House Price Changes and Idiosyncratic Risk: The Impact of Property Characteristics

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Abstract

While the average change in house prices is related to changes in fundamentals or perhaps market-wide bubbles, not all houses in a market appreciate at the same rate. The primary focus of our study is to investigate the reasons for these variations in price changes among houses within a market. We draw on two theories for guidance, one related to the optimal search strategy for sellers of atypical dwellings and the other focusing on the bargaining process between a seller and potential buyers. We hypothesize that houses will appreciate at different rates depending on the characteristics of the property and the change in the strength of the housing market. These hypotheses are supported using data from three New Zealand housing markets.

Introduction

Changes in the price of owner-occupied housing have multiple impacts on homeowners. House price changes affect many households' wealth holdings because home equity comprises a large percentage of household wealth (Aizcorbe, Kennickell, and Moore 2003; Le Blanc and Lagarenne 2004). Variations in residential property prices also affect the risk level of a homeowner's portfolio (Englund, Hwang, and Quigley 2002; Flavin and Yamashita 2002; Sinai and Souleles 2005).

House price appreciation can be tapped through the use of home equity loans and second mortgages. In this way, home equity can be used to pay down other debts or be used to increase current consumption (Case, Quigley and Shiller 2005; Benjamin, Chinloy, and Jud 2004; Haurin and Rosenthal 2005). House price depreciation has been hypothesized to reduce geographic mobility because the loss of wealth by the resident makes it difficult to make a down payment on another home. In contrast, house price appreciation makes trading up in the housing market easier, likely increasing turnover rates in the residential market (Stein 1995, Lamont and Stein 1999, Genesove and Mayer 1997).

While the average change in house prices is related to changes in "fundamentals" such as national and local macroeconomic variables, or perhaps market-wide bubbles (Abraham and Hendershott 1996; Bourassa, Hendershott, and Murphy 2001), not all houses in a market appreciate at the same rate. The primary focus of our study is to investigate the reasons for these variations in price changes among houses within a market. We draw on two theories for guidance, both related to the search process for housing. One theory is related to sellers' optimal search strategy for atypical dwellings. The other theory concerns the bargaining process between a seller and potential buyer. Our major theoretical innovation is to consider the implications of these theories in a multiperiod multi-sale framework. We hypothesize that houses will appreciate at different rates depending on the characteristics of the property and the change in the strength of the housing market.

We use repeat sales data from three New Zealand metropolitan areas to test the model. The standard deviations of the variation of house specific appreciation rates from their local market average are 0.23 (Auckland), 0.17 (Wellington), and 0.15 (Christchurch). For example, the median real house price in our Auckland repeat sales sample changed from $140,000 in 1989 to about $200,000 in 1996. A one standard deviation changes in price from the market-wide increase yield a wide range of real house prices for 1996: $168,000 to $232,000 (the variation is 23 percent of the initial price of $140,000). The empirical tests reveal substantial support for the hypotheses that houses appreciate and depreciate at rates that vary from the market average because of variations in their atypicality and in their attributes that are related to bargaining. This support occurs in three separate markets that had quite different experiences in rates of house price appreciation.

Our review of the literature highlights research that documents differential rates of house price appreciation in the housing market. We also describe prior research on two variants of search models where the focus was on house price determination. Next, we present formal models of these search processes, but emphasize the impact of variation in the strength of the housing market on price outcomes. Descriptions of the data and results follow. We conclude with a discussion of the implications of our findings for urban areas and investments in housing.

Literature

The return and risk characteristics of housing ownership are important for household portfolio decisions. Analyses of these decisions have focused on market-wide measures of returns and risks. However, the risk of investing in housing depends on price movements in individual houses, not the market, and thus investigation of these price movements is needed. Case and Shiller (1989) is one of the few studies that compare individual house price movements to those of a market. They find that market-wide variation explains little of specific houses' price movements and thus housing risk is not well measured by market measures of risk.

The spatial uniformity of house price appreciation has been debated in the literature with some arguing that, while rates of appreciation vary across space, they do not vary systematically across household income levels, race, or housing quality (Pollakowski, Stegman, and Rohe 1991). Others argue that there are significant differences in housing appreciation rates by race and income (Poterba 1991; Kim 2000).[1] Belsky and Duda (2002) find in a sample of four U.S. MSAs that the rate of appreciation of the lowest quality tier of owner-occupied housing is greater than average, but the standard deviation is 2.5 times higher. They also find there are many cases of properties selling for an inflation adjusted loss if transaction costs are accounted for; the range in the cities being from 40 to 56 percent. However, they do not explain why houses vary in their rate of appreciation. Mayer (1993) studies several cities and concludes that high value homes appreciate faster on average, but they also are more volatile. Clapp and Giaccotto (1998) find that the evolution of prices for large and small houses differs. Gill and Haurin (1991) report evidence that variations in house prices within coastal California markets are related to the distance from the sea coast, due to legislation that restricted coastal residential construction. Archer, Gatzlaff, and Ling (1996) find that house price appreciation is weakly related to a property's distance from the central business district. Coulson and Lahr (2005) report that the value of properties in neighborhoods zoned as historical rose by 14 to 23 percent more than that of properties in otherwise similar neighborhoods in Memphis TN.

