAU,t} = \\ &a + \theta_t(\text{area characteristics})_{CAU,t} + e_{CAU,t} \\ &\text{Where } e_{CAU,t} = \mu_{CAU} + \tau_t + \varepsilon_{CAU,t} \;,\; t = 1991, 1996, 2001 \end{aligned} \tag{12}$$

Wald test:

H_0: $\theta_t = \theta$, *for* $t = 1991, 1996, 2001$

H_A: θ_t *is not constant over time*

We reject the null hypothesis of constant coefficients across time, leading to our cross sectional analysis.

Our cross sectional regressions are shown in Equations (13), (14) and (15). We do not include the change in explanatory variables between the two prior censuses as we are examining the determinants of a stock variable, not a flow variable.

$$(\text{State housing stock as \% of state housing stock})_{CAU,t} = a + \beta\,(Dep\_Score)_{CAU,t} + e_{CAU,t} \tag{13}$$

$$\begin{aligned} &(\text{State housing stock as \% of state housing stock})_{CAU,t} = a + \beta\,(Dep\_Score)_{CAU,t} \\ &+ \lambda\,ln(\text{houseprice})_{CAU,t} + e_{CAU,t} \end{aligned} \tag{14}$$

$$\begin{aligned} &(\text{State housing stock as \% of total private dwellings})_{CAU,t} = a + \beta\,(Dep\_Score)_{CAU,t} \\ &+ \lambda(ln(\text{houseprice}/\text{income}))_{CAU,t} + e_{CAU,t} \end{aligned} \tag{15}$$

[21] For example, the stock of state houses in 1996 is modelled as a percentage of the total number of private dwellings in 1996.

4. Discussion of Results

4.1. Acquisitions

From Tables 5, 6 and 7, corresponding to equations (4), (5) and (6), there appears to be a strong relationship between acquisitions (as a percentage of total private dwellings) and the deprivation level of an area over the three census periods. There does not, however, appear to be a consistent relationship between acquisitions and the prior change in the deprivation level of an area. Our results suggest that a greater percentage of acquisitions occurred in deprived areas relative to non deprived areas. This is consistent with both the National and Labour governments' intentions of increasing state housing stocks in areas of high demand, those generally being deprived areas. However, Olssen et al. (2010) documented that during the 2000's, increases in state housing density were witnessed in both (initially) non deprived and deprived areas. The relatively non deprived areas were most likely to be on the outskirts of urban areas with initially low population densities and, hence, given little weighting in the regression analysis. For example, between 2000 and 2009, large state housing increases occurred in initially relatively non deprived areas such as Henderson, Albany and east of East Tamaki – areas all on the outskirts of Auckland city. [22]

From Tables 6 and 7 one can estimate the effect that house prices in an area have on acquisitions. Ignoring the results for the period 1991–1996 (as only 3% of acquisitions occurred during this time), our results indicate a strong, consistent relationship between house prices and acquisitions. Table 6 suggests that a greater percentage of acquisitions occurred in areas with more expensive houses. The interpretation of the coefficient for the period 2001–2006 is as follows: a 10% increase in real median house prices in an area in 2001 is associated with an approximate 0.06 percentage point increase in acquisitions relative to total private dwellings in that area during 2001–2006. Table 7 suggests that a greater percentage of acquisitions occurred in areas with more expensive houses relative to income. The interpretation of the coefficient for the period 2001–2006 is as follows: a 10% increase in real house prices relative to real income in an area in 2001 is associated with an approximate 0.08 percentage point increase in acquisitions in that area during 2001–2006.

This unexpected relationship between acquisitions and house prices may be partly explained by the large number of acquisitions occurring in the outskirts of urban areas. It is most likely that these fringe urban areas, on average, would (initially) have more expensive houses compared to urban areas with high densities of state housing. However, given that our results

[22] Olssen et al. (2010).

suggest more acquisitions occurred in deprived areas, one would expect that house prices, on average, would be cheaper in these areas. Table 3 shows only a weak negative correlation between our measure of deprivation and house prices, likely reflecting the prevalence of deprived areas in Auckland, which has high prices relative to other parts of New Zealand. This "Auckland effect" reinforces the positive relationship between acquisitions and house prices.

Our results also suggest a weaker relationship between acquisitions and the prior change in house prices in an area. Placing greater emphasis on the results for the period 2001–2006 (as 67% of acquisitions occur in this time), our results from Table 6 suggest that during this period, a greater percentage of acquisitions occurred in areas where house prices were falling, and, from Table 7, a greater percentage of acquisitions occurred in areas where house prices were falling relative to income. These results are consistent with an increased number of acquisitions in fringe urban areas, in which house prices may have started to fall due to the rising state housing density. As noted in section 3, the change in the house price variables may be of more relevance to our analysis than the house price level variables. In addition to controlling for unchanging amenities the change variables also effectively control for any "Auckland effect" that may influence our results. Given this interpretation, having controlled for such unchanging amenity and location effects, acquisitions over 2001–2006 predominately occurred in relatively inexpensive areas, consistent with our hypothesis.

4.2. Vacant Sales

From Tables 5, 6 and 7 there appears to be a strong, inverse relationship between the number of vacant sales (as a percentage of total private dwellings) in an area and the deprivation level of an area.[23] This is in accordance with the National government's stated intention of decreasing state housing density in less deprived areas (e.g. Orakei and Mission Bay). There does not, however, appear to be a strong relationship between the percentage of vacant sales and the change in deprivation of an area. One possible reason is that the non deprived areas in which the majority of vacant sales occurred have always been relatively affluent (so having little or no change in deprivation), especially areas such as Orakei and Mission Bay.

From Tables 6 and 7 there appears to exist an inverse relationship between house prices and vacant sales; however, there does not appear to be an obvious relationship between the change in house prices and vacant sales. The results for the period 1996–2001 are likely to be the most useful as this is when the majority of vacant sales occurred. The interpretation of the (levels) coefficient from Table 6 suggests a 10% higher real median house price in an area in

[23] Ignoring results for period 2001-2006 as only 6% of vacant sales occurred during this time.

1996 is associated with a 0.04 percentage point decrease in vacant sales relative to total private dwellings in that area during 1996–2001. The interpretation from Table 7 suggests a 10% higher real median house price relative to real income in an area in 1996 is associated with a 0.08 percentage point decrease in vacant sales in that area during 1996–2001.

Tables 8, 9 and 10, corresponding to Equations (7), (8) and (9), all suggest similar results when examining the effect of deprivation on vacant sales (expressed as a percentage of initial state housing stock) in an area. A greater number of vacant sales occurred in less deprived areas and, once house prices are controlled for, there does not appear to be a relationship between the change in deprivation and the percentage of vacant sales.

The results in Table 10 show evidence of an inverse relationship between vacant sales and house prices relative to income. The interpretation of the 1996–2001 coefficient is as follows: a 10% higher real median house price in an area relative to real income in 1996 led to an approximate 0.6 percentage point decrease in vacant sales relative to the state housing stock in that area between 1996 and 2001.

It is important to distinguish between the results presented in Tables 5, 6, and 7 versus those presented in Tables 8, 9, and 10. When the sales category is defined as a percentage of initial total dwellings, the question we are examining is: Given the state housing stock in each area, would we expect to see a greater number of state house sales in one area compared to another based on area characteristics? When the sales category is defined as a percentage of initial state housing stock the question we are now examining is: Would we expect a greater percentage of initial state houses sold in one area compared to another? Thus, the results in Tables 8, 9 and 10 are examining what area characteristics determine where people are more likely to purchase a state house, whereas Tables 5, 6 and 7 examine the trends of the state housing sales and acquisitions across different areas.

