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# Hedonic Prices and House Numbers: The Influence of *Feng Shui*

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In contemporary practice, *feng shui* incorporates a wide range of concepts considered to affect a person's luck. These include traditional ideas about site selection and building design, as well as newer beliefs about the "luckiness" of certain numbers. Focusing on an area with a relatively high percentage of Chinese households in Auckland, New Zealand, this paper uses hedonic price analysis to investigate whether house values are affected by lucky and unlucky numbers. Sales transactions for 1989 to 1996 are used in this analysis. The results demonstrate that lucky house numbers are capitalised into house values.

### **Keywords**

Feng shui, hedonic price model, lucky, New Zealand.

### **Introduction**

Numbers, according to *feng shui*, can be lucky or unlucky. They are perceived by *feng shui* believers to have hidden powers to affect human fortune and health. Therefore, it is very likely that households who believe in *feng shui* are willing to pay a premium for properties with a lucky house number. Such households would rarely purchase a house with an unlucky number, and only when a substantial discount was offered. The premiums for lucky numbers should be noticeable in areas with high percentages of Chinese households. There may or may not be discounts for unlucky numbers, depending on whether purchasers of houses with such numbers are

influenced by *feng shui*. Focusing on such an area in Auckland, New Zealand, this study uses hedonic price models to investigate whether house numbers have a significant impact on house values.

The next section briefly introduces the concept of *feng shui* and the meaning of numbers in the context of *feng shui*. Section 3 presents the method and data used in this study. The results are discussed in section 4, with conclusions drawn in the subsequent, final section.

### ***Feng Shui* and Numbers**

The Chinese traditionally believe that a person's well-being is governed by three types of luck that come from the heaven, the earth, and the individual himself or herself, respectively. Heaven luck, commonly referred to as fate, is beyond the control of humans and difficult to change. However, earth luck and human luck are within human control, and can be activated and altered by following *feng shui* wisdom.

*Feng shui* literally means wind and water, which are the elemental forces of the earth, and are believed to have hidden power to determine the course of events. *Feng shui* has its roots in the Tao, an ancient Chinese philosophy analysing the environment and interpreting the "way of nature". By watching the many cycles of the physical universe, Taoists perceived a rhythm connecting humanity with nature, and developed a system to enhance that connection some 5,000 years ago (Thompson, 1996). According to the Tao, there is order and balance in the world. By living in harmony with the environment—the winds and waters of the earth—individuals can attract good luck and prosperity. Although the system of *feng shui* is intrinsically linked to the Taoist philosophy, the practical tenets are a complex blend of logical reasoning, common-sense maxims, and oral tradition, some of which are no more substantial than superstitions. The practice of *feng shui* incorporates ideas of geography, ecology, astrology, aesthetics, psychology and more, and it attempts to ensure a good life through site selection and the arrangement of objects on a site.

For centuries, *feng shui* has influenced Chinese thinking, and the Chinese people have relied on *feng shui* when designing cities, building homes, and burying their ancestors. There is evidence that at least 3,000 years ago government buildings and imperial palaces were built using the principles of *feng shui* (Webster, 1997).

With the establishment of the People's Republic in 1949, officials denounced *feng shui* as a primitive superstition that should be abolished. Since then,

*feng shui* has fallen from favour in the land of its origin. However, in other places, like Hong Kong, Taiwan and Singapore, where there are large Chinese populations, *feng shui* thrives as a fact of daily life. People rely on *feng shui* to find or build a house that will bring the family health and prosperity. The business community consults *feng shui* masters in choosing offices and business locations.

While the practice of *feng shui* has been common in Chinese communities for centuries, it is no longer a practice valued by the Chinese alone. In many Western countries, architects, real estate agents, and even homeowners are beginning to be interested in *feng shui* (Wong, 1996; Lagatree, 1996).

Numbers are highly significant to the practice of *feng shui* because they are considered to be symbols that have special meaning and intangible forces. The interpretation of numbers in *feng shui* is originally based on the magic square of nine numbers (1 to 9) called *Lo Shu*, in which every row, column, and diagonal adds up to the same total: 15. In this context, numbers are used as a time dimension in *feng shui* practice and calculated on an individual's birthdate to arrange *feng shui* elements that best fit his or her personality (Too, 1994).

