House Prices and Rents: Socio-Economic Impacts and Prospects

Arthur Grimes and Andrew Aitken

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Author contact details

Arthur Grimes
Motu Economic and Public Policy Research
arthur.grimes@motu.org.nz

Andrew Aitken
Motu Economic and Public Policy Research
andrew.aitken@motu.org.nz

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Motu Economic and Public Policy Research

PO Box 24390
Wellington
New Zealand

Email	info@motu.org.nz
Telephone	+64-4-939-4250
Website	www.motu.org.nz

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Abstract

We use New Zealand property data at the area unit (suburb) level to examine implied prospects for communities over time, and test whether these derived prospects have explanatory power relating to actual future outcomes. We also use the data to analyse whether disadvantaged communities face particular problems in relation to rental markets. Our results indicate that: capital gains and rental growth expectations historically have appeared reasonable in that they have not been suggestive of asset bubbles or other fad behaviour; derived capital gains and rental growth expectations have explanatory power both over actual future capital gains and actual future rental growth; and lower socio-economic areas face higher rental yields even after controlling for non-socio-economic factors than do high socio-economic areas.

JEL classification
R11; R21

Keywords
House prices; house rents; rental yields; capital gains; community prospects

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1 Introduction

Our purposes in this study are threefold. First, we use property data to examine implied forward-looking prospects for communities over time. Second, we examine whether these derived prospects have explanatory power relating to actual future outcomes. Third, we analyse whether disadvantaged communities face particular problems in relation to rental markets.

To undertake this analysis, we use house rental and house price data. House rents indicate the value of living in a certain area at the *current* time. House prices incorporate a strong forward-looking element reflecting, *inter alia*, the expected *future* value of living in the area. We combine these two sources of data to derive measures of forward-looking community prospects relative to the present.

We analyse whether certain types of community face higher or lower rental yields (i.e. higher or lower rent/price ratios) than average. Lower income households are more likely to rent than are high income households, so rental market outcomes are especially relevant to more disadvantaged groups. Particular social concern might arise if there were factors that make rents higher relative to local house prices in low income areas than in high income areas after adjusting for other factors.

We use asset pricing and arbitrage conditions to extract expectations of capital gains and rental price growth from observed rent and house price data. We apply these techniques to 645 area units ("suburbs") of New Zealand using annual data covering 1992 to 2004. Because we have longitudinal data we can control for specific, unchanging characteristics of communities and housing markets within those communities (using area fixed effects). We can also control for national factors affecting all areas in each year (using time fixed effects).

Our analysis builds on those of Clark (1995), Capozza and Seguin (1996), Ayuso and Restoy (2003) and Gallin (2004). Many studies of housing as an asset market reject the implications of the present value model; see, for instance, Case and Shiller (1989, 1990, 2003) and Meese and Wallace (1994). Ayuso and Restoy (2003), however, note that a problem in many present value studies is noisy rent data, the presence of which biases results against finding market efficiency.[1] Capozza & Seguin (1996) highlighted this issue by examining whether cross-sectional differences in the rent-price ratio within the US predict subsequent regional decadal house price growth. Their simple OLS regression finds no effect of the rental yield on price changes; they discuss how this result could be caused by errors in variables bias. Once they instrument the rental yield they find a significant negative relationship between the rental yield and subsequent capital gains with a coefficient close to the expected theoretical value. Similarly, Clark (1995) finds a significant negative relationship between the rental yield and subsequent rent growth. More recently, Gallin (2004) uses error correction models to show that when the rent-price ratio is low, subsequent changes in real rents tend to be larger than normal and subsequent changes in real prices tend to be smaller than normal. These effects are both as expected if rents and house prices each adjust towards equilibrium. Gallin uses long run regressions to show that the rent-price ratio helps predict changes in real rents and real prices over three years.

We add the influence of socio-economic characteristics to this body of work. Their inclusion is required if socio-economic factors affect depreciation and maintenance costs associated with rental housing. Omission of these factors, especially if they vary within areas over time (and so cannot be controlled for using fixed effects), may be another reason why some studies reject market efficiency. Our study further adds to knowledge of rental markets through the use of an entirely new panel dataset applied to a country for which no similar studies have previously been conducted.

As a precursor to the current study, Grimes et al (2005) estimated a cross-sectional relationship for New Zealand rental yields for a single year, 2001. That work indicated that low socio-economic areas tended to face higher rental yields than higher socio-economic areas. Because it used cross-sectional data, the

[1] They show that the estimated present value relationship can also be affected by supply restrictions, regulations and contractual practices in the rental market, and by restrictive

study could not control for fixed area characteristics (such as location, climate, housing composition and quality, etc). It was also impossible to ascertain whether this relationship was peculiar to a single year. By extending the analysis to a twelve year longitudinal study we are able to address these issues and come to stronger conclusions concerning the relationship between rental yields and socio-economic factors.

Section 2 of the paper outlines our theoretical approach, while section 3 describes our data. Empirical work is reported in section 4 and further interpretation is provided in the concluding section. Briefly, our results indicate that:

(a) capital gains and rental growth expectations appear reasonable over the entire sample, in that they are not suggestive of asset bubbles or other fad behaviour;

(b) derived capital gains and rental growth expectations have explanatory power both over actual future capital gains and actual future rental growth; and

(c) lower socio-economic areas face higher rental yields, even after controlling for non-socio-economic factors, than do high socio-economic areas. We maintain that this is due to a relationship between socio-economic status and ownership costs (including tenant turnover costs, depreciation and maintenance). However, other explanations are theoretically possible and disentangling these explanations could be the subject of further research.