Our results in Tables 5, 6 and 7 suggest there were a greater number of vacant sales in areas of low deprivation with low house prices. Our results presented in Tables 8, 9 and 10 suggest a greater percentage of initial state houses were sold as vacant sales in areas of low deprivation where house prices were low relative to income.

4.3. Homebuys

Tables 5, 6 and 7 show a strong inverse relationship between homebuys and deprivation. Our results suggest that a greater number of homebuys (as a percentage of total private dwellings) occurred in less deprived areas consistent with our hypothesis. There does not appear to be a consistent relationship between the number of homebuys and the change in deprivation

(paying particular attention to 1996–2001 results, as this is when the majority of homebuys occurred). Thus, evidence of whether the area was improving or not does not seem to affect the level of homebuys in an area.

House prices appear to impact negatively on the percentage of homebuys in an area, but only to a small degree. Table 6 suggests that a 10% higher real median house price in an area in 1996 led to an approximate 0.006 percentage point decrease in homebuys relative to total private dwellings in that area between 1996 and 2001. For the same period, the results in Table 7 suggest a 10% higher real house price relative to income in 1996 led to an approximate 0.01 percentage point decrease in homebuys during 1996–2001. Our results also suggest that areas in which real house prices were increasing (and real house prices relative to real income were increasing) during 1991–1996 saw fewer homebuys during 1996–2001. These results accord with our hypothesis that many existing residents of state houses were less able to purchase in areas where house prices, on average, were higher.

The results presented in Tables 8, 9 and 10 also show a significant, inverse relationship between homebuys and deprivation. The results suggest that a greater number of homebuy sales (expressed as a percentage of initial state housing stock) occurred in less deprived areas. Also, placing greater emphasis on the results from 1996–2001, one observes that areas which were already improving (in terms of deprivation) during 1991–1996 witnessed a greater number of homebuys relative to their state housing density.

There does not appear to be a relationship between the level of house prices in an area and the number of homebuys (as a percentage of initial state housing stock) in an area. However, our results suggest that areas in which house prices had fallen (and areas where house prices had fallen relative to income) during 1991–1996 witnessed a greater percentage of homebuys during 1996–2001. Thus, homebuys were more prevalent in areas that had become relatively more affordable over time. Again, this result is in accordance with our hypothesis.

Overall the results in Tables 5, 6 and 7 suggest there were a greater number of homebuys in non deprived areas with low house prices, and where house prices (and housing affordability) in the past had fallen. In Tables 8, 9 and 10 our results suggest a greater percentage of initial state houses were sold as homebuys in less deprived areas that were improving, and where house prices (and housing affordability) in the recent past had fallen.

4.4. Discussion of Results by State House Type

4.4.1. Vacant Sales

The results from Table 4 suggest that a greater proportion of 3+ bedroom state houses were sold as vacant sales compared to the proportion of 1–2 bedroom state houses; however, the difference is relatively small. From the Wald test in Table 11, corresponding to Equation (10), we cannot reject either of the null hypotheses. Thus, there is no evidence suggesting that the determinants of the likelihood of a vacant sale are different for state houses of different sizes, and there is also no evidence that investors had a higher propensity to purchase larger houses.

Table 4 also shows that a greater proportion of single unit state houses were sold as vacant sales compared to other property types. In Table 12, we reject the null hypotheses of both Wald tests, indicating that the determinants of sale type differ between single unit and other state house types and that investors had a higher propensity to purchase single unit state houses than other property types. In interpreting the estimates for vacant sales of single unit state houses, our results in Table 14 suggest investors preferred to purchase single unit state houses in less deprived areas where house prices relative to income had fallen over 1991–1996.

4.4.2. Homebuys

Table 4 indicates that a 3+ bedroom house was more likely to be sold as a homebuy than a 1–2 bedroom house. Furthermore, the rejection of both null hypotheses in Tables 11 and 12 shows that, firstly, the determinants of homebuy purchase decisions differed across house type and, secondly, residents had a higher propensity to purchase larger houses. Our results in Table 11 suggest that residents of both 1-2 bedroom and 3+ bedroom state houses were more likely to purchase their house if they lived in a less deprived area; however, the effect of deprivation on homebuys of 1–2 bedroom state houses was not as strong as for 3+ bedroom houses. Residents of 3+ bedroom houses were also more likely to buy in an area where house prices had fallen relative to income over the past five years (1991-1996).

Table 4 shows a much greater proportion of single unit state houses were sold as homebuys compared to other property types. Again, determinants of purchase decisions across the two house types are shown to differ given the rejection of the null hypothesis in the first Wald test. The much larger constant term for single unit relative to other homebuys indicates that residents had a higher propensity to purchase single unit state houses compared to other property types, even after controlling for other determinants. Placing greater emphasis on homebuys for single unit state houses, our results in Table 12 suggest that residents preferred to

purchase single unit state houses in areas that were less deprived and where house prices relative to income had fallen over 1991–1996. These results are consistent with homebuys of 3+ bedroom state houses and homebuys of all state houses.

4.5. State Housing Stock

Finally we examine the characteristics of the spatial distribution of the stock of state houses. There is a strong, consistent relationship between the density of state housing in an area and the deprivation level of the area over each of the four census years covered by this study (Tables 13, 14 and 15). As expected, our results suggest that the more deprived the area, the higher the density of state housing. Secondly, the effect of deprivation on the density of state houses increases over 1991–1996 and falls over 1996–2006. These trends are most likely explained by the two different political parties in power over this time. The 1990s National government placed a greater emphasis on reducing state house holdings in high priced areas and strategically locating state housing in areas of high demand. As a result, during the 1990s less deprived areas witnessed a decline in state housing density. The Labour government, having the aim of increasing the overall state housing stock, increased state housing density in both deprived and (initially) non-deprived areas, albeit with a greater concentration on areas of high demand.

From Tables 14 and 15 there does not appear to be a strong, consistent relationship between state housing density in an area and house prices in an area. This is most likely because the majority of the stock of state houses were acquired many decades ago. The areas in which state houses were initially acquired were most likely then to have been fringe urban with relatively low house prices. However, as population grew and cities expanded, it is likely that these areas were no longer on the outskirts and house prices changed in relative value.

4.6. Auckland Results

All the results estimated and presented for New Zealand (Tables 5–15) have also been estimated for just the Auckland Region, so abstracting from influences that may differ across regions. We have done so because we wish to test, in section 5, the impacts of state house sales and acquisitions at the both the national level and at a regional level for Auckland (New Zealand's dominant city). Prior to doing so, we need to understand which variables we must control for in order to isolate the impacts of the sales and acquisitions variables on deprivation and house price outcomes. For Auckland, we find consistent relationships between deprivation and the level of sales and acquisitions as we did across New Zealand. House price determinants of sales and acquisitions in some cases differ for Auckland relative to New Zealand. However, we find that house prices are still a significant determinant for sales and acquisitions within

Auckland. Thus, in section 5, it remains important to control for both deprivation and house prices, and prior changes in those variables, when looking at the effects of sales and acquisition policies on outcomes.

5. Impacts of HNZC Sales and Acquisitions

Previous studies, cited in the Introduction, have investigated the impact of homeownership on societal outcomes. The difficulty in such studies is to isolate an exogenous event that causes a switch in tenure status from tenant to homeowner (or vice versa). The state house sales programme in New Zealand, driven by political philosophy, is one such exogenous event, especially in the way that the Home Buy scheme enabled existing state house tenants to purchase their existing residence, an option which previously had been denied to them. We investigate whether an increase in acquisitions, vacant sales and, in particular, homebuys led to subsequent changes in deprivation and house prices in an area. The house price outcomes are used as a market-based summary measure of community wellbeing or amenity values. We concentrate on the impacts of sales and acquisitions conducted over the 1996–2001 period since the bulk of sales occurred over this period and the period also saw sizeable acquisition activity.

