Superstition in the Housing Market[1]

By Nicole M. Fortin[2], Andrew J. Hill and Jeff Huang
Department of Economics, University of British Columbia

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Abstract

We provide the first solid evidence that Chinese superstitious beliefs can have significant effects on house prices in a North American market with a large immigrant population. Using real estate data on close to 117,000 house sales, we find that houses with address number ending in four are sold at a 2.2% discount and those ending in eight are sold at a 2.5% premium, in comparison to houses with other addresses. These price effects are found either in neighborhoods with a higher than average percentage of Chinese residents, consistent with cultural preferences, or in repeated transactions, consistent with speculative behavior.

Keywords: superstition; lucky Chinese numbers; housing markets efficiency, immigration.
JEL classification: R2

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[2] Corresponding author e-mail: nicole.fortin@ubc.ca, Department of Economics, #997-1873 East Mall, University of British Columbia, Vancouver, BC, V6T 1Z1.

I. Introduction

In this paper, we explore the price effects of auspicious and inauspicious Chinese numbers in house addresses on transaction sales in a North American market. We focus on the Greater Vancouver area of British Columbia. This metropolitan area comprises a sizeable but overall minority share of immigrants of Chinese ethnicity who tend to concentrate in several ethnic enclaves. Because the superstitious beliefs are not as widespread as in some Asian markets, we can exploit differences in the concentration of ethnic Chinese residents across neighborhoods to identify the effect of the auspicious and inauspicious numbers and claim that they are driven by Chinese own superstitious beliefs or "cultural cues". As the cultural number preferences have become well-known outside of the Chinese community, we can also study potential speculative behavior by investigating price effects of the fateful numbers in repeated sales across Chinese and non-Chinese neighborhoods. The argument for the presence of some speculative behavior is buttressed by the size of the observed effects being in line with transaction costs limiting arbitrage opportunities.

When the Beijing Summer Olympics opened at 08:08:08 pm on the 8th day of the 8th month of 2008, it was shown to the world that the Chinese take the auspiciousness of the number "8" seriously. In Las Vegas, where superstitious beliefs are rampant, many large casino-hotels (such as MGM, Wynn and Palms Place) omit floor numbers 4, 14, 24, 34 and 40 to 49 because the number "4" is considered unlucky in the Chinese tradition.[3] This *tetraphobia* comes from the fact that the pronunciation of the word for four (四: sì) is very similar to the word for death (死: sǐ) in Mandarin, Cantonese, and several Chinese dialects. On the other hand, the word for eight (八: bā) is phonetically similar to the word for prosperity or wealth (发: fā).

Vancouver, B.C., has a long history of Chinese immigration dating back to the construction of the Canadian Pacific Railway in the 19th century. Chinese immigration flows were curtailed with the imposition of a head tax in 1885, and banned formally in 1923. While there was a continuous trickle of Chinese refugees thereafter, the relaxation of ethnic restrictions in Canadian immigration regulations in the 1970s saw a dramatic increase in the number of immigrants from China. But it is the impending return of Hong Kong to the People's Republic of China in 1997 that sent a new wave of immigrants from Hong Kong in the 1980s and 1990s.

[3] Some hotels also omit the 13th floor considered unlucky in the Western tradition. In Vancouver, many new residential towers also skip the floors numbers that include a four.

Since then, Vancouver has continued to see a large number of immigrants from mainland China, many of them admitted as Business Class Applicants. This large influx of immigrants resulted in the development of several Chinese ethnic enclaves in Greater Vancouver.[4] Our immigrant shock is not as punctual as the Mariel Boatlift, studied by Card (1990) and Saiz (2003), but rather a prolonged affair. Yet because the effects sought are directly linkable to Chinese culture and predominantly found in Chinese neighborhoods, we can still accurately pinpoint the effects of the Chinese immigration inflows on housing.

We combine a large and detailed real estate data set containing information on all single-family house sales (close to 117,000 transactions) in the Greater Vancouver area over the five-year period from January 2000 to May 2005 with census tract (CT) information from the 2001 Canadian Census. Our empirical specification begins with a classic hedonic analysis (Rosen, 1974) of the log transaction price where the structural, locational, and neighborhood attributes of a house are thought to affect price. In addition to a host of structural house attributes, we control for detailed location characteristics by including street and CT fixed effects, and we control for seasonal and yearly price effects with month-year fixed effects.

We focus our search for the effects of superstitious beliefs on house address numbers ending with the digits "4" or "8" as these beliefs are thought to be greatest and the last digit of a house number is thought to leave a final impression in the pronunciation of one's address.[5] There may be other digits or combinations of digits in the house number also associated with superstitious beliefs for which we perform some limited tests. We employ a difference-in-difference estimation strategy. Once we control for CT fixed effects and the Chinese concentration in the CT, the coefficient of the interaction between the fateful house address numbers and the Chinese concentration in the CT gives us the relative price effect of fateful house numbers in Chinese neighborhoods in comparison to other neighborhoods. We find that, on average, in neighborhoods where the percentage of Chinese residents exceeds the Greater Vancouver average of 18%, houses with address numbers ending in "4" are sold at a 2.2% discount and those ending in "8" are sold with a 2.5% premium in comparison to houses with address numbers ending in any other digits. Interestingly, we also find similar effects of the

[4] See Hou and Picot (2004) for details.

[5] Many papers investigating the role of Chinese superstitious beliefs also focus on the last digit effect. For example, Simmons and Schindler (2002) in marketing, and Brown, Chua and Mitchell (2002) in finance focus attention on the last digit of the price.

numbers are also found in repeated sales in non-Chinese neighborhoods, consistent with speculative behavior.

We argue below that the magnitude of these average effects is consistent with transaction costs limiting arbitrage opportunities. These results add weight to the argument that transaction costs and heterogeneous preferences limit the efficiency of the market for single-family homes (Case and Shiller, 1989; Meese and Wallace, 1994; Rosenthal, 1999.) Case and Shiller (1989) first suggested that arbitrage opportunities in the single-family home market are difficult to exploit due to transactions costs, carrying costs and tax considerations. Rosenthal (1999) on the other hand, concluded that any inefficiency in the housing market must lie in the market for land itself. To the extent that street addresses are a characteristic of the lot, rather than of the building, our results are consistent with both views.

We also perform some unconditional quantile regressions (Firpo, Fortin, and Lemieux, 2009) and find that the percentage price effects of the lucky numbers are largest at the upper end of the transaction sales distribution. These results are suggestive of Veblen effects rather than actual beliefs that the house addresses will bring "fortune" to the homebuyers. The structure of the paper is as follows. Section II provides the background and rationale for the anticipated effects. Section III introduces the data used. Section IV presents the basic empirical specification and the empirical results. Section IV discusses the interpretation of the results. Section V concludes.

II. Anticipated Effects

There are few markets where the effect of superstitious beliefs can be detected. The small literature on the effects of lucky and unlucky Chinese numbers has been limited to markets where there is a limited supply of such numbers, such as residential markets and the market for special license plates in Hong Kong. We first offer a succinct summary of the empirical and theoretical literature on the price effects of superstitious beliefs. Next we explain why limited relative supply and transaction costs are important for the detection of such effects and offer two distinct predictions with regards to the existence and size of price effects for auspicious and inauspicious Chinese numbers in house addresses.

There are a few studies that present some evidence of Chinese superstitious beliefs on home prices, but they are limited by relatively small sample sizes or by the lack of clear control groups. Bourassa and Peng (1999) consider the effect of unlucky and lucky house numbers on 2,164 house sales in a few neighborhoods of Auckland, New Zealand and find a significant positive premium for lucky numbers.[6] Chau, Ma and Ho (2001) investigate the effects of lucky floor numbers 8, 18 and 28 on 1,019 apartment sale prices in Hong Kong and find that apartment on lucky floors sell for higher prices during property booms.[7] Liu and Wong (2012) consider the effects of unit numbers ending with a "4" or a "8" on the sale price of new apartments in Singapore. They attempt to distinguish the effect of the investors' "own beliefs" from effects coming from the "beliefs of others", which speculators would take into account. They however failed to find significant price effect differences between investors and speculators. Note that existing studies have only considered markets in Asia and Oceania.