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specification of the discount factor for future asset payoffs.

2 Theory

We start our analysis with the forward-looking equation setting current house prices as the present discounted value of net rents:

$$P_{zt} = E_t \left\{ \Sigma_{q=0}^{\infty} (R_{zt+q} - D_{zt+q})/(1+i_{t+q}+r_{t+q})^q \right\} \quad (1)$$

where: the expectation is formed at t, based on Ω_{t-1}, the information set available at end of period t-1;

P_{zt} = house price in area z at time t;

R_{zt} = annual rent in area z at time t;

D_{zt} = annual depreciation and other ownership costs in area z at time t;

i_t = nominal risk free interest rate nationally at time t;

r_t = time-varying risk premium nationally at time t.

For future reference we also define the following variables:

G_{zt} = expected rate of capital gain from t to t+1 on houses in area z given the information set Ω_{t-1}, $(\equiv {}_tP^e_{zt+1}/P_{zt} - 1 | \Omega_{t-1})$;

δ_{zt} = expected rate of rental growth from t to t+1 on houses in area z;

$\mu_t = i_t + r_t$ is the cost of capital (excluding depreciation/maintenance).

We use (1) to derive two separate forward-looking variables that we hypothesise should help explain future price growth. The first variable is derived analytically, based on certain assumptions. The second incorporates fewer explicit assumptions; it is based on auxiliary hypotheses (and associated estimation) concerning expectations formation.

First, assume that (R_{zt+q} - D_{zt+q}) and μ_{t+q} are independent $\forall$q and the expected evolution of net rents and discount rates are given respectively by:

$$E_t (R_{zt+q} - D_{zt+q}) = (1+\delta_{zt})^q (R_{zt} - D_{zt}) \quad \forall q \tag{2a}$$

$$E_t \mu_{t+q} = \mu_t \quad \forall q \tag{2b}$$

Substituting (2a) and (2b) into (1) yields:

$$P_{zt} = (R_{zt}-D_{zt})(1 + \mu_t)/(\mu_t - \delta_{zt}) \tag{3}$$

Solving (3) for the expected rental growth rate, δ_{zt}, gives:

$$\delta_{zt} = \mu_t - R_{zt}/P_{zt} + D_{zt}/P_{zt} - (1 + \mu_t)(R_{zt} -D_{zt})/P_{zt} \tag{4a}$$

If we expand μ_t and drop the (final) second order term we obtain:

$$\delta_{zt} = i_t + r_t - R_{zt}/P_{zt} + D_{zt}/P_{zt} \tag{4b}$$

We cannot observe δ_{zt} directly since we do not observe either r_t or D_{zt}/P_{zt}. We assume that the main variation in δ_{zt} comes from changes in i_t and R_{zt}/P_{zt}, with both the risk premium (r_t) and ownership costs (D_{zt}/P_{zt}) remaining approximately constant, summing to θ.[2] Accordingly, we derive an estimate of rental growth expectations as:

[2] For estimation, we set θ=0.03 (3% p.a.), although its size is immaterial provided a constant is included in the equation. (The variable mortgage rate in New Zealand is set approximately 1.5 percentage points above the 90 day risk-free rate (Grimes, 1994); thus θ=3% implies that ownership costs also equal 1.5% p.a.) In estimating the predictive power of δ_{zt}, we include a constant and time fixed effects as explanatory variables in the relevant equations so dealing with any omissions in the calculation of δ_{zt} due to time-varying (but nationally invariant) risk premia or ownership costs.

$$\delta_{zt} = i_t - R_{zt}/P_{zt} + \theta \tag{5}$$

An alternative approach focuses on estimating implicit capital gains expectations, G_{zt}. Using (1), the expectation at time t of house prices in t+1 is given by:

$$_tP^e_{zt+1} = E_t\{\Sigma_{q=0}^{\infty} (R_{zt+1+q} - D_{zt+1+q})/(1+i_{t+1+q} + r_{t+1+q})^q\} \tag{6}$$

Together, (1) and (6) imply:

$$P_{zt} = R_{zt} - D_{zt} + {}_tP^e_{zt+1}/(1+i_t+r_t) \tag{7}$$

which in turn gives the capital market equilibrium relationship:

$$R_{zt}/P_{zt} - D_{zt}/P_{zt} + G_{zt} = i_t + r_t \tag{8}$$

The implicit definition of G_{zt} in (8) is identical to the definition of δ_{zt} in (4b), demonstrating the theoretical equivalence of the two concepts (δ_{zt} and G_{zt}) under the explicit assumptions adopted for their respective derivations. Both R_{zt}/P_{zt} and i_t are observed, so we can express the difference between the risk-free interest yield and the rental yield as:

$$i_t - R_{zt}/P_{zt} = G_{zt} - r_t - D_{zt}/P_{zt} \tag{9}$$

The right-hand-side elements of this relationship are not observed. In order to derive G_{zt}, we assume the following: r_t is a linear function of a constant plus specific annual risk components that are common across the entire country (time fixed effects); D_{zt}/P_{zt} is a linear function of a constant plus socio-economic factors plus area-specific components that are stable across time (area fixed effects); G_{zt} is formed rationally conditional on publicly observable information available at end of t-1; the relevant public information set comprises lagged rates of change of rents and house prices in the area, which in turn embody information about future community prospects.[3] Imposing the restriction that capital gains expectations are zero in cases where all lagged changes in rents and in prices are each zero, we model capital gains expectations as:

$$G_{zt} = \Sigma_{j=1}{}^{m} \beta_j \Delta \ln P_{zt-j} + \Sigma_{k=1}{}^{n} \beta_{m+k} \Delta \ln R_{zt-k} \qquad (10)$$