5.1. Regression Specifications

First, we examine the impact of sales and acquisitions of state houses during 1996–2001 on the change in deprivation of an area over 2001–2006. We regress the change in deprivation between 2001 and 2006 on vacant sales, acquisitions and homebuys over 1996–2001, each expressed as a percentage of total private dwellings in 1996. We control for the level of deprivation in 2001, the level of real median house price in 2001 and the changes in deprivation and real median house price between 1996 and 2001, and 1991 and 1996. This specification is shown in Equation (16). We then run a similar regression; however, this time we use real median house price relative to income as a control for house prices in an area. Both of these regressions are run for all of New Zealand and for the Auckland Region to examine consistency of results.

$$(\Delta Deprivation)_{CAU,\ 2006\text{-}2001} = a + \theta_1(Vacant\ Sales\ as\ \%\ of\ total\ private\ dwellings)_{96\text{-}01} + \theta_2(Homebuys\ as\ \%\ of\ total\ private\ dwellings)_{96\text{-}01} + \theta_3(Acquisitions\ as\ \%\ of\ total\ private\ dwellings)_{96\text{-}01} + \beta_1\,(Dep\_Score)_{CAU,\ 2001} + \beta_2\,(\Delta Dep\_Score)_{CAU,\ 2001\text{-}1996} + \beta_3(\Delta Dep\_Score)_{CAU,\ 1996\text{-}1991} + \lambda_1(ln(houseprice))_{CAU,\ 2001} + \lambda_2(\Delta ln(houseprice))_{CAU,\ 2001\text{-}1996} + \lambda_3(\Delta ln(houseprice))_{CAU,\ 1996\text{-}1991} + e_{CAU} \quad (16)$$

We then examine the effect of sales and acquisitions on the change in real house prices and real house prices relative to income in an area. First, we regress the change in real median

house prices over 2001–2006 on vacant sales, homebuys and acquisitions over 1996–2001 as a percentage of total private dwellings. We control for the same explanatory variables as in Equation (16). We then run a similar regression, but using the change in real house prices relative to income between 2001 and 2006 as our explanatory variable. Again, we run these regressions for all of New Zealand and just for the Auckland Region to examine the consistency of results obtained across regions with those obtained within a single major region.

$$\Delta ln(\text{houseprice})_{CAU,\ 2006\text{-}2001} = a + \theta_1(\text{Vacant Sales as \% of total private dwellings})_{96\text{-}01} + \theta_2(\text{Homebuys as \% of total private dwellings})_{96\text{-}01} + \theta_3(\text{Acquisitions as \% of total private dwellings})_{96\text{-}01} + \beta_1\,(Dep\_Score)_{CAU,\ 2001} + \beta_2\,(\Delta Dep\_Score)_{CAU,\ 2001\text{-}1996} + \beta_3(\Delta Dep\_Score)_{CAU,\ 1996\text{-}1991} + \lambda_1(ln(houseprice))_{CAU,\ 2001} + \lambda_2(\Delta ln(houseprice))_{CAU,\ 2001\text{-}1996} + \lambda_3(\Delta ln(houseprice))_{CAU,\ 1996\text{-}1991} + e_{CAU} \quad (17)$$

5.2. Discussion of Results

As expected, the results for New Zealand in Tables 16 and 17, corresponding to Equation (16), indicate that an increase in acquisitions over 1996–2001 is associated with a subsequent increase in deprivation over 2001–2006. This result is also apparent for Auckland when using house prices as an explanatory variable but not when using house prices relative to incomes. Contrary to our hypothesis, the New Zealand results suggest that an increase in homebuys in an area during 1996–2001 is associated with an increase in deprivation in that area over 2001–2006. However, this result is not robust since it does not extend to either of the relationships estimated for the Auckland region. Furthermore, it is important to remember that our generated deprivation measure is not as closely linked to household characteristics as the Salmond et al. (2002) measure. For example, residents who purchased their home may then have more children, causing our measure of deprivation to increase for this area.[24] It is therefore more useful to examine the effect of sales and acquisitions on house prices, as house price changes measure the change in the overall "amenity value" that purchasers attribute to a community.

The results in Tables 18 and 19, corresponding to Equation (17), indicate a strong, positive relationship between the percentage of homebuys over 1996–2001 and the change in house prices (and house prices relative to income) over 2001–2006. The result for New Zealand in Table 18 suggests that a 1 percentage point increase in homebuys in an area during 1996–2001 is associated with a 2.7% increase in real house prices in that area over 2001–2006. Table 19 finds, for New Zealand, that a 1 percentage point increase in homebuys in an area during 1996–

[24] The correlation between our deprivation measure and the mean number of 0–4 year olds in a private dwelling is 0.70 for 2001.

2001 is associated with a 2.3% increase in real house prices relative to real income in that area over 2001–2006. When examining just the Auckland region, the results in Tables 18 and 19 indicate an even stronger positive relationship between the percentage of homebuys in an area and the change in local real house prices (and house prices relative to income).

These homebuy results accord with the hypothesis that a change in the housing tenure status of a given resident from state tenant to homeowner (as occurred, by definition, with the Home Buy scheme) has positive spin-offs for the local community. These positive externalities are capitalised into a higher price of houses in the local area over and above what would have occurred due to the effects of our prior deprivation and house price control variables.

The results for both New Zealand and Auckland suggest that vacant sales and acquisitions over 1996–2001 had little or no effect on subsequent house price changes (or changes in house prices relative to income) over 2001–2006. The acquisitions result is perhaps surprising given that acquisitions increase the measured deprivation of an area, consistent with the policy intent to provide homes for deprived people. The practice of "pepper-potting" acquired state houses amongst a broader community, as adopted over this period (mitigating intense concentrations of state housing), may be one reason that local house prices were broadly unaffected by acquisition patterns (Schrader, 2005).

Vacant sales differ from homebuys in that, by definition, a vacant sale corresponds to a change in resident, whereas the resident remains the same with a homebuy. Some vacant sales resulted in a shift in tenancy status for the house from having a tenant to having a homeowner (i.e. of the new resident), but others resulted in sale of the house to a landlord, thereby replacing one tenant with another. Accordingly, compared with the Home Buy scheme, there is less reason to expect that vacant sales will lead to changing amenity values or deprivation levels in a community, and this is in accordance with our results.

6. Conclusions

New Zealand's changing state housing policies over the two decades following 1990 gave rise to two natural experiments regarding the sales and acquisitions of state houses. The 1990s National government sought to reduce the overall state house stock and to redirect it away from non-deprived areas to areas most in need, while the post-1999 Labour government sought to increase the overall stock, often through acquiring new state houses in fringe urban areas. This paper uses state housing data provided by HNZC, population data from the 1986, 1991, 1996, 2001 and 2006 censuses, and house price data from QVNZ, to explore the spatial distribution of sales and acquisitions of state houses over 1991–2006.

We have examined the effect of deprivation and house prices on acquisitions and sales in an area over three inter-censal periods, 1991–1996, 1996–2001, and 2001–2006. Over the three periods, acquisitions generally occurred in deprived areas, where house prices and house prices relative to incomes were high. This latter, unexpected, relationship between acquisitions and house prices was most likely due to a large number of acquisitions occurring in the Auckland urban fringe where house prices, even in deprived areas, were high relative to the rest of New Zealand. Supporting this argument is the inverse relationship between acquisitions over 2001–2006 and the change in house prices (and house prices relative to income) over 1996–2001. We placed a greater emphasis on the results for the change in house price variables (as opposed to house price levels) since the former control for unchanging amenity and location effects. The results based on house price changes are consistent with our hypotheses that high prices discouraged acquisitions and a greater number of acquisitions occurred in deprived areas.