Multiple studies have found that the relationship between a home's original value and the rate of appreciation varies over time according to the prevailing economic climate (Li and Rosenblatt 1997; Smith and Tesarek 1991; Seward, Delaney, and Smith 1992). Both Smith and Tesarek (1991) and Seward, Delaney, and Smith (1992) study single cities and find that high price homes appreciate faster during boom times. They differ in whether there is a relationship between prices and house quality during recessions. Smith and Ho (1996) find that lower-price houses are more likely to appreciate as interest rates fall and income and employment rise.

In general, the literature is silent about the expected relationship of a house's price appreciation and its characteristics. The one exception is a descriptive study by Jud, Roulac, and Winkler (2005) who use data from Greensboro NC and Houston TX. They regress individual property returns on the national rate of return for housing and a vector of property characteristics. While most of house characteristics have significant coefficients in the regressions, they differ in signs comparing the two areas. In contrast, we develop a theoretical model that generates specific hypotheses about the way in which house characteristics affect house price appreciation.

Two theories about the search process for housing predict a relationship between house price levels and the characteristics of a house. One theory begins with the assumption that atypical residential properties generate a relatively large variance of offer prices from potential buyers compared with standard properties. Search theory predicts that sellers of atypical properties will wait relatively long for a high valued draw from the distribution of potential buyers' offers and thus should, on average, take longer to sell (Haurin 1988). Another prediction of the model is that the ratio of the expected sales price to the mean of the offer distribution will be relatively high for atypical properties. A number of subsequent studies have considered the effect of atypicality on house price or the length of time to sale, but no research has considered the impact of atypicality on the rate of house price appreciation, which is the focus of our study. Capozza, Israelsen, and Thomson (2005) use a sample of manufactured homes to study the factors that explain the difference between the original transaction price of a unit and the post-default recovery price. They find that increased atypicality raises the original price as predicted by search theory, but it reduces the recovery price.

A second aspect of search theory related to house characteristics and the observed transaction price is bargaining theory. Empirical studies consistently find that the negotiation process between buyers and sellers influences the final transaction price. Sellers that are highly motivated to sell, which would occur if for example they have purchased another house, tend to sell for a relatively low price compared to the expected value (Glower, Haurin, and Hendershott 1998). Harding, Rosenthal, and Sirmans (HRS, 2003) argue that differences in bargaining power between seller and buyer affect transaction prices multiplicatively and they find supportive evidence using data from the American Housing Survey.[2] In an extension of the HRS model, Harding, Knight, and Sirmans (2003) argue that the negotiation process also may affect the implicit prices of housing characteristics. They test their model using the hedonic price framework (Rosen 1974) and find support for the hypothesis that bargaining affects both house characteristics' implicit prices and the constant in the hedonic estimation.[3] However, there are no studies that consider the effect of bargaining or atypicality on the prices observed when a house sells repeatedly.

We develop a model of the repeated sale of residential single-family properties and investigate the impact of a house's characteristics on the rate of appreciation. The model allows for price to be affected by both atypicality and bargaining. It suggests that if the economic environment is the same at the time of both sales, then there will be no systematic effects of house characteristics on the rate of appreciation. However, if the economic environment worsens, then the rate of house price appreciation will be relatively lower for atypical properties.[4] Further, a changing economic environment affects the relative bargaining power of sellers and buyers and could interact with particular house characteristics.

Model

The Impact of Bargaining on Repeat Sales

The standard hedonic house price model in linear form relates the i-th house's price (P) at time t to house characteristics (X):

(1) $P_{it} = \alpha_t + X_{it}\beta_t$

where the constant and coefficients of the house's characteristics may vary over time. HRS argue that a particular house's observed price also is a function of the outcome of buyer and seller bargaining. The financial outcome of bargaining depends on buyer and seller characteristics. However, we note that the bargaining outcome also should depend on the overall strength of the housing market at the time of sale. For example, sellers with low motivation to sell should have relatively high bargaining power, but this bargaining power should be larger when the demand for houses is high. In a weak market, these sellers' bargaining power should be attenuated because of the lack of potential buyers.

Inclusion of bargaining in the model results in:

(2) $P_{it} = \alpha_t + X_{it}\beta_t + \theta B_i(M_t)$

where $B_i(M_t)$ represents the effect of bargaining on house price when the strength of the housing market is M_t. Following HKS, we further assume that the impact of bargaining is reflected in both the implicit prices of a house's characteristics and a factor that additively shifts the hedonic price equation (σ):

(3) $B_i(M_t) = \sigma M_t + (X_{it}\delta)M_t$.

In (3), both the bargaining shift factor and the slope factor depend on the strength of the house market at that time. Substituting (3) into (2) yields:

(4) $P_{it} = \alpha_t + X_{it}\beta_t + \theta(\sigma M_t + (X_{it}\delta)M_t)$.