Other papers that investigate the impact of Chinese superstitious beliefs have focused on the willingness to pay (WTP) for special license plates in Hong Kong (e.g. Woo, Horowitz, Luk, and Lai, 2008; Ng, Chonga and Du, 2010). Woo et al (2008) study the impact of lucky numbers on the WTP of consumers at 348 auctions between 1990 and 2005. Because there is a large choice of available digit combinations, the authors are able to study a wide range of 3-digits and 4-digits combinations, each with different meaning.[8] They find significantly higher WTP for auspicious license plates numbers that cater to the motorists' superstitions, and they also find that the WTP for these license plates is influenced by economic conditions, like other conspicuous consumption. Ng, Chonga and Du (2010) consider the effects of single digits on the WTP for license plates in a larger set of auctions and find that number ''8" is associated with plates with significantly higher winning bids, while number ''4" is associated with plates with significantly lower winning bids. While these results are interesting, the license plate market is arguably a thin market where the absence of a resale market (for special plates) prevents prices to be observed on the equilibrium path, thus the focus on the WTP instead.

[6] Bourassa and Peng argue that the Chinese homophonic principles of number interpretation are linked to the practice of *Feng Sui*, a system which is intrinsically linked to the Taoist philosophy and is more substantial than simple superstitions.

[7] Chau et al. (2001) use the transaction records of apartment sales from only one private sector real estate company in Hong Kong's apartment market, which is not necessarily representative of the entire market.

[8] For example, they consider ''228 (double easy prosperity)'', ''338 (double longevity and prosperity)'', ''988 (long-lasting double prosperity)" among many others.

There is relatively little theoretical work in economics that focus directly on superstitious beliefs, although there is a growing literature in finance that analyses how heterogeneous beliefs among investors generate speculation and trading (Scheinkman and Xiong, 2003). For example, Morris (1996) shows that after an initial public offering, there is room for a speculative premium to emerge before all traders learn about the true distribution of the asset's dividend. In a game-theoretic model with rational learning, Fudenberg and Levine (2006) characterize the conditions under which superstitious beliefs can be expected to persist over time. They argue that these false beliefs are more likely to persist for events off the equilibrium path. In this context, agents are never presented with counterfactual evidence to dispel the superstitious beliefs. In the housing market, fateful outcomes are not easily measured or evaluated, making counterfactuals difficult to construct and leaving room for these beliefs to persist.[9] On the other hand, to the extent that the beliefs are not factual, and because homes represent sizeable assets, there may exist some attractive arbitrage opportunities, so that the belief-based equilibrium could be fragile. We show below that transaction costs limit these arbitrage opportunities allowing us to observe the price effects associated with the fateful house addresses.

First, for superstitious beliefs to have a quantifiable impact in competitive markets, a sufficient number of buyers need to hold these beliefs. Homebuyers typically choose a neighborhood or set of neighborhoods in which they would like to live, and then search within those neighborhoods for specific houses. In addition, it is well-known that individuals exhibit a preference for living in neighborhoods in which their ethnicity has a notable presence. This is particularly true for immigrants (Bartel, 1989). Notwithstanding arbitrage opportunities, we thus expect to find a premium on houses associated with good luck in neighborhoods where there are more buyers who hold these beliefs than they are such houses available.

In order to formulate more precisely the relationship between the proportion of superstitious buyers π_S , the proportion of lucky houses π_8, and the market premium δ_8 for a lucky address, let's first assume that there are only two types of buyers in this market: the superstitious (S) and the non-superstitious buyers (N). The WTP a premium for a lucky house is greater among superstitious buyers than among non-superstitious buyers, $\nu_{S8} > \nu_{N8} = 0$, for whom it is equal to zero. Following an hedonic housing framework, let $\bar{P}_{sct}(H)$ be the average

[9] Conversely, Brown and Mitchell (2008) who study price clustering on the Shanghai and Shenzhen stock exchanges, find that preferences for prices ending with "8" relative to "4" have declined over time.

price of a house on street s in Census tract c at time t with a neutral address and housing characteristics H , and let $(1+\delta_8)\bar{P}_{sct}(H)$ the price for a house with similar characteristics, but with a lucky address. The δ_8 then represents the percentage premium paid for this property.

Proposition 1. *i)* The market premium δ_8 will be positive only if $\pi_S > \pi_8$, and *ii)* as long as this inequality is satisfied, increases in the proportion of superstitious buyers π_S will not increase the premium δ_8.

Proof. There are three cases. In the case $\pi_S < \pi_8$, where the proportion of superstitious buyers is below the proportion of lucky houses, there is excess supply of lucky houses and buyers have the bargaining power. As a result, the maximum premium of a lucky house must be the willingness of the non-superstitious buyers to pay a premium for this type of house, and there is no premium for lucky houses, $\delta_8 = \nu_{N8} = 0$. In the case $\pi_S > \pi_8$, there are more superstitious buyers than the supply of lucky houses. Assuming that all superstitious buyers are willing to pay the same premiumν_8 for their preference, the price premium comes from the competition between these buyers: $\delta_8 = \nu_{S8} > 0$. As a result, as long as the fraction of superstitious buyers exceeds the cutoff, further increase in this type of buyer does not increase price premium. In the knife edge case $\pi_S = \pi_8$, the premium $\delta_8 \in (0, \nu_{S8})$ can take any value in that range. ■

Note that not all ethnic Chinese residents hold superstitious beliefs or cultural preferences for certain addresses. Although, as Tsang (2004) argues, half-believers of superstition may suffer from cognitive dissonance issues and also base their decisions on superstition, even though they know that they should not. Thus in practice, Proposition 1 provides only a lower bound: below a certain proportion of ethnic Chinese residents in a neighborhood, equal to the proportion of lucky houses, we should not expect to see the premium.

A similar logic applies to the case of unlucky houses; the presence of a discount depends on the mix of buyers. There will be a percentage discount on a house associated with bad luck, say δ_4, in neighborhoods where the proportion of potential buyers who hold these beliefs π_S is greater than the proportion of neutral and lucky houses $(1-\pi_4)$. With an insufficient number of non-superstitious buyers to buy all unlucky houses, $\pi_N = (1-\pi_S) < \pi_4$, some superstitious buyers will buy the unlucky houses at discount, $\delta_4 = \nu_{S4}$, where ν_{S4} is the percentage discount that makes the superstitious buyers willing to pay for the unlucky property rather than the neutral home. In practice, the proportion of non-superstitious buyers π_N living in a particular neighborhood may be linked to the perceived benefit or cost of living in a Chinese neighborhood.

We would observe reduced (or the absence of) discounts on houses associated with bad luck if non-Chinese (non-superstitious) buyers perceive little or no cost to living in Chinese neighborhoods. Determining a precise cut-off for the emergence of superstitious beliefs is thus empirically challenging, and our prediction about the stability of the premiums and discounts as the concentration of ethnic Chinese residents increases should be easier to observe.

Second, we consider limits to the arbitrage opportunities created by the idiosyncratic and revealed preferences of some buyers. There is ample anecdotal evidence that the Chinese cultural preferences have not been ignored by opportunistic real estate agents. In particular, they can act as informed buyers (*I*) who exploit the existence of both superstitious and non-superstitious buyers.[10] Transaction costs, however, which importantly include the real estate agents' margins of between five and six percent of the transaction price equally split between the agent of the home seller and the agent of the home buyer, limit profitable arbitrage opportunities. Even when real estate agents themselves are involved in the transaction as buyer or seller, they still have to pay the other agent's fee.[11] Consider the case where arbitrage opportunities are exercised within the same day in order to abstract from mortgage bridging costs, which would reduce potential profits and make them depend on the elapsed time between buying and selling. Clearly intra-day buying and selling represent the ultimate expression of speculative demand for housing and are thus relatively rare. In our sample of 22,710 repeated sales, we observe only 128 intra-day transactions, but 20% (4480) of repeated sales occur within 240 days and could be considered speculative.

Proposition 2. Transaction costs, modeled as a linear tax *c* imposed on the transaction price $\bar{P}_{sct}(H)$, limit the arbitrage opportunities for the fateful addresses in the following way:
i) The maximum premium attainable for addresses ending with the fortuitous number 8 is $\delta_8^* = c/(1-c)$.
ii) The maximum discount for addresses ending with the undesirable number 4 is $\delta_4^* = c$.
Proof. *i)* An informed house flipper would make a profit buying a house with a street address with ending with a number "8" from a non-superstitious seller at $\bar{P}_{sct}(H)$ and selling it at $(1 +$

[10] Numerous ads by real estate agents, especially those who cater to a clientele from Mainland China, show that they are fully informed of the superstitious beliefs. Not only do they seek to offer to properties with lucky addresses, but they display asking prices frequently ending with a series of "8".
[11] Some also have to pay a portion to their firms, but some agents are independent. There are also a few discount (1%) real estate agents.