For vacant sales and homebuys we focused our attention on the results for the period 1996–2001, as this is when the majority of each sale type occurred. We find that there was a greater number of vacant sales in areas of low deprivation with relatively low house prices and low house prices relative to income. We find no evidence to suggest that purchasers preferred to purchase larger houses versus smaller houses (based on bedroom numbers). However, the evidence indicates that purchasers preferred to purchase stand-alone dwellings rather than other property types.

As hypothesised, we find that a greater number of homebuys occurred in less deprived areas with low house prices and low house prices relative to income. Furthermore, our results suggest that a greater number of homebuys occurred in areas where house prices and house prices relative to income had fallen in the recent past. We also find that, for a given set of state houses, residents were more likely to purchase their house in a less deprived area that was

improving (in terms of deprivation) and where house prices and housing affordability had fallen in the past five years. When we further examined homebuys by house type we find that residents, on average, preferred to purchase larger, standalone houses.

We also explored the area characteristics of the stock of state houses over time. As expected, higher densities of state houses were located in more deprived areas. There was no consistent relationship between the state housing stock and house prices. This reflects the fact that the majority of state houses had been acquired many decades before and so the current stock was unrelated to current house prices.

Having determined which factors need to be controlled for with regard to the purchase decision, we were able to examine the impacts of sales and acquisitions on subsequent changes in deprivation and house prices in an area. As expected, areas which experienced an increase in acquisitions over 1996–2001 witnessed an increase in deprivation over 2001–2006. Areas that experienced a relatively high percentage of homebuys over 1996–2001 witnessed an increase in real median house prices (and real median house prices relative to income) over 2001–2006. These results are consistent both for New Zealand and for the Auckland Region. The results for the latter area, which are estimated across a more homogeneous housing market than the full New Zealand sample, suggest an even stronger positive relationship between homebuys and future house price increases in an area than indicated by the New Zealand results. Thus, after controlling for existing levels and prior changes in both deprivation and house prices, our results are consistent with the hypothesis that the sale of state houses to existing tenants had positive impacts on the local community, with this effect being capitalised into local house prices.

Future work could extend these results to a unit record analysis of whether neighbouring properties benefit more from state house homebuy sales than do more distant properties. If so, this would suggest that observable characteristics of the house (e.g. mown lawns, house maintenance, etc.) or of the household (e.g. residents' behaviour) may have changed as a result of the purchase decision. If the effect is spatially more diffuse, the neighbourhood benefits may reflect more of a changing social capital phenomenon whereby the purchaser participates more fully in local community activities such as Neighbourhood Watch (a local crime-reduction scheme) or assisting in school activities. New Zealand's natural experiments with state housing, driven by differing political philosophies of alternating governments, therefore offer valuable opportunities to investigate the impacts that tenure status can have on individual and community outcomes. Our results suggest that the Home Buy scheme did affect community outcomes positively, but the exact source of those benefits is still yet to be determined.

7. References

Barker, David and Eric Miller. 2009. "Homeownership and Child Welfare", *Real Estate Economics*, 37:2, pp. 279–303.

Cobb-Clark, D.A. and V.A. Hildebrand. 2006. "The Wealth and Asset Holdings of US-born and Foreign-born Households: Evidence from SIPP Data", *Review of Income and Wealth*, 52:1, pp. 17–42.

DiPasquale, Denise and Edward L. Glaeser. 1999. "Incentives and Social Capital: Are Homeowners Better Citizens?" *Journal of Urban Economics*, 45:2, pp. 345–84.

Ellis, L. 2006. "Housing and Housing Finance: The View from Australia and Beyond", http://www.rbnz.govt.nz/research/workshops/14nov06/2895717.pdf

Glaeser, E.L., D. Laibson and B. Sacerdote. 2002. "An Economic Approach to Social Capital", *The Economic Journal*, 112:483, pp. F437–58.

Green, Richard K. and Michelle J. White. 1997. "Measuring the Benefits of Homeowning: Effects on Children", *Journal of Urban Economics*, 41:3, pp. 441–61.

Haurin, Donald R., Toby L. Parcel and R. Jean Haurin. 2002. "Does Homeownership Affect Child Outcomes?" *Real Estate Economics*, 30:4, pp. 635–66.

Mohantly, L.L. and L.K. Raut. 2009. "Home Ownership and School Outcomes for Children", *American Journal of Economics and Sociology,* 68:2, pp. 465–89.

Olssen, Alex, Hugh McDonald, Arthur Grimes and Steven Stillman. 2010. "A State Housing Database: 1993-2009", *Motu Working Paper 10-13*, Motu Economic and Public Policy Research, Wellington.

Oswald, A. 1996. "A Conjecture on the Explanation for High Unemployment in the Industrialized Nations: Part I", *IDEAS: The Warwick Economics Research Paper Series* 475, Department of Economics, University of Warwick, Coventry.

Oswald, A. 1999. "The Housing Market and Europe's Unemployment: A Non-Technical Paper", Mimeo, University of Warwick, Coventry.

Salmond, Clare and Peter Crampton. 2002. "NZDep2001 Index of Deprivation: User's Manual", Department of Public Health, University of Otago: Wellington. Available online at http://www.uow.otago.ac.nz/academic/dph/research/socioeconomicdeprivation.html. Last accessed 28 March 2011.

Sampson, R.J., S.W. Raudenbush and F. Earls. 1997. "Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy", *Science* 277:5328, pp. 918–24.

Schrader, Ben. 2005. *We Call it Home.* Auckland: Reed Books.

Sinning, M. 2010. "Homeownership and Economic Performance of Immigrants in Germany", *Urban Studies.* 47:2, pp. 387–409.

Skilling, D. 2004. "It's Not Just about the Money: The Benefits of Asset Ownership", *Discussion Paper 2004/2,* The New Zealand Institute, Auckland.

Skilling, D. 2005. "Opportunity for a Lifetime: Creating an Ownership Society in New Zealand", *Discussion Paper 2005/2,* The New Zealand Institute, Auckland.

Stillman, Steve and David Maré. 2008. "Housing Markets and Migration: Evidence from New Zealand," *Motu Working Paper 08-06,* Motu Economic and Public Policy Research, Wellington.