From these assumptions, we can estimate an equation for the yield differential as:

$$i_t - R_{zt}/P_{zt} = \Sigma_{j=1}{}^{m} \beta_j \Delta \ln P_{zt-j} + \Sigma_{k=1}{}^{n} \beta_{m+k} \Delta \ln R_{zt-k} + \gamma_0 + \gamma_1 DEG_{zt} + AFEs + TFEs + \varepsilon_{zt} \qquad (11)$$

where: DEG_{zt} is the proportion of the population with a university qualification (proxying socio-economic characteristics of the area over time);[4]

AFEs are area fixed effects;

TFEs are time fixed effects;

ε_{zt} is a residual that is orthogonal to all other variables in (11).

The area fixed effects control for any area-specific ownership costs plus composition effects of the rental versus total housing stock that are stable across time in each area. The time fixed effects control for time-varying risk premia plus

[3] Prospects include, *inter alia*, the value of future amenities, infrastructure provision, transport costs and new housing supply.

[4] Grimes et al (2005) found that this proxy for socio-economic factors performed similarly to a number of other proxies, including a broad deprivation index, so just a single proxy is used in this study.

any composition effects that vary over time on a national basis. Having estimated (11) we extract the implied capital gains expectations, G_{zt}, using (10).[5]

Differences in rental yields and capital gains expectations across areas indicate differing expected rental paths for those areas. An area with high expected rental growth will have a high P_{zt} relative to (current) R_{zt} and hence a low rental yield relative to an area with low expected rental growth. Inter-area comparisons can therefore be used to determine market-based expectations of comparative future rental performance, and hence expectations of relative future community desirability, across areas.

Having derived series for δ_{zt} and G_{zt} we test whether each series has predictive power for actual (future) capital gains and rental growth. If so, this information may be useful for policy/planning agencies. For instance, a currently disadvantaged community that exhibits expected future rental decline might be in greater need of attention than a similarly disadvantaged community that exhibits expected strong positive rental trends.

To assess predictive power, we estimate "accelerationist" regressions that test whether the growth rate (of prices and rents) increases where the expected growth rate exceeds the actual growth rate in the previous period. Since, under certain assumptions, $\delta_{zt} = G_{zt}$, we can use either variable to predict growth rates in both rents and prices. The derived variables (δ_{zt} and G_{zt}) have predictive power if a_1 is positive and significant in (12) and (13) (in which ς^1_{zt}, ς^2_{zt}, ς^3_{zt} and ς^4_{zt} are error terms with standard properties).[6] In a fully efficient market and with fully rational expectations, a_1 should equal unity.

$$\Delta \ln P_{zt} = a_0 + a_1\delta_{zt-1} + (1-a_1)\Delta \ln P_{zt-1} + TFEs + \zeta^1_{zt} \quad (12a)$$

$$\Delta \ln P_{zt} = a_0 + a_1 G_{zt-1} + (1-a_1)\Delta \ln P_{zt-1} + TFEs + \zeta^2_{zt} \quad (12b)$$

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[5] The inclusion of time fixed effects in (11) means that any national expected "excess returns" (positive or negative) to rental housing will not be incorporated into our estimates of G_{zt}. This is justified theoretically by our maintained hypothesis that the housing asset market is efficient. Nevertheless, we inspect the pattern of estimated time fixed effects to check whether they may also be proxying for any material excess returns (bubble or fad behaviour) in the housing market.

[6] An equivalent way of expressing (12a), and *mutatis mutandis* for the other three equations, is: $(\Delta \ln P_{zt} - \Delta \ln P_{zt-1}) = a_0 + a_1(\delta_{zt-1} - \Delta \ln P_{zt-1}) + TFEs + \zeta^1_{zt}$.

$$\Delta \ln R_{zt} = a_0 + a_1\delta_{zt-1} + (1-a_1)\Delta \ln R_{zt-1} + TFEs + \zeta^3_{zt} \quad (13a)$$

$$\Delta \ln R_{zt} = a_0 + a_1 G_{zt-1} + (1-a_1)\Delta \ln R_{zt-1} + TFEs + \zeta^4_{zt} \quad (13b)$$

Time fixed effects are included in each equation to cater for the potential presence of time varying risk premia. Area fixed effects do not appear since, in an efficient market, the relationships should hold in the same manner across all areas (recalling that these are accelerationist, rather than levels, specifications). We therefore present results incorporating time fixed effects but not area fixed effects; we discuss the robustness of the results to inclusion and exclusion of each set of effects.

Another aspect of our estimates that informs the questions posed at the outset of the study is the effect of DEG_{zt} on rental yields in (11). If $\gamma_1>0$, the implication is that higher socio-economic areas face lower rental yields than do lower socio-economic areas, even after controlling for area fixed effects (such as locational desirability, housing condition and composition effects). Our theoretical specification interprets such a result as indicating that lower socio-economic areas have higher ownership costs than do higher socio-economic areas. This could be due to tenants having shorter tenancy periods in lower socio-economic areas, so increasing turnover costs. It is also possible that rents are less likely to be paid in lower socio-economic areas or that house damage is more prevalent in such areas. Both of these factors would increase ownership costs.