In the contemporary practice of *feng shui*, homophonic principles are also applied in interpreting numbers. Many Chinese words, when spoken, sound alike. If a number sounds like something good, it is considered to be a good number. If it sounds like something bad, it is considered to be bad. According to this rule, Three, Six, Eight and Nine are considered to be lucky numbers, while Four is considered to be an unlucky one. Three sounds like the word for "growth" and "alive", six sounds the same as the Cantonese word for "wealth", eight sounds like the word for "to generate wealth", and nine sounds like the word for "to be sustained and long-lived". However, Four sounds like the word for "death".

Although it seems to have nothing to do with the traditional approaches employed in practising *feng shui*, the application of homophonic principles to the interpretation of numbers has been recognised as an integral part within the contemporary *feng shui* practice (Kwok and O'Brien, 1991; Lip, 1992; Noble, 1994; Schneider, 1992; Thompson, 1996).<sup>1</sup> In fact, the interpretation of

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<sup>1</sup> Two different approaches are regarded as "traditional" in practising *feng shui*, the Form School and the Compass School. The Form School focuses on the visible form of the landscape surrounding the site under consideration, and the Compass School uses the detailed analysis of directions, elements, etc. as indicated by an elaborate many-ringed compass. These two approaches are usually applied in combination by most *feng shui*

numbers according to homophonic principles is common in everyday *feng shui* practice because it is simple and straightforward.

While they try to avoid being involved with unlucky numbers whenever possible, people in areas influenced by the practice of *feng shui* would usually be willing to pay a premium for goods associated with a lucky number. In Hong Kong, the license plate with the single number Eight has been auctioned for US\$640,000. The successful bidder was firm in the conviction, "Whatever it cost, I would have paid." He said he was not sure which of his eight cars would get the lucky plate (Schneider, 1992). In predominantly Chinese parts of Asia outside mainland China, buildings and hotels often have floors numbered in the sequence of One, Two, Three and Five. It would be a brazen hospital in Hong Kong and Taipei that would presume to have a "death" floor between the third and fifth.

This study focuses on the significance of house numbers in the practice of *feng shui*, as other aspects of *feng shui* are not reflected in the data that are available for analysis. As discussed by Too (1997), the address of a house is very important, because a lucky house number adds fortune to people living there.<sup>2</sup> The lucky house numbers are not only meaningful to *feng shui* believers. A survey done in Auckland by Boyer (1995a) reveals that Chinese buyers who do not believe in *feng shui* still prefer lucky house numbers and avoid unlucky numbers because they are concerned about resale prospects. It is also found that Western real estate professionals are taking advice from *feng shui* experts, and using lucky house numbers for marketing property (Building Today, 1995).

## Method and Data

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experts and are very closely related. In addition to these two schools of thought, a motley collection of many other considerations is employed in contemporary *feng shui* practice, and might be called a "Third" school of *feng shui* (Walters, 1995). These considerations, no matter where they are from, are playing an important role in contemporary practice.

<sup>2</sup> An example of how people avoid unlucky numbers is given by a real estate agent in Auckland, New Zealand. A family from Hong Kong had searched for a long while for a house before the agent finally found a dwelling that was in the right neighbourhood, with the desired physical characteristics, and within the price range the family had specified. However, when realising the address of the dwelling, the family would not even look at it, because it was located at number Four, Risk Road.

Our hypothesis is that, in areas with large numbers of *feng shui* believers, it will be possible to observe that premiums are paid for houses with lucky numbers. On the other hand, discounts for unlucky numbers may or may not be observed, depending on whether buyers of such houses are believers in *feng shui* or are at least influenced by *feng shui* considerations, such as the prospects for resale to Chinese households. As it is likely that Chinese would, if possible, avoid houses with unlucky numbers, in the Auckland context this may mean that such houses would be purchased by other groups. To test these hypotheses, we employ sales transactions data and hedonic price methods.