Next, consider multiple sales of a single property. Differences in bargaining outcomes depend on changes in the strength of the housing market. Differencing (3) and comparing sales at time t and T yields:

(5) $\Delta B_i = \sigma\Delta M_{tT} + (X_i\delta)\Delta M_{tT}$.

where we assume that property characteristics are unchanged.[5] The result of comparing sales prices is:

(6) $\Delta P_{itT} = \Delta\alpha_{tT} + X_i\,\Delta\beta_{tT} + \theta(\sigma\Delta M_{tT} + (X_i\delta)\Delta M_{tT})$.

A house's price change depends on changes in the strength of the housing market that affect bargaining outcomes, market-wide changes in the valuation of house characteristics, and the change in the intercept, which likely reflect house price inflation.

To highlight the impact of bargaining, we subtract market-wide changes in price from the idiosyncratic price change for a particular property. Market-wide changes are the result of three components: $\Delta\alpha_{tT}$, $\Delta\beta_{tT}$, and $\sigma\Delta M_{tT}$.[6] The result is ΔP_i^* where:

(7) $\Delta P_i^* = (X_i\delta')\Delta M_{tT}$.

In the empirical work, one of the hypotheses we test is whether price changes that deviate from the market average are related to changes in the interaction of the strength of the housing market and a house's characteristics.

The Impact of Atypicality on Repeat Sales

Optimal stopping theory (DeGroot 1970, McCall 1970) argues that sellers searching for a buyer set a reservation price and accept the first offer that meets or exceeds it. The reservation price depends on the characteristics of the item being sold and the distribution of expected offers. Haurin (1988) applied this theory to housing and argues that the distribution of potential offers for a house differs not only in mean but also in variance. He proved that sellers facing a larger variance of offer prices, holding the mean constant, will set a higher reservation price in the search process. Empirically, a greater variance of offers is likely for properties with unusual characteristics; that is, atypical properties. The expected impact of owning an atypical property is that the waiting time for a successful bid should be longer, and the sales price (relative to the mean of the offer distribution) should be larger.

Intuition suggests that if an atypical property sells twice under identical economic conditions, then its price appreciation will tend to match that of the market. However, similar to the analysis of bargaining, if the economic conditions change over time, then a property's rate of appreciation should be related to its degree of atypicality. In the Appendix we derive the reservation and expected sales prices for a property, the values accounting for the cost of selling and the variance of offers. For the case of a uniform distribution of potential offers, we show that if the local economy booms, causing the cost per search to fall as the arrival rate of offers increases, then the expected selling price of a property rises. Further, it rises by a greater amount the more atypical is the property.

We conclude that atypical properties' price paths should differ from those of the market assuming there are intertemporal variations in market strength. Empirically, an interaction of a measure of changes in the strength of the housing market with the level of atypicality of a property should affect the rate of change in a property's price relative to the market. The modified version of (7) used to test the hypotheses is:

(8) $\Delta P_i^* = (X_i\delta')\Delta M_{tT} + \tau A_i \Delta M_{tT}$.

Data

Our data are drawn from the 1989-1996 period in three metropolitan areas (Auckland, Christchurch, and Wellington) in New Zealand. The date of sale and property characteristics are recorded.[7] Our transaction based data set is limited to include only those houses where repeat sales are observed. The data source is the Real Estate

Research Unit at the University of Auckland, who obtained it from Quotable Value Ltd. Deletions from the data set included properties that were not arm's length transactions, properties with floor sizes less than 30 square meters or greater than 1,000 square meters, those that could be subdivided, properties with more than six parking spaces in the garage, condominiums, and properties with missing or changing characteristic values.[8]

The pattern of semi-annual real house price changes is displayed in Figures 1-3 for the three areas. In Auckland and Wellington, real house prices trended downwards from 1989 to 1992, and then they rose through 1996. In Christchurch, real prices rose between 1989 and the first half of 1991, were stagnant until about the first half of 1993, and then trended upwards through the end of 1996. The range of increase in real prices over the period was from four percent in Wellington to 47 percent in Auckland.

Also displayed in the figures are time series indexes for real wages, total employment, and the number of housing transactions. These time series are used to measure the strength of the housing market, which is needed for the calculation of ΔM_{tT} in (8). The product of real wages and employment is one measure of aggregate demand. The other measure is based on the insight of Berkovec and Goodman (1996), who argue that the turnover rate of existing houses is the best measure of housing market demand. Given that the stock of housing was relatively constant during our sample period, we use the number of sales per semi-annual period as a measure of turnover.

Real wages are relatively flat in each of the three markets, increasing between four and seven percent. Changes in employment appear to be a more important driver of price changes, with increases of between seven and 19 percent. The numbers of transactions appear to anticipate price changes in Auckland and Wellington, but the relationship is less clear in Christchurch.