An alternative explanation could be that high socio-economic areas have higher expected rental growth rates than do lower socio-economic areas. While one could hypothesise that this may be the case at certain times, this explanation becomes more difficult to maintain over a period of nine years (our sample period). We therefore prefer to maintain the hypothesis that this variable is proxying for the relationship between socio-economic status and ownership costs.

3 Data and Sample Selection

We have formed an annual house price and rent dataset for New Zealand for the period 1992-2004 covering 645 area units (AUs). Statistics New Zealand divides New Zealand into 1,860 AUs. Area units correspond approximately to suburbs in major cities and to comparable population groupings in rural areas. We utilise two main sources of data in our analysis. House price data are sourced from Quotable Value New Zealand (QVNZ), a state-owned organisation. The data include median sales prices, median capital values (i.e. official valuations used for property tax purposes) and the number of sales of residential property at AU level. We use annual data from 1992 to 2004.

QVNZ provides data for residential dwellings covering several categories. In this analysis we use residential dwellings defined as those dwellings of a fully detached or semi-detached style on their own clearly defined piece of land. We use median rather than mean data, as this is less susceptible to being distorted by extremely low or high observations. We mix-adjust the median data for each AU, recognising that the types of property sold vary from year to year within an AU. Our mix-adjustment procedure is influenced by the valuation-based adjustment approach suggested by Bourassa et al (2004). We hypothesise that the observed house sales price, SP_{zt}, comprises three components: a (flexible) trend component (SPF_{zt}), a component due to the mix of houses sold in each year MIX_{zt}, and a random element, χ_{zt} that is orthogonal to MIX_{zt}. We assume that SP_{zt} is proportional to SPF_{zt}; thus we maintain that the following relationship exists explaining the observed SP_{zt} data:

$$\ln(SP_{zt}) = \ln(SPF_{zt}) + c_{0z} + c_{1z}\ln(MIX_{zt}) + \chi_{zt} \qquad (14)$$

SPF_{zt} is formed as the HP filtered median sales price. MIX_{zt} is obtained by calculating the ratio of the median capital value for houses sold each year to the trend (HP filtered) median capital value of houses sold. This ratio is a proxy that relates the valuation of the median house sold in an AU to the valuation of the typical house situated within that AU. The valuation placed on each house in turn accounts for the influence of the types of factors typically included in a hedonic regression.

We estimate (14) for each AU and then derive the mix-adjusted price (P_{zt}) as:

$$P_{zt} = \exp[\ln(SP_{zt}) - c_{1z}\ln(MIX_{zt})] \equiv \exp[\ln(SPF_{zt}) + c_{0z} + \chi_{zt}] \quad (15)$$

The volatility, measured by the standard deviation, is lower for the mix-adjusted sales price than for the raw median sales price for every AU. The smoothing is greater for AUs with more volatile data where volatility is related inversely to the number of sales observed within the AU. This indicates that the adjustment is indeed compensating for mix differences within AUs across years.

We source data on rents from the Department of Building and Housing (DBH). These data are collected from tenants' bonds which landlords are required by law to lodge with the Tenancy Services division of the department at the beginning of a tenancy. While it is not compulsory for a landlord to require a bond from a tenant, any bond that is required from the tenant must legally be lodged by the landlord with Tenancy Services; thus the data cover most arms-length rentals in New Zealand. These data provide us with weekly mean and median rent for each AU by the number of bedrooms and the number of bonds; we use the average weekly rent (received by private landlords) for all house sizes, excluding apartment rents (to be consistent with our house price measure). The data are available quarterly from 1991-2004, although 1991 is dropped due to sparse data.

The data are aggregated to an annual frequency (weighted by the number of bonds). We only use data from AUs for which we have all 13 annual observations. This leaves a panel of 13 years (1992-2004) across 645 area units. In population terms, this covers a 2001 population of 2,179,062 out of a total New

Zealand population of 3,737,187. The fact that our data cover 58% of the population and 35% of area units indicates that our sample is weighted predominantly towards urban areas for which denser rental markets exist.

The volatile year-to-year nature of the rent and price series (even after mix adjustment of the latter) indicates an errors in variables situation, as discussed also by Capozza and Seguin (1996) and Gallin (2004). The volatility is not surprising given the small areas (and hence sparse sales and new rental agreements) with which we are dealing. To deal with this issue, we instrument the price series by regressing the mix-adjusted AU median sales price on the median sales price of the Territorial Local Authority (TLA) in which the AU belongs plus a constant and a quadratic time trend. Similarly, we create an instrumented rent series by regressing the annualised rent on the median rent of the appropriate TLA plus a constant and a quadratic time trend. Use of the TLA price (rent) overcomes the problems of sparse data while still using a price (rent) series that is appropriate for the local region; inclusion of the quadratic time trend allows prices (rents) in individual AUs to evolve uniquely over time relative to other AUs within the same TLA.

In addition to these two datasets we use the 90-day nominal interest rate, sourced from the Reserve Bank of New Zealand (RBNZ), as our measure of the risk-free interest rate. We obtain the proportion of people who have a tertiary qualification from the 1991, 1996 and 2001 censuses (interpolated annually) as an indicator of the socio-economic status of an area unit.[7]

Summary statistics of the main variables used in this analysis are provided in Table 1. A key variable in the analysis is the rental yield (R/P). We illustrate the nature of variation in this variable in Figure 1 for 10 AUs, representing AUs across different types of area (urban and rural; high and low degrees of deprivation).[8] In most AUs, the rental yield has declined over the sample (as has the risk-free interest rate) although this decline is not always

[7] The 2001 proportion is used as a proxy for 2002-2004.