$\delta_8)\overline{P}_{sct}(H)$ to a superstitious buyer, where $\delta_8 > 0$ is the premium for the lucky home. Assuming a linear transaction cost of c, this house flipper will make a profit

$$(1-c)(1+\delta_8)\bar{P}_{sct}(H) - \bar{P}_{sct}(H) \geq 0 \leftrightarrow \delta_8 \geq c/(1-c)$$

Arbitrage opportunities would remain if this were a strict inequality. Consider $\delta_8 = \frac{c}{1-c} + \varepsilon$, with $\varepsilon > 0$. Then a second flipper could buy the house at $(1-c)\left(1+\frac{c}{1-c}+\varepsilon\right)\bar{P}_{sct}(H)$, resell it at the uninformed market price of $\bar{P}_{sct}(H)$, and make a profit of $\varepsilon(1-c)\bar{P}_{sct}(H)$, which may be non-trivial if $\bar{P}_{sct}(H)$ is large. Thus only when $\varepsilon = 0$, and $\delta_8^* = c/(1-c)$ will all potential arbitrage opportunities have been exercised.

ii) Conversely, an informed house flipper could make a profit buying a house with a street address with ending with a number "4" from a superstitious seller at a discounted price $(1 - \delta 4 PsctH$ and selling it at $Psct(H)$ to a non-superstitious buyer, where $\delta 4 > 0$ is the discount for the unlucky address. This house flipper would make a profit of $(1-c)\bar{P}_{sct}(H) - (1-\delta_4)\bar{P}_{sct}(H)$ which will be non-negative if $\delta_4 \geq c$. But, as before, if there remains some positive profits, another house flipper could bid it away. As a result, $\delta_4^* = c$ represents the discount after all arbitrage opportunities have been exercised.■

The likelihood of finding such seller/buyer combinations is greater in neighbourhoods that have experienced a recent influx of Chinese immigrants. Because of the manipulation of home addresses, a thinner market for addresses ending with a "4" is likely found in Chinese neighbourhoods where a high proportion of residents have distaste for this home address, and where fewer non-Chinese residents prefer to live. Indeed, there is ample anecdotal evidence that arbitrage opportunities are being exercised that way. Some homebuyers purchase houses with address numbers ending in "4" and then petition the cities for a change in house number. This reduces the number of inauspicious houses for sale. We do indeed observe that transactions with street addresses ending in "4" represent only 3.9% of sales in CTs with an above average proportion of ethnic Chinese versus 7.4% of sales in other CTs.[12]

In a market where arbitrage opportunities are exercised only by regular homebuyers paying a commission in the 5% to 6% range, we would expect a premium of 5.3% to 6.4% and a discount of 5% to 6%. But, as argued by Levitt and Syverson (2008), real estate agents are more

[12] Fearing the disappearance of the number "4", the suburban city of Richmond adopted the following policy in 2008: "Address changes as a result of a personal preference on the part of the property owner are discouraged for any other reason, i.e. superstition and religious beliefs, numerology,etc." (City of Richmond, 2008).

likely to be "rehabbers" than other sellers given that they are more informed than regular homebuyers about client preferences and neighbourhoods dynamics. In this case, because real estate agents incur a transaction cost of only half the total commission (that of the other agent), the premium for house address ending with an "8" would be in the 2.7%- 3.2% range, not accounting for additional fixed closing costs. Conversely, we should see a discount in the 2.5%-3% for houses with street addresses ending with a "4". Because of additional closing costs, we expect to find premiums and discounts in this range, but perhaps a little bit smaller in magnitude.

III. Data Used

We use high quality housing data compiled by the property assessment firm, Landcor Data Corporation. This firm works closely with the British Columbia Assessment Authority (BCAA), a public corporation responsible for property assessments used to establish property taxes. From the complete universe of transaction records from January 2000 to May 2005, we select sales transactions for single-family dwellings for 13 major cities in the Greater Vancouver area.[13] We omit records from rural areas, estates of more than 10,000 square feet, and other observations with missing values, this brings our sample down to 116,939 observations from a potential of 123,542 observations. Figure 1 displays the average nominal price for the entire Greater Vancouver area and for our sample. It shows that by contrast with other North-American metropolitan areas, our data largely precede what some see as a large and continuing bubble in housing prices, which barely burst in the 2008 housing crisis. Year to year variations in the seasonality of prices suggest that month-year fixed effects will best capture the housing price inflation.

The housing information includes the street address, the date of the transaction and the transaction price, as well as a host of structural house characteristics: lot size, finished floor area, finished basement area and total basement area, house age, number of bedrooms, full bathrooms, half bathrooms, single-car garages, multi-car garages and stories, and the presence of a basement suite and a swimming pool.[14] We do not know the identity or ethnicity of the buyers and sellers or of the real estate agents, nor the details of the transaction (asking price, time of the market,

[13] These include Burnaby, Coquitlam, Delta, Langley, Maple Ridge, New Westminster, North Vancouver, Pitt Meadows, Port Coquitlam, Richmond, Surrey, Vancouver, and West Vancouver.
[14] We exclude observations below $100,000 as these are likely to include "other considerations" as part of the transaction. Descriptive statistics on the housing and CT data are available in the online Appendix.

and so on). Thus we cannot directly assess whether the price effects sought would be different depending on the education level, the religious status or income level of the buyer.

We appeal to census data to supplement the ethnicity information at the neighborhood (CT) level. The census asks many questions about immigrant status: country of origin, languages spoken, single and multiple ethnicities, and visible minority status. We use the Chinese category of the visible minority status question to compute the proportion of ethnic Chinese residents in a CT to avoid the problem of double counting people with multiple ethnicities. The census provides information on the average characteristics of the CT based on interviews of one in five residents in the CT.[15] While ethnic Chinese residents made up about 18% of the total population of Greater Vancouver on average in 2001, there are 22 census tracts in Vancouver and its suburb of Richmond where the percentage of ethnic Chinese exceeded 50% of the population.[16] Figure 2 illustrates the percentage of single ethnic Chinese origin by CT in 2001 and shows great diversity across the metropolitan area with concentrations of Chinese residents in the core city as well as in some suburbs. The sales transactions data are merged with Census data for 363 CTs using postal codes.[17]

Figure 3 displays the proportion of house addresses ending with digits 0 to 9, separating CTs with a proportion of ethnic Chinese residents above and below the overall average. The figure focuses on Greater Vancouver, excluding the suburban city of Richmond, (10074 observations) where a disproportionate number of home addresses (80%) end in "0" or "1" due to historical lot division and renumbering policies.[18] The numbers are consistent with the Chinese cultural cues. The largest and statistically significant differences in the proportion of home transactions, across more and less Chinese neighborhoods, are found for addresses ending with either "4" (t-stat: 15.8), which are found less frequently in more Chinese CTs, or ending with an "8" (t-stat:-11.9), which are found more frequently in more Chinese CTs. The fact that transactions of homes with address ending with a "5' are found at a statistically significant

[15] Census tract populations range from 280 to 11,915 residents in our area of interest.
[16] We note that in Chinese, Richmond translates as the "City of Rich Gate" since mond" has the same pronunciation as "gate" in Chinese.
[17] Each street address in the sales transactions data is matched to a postal code, and this postal code is matched to a CT through the postal code conversion files provided by the Canadian Census Analyzer at the University of Toronto.
[18] This usual distribution has arisen from the urbanization of the municipality through the densification of older larger lots. The transformation of 3 digits addresses into 4 digit addresses for many subdivisions was made by adding a "0"(even) or a "1"(odd) to the previous 3-digits address, occasionally intercalating new houses with addresses with other digits.

higher frequency (t-stat: -6.4) in more Chinese CTs may be due to a greater conversion of addresses ending with "4" in these neighborhoods. The means of the transaction prices and house characteristics for the entire sample, as well as for CTs with a proportion of ethnic Chinese residents below and above the city's average separately, are reported in Appendix Table A1. The numbers show that, on average, homes in the more Chinese neighborhoods are larger and almost twice as likely to include a basement suite –possibly due to multi-generational households –and are sold at a transaction price higher $100,000 greater than homes in other neighborhoods.

II. Empirical Analysis

Our more complete empirical specification subsumes the classic hedonic price regression on the logarithm of transaction price of observation *i* on street *s* in CT *c* at time *t*,

$$\ln(P_{isct}) = \beta_0 + \beta_4 L4_{isct} + \beta_8 L8_{isct} + \boldsymbol{H}'_{isct}\boldsymbol{\alpha}_H + \boldsymbol{D}'_t\boldsymbol{\alpha}_t + \boldsymbol{D}'_s\boldsymbol{\alpha}_s + \boldsymbol{D}'_c\boldsymbol{\alpha}_c + \delta_e E_c + \delta_{4e} E_c * L4_{isct} + \delta_{8e} E_c * L8_{isct} + \varepsilon_{isct}, \quad (1)$$

where $L4_{isct}$ and $L8_{isct}$ denote a house address number ending with a four or an eight, respectively, $\boldsymbol{H}'_{isct}$ is a vector of house characteristics, and $\boldsymbol{D}'_t$, $\boldsymbol{D}'_s$ and $\boldsymbol{D}'_c$ are vectors of month-year, street, and CT dummies to control for time and location effects. The *Chineseness* of the census tract is identified with the variable E_c. The parameters β_4 and β_8 thus capture the base effect (in the non-Chinese neighborhoods) on log transaction price of a house street address ending with the fateful numbers, and the parameters δ_4 and δ_8 capture the added effect of the fateful numbers in Chinese neighborhoods.