[INSERT FIGURES 1-3]

The dependent variable in (8) is the difference between the percentage change in a property's real value and the percentage change in the market average. The time period is determined by the sale dates of the property, and the market average is a constant-quality measure of real house price inflation.[9] Thus, we are explaining deviations in a particular house's price change from the market's movement within a metropolitan area. The choice of explanatory variables is guided by our theories, which suggest that house price characteristics, atypicality, and the strength of the housing market determine the price deviations. Variables' means and standard deviations are reported in Table 1.

[INSERT TABLE 1]

We have two measures of a property's atypicality, one is an indicator of whether the property has a view of the ocean and the other is a measure of the aggregate value of deviation of a property's characteristics from the sample mean. Because an ocean view is solely dependent on a property's location and topography, it cannot be modified by the property owner and is thus a permanent measure of atypical properties. Also, it is relatively rare in the three localities being present in from two to 18 percent of observations.[10] Buyer and seller also could bargain over the value of an ocean view, and thus this variable plays two roles in the estimation. The implication is that the independent contributions of bargaining and atypicality cannot be identified for ocean views.

The second atypicality measure is created by first differencing a property's and the market's amount of each house characteristic. Then each difference is valued by the implicit price of that characteristic, derived from a hedonic price estimation. Then we sum the absolute values of the valuation of the differences. Atypical properties are thus characterized by those with unusual features.[11]

The set of property characteristics that we include to test the hypotheses about bargaining includes land area, size of dwelling, age, distance to the central business district, distance to the nearest commercial subcenter (Auckland only), unusually poor or good condition of the exterior wall ("average" is the omitted category), and the number of garage parking spaces. Each of these variables is interacted with one of the measures of the change in market conditions.

Empirical Results

Regressions of the form in (9) are estimated for each of the three localities:[12]

(9) $\Delta P_i^* = a_0 + (X_i\delta')\Delta M_{tT} + \tau A_i \Delta M_{tT} + \varepsilon_i$.

We report results in Table 2 for six variations on equation (9), two for each of the three cities. One set of results for each city interacts the hedonic characteristics and atypicality measures with the first market strength measure, which is the percentage increase in employment multiplied by real wages. The second set of results for each city uses the other market strength measure, which is the change in the number of transactions.

[INSERT TABLE 2]

Age of the structure is consistently positive and significant across the six sets of results. Distance from the central business district and floor area are negative and significant in five of the estimations. The dummy variable indicating poor condition walls is positive and significant in four of the estimations, while that for good condition walls is negative and significant in three estimations. Distance from the nearest commercial subcenter is positive and significant in both of the Auckland equations (it is not relevant in the other cities). A property's lot size is significant in four of the estimations, but has inconsistent signs.

These results suggest that in a strong market there is a premium with respect to the overall market for older, smaller, centrally-located properties that are in relatively poor condition; however, such properties sell at a discount in weak markets. These properties may become more attractive in a rising market in part because renovation becomes economically more feasible. Also, older and centrally-located properties are in relatively fixed supply, giving sellers more bargaining power in a strong market. However, the relative thinness of the markets for these characteristics means that sellers have less bargaining power in a weak market. In contrast, newer and larger suburban properties in better condition tend to move at the market, most likely because they are in direct competition with newly constructed houses.

With respect to our two measures of atypicality, we obtain the same results when they are both included in the estimation as when they are entered separately (the latter results are not reported). The ocean view variable is significant only in Christchurch and only when interacted with the first of the market strength variables. This result could be due in part to the fact that ocean view is more atypical in Christchurch: two percent of properties in Christchurch have ocean views, compared with 11 and 18 percent in Auckland and Wellington, respectively. Figure 3 suggests that the second market strength variable (number of transactions) is not a good measure in Christchurch, which probably explains why the interaction of that variable and ocean view is not significant for that city.

The second atypicality measure is significant in Wellington and Christchurch when interacted with the first market strength measure and in Auckland and Wellington when interacted with the second market strength measure. It is not surprising that the atypicality variable interacted with the number of transactions does not work in Christchurch given our doubts about the accuracy of the second market strength variable for that city. In contrast, we expect that the number of transactions may be a better indicator of market strength than changes in employment and wages in Auckland, given the impact of substantial immigration from Hong Kong and elsewhere in Asia. In some cases, these immigrants entered the housing market but not the labor market. Overall, we find that our two measures of atypicality perform as expected. The exceptions to this can be explained by differences in the degree of atypicality in the case of ocean views and differences across the three cities in the accuracy of the two measures of market strength.

Conclusions

Results from previous research indicate substantial variability in returns to particular properties relative to the market average. For example, the ratio of returns to the standard deviations of returns is 5.7 in Sweden (Englund, Hwang, and Quigley 2002) and is in the range of 1.5 to 3 for four U.S. metropolitan areas (Goetzmann 1993). We also find substantial variation in the ratio in three New Zealand areas, with the ratio ranging from 1.2 to 2.6. The goal of our paper is to explain these variations.