8. Tables and Figures

Figure 1: NZDep2001 and Generated Deprivation Score

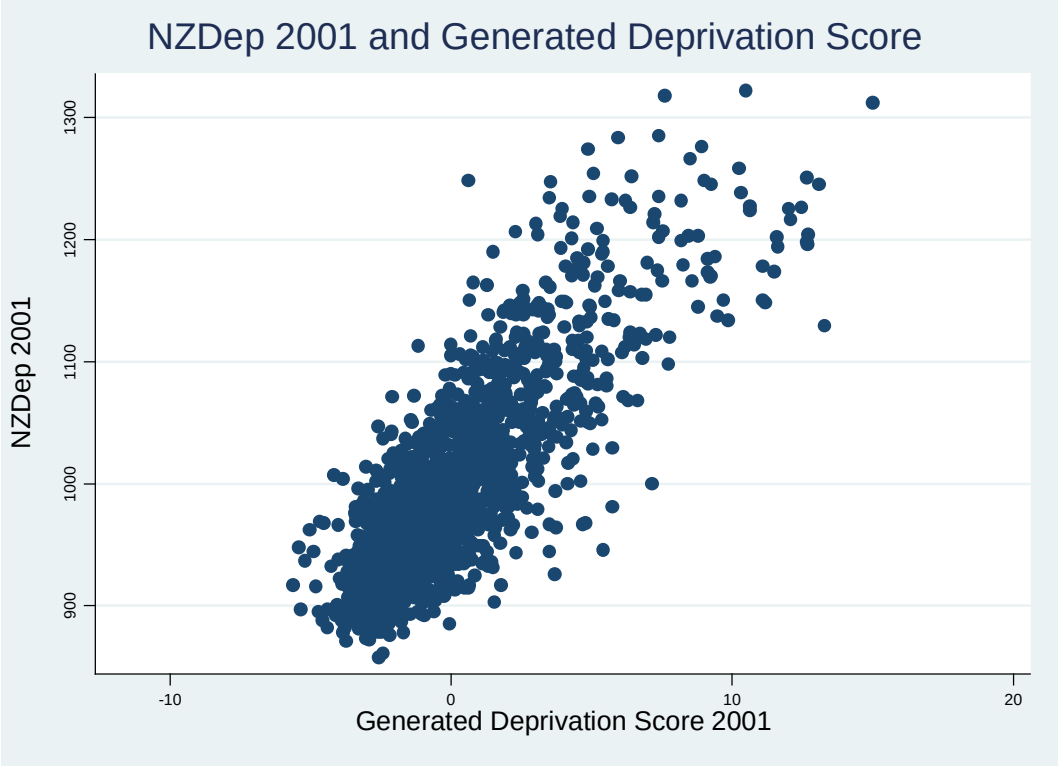

Table 1: Acquisitions, Vacant Sales and Homebuys over the Three Census Periods

	March 1993 - February 1996	March 1996 –February 2001	March 2001 - February 2006
Acquisitions	273	2552	5774
% of Total Acquisitions	3.17%	29.68%	67.15%
Vacant Sales	1014	7718	644
% of Total Vacant Sales	10.81%	82.32%	6.87%
Homebuys	716	2387	10
% of Total Homebuys	23.00%	76.68%	0.32%

Notes: the percentages are expressed as the number of sales/acquisitions for the census period over the total number of sales/acquisitions that occurred during 1993-2006.

Table 2: Population Characteristics in 2001 Census Area Units

Variables (Means unless otherwise stated)	1986	1991	1996	2001	2006
Local Population	1377	1443	1502	1562	1697
Real median house price	139531	140205	173985	189305	314661
Percent owning their own dwelling	73.9	74.5	72.2	70.1	69.2
Percent unemployed or not in the labour force	35.8	42.2	37.2	35.7	32.1
Age	42.3	43.0	44.0	45.5	46.2
Percent aged 65 and over	13.7	14.4	15.0	15.9	16.4
Number of 0–4 yr olds in private dwellings	0.26	0.26	0.25	0.22	0.21
Number of 5–12 yr olds in private dwellings	0.42	0.36	0.37	0.37	0.34
Number of 13–17 yr olds in private dwellings	0.30	0.24	0.22	0.21	0.23
Number of 18–24 yr olds in private dwellings	0.50	0.46	0.40	0.35	0.36
Number of 25–64 yr olds in private dwellings	1.60	1.61	1.63	1.62	1.62
Number of 65+ yr olds in private dwellings	0.25	0.26	0.27	0.29	0.30
Percent female	50.0	50.4	50.9	51.2	51.3
Percent of migrants	17.0	17.2	18.3	19.6	22.2
Percent European	87.3	85.7	85.2	82.7	81.1
Percent Maori	10.6	11.2	13.0	12.8	13.3
Percent Pacific Islander	2.5	3.0	3.5	3.8	4.0
Percent Asian	1.3	2.2	3.5	4.6	6.3
Percent Other Ethnicity	0.1	0.2	0.3	0.5	0.6
Percent with no qualifications	38.7	33.3	34.3	25.6	24.2
Percent with school qualifications	22.4	23.9	25.7	33.7	30.7
Percent with post school qualifications	25.9	31.2	19.6	19.5	24.3
Percent with degree	5.1	6.0	7.9	9.9	13.9
Percent with missing qualifications	7.9	5.6	12.5	11.3	6.9
Real income	22574	21595	25997	27753	30102
Percent with zero or negative income	2.6	2.3	3.7	3.3	3.5
Percent with missing income	4.9	4.1	5.6	7.4	6.1
Percent never married	20.7	21.8	20.0	20.3	20.1
Percent married	61.5	57.6	54.6	52.3	50.3
Percent de facto	5.1	6.6	9.9	12.7	15.1
Percent divorced or separated	6.1	7.4	6.8	7.7	7.9
Percent widowed	6.4	6.5	5.8	6.0	5.5
Percent missing marital status	0.2	0.0	2.9	1.0	1.1
Percent with no family	24.5	25.6	25.2	28.3	26.2
Percent couple with kids	45.9	41.6	38.9	34.7	35.1
Percent couple with no kids	22.9	24.9	27.7	28.4	30.1
Percent single with kids	6.7	7.9	8.2	8.6	8.6
Observations	1645	1859	1859	1859	1859

Notes: all population characteristics come from census data except for the real median house price with comes from QVNZ data. Real income and house prices are expressed in 1991 NZ dollars.

Table 3: Correlation Coefficients between Deprivation Variables & Area Characteristics for 2001

	NZDep 2001	deprivation score (generated)
NZDep2001	1	
Deprivation score (generated)	0.8180	1
Natural log of real income	-0.7917	-0.6011
Percent with zero or negative income	0.0492	0.3767
Percent with missing income	0.6830	0.7772
Natural log of house prices	-0.3650	-0.0995
Percent unemployed or not in the labour force	0.6911	0.4433
Percent female	0.0939	*-0.0005*
Percent of migrants	*0.0228*	0.3735
Percent European	-0.7037	-0.9034
Percent Maori	0.7028	0.6261
Percent Pacific	0.4682	0.7143
Percent Asian	*-0.0155*	0.2982
Percent other ethnicity	0.0909	0.2376
Percent with missing qualifications	0.7321	0.5309
Percent with school qualifications	-0.4207	-0.0894
Percent with post school qualifications	-0.6942	-0.6820
Percent with a degree	-0.4467	-0.2365
Mean age	-0.1519	-0.5423
Percent of people aged 65+	0.0590	-0.3135
Percent living in private dwelling	-0.1021	-0.1853
Percent owning their own home	-0.5559	-0.6610
Mean number of 0–4 year olds	0.4863	0.6951
Mean number of 5–12 yr olds	0.3904	0.5423
Mean number of 12–17 yr olds	0.2285	0.4101
Mean number of 18–24 yr olds	0.2497	0.4725
Mean number of 25–64 yr olds	-0.0653	0.2968
Mean number of 65+ yr olds	0.0504	-0.2988
Percent married	-0.6694	-0.6928
Percent de facto	0.3933	0.4126
Percent divorced/separated	0.5692	0.3345
Percent widowed	0.2776	*-0.0184*
Percent missing marital status	0.2633	0.4097
Percent couple with kids	-0.3729	-0.1254
Percent couple without kids	-0.5543	-0.8143
Percent single with kids	0.7658	0.7080

Notes: all coefficients are significant at a 5% significance level except for those in *italics*.