We begin in Table 1 by establishing the distinctiveness of the numbers "4" and "8" by regressing the last digit of the house address on log transaction price, controlling for house characteristics and including 52 month-year dummies. Columns (1) and (2), respectively omitting the numbers "4" and "8", show that the effect of the other digits are all statistically different from the omitted category (F-statistic= 29.83), positive in the first case and negative in the second case. We note that none of the other digits have this property.[19] Column (3) shows that without location controls, the negative price effect of a house number ending in four $\hat{\beta}_4$ is about 3.1%, and the positive price effect of a house number ending in eight $\hat{\beta}_8$ is about 3.4% in comparison to house numbers ending in any other digit. The parameter estimates of the other

[19] For each other last digit, the effect of at least one other last digit is not statistically distinguishable. For example, the effects of "0" and "5", "2" and "7" and all of "1", "3", "6" and "9" are not statistically different.

housing characteristics are reported in Appendix Table A2; they show for example that the effect of the lucky and unlucky addresses is comparable in magnitude to the effect of the house possessing a basement suite, an amenity which delivers tangible housing services.[20]

In Table 2, we add our extensive set of locational controls, the street (6100 dummies) and CT fixed effects (363 dummies), respectively thought to capture location attributes, such as views or commercial streets, and neighborhoods amenities, such as school quality, proximity to rapid transit, or ethnic mix.[21] In accordance to the "location, location, location" precept of real estate the introduction of these controls increases the adjusted R^2 from 0.44 to 0.76. Column (1) shows that the effects of fateful numbers are almost entirely absorbed by our location controls. As anticipated, there are some locations where the fateful numbers have an impact and others where they do not. In Columns (2) and (3), we unbundle the effects of location controls by singling out the effect of Chinese ethnicity. In Column (2), Chinese ethnicity, $E_c = \mathbb{I}[A_c > 0.18]$, is measured using a dummy indicating an above average percentage (greater than 18%) of Chinese residents in the CT. The values of $\hat{\delta}_4$ and $\hat{\delta}_8$ indicate a 2.1% discount and a 2.5% premium arising from the fateful numbers in CTs with above average Chinese ethnicity. In Column (3), we exclude within-sample repeated sales and see the magnitude of premium and discount increases somewhat but not significantly, reflecting the fact that some repeated sales may be used as arbitrage opportunities.[22] In either case, the size of the effects is consistent with the predictions of Proposition 2, which predicts a slightly larger premium associate with the last "8" than the discount associated with the last "4" and also predicts that the size of the effects should be roughly equal to half of the real estate agents' commissions, since no arbitrage opportunities remain at that level. Moreover, in both Columns (2) and (3), the effects of the fateful numbers in non-Chinese neighborhoods, $\hat{\beta}_4$ and $\hat{\beta}_8$, go to zero, showing the effects of the fateful numbers originate from CTs with substantial proportions of residents potentially holding Chinese superstitious beliefs.

In Figure 4, we present a test of Proposition 1. We display the values of $\hat{\delta}_4$ and $\hat{\delta}_8$ as the proportion of ethnic Chinese residents a that turns the dummy $E_c = \mathbb{I}[A_c > a]$, is gradually

[20] While some basement suites are used as nanny or guest suites, some are actually rented out.
[21] For street fixed effects, we actually use the STATA command "areg" which absorbs the effects of 6,100 streets.
[22] More precisely, column (3) excludes the second, third, and higher transactions on the same property roll-number. When we also exclude the first transaction on these properties, the values of $\hat{\delta}_4$ and $\hat{\delta}_8$ are -0.025 (0.007) and 0.024 (0.005), respectively.

increased from zero to one. For the last "8", it shows that $\hat{\delta}_8$ starts at zero in non-Chinese neighborhoods and becomes positive and significant quite sharply as the proportion of ethnic Chinese residents begins to exceed the availability of these addresses (about 11%), reaching 2% when a attains 0.12. Also as predicted by Proposition 1, as the proportion of ethnic Chinese residents grows, the point estimates for $\hat{\delta}_8$ remains relatively stable between 2% and 3%. For the last "4", the point estimates for the penalty hover around 2% as the proportion of ethnic Chinese residents increases, but they become non-significant as very few transactions of houses with addresses ending with the "death"-ridden number "4" are actually observed. The attrition of house ending with last "4" is also subject to institutional constraints as mentioned above.

We conducted additional tests of alternative placement of the fateful digits and found these effects to be dominated by the last digit effects. We report in Table 3 the results of tests for two other salient combinations of digits. The effects of house address numbers ending with the two-digit combination "88", which resembles "double joy" or "happiness", and is sought after by real estate agents who cater to buyers from mainland China, and the two-digit combination "13", thought to be unlucky in the Western tradition. The results from specifications corresponding to Column (3) of Table 1, first show that including these additional fateful combinations yield a statistically significant positive effect of 6.1% for the numbers ending in "88", and a negative effect of 2.8% for the numbers ending in "13" in columns (1) and (3) of Table 3. Second, these additions does not change the effects of the last "4" or the last "8" found Column (3) of Table 1 and Column (2) of Table 2, the latter remaining at 2.1-2.2% for the discount and 2.4-2.5% for the premium. Third, we were unable to trace these added effects to the Chinese ethnicity, meaning that the corresponding parameters $\hat{\delta}_{88}$ and $\hat{\delta}_{13}$ were not statistically significant from zero. In the first case, we speculate that for Chinese buyers the desirability of the number "88" may outweigh the desirability of living in a neighborhood with an above average proportion of ethnic Chinese residents. In the second case, the fact that the unluckiness of the numbers ending in "13" did not get any traction in Chinese neighborhoods is consistent with the view that this number is not considered unlucky in the Chinese tradition.

In Table 4, we pursue our investigation of the diffusion of Chinese number preferences outside Chinese neighborhoods. Here we hypothesized that the cultural number preferences have first become well-known outside of the Chinese community among agents involved in speculative house buying and selling behavior. Given a 10 to 15 years median homeowner

survival rate (Quigley, 2002; Emrath, 2009), our five years time horizon is relatively short in terms of housing tenure, thus it is not unreasonable to assume that a sizeable portion of the repeat sales that we observed involve speculative behavior.[23] We capture this potential phenomenon by first introducing dummies for repeat sales and its interaction with last 4 and last 8, in column (1) of Table 4. The estimates indicate an average potential capital gain of 11% over the period we study, reduced by 3.5% for home addresses ending in "4", but bettered by 2% for home addresses ending with a "8". What is interesting is that this effect is found across Chinese and non-Chinese neighborhoods indicating that the Chinese cultural cues are exploited in repeated sales across the Greater Vancouver area. In column (2) of Table 4, we re-introduced our interactions variables with the ethnicity of neighborhoods. Here we discover the price effects in interactions with repeated sales or with Chinese neighborhoods, but not in both. The triple interaction with repeat sales and Chinese neighborhoods actually undoes one of the double interactions, consistent with the exercise of arbitrage opportunities, albeit limited by transaction costs. In Table 2, we had found no general prices effects of the superstitious Chinese numbers outside of Chinese neighborhoods, but in Table 4, they re-emerge in repeated sales arguably as a manifestation of speculative behavior. Considering Liu and Wong (2012)'s conjecture about differentials price effects arising either from own superstitious beliefs or from of the superstitious beliefs of others, it is interesting that we find that the effects arising from own beliefs (in Chinese neighborhoods) and from the beliefs of others (in repeated sales outside of Chinese neighborhoods) are of roughly the same magnitude. But then it is not surprising given that Proposition 2 argues that the size of the effects is limited by transaction costs.