Our theoretical model posits that if market conditions change then the characteristics of properties will affect the price path of a given property relative to the market. The model draws on two theories. First, the bargaining process between buyers and sellers on selected characteristics will change when market conditions are altered. In a strong market, houses with characteristics in limited supply will attract more buyers and hence the bargaining power of sellers will increase, leading prices of properties with these characteristics to rise at a faster rate than the market. On the other hand, such properties will decline more than the market when economic conditions weaken. Second, greater price increases are expected for atypical properties in a strong market because the ratio of the expected sales price to the mean of the offer distribution will be relatively high for such properties.

Our empirical analyses in a repeat-sales framework for three New Zealand cities confirm these hypotheses. In a strong market, smaller, older, centrally-located properties in relatively poor condition are increasingly appealing to investors and exhibit larger price increases than the market. Properties with such characteristics are in relatively limited supply, giving sellers more bargaining power in bullish markets. There also is general support for the atypicality hypothesis. The values of atypical homes rise at higher than average rates in strong markets, while the reverse holds in weak markets.

The impact of property characteristics on returns has important implications for risk management. First, mortgage lenders should take property characteristics into account. For example, the risk that is borne when financing an atypical property is greater than when a standard house is financed. This also has implications for the stability of urban neighborhoods to the extent that houses with relevant characteristics tend to be concentrated in certain areas. Because houses in such neighborhoods experience exaggerated price cycles, relatively conservative underwriting standards may be warranted to avoid excessive concentrations of foreclosures and possible abandonment of houses when the market is weak.

Second, given that housing is a large proportion of household portfolios, property idiosyncrasies can have a substantial impact on household wealth. Many households are probably aware that investing in an atypical or idiosyncratic house is riskier than purchasing a standard house. We provide strong evidence to confirm that conventional wisdom. Some authors have suggested that hedging instruments would be very useful in reducing risk in the housing sector. For example, Englund, Hwang, and Quigley (2002) consider short sales of securitized real estate for hedging housing risk, while Shiller (2003) discusses the usefulness of insurance contracts. Hedges, however, will be effective against market-wide price declines but not against any decline due to the idiosyncratic nature of a property. Any hedging device to cover idiosyncratic risk is likely to be too costly to market to property owners.

Figure 1: Auckland—Real House Price Changes, Real Wages, Employment, and Housing Market Turnover

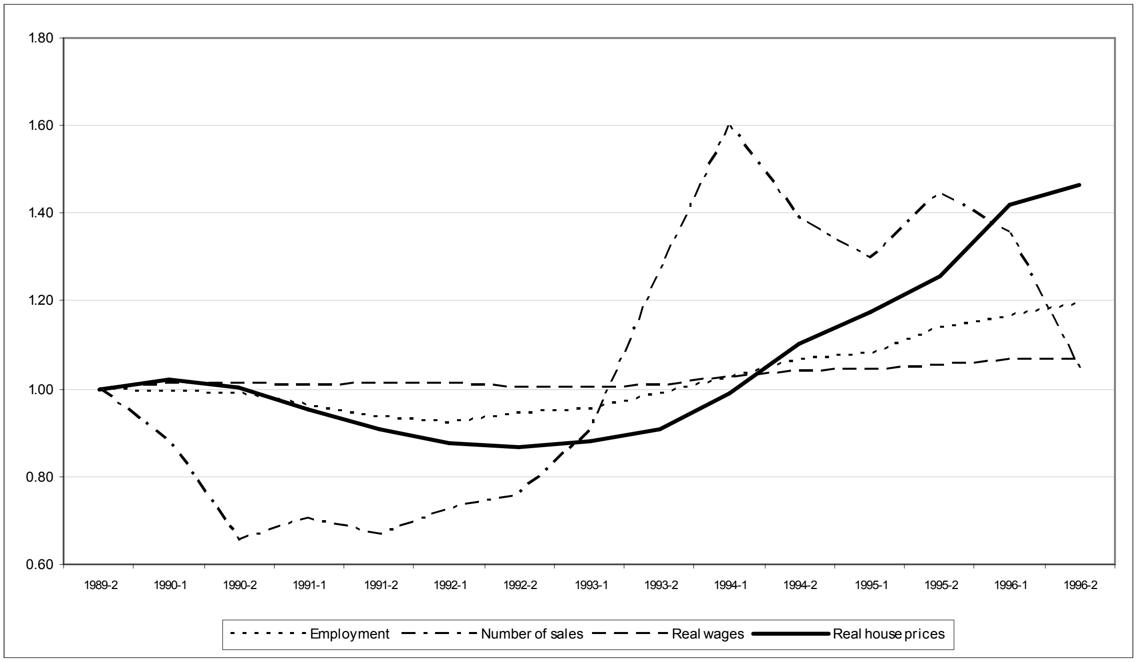

Figure 2: Wellington—Real House Price Changes, Real Wages, Employment, and Housing Market Turnover