[8] Brooklyn is in Wellington; Gladstone-Avenal is in Invercargill; Kuirau is in Rotorua; Matamata is in the Waikato; McLean Park is in Napier; Riccarton is in Christchurch; Royal Oak is in

monotonic; for example, Westport Urban experienced a rising and then falling rental yield. These illustrative graphs indicate that there is considerable temporal and regional variation in rental yields to explain.

Auckland; Toi Toi is in Nelson; Wanganui Central is in Wanganui; and Westport Urban is in Westport.

4 Results

We begin our empirical analysis with estimation of equation (11) explaining the difference between the risk free interest yield and the rental yield. We use the instrumented data for rents and prices in all empirical work. We include three lags of both past price growth and past rent growth in the equation. This lag length is in keeping with the three year expectations period reported in Grimes, Aitken and Kerr (2004) in calculating the user cost of capital for housing purposes. We report the estimated equation as (16).[9]

$$\underset{}{i_{zt} - R_{zt}/P_{zt}} = \underset{(13.88)^{***}}{0.032\Delta\ln P_{zt-1}} + \underset{(9.46)^{***}}{0.019\Delta\ln P_{zt-2}} + \underset{(10.61)^{***}}{0.022\Delta\ln P_{zt-3}} - \underset{(9.14)^{***}}{0.033\Delta\ln R_{zt-1}}$$

$$- \underset{(5.05)^{***}}{0.019\Delta\ln R_{zt-2}} - \underset{(2.33)^{**}}{0.009\Delta\ln R_{zt-3}} + \underset{(7.30)^{***}}{0.098DEG_{zt}} \qquad (16)$$

$R^2 = 0.967$ RMSE=0.0045 observations=5,805

Area fixed effects, time fixed effects and constant included but not reported; t-statistics calculated using standard errors robust to arbitrary heteroskedasticity (in parentheses); * significant at 10%; ** significant at 5%; *** significant at 1%.

Three key observations arise from (16). The first relates to the affect of socio-economic factors on rental yields. Consistent with our priors, the coefficient on DEG_{zt} is positive implying that rental yields are higher in lower socio-

[9] We estimate (16) using pooled least squares (PLS) since the only current explanatory variable, DEG_{zt}, is slow moving and can be assumed exogenous in the equation. Lagged values of R_{zt} and P_{zt} appear as explanatory variables in differenced form (as opposed to levels as in the dependent variable). Estimates using the Arellano and Bond procedure yield similar results to the PLS estimates with $\Delta\ln P_{zt-1}$, $\Delta\ln P_{zt-2}$, $\Delta\ln P_{zt-3}$ and $\Delta\ln R_{zt-1}$ all significant at the 5% level, the sum of the price and rent coefficients equalling 0.013 (compared with 0.012 in the PLS equation), and with the coefficient on DEG_{zt} estimated at 0.076 (significant at 1%). We have also estimated the equation using the Prais-Winsten method (akin to a Cochrane-Orcutt transformation) to take

economic areas than in more advantaged areas. Thus even after controlling for housing composition mix and for factors such as location and climate (through inclusion of area fixed effects) we find that people living in more deprived areas tend to pay a relatively high level of rent as a ratio of local house prices. We discuss this finding further in the final section.

Second, implied expected capital gains (G_{zt}) are a positive function of the past three years' capital gains in the area. Conversely, expected capital gains are a negative function of prior rental growth, consistent with the mean reversion in rental yields found by Clark (1995), Capozza and Seguin (1996) and Gallin (2004). The overall effect is for relatively little extrapolation of price and rent growth where prices and rents have increased at equal rates. For instance, if both rents and prices had been growing at an annual rate of 10% for the past three years in an area, the implied expected capital gain for that area over the following year is 1.2%.

Third, we examine the pattern of time fixed effects to judge whether the housing market nationally may be prone to bouts of excessive optimism or pessimism. Recall that we interpret the time fixed effects as time-varying risk premia. Intuitively, one would not expect risk premium variations to be "large";[10] if the estimates are large, they may be suggestive of fad or bubble behaviour in the national housing market. Table 2 presents the estimated time fixed effects. For comparison, we present the median rate of house price increase (across area units) in each year. Despite high house price increases at the end of the sample, the time fixed effects show no evidence of "excessive euphoria". All time fixed effects are bounded between -2.4% and 1.6%, and so are small relative to actual house price growth rates. We conclude that the hypothesis that the time fixed effects represent small time variations in risk premia is reasonable.

We derive G_{zt} from (16) and δ_{zt} from (5) as discussed in section 2, and test whether these derived variables have predictive power by estimating

account of any autocorrelation, and the results are very similar to the PLS results. All equations in the paper are estimated using Stata 9.

[10] Though what is "large" will, in part, be in the eye of the beholder.

specifications (12) and (13).[11] Figures 2 and 3 present the derived G_{zt} and δ_{zt} for the same ten area units as depicted in Figure 1. The data show variation both over time and over area units for each variable, while being bounded within plausible ranges. Inspection across other area units indicates similarly reasonable ranges for the two derived variables.