Finally, although we found reliable price effects of the superstitious Chinese numbers, we are unsure about the psychological foundation of the effects. Some buyers of fateful house numbers may believe in the "magic" or fear the "doom" of the numbers. In the license plate market, auspicious and inauspicious outcomes might be measured by the frequency of car crashes.[24] In terms of labor market outcomes, Wong and Yung (2005) have investigated whether individuals born on Dragon years have higher labor market earnings using Hong Kong census

[23] The numbers of homeownership mobility were computed using U.S. data from the Panel Study of Income Dynamics (PSID) in Quigley (2002) and from the American Community Survey (ACS) in Emrath (2009).
[24] The China Global Times reported on October 20, 2010, that the Beijing Traffic Management Bureau had stopped issuing license plates that contain the number four. It is not known whether this was the result of simple superstitions or of an impact analysis of the license plate numbers on car accidents, but the later might have been feasible.

data and found inconclusive evidence. In medicine, Phillips *et al.* (2001) found that for Chinese Americans and Japanese Americans, the peak of mortality among chronic cardiac patients occurs on the 4th of the month, a striking pattern not found among White Americans. But one could argue that this pattern is the result of harvesting, rather enhanced mortality. In the housing market, it is not clear that there are such fateful outcomes; fires or burglaries would be not frequent enough to serve as such a measure.

But we can provide some limited tests of whether some buyers seek the lucky numbers for associated Veblen or status effects by investigating differential effects across the transaction sales distribution. We estimate the effects of the last "4" and last "8" across the distribution of transaction sales by estimating unconditional quantile regressions (UQR) (Firpo, Fortin, and Lemieux, 2009).[25] The UQR regressions include the same set of covariates as previous regressions, importantly the street and CT fixed effects. In Table 4, we report estimates similar to those reported in column1 of Table 2 for the mean, here for very bottom (5^{th} percentile), the median, and for the top (85^{th} percentile) of the transaction sales distribution. Consider the death-ridden number "4", going across columns (3) to (5) on the second row of Table 4 shows, we find a U-shaped effect with a somewhat larger point estimate at the lower end, although none of the differences in the penalties across the distribution are statistically significant. Is there a more important "fear of doom" effect among buyers of lower priced homes? As indicated above, we do not know the education or income level of the buyers, but if they were correlated with the home price, we could argued that lower educated buyers are more likely superstitious in the "fear" domain (loss aversion) than in the "luck" domain.[26]

Consider now the "wealth"-laden "8" , going across columns (3) to (5) on the third row of Table 4 shows, we find a U-shaped effect with a point estimate more twice as large at the top end than at the lower end. Figure 4 further illustrates these effects at each fifth percentile of the transaction sales distribution, and compare then to the OLS results of Table 2.[27] The UQR estimates of the last "8" in substantially Chinese neighbourhoods are not statistically different from the OLS results in the middle of the distribution, from the 45^{th} to the 75^{th} percentiles, and in

[25] To the extent that higher priced "prestige" properties are the ones likely to generate Veblen effects, we want to look across the distribution of transaction sales, rather than across the distribution of residuals from the hedonic function of transaction sales, which would correspond to the conditional quantile regression estimates.
[26] We have conducted some tests using the average education level or average income level in the census tract, but the CT average education or income levels turned out to be too remote to give any significant results.
[27] We do not illustrate similar results for last "4" because of limited statistical significance, reported in Table 4. This is due to the reduced number of transaction sales of homes with addresses ending in "4" as shown in Figure 3.

the tails of distribution where the confidence bands widen. In the upper tail, we start to find larger effects, statistically different from the OLS at the 75th percentile. At the 85th percentile, the point estimate is 0.087 (0.014) more than twice as large as the average premium.[28] We argue that these larger effects at the top of the distribution of transaction prices likely arise from Veblen or status effects, where buyers may gain bragging rights or favorable treatment from family, friends, and clients. We reconcile the larger size of these effects with the predictions of Proposition 2, where arbitrage opportunities are set to drive down the premium for the lucky addresses, by arguing that these opportunities are likely more scare or more risky in the top tiers of the market. Further the mortgage bridging cost associated with holding higher priced properties (in the CAD$5,000,000 plus range at the 85th percentile) in between buying and selling may pose some cash flow issues for speculators.

IV. Conclusion

In this paper, we have shown that in the presence of sizeable transaction costs, superstitious beliefs associated with fateful Chinese numbers can sustain statistically and quantitatively significant effects on house prices, in a North American residential market with a substantial ethnic Chinese presence. Given a mean nominal house price of about CAD$400,000 over the sample period, we have found that in neighborhoods where the percentage of ethnic Chinese residents exceeds the average of 18%, houses with address numbers ending with the "death"-ridden "4" are sold at a $8,000 discount and those ending with the "wealth"-laden "8" are sold with a $10,000 premium in comparison to houses with address numbers ending in any other digit. Price effects of a similar size have been found outside of these Chinese neighborhoods, but only for repeated sales consistent speculative behavior. These results highlight the role of high transaction costs in limiting the efficiency of the real estate market. At the top end of the market, where the exercise of arbitrage opportunities is likely more risky, we have found even larger premium for lucky addresses.

To what extent could these results be reproduced in other North American housing markets? There are many cities in the San Gabriel Valley near Los Angeles where there is sizeable enough minority American Chinese residents for these types of effects to emerge. There

[28] In the extreme upper tail, however the smaller number of observations entails larger standard errors, the difference in no longer statistically different.

is wider interest in the use of "Feng Shui" in many upscale U.S. housing markets. On the other hand, there may be some stigma associated with superstitious beliefs which prevent real estate agents from overtly exploiting these beliefs. Further, our findings have raised the interest of the popular press in Canada and in the United States, thus likely more non-superstitious sellers will act as informed agents in markets with a significant Chinese presence.[29] Thus how widespread these effects are and how long they can be expected to persist after the arrival of the new immigrants remains an open question.

Finally, our results also speak to the impact of immigrants' cultural beliefs on their integration into the host country. Popular anti-immigrant sentiments often emerge not only when natives feel threatened in their economic position (Mayda, 2006), but perhaps as importantly when their cultural values are threatened by newcomers (Dustmann and Preston, 2007). Our analysis goes beyond the anecdotal evidence documenting the relatively benign elimination of the number "4" in the elevators of many new residential towers in Vancouver and investigates the price effects of culturally driven beliefs. Clearly, for many long time residents of Greater Vancouver living at an address ending with a "4", it is unwelcome news that because of the recent influx of Chinese immigrants their homes are now likely to be sold for 2% less than homes with neutral addresses. For them, the price of welcoming other cultures and their superstitious beliefs is steep. At the same time, of course, a longtime resident living at an address ending in an "8" is likely to be much more welcoming.

[29] See among others, The Wall Street Journal (Nov 9, 2012) , the Globe and Mail (Nov 26, 2010), and the Vancouver Sun (Nov 25, 2010).