Court (1939) and later Griliches (1971) introduced techniques of hedonic price analysis to estimate the value of heterogeneous goods. Rosen (1974) further developed the theory of hedonic price analysis and its empirical implications. The hedonic theory suggests that goods are valued for their utility-bearing attributes. Within the theoretical framework established by Rosen (1974), the hedonic price function is the market clearing function produced by the interaction of bid functions of consumers and offer functions of suppliers, which represents the marginal market trade-offs among various attributes associated with the goods. A hedonic price model is constructed by treating the price of a good as a function of its utility-bearing attributes.

Houses are heterogeneous goods that are comprised of a bundle of quantitative and qualitative attributes describing their locational and structural characteristics, including characteristics such as, in our case, house numbers. The coefficients obtained by regressing house prices on the house characteristics are the hedonic prices and are interpreted as the households' implicit valuations of different housing attributes.

The house price and descriptive data used in this study are drawn from Valuation New Zealand (VNZ) sales records.<sup>3</sup> The independent variables chosen for the analysis reported are limited to those available in the data set and known, based on theory and previous empirical studies, to be related to house price. These variables are—in addition to house number—floor area, land area, the value of chattels, age of the house, quality of the principal structure (as assessed by a valuer), and roof and wall materials. Dummy variables for each year of sale in the data except for the first, were included in the model to control for movements in house prices over time. Experiments with various transformations of the independent variables indicated that the

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<sup>3</sup> Valuation New Zealand was, until recently, a government agency responsible for the national property database.

model could be improved by using the natural logarithms of floor size, land area, house age, and chattels value. Lucky numbers and Unlucky numbers are used as dummy variables in the analysis.

One fundamental assumption in multiple regression analysis is the normality of the dependent variable. If the variation from the normal distribution is sufficiently large, resulting statistical tests are invalid, as normality is required in using the  $F$  and  $t$  statistics. It was found that the logarithmic transformation could effectively improve the data distribution of the dependent variable, total sale price. The skewness of the distribution dropped from 1.7 for the untransformed variable to 0.1 for its natural logarithm. Therefore, consistent with many previous hedonic analyses of house prices, we specify the dependent variable in logarithmic terms.

Census data, providing demographic and socio-economic characteristics of geographic areas, were used to select areas with relatively high percentages of Chinese households. The census is conducted in New Zealand every five years, and the data used to define the study areas are from the latest census conducted in 1996. The numbers of Chinese immigrants, including those from the People's Republic, Hong Kong and Taiwan are available at the area unit (AU) level.<sup>4</sup> Two AUs with the highest percentages of Chinese, 40.7 per cent (Maungamaungaroa) and 68.0 per cent (Cascades), respectively, in the Auckland region were selected (Table 1). These two AUs are contiguous and located in Auckland's eastern suburbs. In the area formed by these two AUs, about half (52.4 per cent) of the population is Chinese. For comparison purposes, we also estimate the hedonic model for a similarly located area (Otara East and Ferguson) with relatively few Chinese.<sup>5</sup>

The VNZ sales data available to us are from 1986 to 1996. Before the government introduced a new immigration policy in late 1986 that emphasised the selection of individuals rather than particular countries of origin, Chinese people had little opportunity to settle in New Zealand. As shown in Table 2, the number of Chinese immigrants entering New Zealand became noticeably significant only from 1989. Therefore, the time period chosen for this study is from 1989 to 1996.

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<sup>4</sup> There are 326 area units (AUs) in the Auckland region, and the average size of those AUs is 18 square kilometres.

<sup>5</sup> They are similar in terms of distance to the central business district, geographical size, population, and number of transactions.