Table 3 reports the results from estimating (12a), (12b), (13a) and (13b) respectively (with time fixed effects included and area fixed effects excluded). The predictive power of both δ_{zt} (derived rental growth expectations) and G_{zt} (derived capital gains expectations) for actual future price and rental growth is apparent. No matter which way we test the relationship, we find that the actual (price and rent) growth rate has a coefficient of between 0.63 and 0.79 on the lagged expected growth rate. In all cases, the estimate is significantly different from zero at the 1% level. However it is also the case that all estimates are significantly different from unity, so full weight is not given to lagged expectations; the lagged actual rate of growth also helps determine the current rate of growth of prices and rents. Nevertheless, the expectations variables have strong predictive content over the direction of change of both price and rent growth.

The explanatory power of the equation is virtually unaffected by inclusion or exclusion of area fixed effects, consistent with theory. Time fixed effects have a major bearing on explanatory power, consistent with national variations in risk premia affecting capital gains across the country. The a_1 coefficient remains significant at 1% in all cases whether or not time and/or area fixed effects are included or excluded.

[11] Since G_{zt} is derived from (16), which includes three annual lags, we lose three years worth of observations relative to the set of observations available for δ_{zt}.

5 Interpretation and Conclusions

We have examined whether use of an efficient markets paradigm to model house prices and rents produces reasonable estimates of future price and rent growth. We have then examined whether these estimates have predictive power over future price and rent developments. Finally, we have investigated whether factors other than market yield affect rental yields across areas over time. We use a newly derived panel dataset pertaining to the area units (suburbs) of New Zealand, incorporating both market rents and house prices, for the analysis.

Despite much comment in the press, including magazines such as *The Economist*, that the housing market is prone to bubbles and fads, we find no evidence in our data of such behaviour. Rent and price behaviour - after adjusting for area characteristics, changes in interest rates, (small) variations in risk premia and socio-economic factors - show no material signs of bubble or fad behaviour.

Based on a maintained hypothesis of efficient markets, the relationship between prices, rents and other variables enables us to derive variables embodying market expectations of future price and rent growth. These derived variables have significant predictive content with regard to future price and rent developments.

From a market perspective, these results are reassuring. From a policy perspective, a key result is the tendency for lower socio-economic areas to pay higher than average rents relative to house prices in the area.[12] This relationship exists even after we control for composition and housing quality effects, location, climate and other (time invariant) area characteristics. A one standard deviation reduction in the proportion of people with university qualifications (relative to the mean) is estimated to increase the rental yield by 0.8% (compared with a sample mean of 6.5%). Using period averages, this implies an annual rent of $12,878 for the AU compared with a rent of $11,474 for an AU with the same house prices but with the mean proportion of university qualified residents.

[12] Of course, to the extent that house prices are lower in lower socio-economic areas, the absolute value of rents will tend to be lower in these areas than in higher socio-economic areas.

We maintain that this result arises from increased ownership costs in lower socio-economic areas. Such areas may have higher than average turnover rates (so increasing turnover costs for the owner), and/or high rates of rental default or arrears, and/or higher than average rates of property damage. This finding may be of concern if "dependable" individuals with certain socio-economic characteristics (e.g. degree status) cannot be differentiated from "less dependable" individuals with the same characteristics. A simple collateral bond designed to protect the landlord against the potential costs of damage, early turnover, or default is evidently not sufficient to overcome this problem since our data relates to rental agreements for which a bond exists.[13] Thus even after posting a bond (within the regulatory limits) tenants living in low socio-economic areas face high rents relative to the price of houses in the area in which they live. An alternative way of viewing this result is that house prices are low for a given rent in low socio-economic areas. Given the maintained hypothesis, this explanation is equivalent to the former explanation: prices are low relative to rents because landlords face high ownership costs.

Two alternative explanations, both based on (1), are nevertheless possible. First, the risk premium applied to lower socio-economic areas may be higher than that applied to higher status areas. While this situation should not occur in an efficiently diversified market, the majority of rental houses in New Zealand are owned by "hobbyist" landlords with only one or two rental properties (Smith and Fraser, 2004). If there were a higher degree of unsystematic risk pertaining to properties in low socio-economic areas (which appears reasonable), a higher risk premium may be applied to rents in such areas. This explanation, if relevant, would supplement our maintained hypothesis since rental yields would then be affected both by higher ownership costs and higher variance of those costs as socio-economic status declines.

A second potential explanation for the socio-economic effect would be a consistent tendency for property market agents to expect higher than average capital gains and rental growth in high relative to low socio-economic areas over

[13] Recall that our rental data is derived from the tenancy bond database of New Zealand's Department of Building and Housing.

the sample period. In this situation, house prices will be high in less deprived areas relative to current rents in those areas; thus rental yields will be lower in high status areas than in more deprived areas. As income differentials for skill vary over time, it is reasonable to postulate that house price differentials relating to people with different skills also vary over time. It is less plausible, however, to postulate that this trend changes consistently over an extended period, so being reflected in forward-looking asset price changes over the full period. Nevertheless, given widespread evidence that returns to higher-skilled occupations (i.e. higher socio-economic groups) have increased over time, we leave this alternative explanation on the agenda for future research.

We conclude by providing an example of the use that policy agencies may make of the forward-looking data that we have derived. Toi Toi and Wanganui Central, both included in Figures 1 to 3, are relatively deprived suburbs within small cities (Nelson and Wanganui respectively); each is within the most deprived quintile of area units in the country (Crampton et al, 2000). The data indicate that their prospects towards the end of the sample are viewed quite differently from one another. Wanganui Central has expectations of zero to slightly negative capital gains and rental growth across the two measures. Toi Toi, in contrast, has an increasingly positive trend according to the two measures. A policy agency may use this information in allocating its resources to the area that is prospectively most in need (in this case, Wanganui Central). Efficient markets theory, coupled with observed pricing data, may therefore usefully be added to the toolbox of social policy and planning agencies, as well as providing direct information on current and future housing market conditions.