Table 4: Mean Percentage of Sales and Acquisitions over the Three Census Periods

Percentage of Initial Total Private Dwellings			
	1991–1996	1996–2001	2001–2006
Vacant Sales of State Houses	0.1030	0.7296	0.0573
Vacant Sales of 1-2 Bedroom State Houses	0.0525	0.3272	0.0244
Vacant Sales of 3+ Bedroom State Houses	0.0505	0.4026	0.0330
Vacant Sales of Single Unit State Houses	0.0888	0.5126	0.0285
Vacant Sales of Other Property Type State Houses	0.0145	0.2172	0.0289
Homebuys of State Houses	0.0729	0.2257	0.0009
Homebuys of 1-2 Bedroom State Houses	0.0163	0.0663	0.0006
Homebuys of 3+ Bedroom State Houses	0.0566	0.1594	0.0003
Homebuys of Single Unit State Houses	0.0695	0.2011	0.0004
Homebuys of Other Property Type State Houses	0.0034	0.0246	0.0004
Acquisitions of State Houses	0.0278	0.2412	0.5145
Acquisitions of 1-2 Bedroom State Houses	0.0058	0.0513	0.2792
Acquisitions of 3+ Bedroom State Houses	0.0220	0.1901	0.2353
Acquisitions of Single Unit State Houses	0.0228	0.1822	0.2577
Acquisitions of Other Property Type State Houses	0.0050	0.0591	0.2568
Stock of State Houses	7.0604	6.4174	5.3165
Stock of 1–2 Bedroom State Houses	3.1556	2.8717	2.3608
Stock of 3+ Bedroom State Houses	3.9044	3.5456	2.9559
Stock of Single Unit State Houses	4.5361	4.085	3.3090
Stock of Other Property Type State Houses	2.5239	2.3323	2.0076
Percentage of Initial State Housing Stock			
Vacant Sales of State Houses	3.4743	15.9493	2.3092
Homebuys of State Houses	1.5033	4.2479	0.0114
Percentage of 1-2 Bedroom State Houses			
Vacant Sales of 1–2 Bedroom State Houses	2.6240	14.8413	2.2167
Homebuys of 1–2 Bedroom State Houses	0.5375	2.5078	0.0130
Percentage of 3+ Bedroom State Houses			
Vacant Sales of 3+ Bedroom State Houses	3.8915	17.1932	2.4006
Homebuys of 3+ Bedroom State Houses	2.2777	5.7705	0.0065
Percentage of Single Unit State Houses			
Vacant Sales of Single Unit State Houses	4.2883	19.4162	2.0595
Homebuys of Single Unit State Houses	2.0521	5.7377	0.0068
Percentage of Other Property Type State Houses			
Vacant Sales of Other Property Type State Houses	1.1155	9.1608	2.1483
Homebuys of Other Property Type State Houses	0.3854	1.488	0.0125
Sample Size	1859	1859	1859

Notes: the percentages are expressed firstly as a percentage of initial total private dwellings e.g. acquisitions during 1991–1996 are expressed as a percentage of total private dwellings in 1991. The sales categories are also expressed as a percentage of initial state housing stock and as a percentage of initial state housing stock of each sub-category. For example the number of vacant sales of 1–2 bedroom state houses during 1996–2001 as a percentage of 1–2 bedroom state houses in 1996.

Table 5: Cross Sectional Regressions Examining the Relationship between Deprivation and each Category Expressed as a Percentage of Total Private Dwellings

	Acquisitions			Vacant Sales			Homebuys		
	1991–1996	1996–2001	2001–2006	1991–1996	1996–2001	2001–2006	1991–1996	1996–2001	2001–2006
Variables									
Deprivation	**0.00862***	**0.105*****	**0.187*****	**-0.0279*****	**-0.184*****	-0.000636	**-0.0304*****	**-0.0343*****	**-0.000234***
ΔDeprivation	-0.000956	0.0351	**-0.122****	0.00408	-0.00321	0.00527	**0.0121*****	**-0.0178****	**-0.000916****
State housing stock	**0.000575***	0.00688	-0.00151	**0.00940*****	**0.131*****	**0.00511*****	**0.0105*****	**0.0368*****	**0.000172*****
Constant	**0.0251*****	0.148**	**0.461*****	**0.0330*****	-0.0612	**0.0296*****	0.00339	0.00947	0.000225
Observations	1,123	1,130	1,133	1,123	1,130	1,133	1,123	1,130	1,133
R-squared	0.069	0.037	0.144	0.148	0.427	0.031	0.367	0.540	0.018

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU. 3% of acquisitions occurred during 1991–1996, 30% occurred during 1996–2001 and 67% occurred during 2001–2006. 11% of vacant sales occurred during 1991–1996, 82% occurred during 1996–2001 and 7% occurred during 2001–2006. 23% of homebuys occurred during 1991–1996, 77% occurred during 1996–2001 and <1% occurred during 2001–2006.

Table 6: Cross Sectional Regressions Examining the Relationship between House Prices and each Category Expressed as a Percentage of Total Private Dwellings

	Acquisitions			Vacant Sales			Homebuys		
	1991–1996	**1996–2001**	**2001–2006**	**1991–1996**	**1996–2001**	**2001–2006**	**1991–1996**	**1996–2001**	**2001–2006**
Variables									
Deprivation	0.00848	**0.0948*** **	**0.210*** **	**-0.0288** **	**-0.196*** **	-0.00226	**-0.0333*** **	**-0.0331*** **	-0.000226
Δ Deprivation	-0.000724	0.0206	-0.0956	0.00307	0.0308	-0.00469	**0.0132*** **	-0.00603	**-0.000921***
ln(houseprice)	0.00155	**0.132** **	**0.600*** **	**-0.0579*** **	**-0.383*** **	**-0.0791*** **	-0.0149	**-0.0629*** **	0.000555
Δ ln(houseprice)	-0.000360	0.203	**-0.533** **	0.0136	-0.0248	-0.0631	0.0392	**-0.196*** **	-0.000268
State housing stock	0.000535	**0.00939*** **	-0.00187	**0.00962*** **	**0.130*** **	**0.00510*** **	**0.0107*** **	**0.0354*** **	**0.000176*** **
Constant	0.00774	**-1.504***	**-6.794*** **	**0.716*** **	**4.553*** **	**0.992*** **	0.180	**0.808*** **	-0.00651
Observations	1,078	1,102	1,105	1,078	1,102	1,105	1,078	1,102	1,105
R-squared	0.070	0.128	0.193	0.164	0.442	0.062	0.372	0.563	0.019

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 7: Cross Sectional Regressions Examining the Relationship between Housing Affordability and each Category Expressed as a Percentage of Total Private Dwellings.

	Acquisitions			Vacant Sales			Homebuys		
	1991-1996	**1996-2001**	**2001–2006**	**1991–1996**	**1996–2001**	**2001–2006**	**1991–1996**	**1996–2001**	**2001–2006**
Variables									
Deprivation	0.00675	**0.0894*** **	**0.184*** **	**-0.0190***	**-0.186*** **	0.00133	**-0.0305*** **	**-0.0306*** **	**-0.000246***
Δ Deprivation	0.000179	0.00613	**-0.117***	-0.00173	**0.0722** **	0.00665	**0.0117*** **	0.00349	**-0.000956** **
ln(houseprice/income)	0.00892	**0.215** **	**0.830*** **	**-0.100*** **	**-0.786*** **	**-0.101*** **	**-0.0271***	**-0.131*** **	0.000364
Δ ln(houseprice/income)	0.0156	0.112	**-0.657*** **	-0.00901	**0.427***	-0.0589	0.0224	**-0.0987***	-0.000182
State housing stock	0.000507	**0.00890** **	-0.00344	**0.00993*** **	**0.132*** **	**0.00540*** **	**0.0107*** **	**0.0358*** **	**0.000174*** **
Constant	0.00911	-0.278	**-1.135*** **	**0.214*** **	**1.386*** **	**0.223*** **	**0.0515** **	**0.260*** **	-0.000483
Observations	1,078	1,102	1,105	1,078	1,102	1,105	1,078	1,102	1,105
R-squared	0.072	0.127	0.200	0.172	0.452	0.059	0.372	0.562	0.019

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 8: The Relationship between Deprivation and Sales Expressed as a Percentage of the State Housing Stock