**Table 1: Chinese immigrants living in Cascades and Maungamaungaroa**

Area unit	Mainland China	Hong Kong	Taiwan	Total Chinese	Total population	Chinese (%)	Intercensal growth due to Chinese immigration (%)
	<i>1986</i>						
Cascades	0	0	0	0	261	0	—
Maungamaungaroa	0	0	0	0	48	0	—
Total	0	0	0	0	309	0	—
	<i>1991</i>						
Cascades	42	114	54	210	1161	18.1	23.3
Maungamaungaroa	75	228	138	441	1341	32.9	34.1
Total	117	342	192	651	2502	26.0	29.7
	<i>1996</i>						
Cascades	390	1656	483	2529	3717	68.0	90.7
Maungamaungaroa	369	1212	459	2040	5007	40.7	43.6
Total	759	2868	942	4569	8724	52.4	63.0

Source: Census of Population and Dwellings

**Table 2: Numbers of Chinese immigrants entering New Zealand, 1986-1995**

Place of origin	Year									
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Mainland China	118	175	256	686	692	1,077	1,452	2,427	2,027	5,181
Hong Kong	162	188	512	1,016	2,640	3,319	5,411	3,590	2,693	2,799
Taiwan	12	25	95	1,640	2,555	1,648	970	2,651	3,597	7,470

Source: Boyer (1995b), p. 117.

Note: Years ended in March except for 1994 and 1995, which ended in June.

This paper follows the homophonic principles of number interpretation in *feng shui* practice to determine whether an address is a lucky one or not. In this context, the nature of a number, lucky or not, is generally determined by its last digit, although different combinations of the other digits can affect the degree of luckiness. To simplify the analysis, this study focuses on the last digit of a house number.<sup>6</sup> If a house number ends with Three, Six, Eight, or Nine, then it is classified as a lucky house number, and if it ends with Four, then it is classified as unlucky. Only detached houses were selected for this analysis. This is because, in the case of attached units, the number of the unit is more meaningful to Chinese than the address of the building, and the unit numbers are not available in the data. After deleting aberrant observations, there are 2,164 sales suitable for analysis.<sup>7</sup> The sale prices and chattel values have been adjusted to 1996 New Zealand dollars using the consumer price index net of housing costs.<sup>8</sup>

<sup>6</sup> It may be argued that, in Chinese, Five sounds like the word for “negate” and can be interpreted as the English prefixes un-, non- or in-, and thus creates an unlucky number when combined with a lucky one. However, number 5 also sounds like “I”, “myself” (e.g., Kwok and O’Brien, 1991), and according to the authors’ experience, a number combining Five and a lucky number is generally interpreted as a lucky one. Experimentation with such combinations as 53, 56, 58, 59, etc., shows that excluding these numbers results in less significant price premiums for lucky numbers. This indicates that these numbers are actually regarded as lucky numbers that require a price premium, a result consistent with the definition of lucky number used in this paper.

<sup>7</sup> A transaction would be identified as aberrant and discarded from the analysis as unrepresentative if it fell into one of the following categories: the land area was larger than 0.25 hectares (this excluded properties that might have been sold primarily for redevelopment purposes); the floor size was either larger than 500 square meters or less than 30 square meters; or the chattels accounted for more than 10 per cent of the total price.

<sup>8</sup> This makes it easy to interpret the estimated coefficients for Lucky and Unlucky. The

The focus area is small in the size (less than five square kilometres) and far (about 22 kilometres) from the Central Business District (CBD). This means that all houses in the area are approximately uniform in terms of their access to the CBD. Furthermore, socio-economic characteristics—such as household income, average cars owned by each household, percentage of people driving to work, home ownership rate, unemployment rate, percentage of people receiving income support, and density of dwellings—are approximately homogeneous in these two AUs. The uniformity of locational and neighbourhood characteristics in the study area allows our analysis to be simplified and focused on the houses' physical attributes as well as the house numbers. Table 3 presents summary statistics for the data.

**Table 3: Summary statistics for residential sales, Cascades and Maungamaungaroa area units, 1989-1996**

Variable	Mean	Standard deviation	Minimum	Maximum
Sale price (NZ\$)	295,838	85,941	100,000	874,873
Chattel value (NZ\$)	11,441	4,521	0	43,011
Floor size (m <sup>2</sup> )	199	52	70	460
Land area (m <sup>2</sup> )	706	120	368	2,066
Age (years)	6	6	1	60
Quality of the principle structure				
Superior	0.825	0.380	0	1
Other	0.175	0.380	0	1
Roof material				
Tile	0.924	0.265	0	1
Other	0.076	0.265	0	1
Wall material				
Brick	0.649	0.477	0	1
Wood	0.048	0.214	0	1
Fibrolite	0.061	0.240	0	1
Other	0.242	0.428	0	1

Source: Authors' calculations based on Valuation New Zealand transactions data.