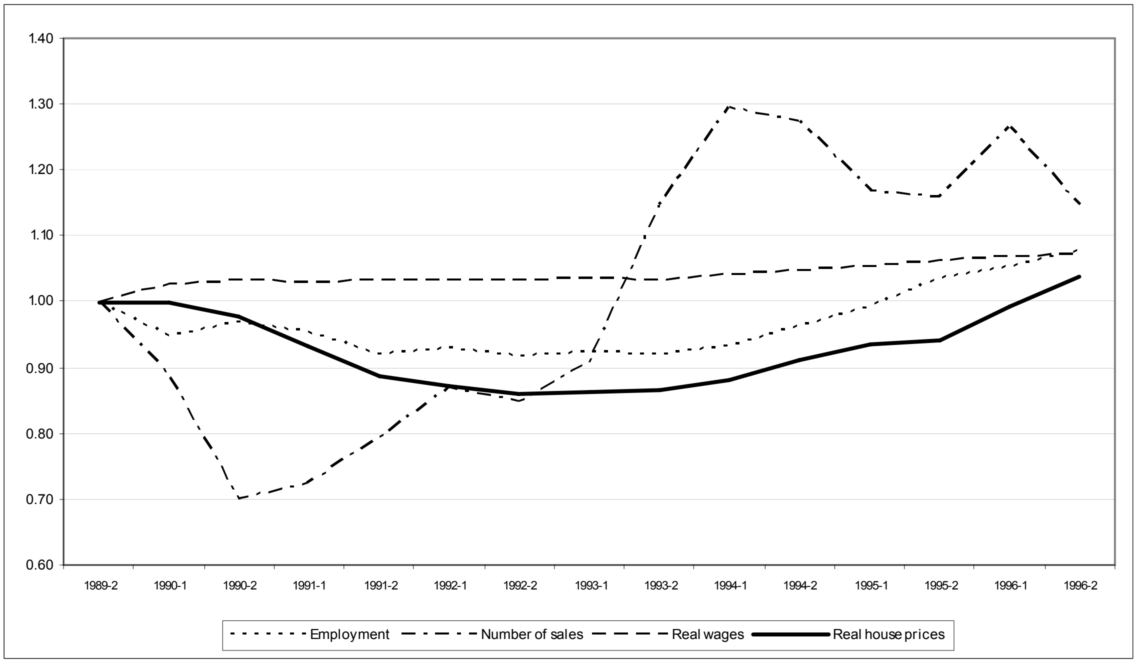

Figure 3: Christchurch—Real House Price Changes, Real Wages, Employment, and Housing Market Turnover