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Table 1: Summary Statistics

Variable	Obs.	Mean	Std. Dev.
P (Instrumented house price)	8385	177,138	109,183
R (Instrumented annual rental)	8385	11,474	4,059
Annual house sales	8385	88	48
Average number of rental bonds	8385	20	12
90 day interest rate	8385	0.067	0.013
Proportion of population with a tertiary qualification	8385	0.083	0.069
R/P	8385	0.074	0.020

Table 2: Time Fixed Effects from (16)

Year	Estimated time fixed effect	t-statistic	Median house price growth rate
1996	0.016***	(35.45)	0.071
1997	0.002***	(4.03)	0.055
1998	-0.0002	(0.65)	0.029
1999	-0.024***	(66.45)	0.028
2000	-0.005***	(13.89)	0.054
2001	-0.012***	(36.81)	0.043
2002	-0.012***	(33.00)	0.066
2003	-0.013***	(39.81)	0.048
2004	0.000	na	0.090

Notes: 2004 dropped (=0) from equation owing to inclusion of constant;
t-statistics calculated using robust standard errors;
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Predictive Power of δ_{zt-1} and G_{zt-1} for ΔlnP_{zt} and ΔlnR_{zt}

Dependent Variable: Explanatory Variable:	ΔlnP_{zt} δ_{zt-1}	ΔlnP_{zt} G_{zt-1}	ΔlnR_{zt} δ_{zt-1}	ΔlnR_{zt} G_{zt-1}
a_0	0.0857 (25.69)	0.0402 (15.95)	-0.0148 (8.40)	0.0249 (13.07)
a_1	0.6351 (29.34)	0.6678 (25.07)	0.6962 (37.90)	0.7839 (37.41)
R^2	0.457	0.491	0.507	0.541
RMSE	0.055	0.054	0.034	0.034
Observations	7,095	5,159	7,095	5,159

Estimated equations (TFEs not reported):

$$\Delta lnP_{zt} = a_0 + a_1\delta_{zt-1} + (1-a_1)\Delta lnP_{zt-1} + TFEs$$
$$\Delta lnP_{zt} = a_0 + a_1 G_{zt-1} + (1-a_1)\Delta lnP_{zt-1} + TFEs$$
$$\Delta lnR_{zt} = a_0 + a_1\delta_{zt-1} + (1-a_1)\Delta lnP_{zt-1} + TFEs$$
$$\Delta lnR_{zt} = a_0 + a_1 G_{zt-1} + (1-a_1)\Delta lnP_{zt-1} + TFEs$$

Estimation period: 1994-2004 (δ_{zt-1} equations); 1997-2004 (G_{zt-1} equations)

t-statistics (in parentheses) are calculated using robust standard errors; all variables are significant at 1%.