Note: Values have been adjusted to 1996 NZ dollars using the CPI net of housing costs.

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CPI net of housing costs is derived from information in several Statistics New Zealand publications, including *Key Statistics* (various issues). This index excludes the mortgage interest as well as other housing components of the CPI.

## Results

The results are presented in Table 4. The adjusted  $R^2$  statistics for the two models estimated for the Chinese area are close to 0.73. All signs of the coefficients are as expected. Floor size, land area and chattel values are positively related to the sale price. Age of the dwelling is negatively related to house value. Tile roofs are more valuable than other types (usually metal) and houses with plaster or a mix of exterior wall materials are generally more valuable than those with brick, wood, or fibrolite wall coverings.

There was a one-year lag before the property market absorbed the downturn caused by the economic crisis in late 1989. Transactions in the years 1991 to 1994 were affected in real terms by this economic downturn as indicated by the negative and significant coefficients estimated for those years. Subsequently, the Auckland economy recovered, contributing to price increases in 1995 and 1996.

In the first set of results shown in Table 4, it is found that houses with lucky numbers were sold for higher prices, and houses with unlucky numbers sold for lower prices. The positive effect of lucky numbers is significant at the 10 per cent level, but the negative effect of unlucky numbers is not significant at the usual levels. This is consistent with our expectations. While they are willing to pay a premium for houses with lucky street numbers, Chinese households would generally avoid any transactions involving unlucky street numbers. Non-Chinese households would purchase most of the houses with unlucky numbers and would be much less likely than Chinese households to require a discount.

Given the insignificance of the coefficient for unlucky numbers, we estimated the model without that variable. This produced the second set of results shown in Table 4. In this case, the coefficient for Lucky is somewhat larger and is significant at the 5 per cent level. We also estimated the model with separate dummy variables for each of the lucky numbers. Not all of the resulting estimates were statistically significant, although this was evidently due to sample size problems rather than significant differences among the estimated coefficients for the dummies.<sup>9</sup> A series of  $F$  tests reveals that the differences among the coefficients are all insignificantly different from zero.

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<sup>9</sup> The sample size for each lucky number is about 200, or one-tenth of the total sample. This problem may also account for the insignificance of Unlucky.

**Table 4: Results for hedonic analysis**

Variable	Neighbourhood with large increase in Chinese households			Same neighbourhood with “Unlucky” omitted			Similarly located neighbourhood with relatively few Chinese		
	Estimate	Standard error	P-value	Estimate	Standard error	P-value	Estimate	Standard error	P-value
Constant	8.3538	0.1426	0.0001	8.3461	0.1425	0.0001	7.3130	0.1731	0.0001
Log of floor area	0.5528	0.0151	0.0001	0.5524	0.0151	0.0001	0.6387	0.0231	0.0001
Log of land area	0.2017	0.0213	0.0001	0.2028	0.0213	0.0001	0.2044	0.0242	0.0001
Log of chattel value	0.0084	0.0016	0.0001	0.0085	0.0016	0.0001	0.0440	0.0023	0.0001
Log of age	-0.0624	0.0041	0.0001	-0.0627	0.0041	0.0001	-0.0587	0.0130	0.0001
Superior quality of principal structure	0.0396	0.0094	0.0001	0.0396	0.0094	0.0001	0.3106	0.0222	0.0001
Tile roof material	0.0244	0.0124	0.0483	0.0246	0.0124	0.0471	0.0108	0.0126	0.3901

(continued on next page)