	Vacant Sales			Homebuys		
	1991–1996	**1996–2001**	**2001–2006**	**1991–1996**	**1996–2001**	**2001–2006**
Variables						
Deprivation	**-1.648*** **	**-2.021*** **	**-0.241** **	**-0.592***	**-0.307*** **	0.00125
Δ Deprivation	**0.626** **	**-1.256** **	-0.243	**0.275***	**-0.787*** **	**-0.0165** **
Constant	**3.681*** **	**17.50*** **	**2.490*** **	**1.649*** **	**4.859*** **	**0.0137*** **
Observations	1,016	1,004	991	1,016	1,004	991
R-squared	0.024	0.089	0.006	0.004	0.028	0.005

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 9: The Relationship between House Prices and Sales Expressed as a Percentage of the State Housing Stock

	Vacant Sales			Homebuys		
	1991–1996	1996–2001	2001–2006	1991–1996	1996–2001	2001–2006
Variables						
Deprivation	**-1.075****	**-2.095*****	**-0.269****	**-0.618***	**-0.302*****	0.00194
Δ Deprivation	0.311	-0.778	-0.531	**0.297***	**-0.686*****	**-0.0164****
ln(houseprice)	1.007	-2.473	**-1.468****	0.419	-0.0715	**0.0167***
Δ ln(houseprice)	-1.091	-3.522	-1.923	-0.333	**-3.538****	-0.0307
Constant	-8.635	**47.60*****	**20.38****	-3.285	6.350	-0.188
Observations	990	991	979	990	991	979
R-squared	0.031	0.095	0.014	0.005	0.036	0.009

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 10: The Relationship between Housing Affordability and Sales Expressed as a Percentage of the State Housing Stock

	Vacant Sales			Homebuys		
	1991-1996	1996–2001	2001–2006	1991–1996	1996–2001	2001–2006
Variables						
Deprivation	**-0.979****	**-1.939*****	-0.177	**-0.576***	**-0.274*****	0.00133
Δ Deprivation	0.254	-0.104	-0.285	0.272	**-0.576****	**-0.0161****
ln(houseprice/income)	0.0571	**-6.335*****	**-2.431*****	0.117	-0.279	0.0142
Δ ln(houseprice/income)	-2.559	-4.466	-2.038	-1.196	**-4.041****	-0.0323
Constant	**3.318***	**29.09*****	**7.160*****	1.524	**5.446*****	-0.0141
Observations	990	991	979	990	991	979
R-squared	0.031	0.108	0.018	0.005	0.038	0.007

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 11: Seemingly Unrelated Regressions for Vacant Sales and Homebuys of 1–2 Bedroom and 3+ Bedroom State Houses (as a Percentage of Stock of 1–2 Bedroom State Houses and 3+ Bedrooms State Houses, Respectively)

	1996–2001			
	Vacant Sales		Homebuys	
Variables	**1-2 Bedrooms**	**3+ Bedrooms**	**1-2 Bedrooms**	**3+ Bedrooms**
Deprivation	**-1.895*** **	**-2.225*** **	**-0.185*** **	**-0.541*** **
Δ Deprivation	-0.235	**1.134***	-0.00551	**-0.618***
ln(houseprice/income)	**-5.464** **	**-7.769*** **	0.292	**2.199***
Δ ln(houseprice/income)	-2.310	-4.839	-1.650	**-7.211*** **
Constant	**26.77*** **	**31.82*** **	**2.130***	2.513
Observations	796	796	796	796
R-squared	0.090	0.133	0.014	0.041
Wald test (1)	0.2102		0.0012	
Wald test (2)	0.1121		0.0000	

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU. 12% of vacant sales of 1–2 bedroom houses occurred during 1991–1996, 81.5% occurred during 1996–2001 and 6.5% occurred during 2001–2006. 18% of homebuys of 1–2 bedroom houses occurred during 1991–1996, 81% occurred during 1996–2001 and 1% occurred during 2001–2006. 10% of vacant sales of 3+ bedroom houses occurred during 1991–1996, 83% occurred during 1996–2001 and 7% occurred during 2001–2006. 25% of homebuys of 3+ bedroom houses occurred during 1991–1996, 75% occurred during 1996–2001 and <1% occurred during 2001–2006. Wald test (1) tests if all coefficients of the explanatory variables excluding the constant term are the same across the two sub-categories. Wald test (2) includes the constant term.

Table 12: Seemingly Unrelated Regressions for Vacant Sales and Homebuys of Single Unit and Other Property Type State Houses (as a Percentage of Stock of Single Unit State Houses and Other Property Type State Houses, Respectively)

	1996 - 2001			
	Vacant Sales		Homebuys	
Variables	**Single Unit**	**Other**	**Single Unit**	**Other**
Deprivation	**-2.300*** **	**-0.836*** **	**-0.320*** **	-0.120
Δ Deprivation	**1.704** **	-1.094	0.320	**-0.884*** **
ln(houseprice/income)	**-4.951***	-1.527	-0.0270	1.113
Δ ln(houseprice/income)	**-12.16** **	-0.428	**-5.377** **	1.447
Constant	**28.69*** **	**13.55*** **	**6.025** **	0.0610
Observations	682	682	682	682
R-squared	0.150	0.028	0.023	0.026
Wald test (1)	0.0000		0.0000	
Wald test (2)	0.0000		0.0000	

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU. 13% of vacant sales of single unit houses occurred during 1991–1996, 82% occurred during 1996–2001 and 5% occurred during 2001–2006. 24% of homebuys of single unit houses occurred during 1991–1996, 76% occurred during 1996–2001 and <1% occurred during 2001–2006. 5% of vacant sales of other property types occurred during 1991–1996, 83% occurred during 1996–2001 and 12% occurred during 2001–2006. 11% of homebuys of other property types occurred during 1991–1996, 87% occurred during 1996–2001 and 2% occurred during 2001–2006. Wald test (1) tests if all coefficients of the explanatory variables are the same across the two sub-categories, but excludes the constant term. Wald test (2) includes the constant term.

Table 13: Cross Sectional Regressions Examining the Relationship between Deprivation and the State Housing Stock

	State Housing Stock			
	1991	**1996**	**2001**	**2006**
Variables				
Deprivation	**1.979*** **	**2.286*** **	**2.089*** **	**1.967*** **
Constant	**7.611*** **	**5.791*** **	**4.416*** **	**4.180*** **
Observations	1130	1133	1134	1133
R-squared	0.305	0.410	0.470	0.474

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 14: Cross Sectional Regressions Examining the Relationship between House Prices and the State Housing Stock

	State Housing Stock			
	1991	**1996**	**2001**	**2006**
Variables				
Deprivation	**2.018*** **	**2.266*** **	**2.094*** **	**1.994*** **
ln(houseprice)	0.645	**-1.087** **	-0.0381	-0.319
Constant	0.00862	**18.92*** **	4.888	8.264
Observations	1108	1115	1116	1109
R-squared	0.310	0.417	0.472	0.487

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 15: Cross Sectional Regressions Examining the Relationship between Housing Affordability and the State Housing Stock

	State Housing Stock			
	1991	**1996**	**2001**	**2006**
Variables				
Deprivation	**2.045*** **	**2.309*** **	**2.084*** **	**1.999*** **
ln(houseprice/income)	**5.313*** **	-0.649	0.613	0.208
Constant	-2.321	**7.063*** **	**3.244*** **	**3.749*** **
Observations	1108	1115	1116	1109
R-squared	0.334	0.415	0.472	0.487

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the total number of private dwellings in each CAU.

Table 16: Relationship between the Change in Deprivation over 2006–2001 and the Percentage of Acquisitions, Homebuys and Vacant Sales over 1996–2001.