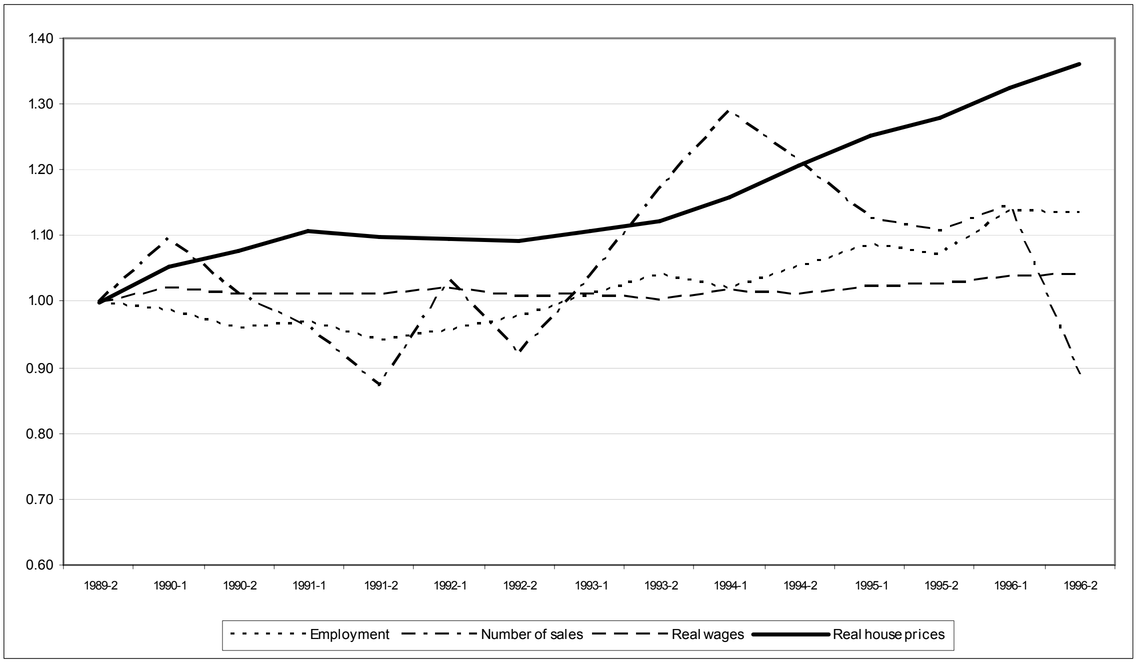

Table 1: Sample Descriptive Statistics

	Auckland		Wellington		Christchurch	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Real % Price Change	0.224	0.303	0.071	0.188	0.129	0.151
Index % Price Change	0.184	0.211	0.026	0.092	0.102	0.104
Lot Size	0.799	0.399	0.602	0.437	0.712	0.230
Dist. CBD	12.068	6.599	5.396	3.587	5.176	2.424
Dist. Subcenter	6.081	3.219	---	---	---	---
Floor Area	0.137	0.054	0.137	0.052	0.127	0.045
Age	34.390	23.432	49.558	27.742	43.301	24.621
Garage Parking	1.420	0.740	1.005	0.792	1.509	0.671
Wall-good	0.475	0.499	0.435	0.496	0.442	0.497
Wall-poor	0.029	0.167	0.036	0.187	0.046	0.209
Ocean View	0.107	0.309	0.180	0.384	0.021	0.144
Atypicality	1.534	0.592	0.795	0.416	0.786	0.334
Growth Change	0.110	0.104	0.068	0.080	0.073	0.068
Transactions Change	0.426	0.773	0.039	0.062	0.064	0.235
Sample size	15,776		2,086		11,086	

Notes: The descriptive statistics are for the underlying variables including the house characteristics and measures of housing market strength. The estimation is based on interactions of these variables. The real price change is property specific and measured between the first and second sales. Index is the real price change of the official house price index for the locality, measured for the same time periods. Distance to the CBD and primary subcenters is measured in thousands of meters. Lot size and house floor area are measured in thousands of square meters. Atypicality is measured in hundreds of thousands of dollars. Growth is the percentage change between sales in the product of the real wage in a locality and the number employed, divided by 100. The transactions variable is the change in the number of sales between sales, measured in thousands.

Table 2 Panel A: Estimation of a House's Price Increase Relative to the Market: The Change in Market Demand is Measured by the Change in the Product of Real Wages and Employment (M1)

	Auckland		Wellington		Christchurch	
	Coefficient	t value	Coefficient	t value	Coefficient	t value
Intercept	0.058	23.64	0.048	10.93	0.038	19.27
M1*Lot Size	0.305	9.22	-0.414	3.93	0.088	1.42
M1*Dist. CBD	-0.033	18.30	-0.060	5.77	-0.050	9.21
M1*Dist. Subcenter	0.013	3.78	---	---	---	---
M1*Floor Area	-3.317	11.70	-2.377	2.84	-1.863	3.84
M1*Age	0.016	26.60	0.013	13.62	0.010	18.75
M1*Garage Parking	-0.113	6.37	-0.040	0.80	-0.157	6.94
M1*Wall-good	-0.049	1.86	-0.154	2.16	-0.131	4.18
M1*Wall-poor	0.574	7.19	0.590	3.26	-0.004	0.05
M1*Ocean View	0.072	1.74	0.008	0.09	0.275	2.71
M1*Atypicality	0.000	0.08	0.384	3.34	0.179	2.57
Adjusted R-squared	0.149		0.147		0.091	
Sample size	15,776		2,086		11,086	

Panel B: Estimation of a House's Price Increase Relative to the Market: The Change in Market Demand is Measured by the Change in the Number of Housing Transactions (M2)

	Auckland		Wellington		Christchurch	
	Coefficient	t value	Coefficient	t value	Coefficient	t value
Intercept	0.033	16.46	0.045	10.99	0.018	12.40
M2*Lot Size	0.017	3.22	-0.133	1.47	0.055	2.26
M2*Dist. CBD	-0.007	23.47	-0.079	5.90	0.003	1.53
M2*Dist. Subcenter	0.002	3.40	---	---	---	---
M2*Floor Area	-0.128	2.68	-2.444	2.09	0.390	1.96
M2*Age	0.002	20.49	0.013	9.68	0.002	9.26
M2*Garage Parking	-0.012	3.99	-0.015	0.20	-0.008	0.85
M2*Wall-good	0.000	0.06	-0.201	1.95	-0.008	0.58
M2*Wall-poor	0.022	1.74	0.826	2.68	0.083	2.77
M2*Ocean View	0.004	0.55	-0.090	0.70	0.037	0.89
M2*Atypicality	0.024	4.79	0.446	2.78	-0.048	1.63
Adjusted R-squared	0.116		0.082		0.058	
Sample size	15,776		2,086		11,086	

Appendix: The Relationship between Expected Selling Price, the Cost of Search, and Atypicality in Repeat Sales Observations

We assume the seller of a property performs a sequential search for offers. The seller sets a reservation price ε equal to the maximum expected return on the sale of a house and considers each offer, P, in turn. If the offer exceeds the reservation price then it is accepted, otherwise it is rejected and the search continues (DeGroot 1970; McCall 1970; and Haurin 1988). There is no recall of offers, the offers are independent, and they have identical distribution functions, $\phi(P)$. Further, the cost per offer c is constant over time. The net return from search for the n^{th} offer is R_n and V_n is the revenue earned from the n^{th} offer, given the value of the n^{th} offer is P_n. Net returns are: $R_n = V_n - cn$. The expected value of net revenues, given n searches is:

(A1) $E\left(R_n \middle| n\right) = E\left(V_n \middle| n\right) - cn$.