**Table 4: Results for hedonic analysis (continued)**

Variable	Neighbourhood with large increase in Chinese households		Same neighbourhood with "Unlucky" omitted		Similarly located neighbourhood with relatively few Chinese	
	Estimate	Standard error P-value	Estimate	Standard error P-value	Estimate	Standard error P-value
Wall material						
Brick	-0.0314	0.0073 0.0001	-0.0318	0.0073 0.0001	-0.0930	0.0225 0.0001
Wood	-0.0763	0.0163 0.0001	-0.0760	0.0163 0.0001	-0.1155	0.0202 0.0001
Fibrolite	-0.0551	0.0161 0.0006	-0.0556	0.0161 0.0006	-0.0606	0.0290 0.0371
House number						
Lucky	0.0119	0.0064 0.0627	0.0142	0.0062 0.0223	0.0052	0.0125 0.6781
Unlucky	-0.0171	0.0114 0.1335	—	—	-0.0129	0.0203 0.5250
Year of sale						
1990	0.0382	0.0235 0.1045	0.0366	0.0235 0.1198	-0.0714	0.0240 0.0030
1991	-0.1359	0.0204 0.0001	-0.1360	0.0204 0.0001	-0.1607	0.0267 0.0001
1992	-0.1778	0.0171 0.0001	-0.1782	0.0171 0.0001	-0.1887	0.0251 0.0001
1993	-0.1779	0.0166 0.0001	-0.1773	0.0166 0.0001	-0.1382	0.0253 0.0001
1994	-0.0833	0.0160 0.0001	-0.0829	0.0160 0.0001	-0.0702	0.0226 0.0020
1995	0.0159	0.0157 0.3116	0.0165	0.0157 0.2946	0.0214	0.0227 0.3469
1996	0.0854	0.0156 0.0001	0.0856	0.0156 0.0001	0.1842	0.0225 0.0001

For comparison purposes, the third set of results in Table 4 is for an area with relatively few Chinese. In this case, as expected, neither Lucky nor Unlucky approaches statistical significance.

The average dollar value of lucky house numbers is also calculated, based on the estimates for the model that excludes Unlucky. As the dependent variable, total sale price, is in natural logarithmic form, and the log function is concave, the average of the logs is less than the log of the average if there is any variance in the data. Therefore, in calculating the impact of lucky house numbers, it is necessary to adjust for the model variance,  $\sigma^2$ , as in the following equation:

$$\frac{P_{lucky}}{P_{other}} = \exp(\beta_{lucky}) * \exp(\frac{1}{2}\sigma^2) \quad (1)$$

where  $P_{lucky}$  and  $P_{Other}$  are the prices of houses with lucky numbers and those without lucky numbers, respectively, and  $\beta_{lucky}$  is the hedonic price of lucky numbers.

It is found that houses with lucky numbers sold for an average 2.4 per cent premium. As the average price for houses without lucky numbers is NZ\$293,200 (in 1996 values), a lucky number would add about NZ\$7,100 to house value. Suppose for the purposes of illustration that all Chinese, some of whom may not be *feng shui* believers but are concerned with the resale prospects for their properties, care about house numbers and will pay a premium for lucky numbers. Assume further that only Chinese will pay a premium. If it is also assumed that these Chinese households are randomly distributed in houses with various numbers, then about 50 per cent of houses with lucky numbers would be occupied by Chinese. In this case, the hedonic results imply that a Chinese household would be willing to pay an average premium of about 4.8 per cent, or NZ\$14,200 for a lucky house number. An extreme assumption would be that all houses with lucky numbers (40 per cent of the stock) were occupied by Chinese. In that case, the average premium implied by the hedonic results would be about 2.4 per cent, or NZ\$7,100. This range of estimates seems reasonable when compared with anecdotal evidence.

## Conclusions

Focusing on an area with a relatively high percentage of Chinese households in Auckland, New Zealand, this paper uses hedonic price analysis to

investigate whether house numbers, which according to *feng shui* can be lucky or unlucky, affect house values. The results of the analysis reveal that lucky numbers are capitalised into the sale prices of houses: lucky numbers have significant positive hedonic prices, respectively. Due to the stigma associated with an unlucky number, it appears that Chinese households may avoid purchasing houses with such numbers. These findings confirm anecdotal evidence that Chinese house-buying behaviour is influenced in a significant way by *feng shui* beliefs in the power of numbers to affect well-being.

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