Δ Deprivation$_{06-01}$		
	NZ	**Auckland**
Vacant Sales$_{96-01}$/TPD$_{96}$	-0.0185	-0.0301
Homebuys$_{96-01}$/TPD$_{96}$	**0.125****	0.0228
Acquisitions$_{96-01}$/TPD$_{96}$	**0.0398****	**0.0374***
Deprivation$_{01}$	**0.0227*****	0.00974
ΔDeprivation$_{01-96}$	**0.0885*****	**0.247*****
ΔDeprivation$_{96-91}$	**0.0585*****	0.0155
ln(houseprice) 2001	**0.461*****	**0.307***
Δ ln(houseprice)$_{01-96}$	**-0.633*****	-0.505
Δ ln(houseprice)$_{01-96}$	**-0.426*****	**-0.521***
Constant	**-5.402*****	**-3.383***
Observations	1094	262
R-squared	0.165	0.152

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the average population over 1986–2006 in each CAU.

Table 17: Relationship between the Change in Deprivation over 2006–2001 and the Percentage of Acquisitions, Homebuys and Vacant Sales over 1996–2001.

Δ Deprivation$_{06-01}$		
	NZ	**Auckland**
Vacant Sales$_{96-01}$/TPD$_{96}$	-0.0135	-0.0268
Homebuys$_{96-01}$/TPD$_{96}$	**0.133*****	0.0714
Acquisitions$_{96-01}$/TPD$_{96}$	**0.0386****	0.0320
Deprivation$_{01}$	0.000212	-0.0142
Δ Deprivation$_{01-96}$	**0.103*****	**0.268*****
ΔDeprivation$_{96-91}$	**0.0378****	0.000426
ln(houseprice/income)$_{01}$	**0.447*****	0.312
Δ ln(houseprice/income)$_{01-96}$	**-0.401*****	0.00238
Δ ln(houseprice/income)$_{96-91}$	-0.0888	0.0967
Constant	**-0.779*****	-0.413
Observations	1094	262
R-squared	0.129	0.133

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the average population over 1986–2006 in each CAU.

Table 18: Relationship between the Change in House Price over 2006–2001 and the Percentage of Acquisitions, Homebuys and Vacant Sales over 1996–2001.

Δ ln(houseprice)$_{06-01}$		
	NZ	**Auckland**
Vacant Sales$_{96-01}$/TPD$_{96}$	-0.00130	0.000616
Homebuys$_{96-01}$/TPD$_{96}$	**0.0271****	**0.0590****
Acquisitions$_{96-01}$/TPD$_{96}$	0.00146	0.000423
Deprivation$_{01}$	**-0.00984*****	**-0.00877*****
Δ Deprivation$_{01-96}$	**-0.0208*****	**-0.0258*****
Δ Deprivation$_{96-91}$	**0.00637***	0.00180
ln(houseprice)$_{01}$	**-0.127*****	**-0.122*****
Δ ln(houseprice)$_{01-96}$	**-0.277*****	**-0.178*****
Δ ln(houseprice)$_{96-91}$	**0.0809*****	**0.135*****
Constant	**2.029*****	**1.942*****
Observations	1078	262
R-squared	0.363	0.268

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the average population over 1986–2006 in each CAU.

Table 19: Relationship between the Change in House Price Relative to Income over 2006–2001 and the Percentage of Acquisitions, Homebuys and Vacant Sales over 1996–2001.

Δ ln(houseprice/income)$_{06-01}$		
	NZ	**Auckland**
Vacant Sales$_{96-01}$/TPD$_{96}$	**-0.00467***	-0.00514
Homebuys$_{96-01}$/TPD$_{96}$	**0.0228****	**0.0455****
Acquisitions$_{96-01}$/TPD$_{96}$	0.00219	0.00307
Deprivation$_{01}$	-0.00115	-0.000572
Δ Deprivation$_{01-96}$	0.00759	0.0124
Δ Deprivation$_{96-91}$	**0.0115*****	0.00106
ln(houseprice/income)$_{01}$	**-0.143*****	**-0.134*****
Δ ln(houseprice/income)$_{01-96}$	**-0.345*****	**-0.294*****
Δ ln(houseprice/income)$_{96-91}$	-0.0119	-0.000562
Constant	**0.671*****	**0.635*****
Observations	1078	262
R-squared	0.368	0.255

Notes: *p<0.10, **p<0.05, ***p<0.01. All estimates are variance weighted by the average population over 1986–2006 in each CAU.

Recent Motu Working Papers

All papers in the Motu Working Paper Series are available on our website www.motu.org.nz, or by contacting us on info@motu.org.nz or +64 4 939 4250.

11-02 Roskruge, Matthew, Arthur Grimes, Philip McCann and Jacques Poot. “Homeownership and Social Capital in New Zealand”.

11-01 Fabling, Richard. 2011. “Keeping It Together: Tracking Firms on New Zealand’s Longitudinal Business Database”.

10-14 Stroombergen, Adolf. 2010 “The International Effects of Climate Change on Agricultural Commodity Prices, and the Wider Effects on New Zealand”.

10-13 Olssen, Alex; Hugh McDonald, Arthur Grimes, and Steven Stillman. 2010. “A State Housing Database: 1993–2009”.

10-12 Cochrane, William; Arthur Grimes; Phillip McCann and Jacques Poot. 2010. “The Spatial Impact of Local Infrastructural Investment in New Zealand”.

10-11 Grimes, Arthur and Chris Young. 2010. “Anticipatory Effects of Rail Upgrades: Auckland’s Western Line”.

10-10 Grimes, Arthur and Chris Young. 2010. “A Simple Repeat Sales House Price Index: Comparative Properties Under Alternative Data Generation Processes”.

10-09 Evans, Lewis; Greame Guthrie and Andrea Lu. 2010. "A New Zealand Electricity Market Model: Assessment of the Effect of Climate Change on Electricity Production and Consumption".

10-08 Coleman, Andrew and Hugh McDonald. 2010. "“No country for old men”: a note on the trans-Tasman income divide".

10-07 Grimes, Arthur; Mark Holmes and Nicholas Tarrant. 2010. "New Zealand Housing Markets: Just a Bit-Player in the A-League?"

10-06 Le, Trinh; John Gibson and Steven Stillman. 2010. "Household Wealth and Saving in New Zealand: Evidence from the Longitudinal Survey of Family, Income and Employment".

10-05 Grimes, Arthur. 2010. "The Economics of Infrastructure Investment: Beyond Simple Cost Benefit Analysis".

10-04 van Benthem, Arthur and Suzi Kerr. 2010. “Optimizing Voluntary Deforestation Policy in the Face of Adverse Selection and Costly Transfers”.

10-03 Roskruge, Matthew; Arthur Grimes; Philip McCann and Jacques Poot. 2010. "Social Capital and Regional Social Infrastructure Investment: Evidence from New Zealand”.

10-02 Coleman, Andrew. 2010. "Uncovering uncovered interest parity during the classical gold standard era, 1888-1905".

10-01 Coleman, Andrew. 2010. "Squeezed in and squeezed out: the effects of population ageing on the demand for housing".

09-17 Todd, Maribeth and Suzi Kerr. 2009. "How Does Changing Land Cover and Land Use in New Zealand relate to Land Use Capability and Slope?"

09-16 Kerr, Suzi and Wei Zhang. 2009. "Allocation of New Zealand Units within Agriculture in the New Zealand Emissions Trading System”.

09-15 Grimes, Arthur; Cleo Ren and Philip Stevens. 2009. "The Need for Speed: Impacts of Internet Connectivity on Firm Productivity”.

09-14 Coleman, Andrew and Arthur Grimes. 2009. "Fiscal, Distributional and Efficiency Impacts of Land and Property Taxes”.

09-13 Coleman, Andrew. 2009. "The Long Term Effects of Capital Gains Taxes in New Zealand”.