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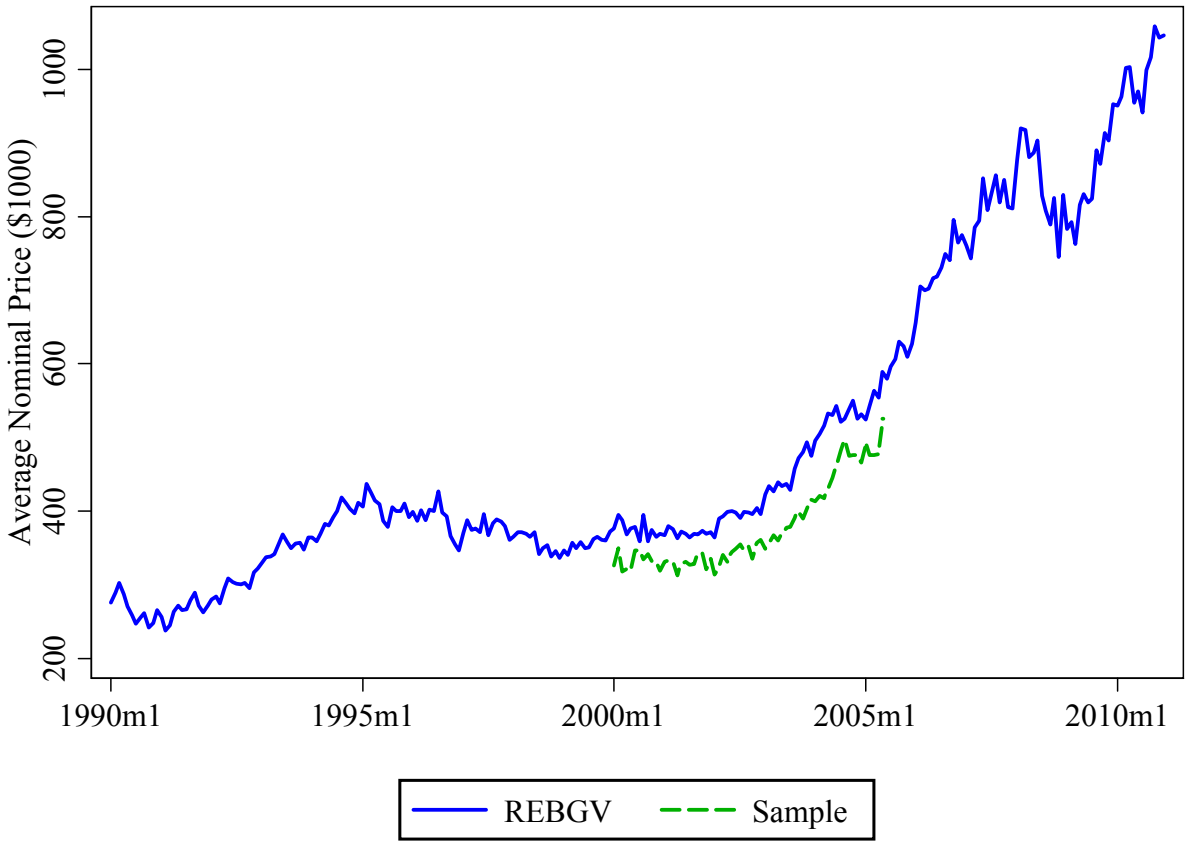
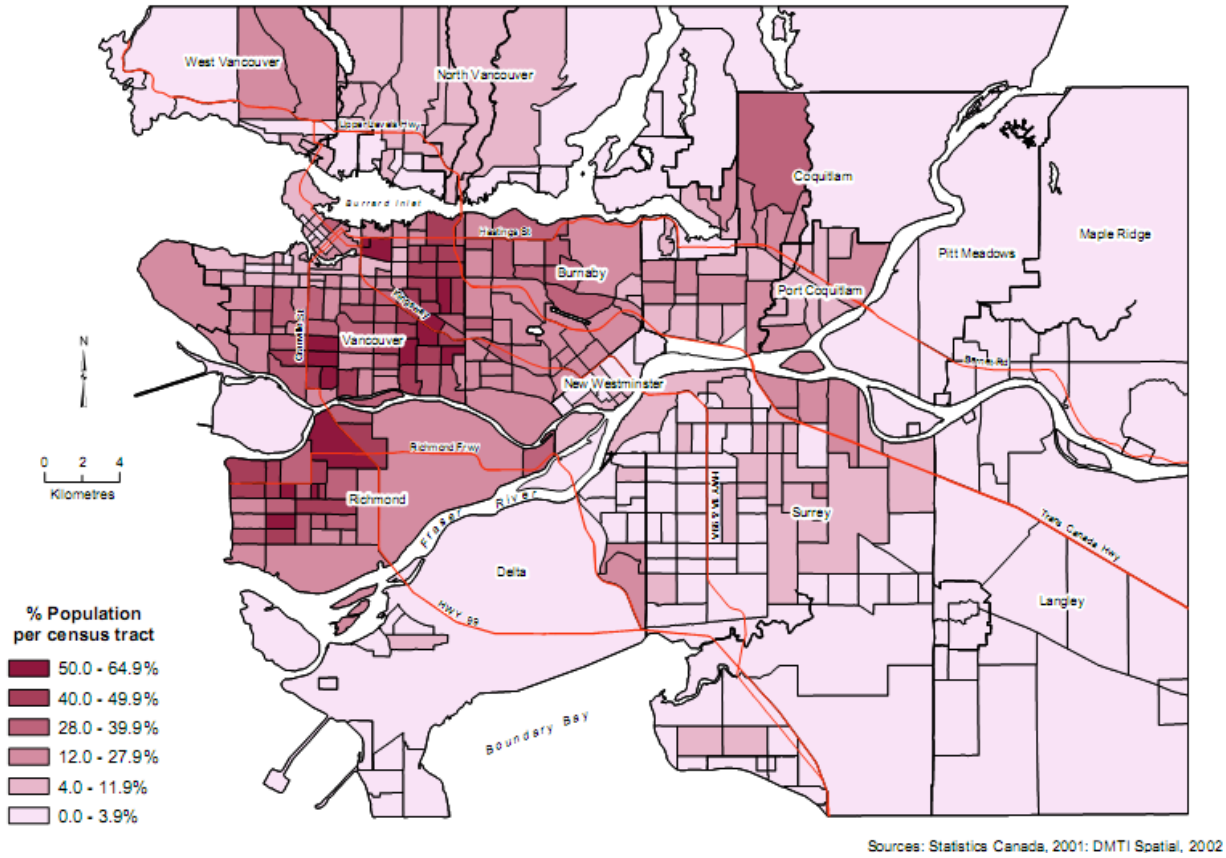
Figure 1 – Average Nominal Price of Detached Homes in the Greater Vancouver Area



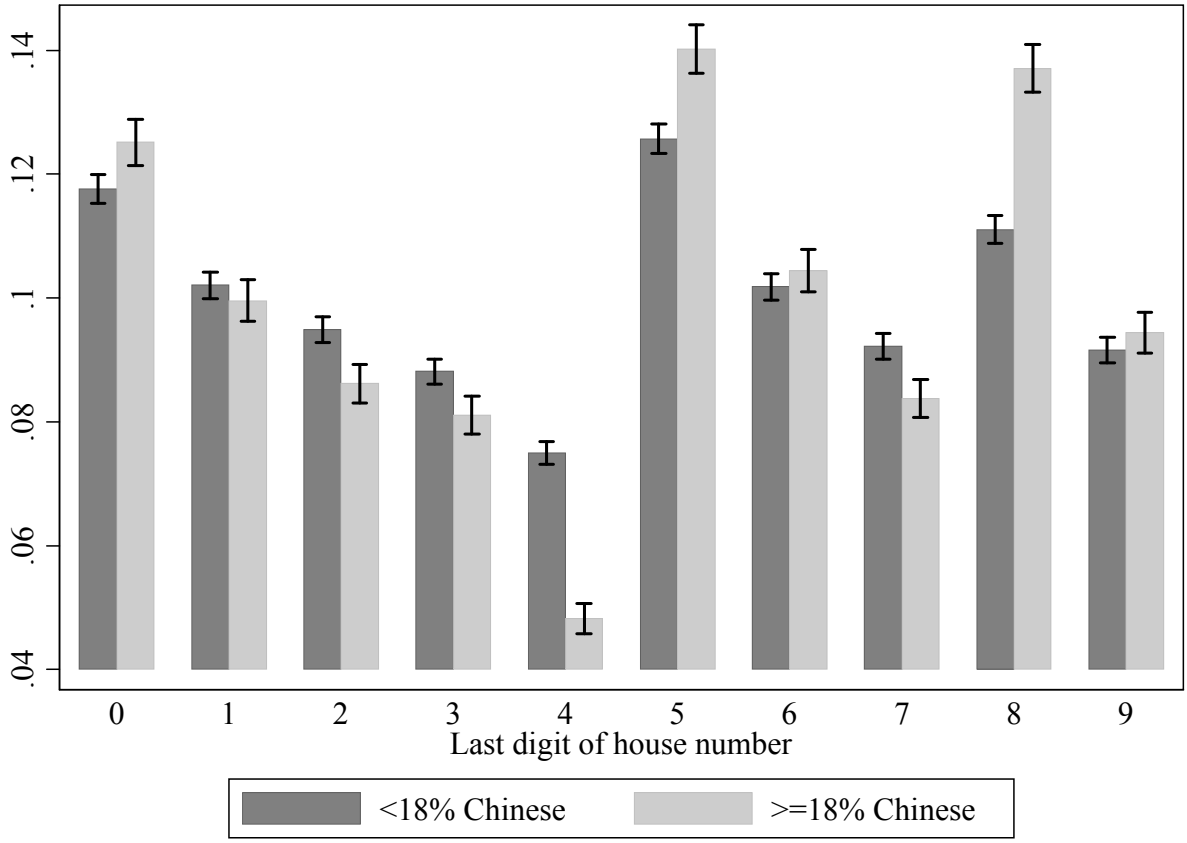
Source: REBGV is the average price data are from the Real Estate Board of Greater Vancouver.