Figure 1: Rent/Price Ratios (R_{zt}/P_{zt}), 10 Area Units

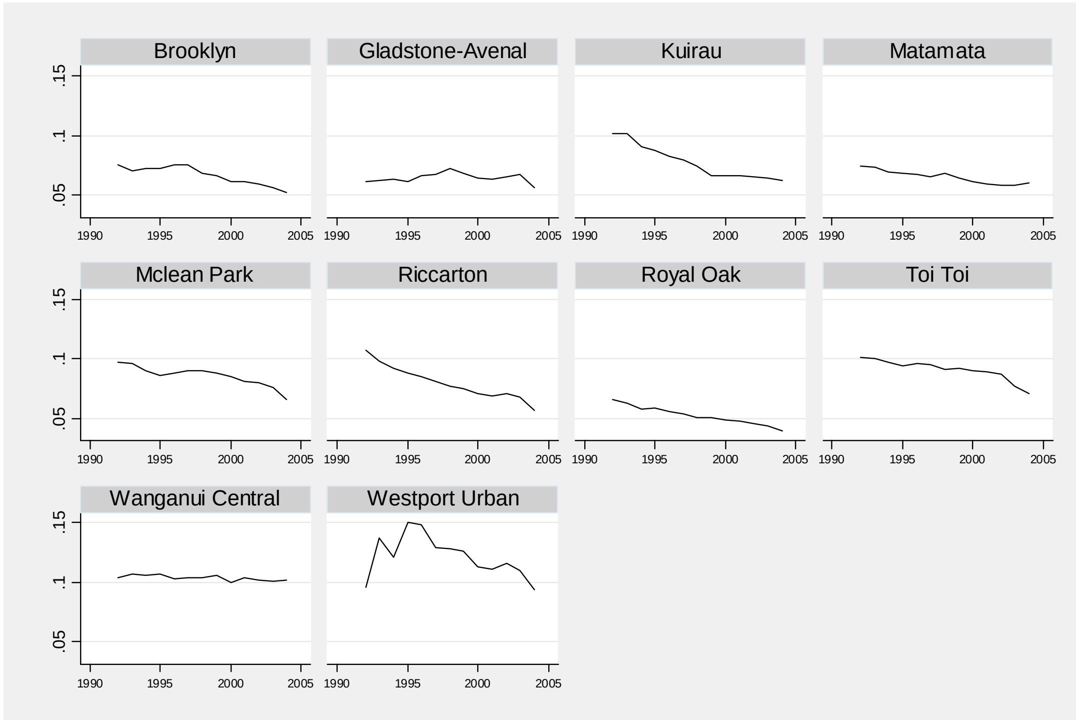


Figure 2: Expected Capital Gains Estimates (G_{zt}), 10 Area Units

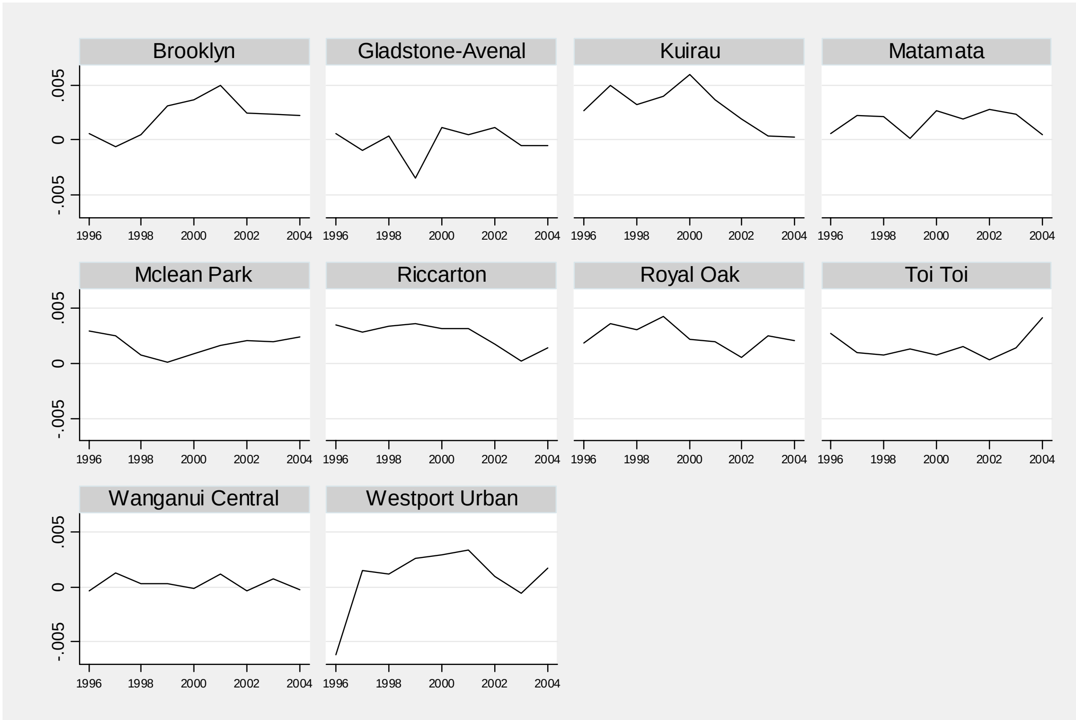
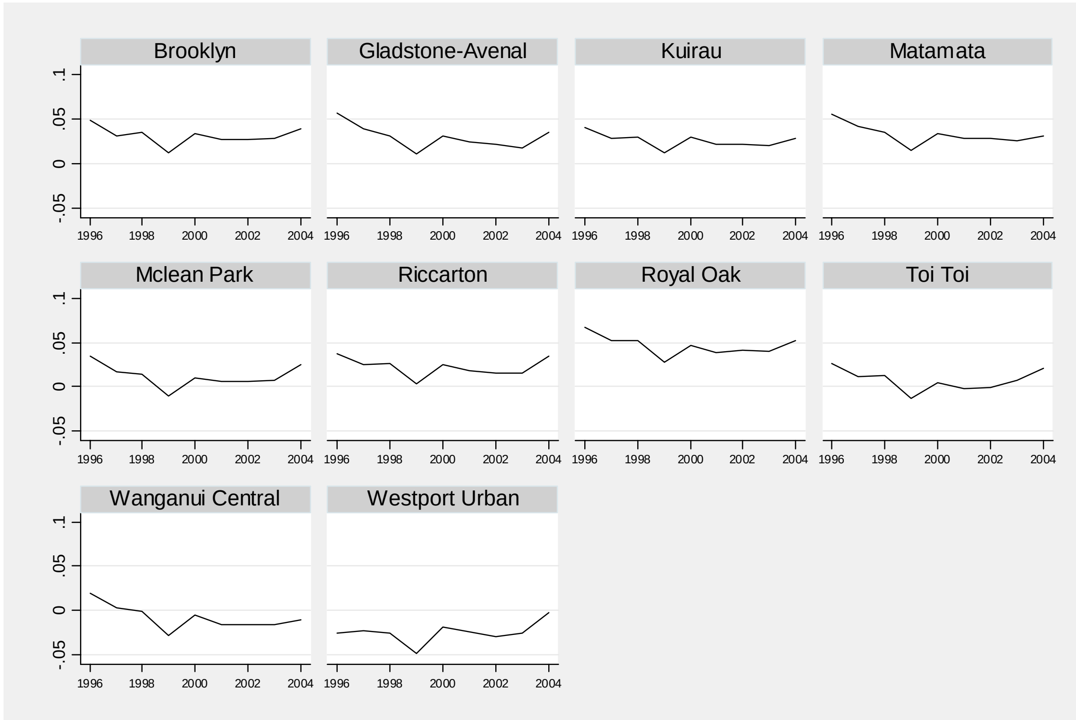


Figure 3: Expected Rental Growth Estimates (δ_{zt}), 10 Area Units



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