Because the offers are independent, the expected net return given n offers is maximized when n equals the expected number of offers received before the arrival of the first acceptable offer, N. Thus N equals the number of offers required for $P_n \geq \varepsilon$. Rewriting (A1) yields:

(A2) $E(R_N \mid N) = E(P_N \mid N) - cN$

The unconditional expectation of R_N is:

$$E[E(R_N \mid N)\} = E[E(P_N \mid N) - cN],$$

which simplifies to:

(A3) $E(R_N) = E(P_N) - cE(N)$

where $E(P_N)$ is the expected value of the accepted offer and $E(N)$ is the expected number of searches. In the general case, the probability density function of the acceptable offer price P_N is $\phi_{P_N} = \frac{\phi(P_N)}{\int_\varepsilon^\infty \phi(t)dt}$. Thus, the expected sales price is:

(A4) $$E(P_N) = \int_\varepsilon^\infty \frac{P_N \phi(P_N)}{\rho} dP_N ,$$

where $\rho = \int_\varepsilon^\infty \phi(t)dt$ = $1/E(N)$. Substituting equations (A4) into (A3) yields the maximum expected return on the sale of the house:

(A5) $$E(R_N) = \int_\varepsilon^\infty \frac{P_N \phi(P_N) dP_N - c}{\rho} .$$

Thus, the reservation price equals $[E(R_N)]_{\max}$:

(A6) $$\varepsilon = \int_\varepsilon^\infty \frac{P_N \phi(P_N) dP_N - c}{\rho} .$$

A key question of this study is how the expected sales price (A4) changes between sales in times when the strength of the housing market changes. Changes in the market can be characterized by changes in the arrival rate per unit time or, equivalently, the cost per search, c. Thus, the derivative of $E(P_N)$ with respect to c reflects the effect of changes in market conditions on the expected sales price. The sensitivity of this effect to the atypicality of a property is found by evaluating $\partial^2 E(P_N)/\partial c \partial \sigma$ where σ^2 is the variance of the offer distribution.

Consider the uniform distribution, $\phi(x) = \frac{1}{b}$ on the range of [0, b]. From (A6) the reservation price is:

(A7) $$\varepsilon = b - \sqrt{2bc} .$$

The expected sales price from (A4) is:

(A8) $$E(P_N) = \frac{b^2 - \varepsilon^2}{2(b-\varepsilon)}.$$

Increasing the cost per search reduces both the reservation price and the expected sales price:

(A9) $$\frac{\partial E(P_N)}{\partial c} = -\frac{b}{2(b-\varepsilon)} = -\frac{b}{2\sqrt{2bc}} < 0.$$

Also, the above effect is larger the greater is the variance of the distribution, b.

(A10) $$\frac{\partial^2 E(P_N)}{\partial c \partial b} = -\frac{1}{4(b-\varepsilon)} = -\frac{1}{4\sqrt{2bc}} < 0.$$

The above results show that if the local economy booms causing the cost per search to fall as the arrival rate of offers increases, then the expected selling price of a property rises if the distribution of offers is uniform. Further, it rises by a greater amount the more atypical the property. The effect in (A9) is relatively large; however, that in (A10) is clearly smaller.

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Footnotes

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[1] See Dietz and Haurin (2003) for a summary of the evidence for each view.

[2] This survey contains sufficient information to identify the characteristics of the seller and buyer of a property.

[3] They note that a shift in the constant changes the hedonic surface without affecting attributes' implicit prices.

[4] This prediction is somewhat borne out by Capozza, Israelsen, and Thomson's (2005) finding that atypical repossessed houses tend to sell for less relative to their original price than do standard houses.

[5] This assumption can be enforced by limiting the sample to properties with unchanging characteristics. The exception is a characteristic such as the age of the property, which can be directly controlled.

[6] Market-wide shifts in the price of all properties due to changes in the relative bargaining strength of the seller and potential buyer will be reflected in the market rate of house price change.

[7] Often repeat sales data sets contain only information about house prices and not house characteristics, the primary example being the OFHEO data based on Freddie Mac and Fannie Mae underwriting. Thus, these data sets cannot be used to explore the relationship between house type and price changes.

[8] The exception is that the measure of house age varies over time.

[9] We use the official house price indexes which are described in more detail in Bourassa, Hoesli, and Sun (2004a).

[10] Its contribution to the price of properties is documented in Bourassa, Hoesli, and Sun (2004b).

[11] This measure of atypicality was used by Haurin (1988) and Capozza, Israelsen, and Thomson (2005).

[12] An intercept is included to capture the difference in the mean appreciation rate of the sample of repeat sales properties from that of the official index. Thus the dependent variable does not have a zero mean as the values are slightly positive in the three areas.