Figure 2 – Percentage of Ethnic Chinese (Single Ethnic Origin) by Census Tract (2001)



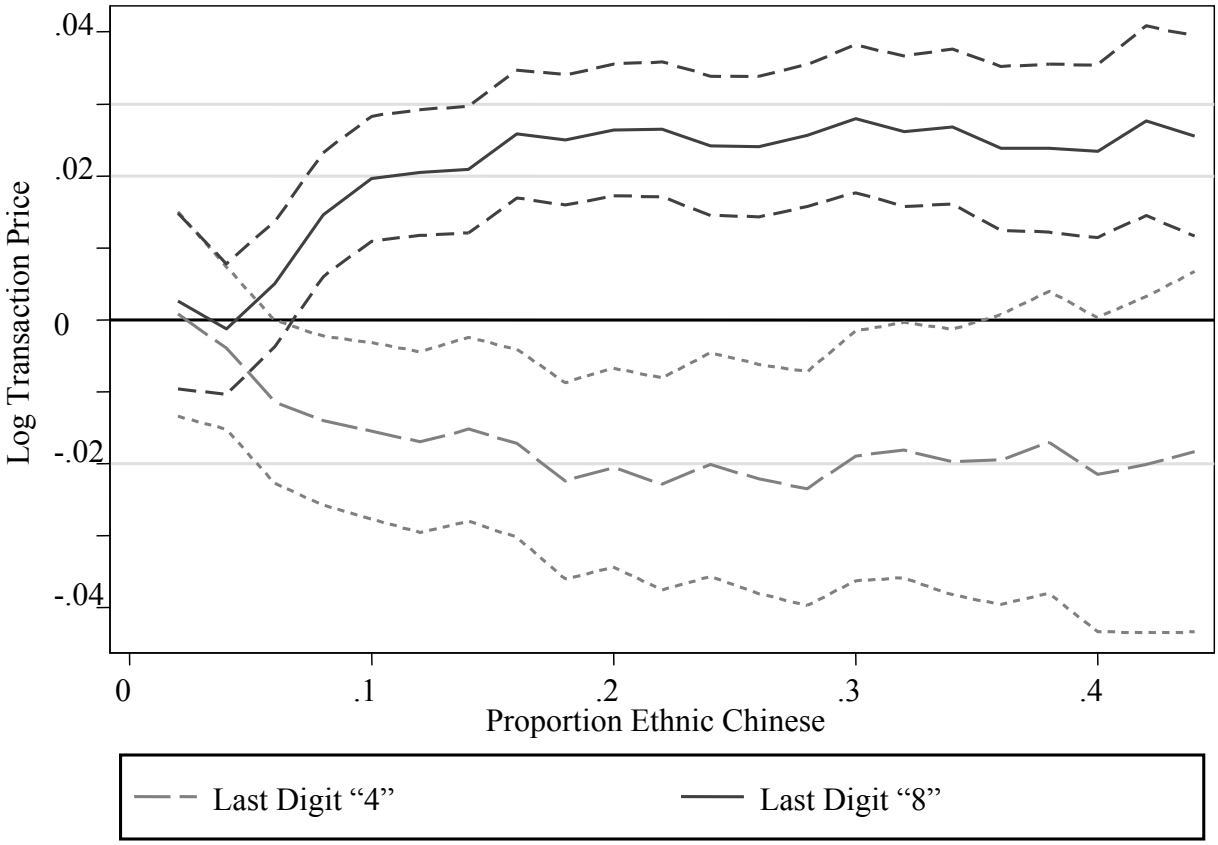
Sources: Statistics Canada, 2001; DMTI Spatial, 2002

Figure 3 – Proportion of House Addresses with Indicated Last Digits
by the Proportion of Ethnic Chinese Residents in the Census Tract



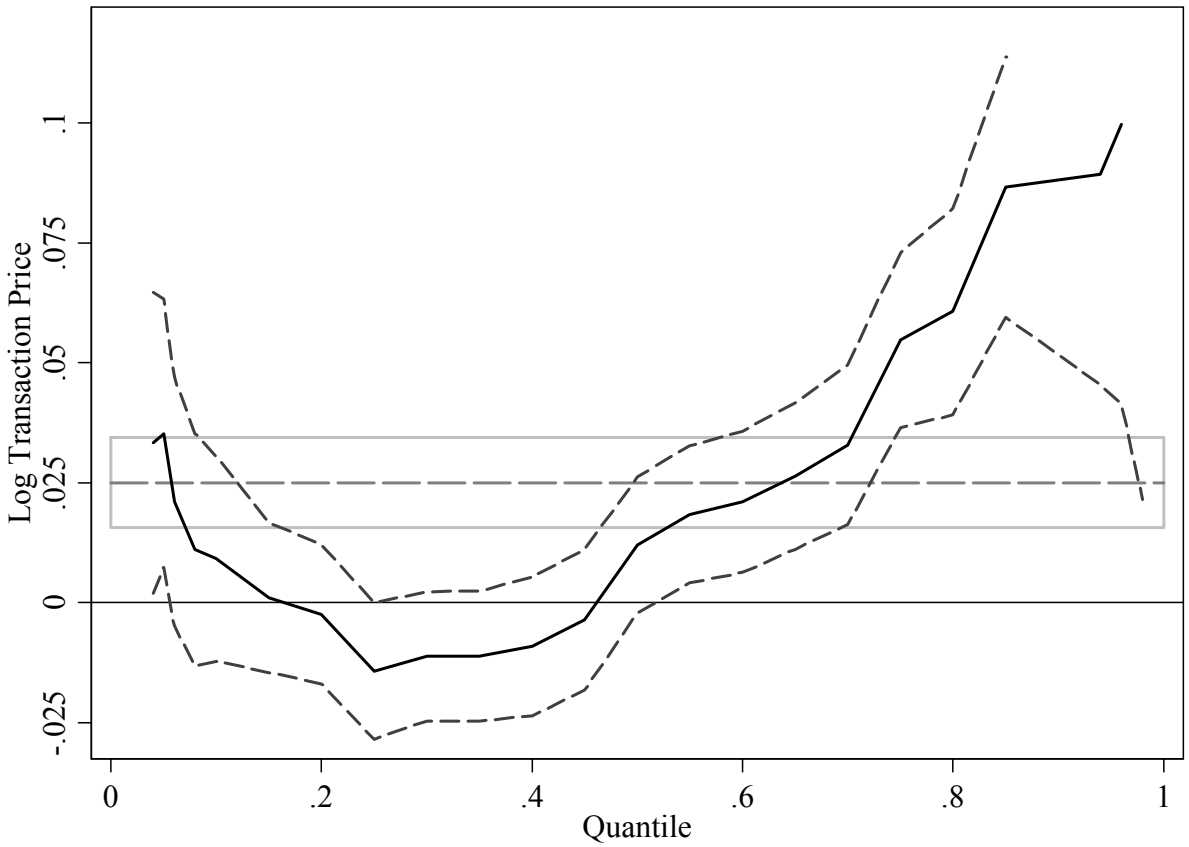
Note: For reasons explained in the text, this figure excludes data from the suburban city of Richmond. The whiskers correspond to the 95% confidence intervals on the proportions.

Figure 4. OLS Price Effects of Last Digit "4" and Last Digit "8"
By the Proportion of Ethnic Chinese Residents in the Census Tract



Note: The dashed and short-dashed lines trace to the 95% confidence intervals of the point estimates.

Figure 5. Unconditional Quantile Partial Effects of Last Digit "8" Interacted with Above Average Chinese Concentration by the Percentile of Transaction Sale Price



Note: The solid black line traces the UQR point estimates; the dashed dark lines are its corresponding 95% bootstrapped confidence intervals. The OLS estimates and its 95% confidence intervals are shown in lighter grey solid and dash lines.

Table 1. Distinctiveness of "8" and "4" in the Effect of House Address Number on Log Transaction Price

	(1)	(2)	(3)
Last digit = 0	0.045***	-0.020***	
	(0.005)	(0.004)	
Last digit = 1	0.027***	-0.037***	
	(0.005)	(0.004)	
Last digit = 2	0.019***	-0.046***	
	(0.005)	(0.004)	
Last digit = 3	0.026***	-0.038***	
	(0.005)	(0.005)	
Last digit = 4		-0.065***	-0.031***
		(0.005)	(0.004)
Last digit = 5	0.043***	-0.022***	
	(0.005)	(0.004)	
Last digit = 6	0.024***	-0.040***	
	(0.005)	(0.004)	
Last digit = 7	0.017***	-0.048***	
	(0.005)	(0.005)	
Last digit = 8	0.065***		0.034***
	(0.005)		(0.003)
Last digit = 9	0.030***	-0.035***	
	(0.005)	(0.004)	
Adj. R-squared	0.444	0.444	0.443

Note: The dependent variable is the natural logarithm of house transaction price. Standard errors are in parentheses. Asterisks indicate the level of statistical significance: *** $p<0.01$, ** $p<0.05$, * $p<0.10$. All regressions include year-month dummies and the following house characteristics: lot size, finished floor area, finished basement area and total basement area (all in 1000 sq ft), house age (10 years), house age squared (100 years) , number of full bathrooms, of half bathrooms, of single car garages, of multi-car garages, of stories, dummies for basement suite and pool. There are 116,939 observations.

Table 2. Impact of Chinese Ethnicity on the Effect of a House Address Number Ending with a "4" or a "8" on Log Transaction Price

	(1)	(2)	(3)
Sample	Full		Excluding Repeated Sales
Ethnicity Control	None	Dummy above average in CT	Dummy above average in CT
Chinese dummy		-0.022***	-0.028***
* Last digit = 4		(0.007)	(0.007)
Chinese dummy		0.025***	0.031***
* Last digit = 8		(0.005)	(0.005)
Chinese dummy		0.616	0.631
		(0.386)	(0.390)
Last digit = 4[a]	-0.002	0.002	0.006
	(0.003)	(0.003)	(0.003)
Last digit = 8[b]	0.008***	-0.001	-0.002
	(0.002)	(0.003)	(0.003)
Census Tract Dummies	Yes	Yes	Yes
Street Fixed Effects	Yes	Yes	Yes
Adj. R-squared	0.756	0.756	0.77
No. of observations	116,939	116,939	94,769

Note: The dependent variable is the natural logarithm of house transaction price. Standard errors are in parentheses. Asterisks indicate the level of statistical significance: *** p<0.01, ** p<0.05, * p<0.10. All regressions include year-month dummies and the same house characteristics as Table 1.

[a] There are 7,262 (6,035) sales of houses ending with "4" in the full (non-repeat) sample.

[b] There are 13,093 (10,466) sales of houses ending with "8"in the full (non-repeat) sample.

Table 3. Impact of Chinese Ethnicity on the Effect of Other Digit Combinations in Address Number on Log Transaction Price

	(1)	(2)	(3)	(4)
Ethnicity Control	None	Dummy above average in CT	None	Dummy above average in CT
Chinese dummy		-0.022***		-0.021***
* Last digit = 4		(0.007)		(0.007)
Chinese dummy		0.024***		0.025***
* Last digit = 8		(0.005)		(0.005)
Chinese dummy		0.008		
* Last two digits=88[a]		(0.013)		
Chinese dummy				0.026
* Last two digits=13[b]				(0.021)
Chinese dummy		0.210		0.210
		(0.340)		(0.340)
Last digit = 4	-0.031***	0.002	-0.031***	0.002
	(0.004)	(0.003)	(0.004)	(0.003)
Last digit = 8	0.026***	-0.002	0.033***	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Last two digits=88	0.061***	0.006		
	(0.009)	(0.008)		
Last two digits=13			-0.028**	-0.001
			(0.013)	(0.010)
Census Tract Dummies	No	Yes	No	Yes
Street Fixed Effects	No	Yes	No	Yes
Adj. R-squared	0.444	0.756	0.443	0.756

Note: The dependent variable is the natural logarithm of house transaction price. Standard errors are in parentheses. Asterisks indicate the level of statistical significance: *** p<0.01, ** p<0.05, * p<0.10. All regressions include year-month dummies and the same house characteristics as Table 1. There are 116,939 observations.

[a] There 1670 sales of houses ending with "88" .

[b] There 658 sales of houses ending with "13".

Table 4. Speculative Demand and Wealth Considerations in the Effect of a House Address Number Ending with a "4" or a "8" on Log Transaction Price

	(1)	(2)	(3)	(4)	(5)
	OLS		Unconditional Quantile Regression		
Percentile			5	50	85
Chinese dummy		-0.029***	-0.048***	-0.021*	-0.040**
* Last digit = 4		(0.007)	(0.016)	(0.011)	(0.018)
Chinese dummy		0.031***	0.035**	0.012*	0.087***
* Last digit = 8		(0.005)	(0.014)	(0.007)	(0.025)
Chinese dummy		0.596	2.833***	-0.363	-0.254
		(0.381)	(0.331)	(0.258	(0.197)
Last digit = 4	0.006*	0.012***	0.027**	-0.002	0.003
	(0.003)	(0.003)	(0.013)	(0.005)	(0.007)
Last digit = 8	0.004	-0.007**	-0.018	-0.001	-0.007
	(0.002)	(0.003)	(0.013)	(0.004)	(0.006)
Repeat Sale	0.108***	0.115***			
	(0.002)	(0.003)			
Repeat Sale	-0.035***	-0.045***			
* Last digit = 4	(0.007)	(0.008)			
Repeat Sale	0.020***	0.028***			
* Last digit = 8	(0.005)	(0.006)			
Repeat Sale		-0.045***			
* Chinese dummy		(0.011)			
Repeat * Chinese		0.034*			
* Last digit = 4		(0.018)			
Repeat * Chinese		-0.025**			
* Last digit = 8		(0.011)			
Census Tract Dummies	Yes	Yes	Yes	Yes	Yes
Street Fixed Effects	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.765	0.757	0.179	0.535	0.503

Note: The dependent variable is the natural logarithm of house transaction price on 116,939 observations. Standard errors are in parentheses. Asterisks indicate the level of statistical significance: *** p<0.01, ** p<0.05, * p<0.10. Chinese dummy is CT with above average ethnic chinese. Repeat sale dummy indicates second and higher transaction on the same property. All regressions include year-month dummies and the same house characteristics as Table 1.

Appendix Table A1. Descriptive Statistics

Sample Split by Chinese Ethnicity	All CTs		CT with less or average		CT with above average	
Housing variables	Means	Standard Errors	Means	Standard Errors	Means	Standard Errors
Transaction price	376,999.40	722.496	340,366.50	787.911	447,392.20	1405.388
Finished floor area (sq ft)	2,407.71	2.980	2,342.41	3.420	2,533.20	5.656
Lot size (1000 sq ft)	809.50	6.277	1,226.55	9.189	810.29	3.828
Finished basement area (sq ft)	584.28	1.615	555.45	0.002	639.68	2.681
Basement area (sq ft)	886.35	1.850	876.86	2.328	904.58	3.033
House age	25.29	0.066	23.21	0.007	29.30	0.013
Number of bedrooms	3.987	0.004	3.845	0.004	4.262	0.007
Number of full bathrooms	2.213	0.003	2.119	0.004	2.392	0.007
Number of half bathrooms	0.598	0.002	0.622	0.002	0.551	0.003
Number of single car garages	0.182	0.001	0.166	0.001	0.198	0.002
Number of multi car garages	0.569	0.001	0.573	0.002	0.587	0.003
Number of stories	1.434	0.001	1.416	0.002	1.455	0.002
Basement suite (dummy)	0.175	0.001	0.134	0.001	0.253	0.002
Swimming Pool (dummy)	0.033	0.001	0.034	0.001	0.033	0.001
No. of observations	116939		76913		40026	

Appendix Table A2. Effects of Housing Characteristics on Log Transaction Price

Specification	Table 1, Col. (3)	Table 2, Col. (1)	Table 2, Col. (2)
Finished floor area (1000 sq ft)	0.2383	0.1625	0.1626
	(0.0022)	(0.0018)	(0.0018)
Lot size (1000 sq ft)	-0.0266	-0.0028	-0.0029
	(0.0005)	(0.0015)	(0.0015)
Number of full bathrooms	0.0532	0.0051	0.0051
	(0.0015)	(0.0011)	(0.0011)
Number of half bathrooms	0.0562	0.0194	0.0194
	(0.0021)	(0.0015)	(0.0015)
Number of multi car garages	0.1221	0.0846	0.0846
	(0.0029)	(0.0022)	(0.0022)
Number of single car garages	0.0156	0.0078	0.0079
	(0.0029)	(0.0021)	(0.0021)
Number of stories	0.0323	-0.0162	-0.0163
	(0.0036)	(0.0028)	(0.0028)
House age (10 years)	0.1458	0.0587	0.0587
	(0.0018)	(0.0015)	(0.0015)
House age squared (100 years)	-0.0093	-0.0072	-0.0072
	(0.0002)	(0.0002)	(0.0002)
Basement suite (dummy)	0.0242	0.0333	0.0334
	(0.003)	(0.0023)	(0.0023)
Basement area (sq ft)	0.0675	0.0482	0.0483
	(0.0026)	(0.002)	(0.002)
Finished basement area (sq ft)	-0.1979	-0.1438	-0.1440
	(0.0037)	(0.0028)	(0.0028)
Swmming Pool (dummy)	0.1407	0.0779	0.0779
	(0.0058)	(0.0042)	(0.0041)
Constant	11.9764	12.4876	12.1256
	(0.0193)	(0.2589)	(0.2978)
Year-Month Dummies	Yes	Yes	Yes
Census Tract Fixed Effects	No	Yes	Yes
Street Fixed Effects	No	Yes	Yes
Observations	116939	116939	116939
Adj. R-squared	0.443	0.757	0.757

Note: The dependent variable is the natural logarithm of house transaction price. Standard errors are in parentheses.