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Residential Stability or Rational Bubble: Proposition 13 in Southern California

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California's Proposition 13, which limits the growth of property tax to 2 percent per year, provides homeowners an incentive to remain in their housing units and thus contributes to residential stability. Yet, with fast home price appreciation, new home buyers may purchase a home and then sell it again within a short period of time. Even though they incur transaction costs, they can gain by the appreciation. Under Proposition 13, faced with a disproportionately large property tax relative to those homeowners who purchased their homes a long time ago at a much lower price, the new homebuyers have an additional incentive to trade homes fast in an up market to avoid paying a high property tax. We call this short term residential trading 'Proposition 13 risk arbitrage' and predict that Proposition 13 induces additional short-term residential trading, which adds to the underlying residential market speculation. Cross-sectional variations of the residential holding periods over the 1993 to 2001 period in the five counties of Southern California are generally consistent with the predictions based on Proposition 13 induced trading: Households which face a higher property tax per square foot and those that experience larger capital gains show a shorter holding period. We also explain the time variation of the aggregate residential holding period using the Proposition 13 risk arbitrage argument.

Keywords

Proposition 13; property tax; residential holding period decision; residential stability; risk arbitrage; Proposition 13 risk arbitrage

Introduction

Proposition 13, officially titled the "People's Initiative to Limit Property Taxation," was a ballot initiative enacted by voters of California in 1978.[1] Under Proposition 13, the real estate tax on property is limited to 1% of its purchase price, with maximum increases of 2% allowed in the assessed value per year. Property value is reassessed when additions or new construction occurs. Proposition 13 has greatly benefited homeowners whose homes have appreciated in value since it was passed, simply because real estate taxes for those who remain in their homes do not increase along with the market value of their homes.

It is thus not only obvious, but there is substantial evidence that Proposition 13 provides homeowners an incentive to stay in the same housing units. For example, Stohs et al. (2001) derive the value of the tax cap embedded in Proposition 13, clearly documenting the benefit of staying in the same home. They also provide evidence, through a comparison of California with Illinois and Massachusetts real estate transactions, that Proposition 13 may have led to a greater residential stability observed in California. In this respect, Proposition 13 in California may serve as a fiscal tool for enhancing residential stability.

But Proposition 13 also affects the apparent fairness of the distribution of taxes, in that it effectively forces new home owners to provide a property tax subsidy for existing home owners, thus creating incentives for incoming buyers to churn residential properties in an up market with the intention of staying ahead of the "tax bite."[2] This churning contributes to residential housing market speculation. Furthermore, if incumbent homeowners at the margin decide to sell their houses and move up into bigger houses, they become de novo home buyers facing the same incentives to become Proposition 13 induced churners.

With fast home price appreciation, new home buyers may purchase a home and then sell it again within months. Even though they incur transaction costs, they can gain by the appreciation. This type of short trading will go on in any residential market with or without Proposition 13. Noting also that this type of short-term residential trading is similar to the merger risk arbitrage (where an investor or an arbitrageur takes a long position in the stock of the target firm expecting that the deal will be closed and the stock price of the target firm will rise to the bid price), we label this short-term residential trading a 'residential risk arbitrage'. This type of arbitrage is

[1] When Proposition 13 was passed, it became article 13A of the California state constitution.

[2] The apparent unfairness of Proposition 13 is the main focus of its opponents. An internet search will result in many relevant citations/articles. We do not address this issue herein.

risky simply because there is a small risk that price will drop rather than continue to appreciate.

Under Proposition 13, faced with a disproportionately large property tax relative to those homeowners who purchased their homes long time ago at a much lower price, the new homebuyers have an additional incentive to trade homes fast in an up market to avoid paying a unfairly high property tax. We label this trading activity 'Proposition 13 risk arbitrage'. Therefore, over and above the usual residential market speculation, which has been discussed in a number of studies (e.g. Fernandez-Kranz and Hon, 2006; Jirasakuldesh et al., 2006), Proposition 13 may induce additional short-term residential trading. The bubble it induces in the residential market can be considered rational because the underlying demand pressure on housing prices is based on a rational cost benefit analysis.

We investigate the time series and cross-sectional variations of the Southern California residential holding period, which is measured by the number of years that people remained in their residences, conditioned on the fact that they have sold those residences. Analyzing Southern California is important because the churning predicted by the Proposition 13 risk arbitrage argument will be more severe in a market expected to rise in value due to an economic fundamental such as a supply shortage. Southern California is widely known to be a market where the housing demand caused by the influx of new residents exceeds the supply of new housing units leading to a perpetual housing shortage. Analyzing Southern California is important also in part because it includes 14,384,280 million people living in Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties in 1990, with over 1.5 million recorded sales of housing units (of which 679,691 are used in the analysis) from 1993 to 2001 for LA and Ventura and from 1997 to 2001 for the other counties and with a combined total of 2,499 Census Tracts.

Residents who sell their homes remained in them for an average of 6.17 years, with a median of 4.33 years. The median residential holding period of sold homes ranges from 2.57 years in Riverside County to 6.79 years in Orange County. The median property tax per square foot is $1.27. Mean total return and annualized return are 74.1% and 15.6%, respectively. The median housing unit age is 29 years. The median year built of homes in Los Angeles County is 1958, but in Riverside is 1985. The median sale price of the homes was $174 thousand, with a median price/square foot of $124 and median size of 1,440 square feet.

We document that households that face a higher property tax per square foot, which measures the cost of carry in the Proposition 13 risk arbitrage operations, show a shorter holding period consistent with the Proposition 13

risk arbitrage argument. We also document that households that face larger capital gains, which counterbalances the cost of carry in the Proposition 13 risk arbitrage operations, show a shorter holding period consistent with the Proposition 13 risk arbitrage argument. These results remain robust even when we control for regional labor market variables and national economic variables.

We can explain the time series variations of the aggregate residential holding periods over 1993 to 2001 period in the four counties of Southern California using the property tax risk arbitrage argument. In the aftermath of the burst bubble (1993) the churners sell out unwinding their tax risk arbitrage operations in the down market bringing down the aggregate residential holding periods of sold homes to 3.18 years (where 41% of all sold homes are sold within a year). As the up market gathers momentum an increasing number of the incumbent home owners at the margin are induced to sell their residences to lock in the gain and/or to move up despite the large option value of not selling the house, pushing up the aggregate residential holding periods from 3.18 years in 1993 quickly to 13.24 in 1997. As the up market matures, the residential holding period stops rising and stays high at about 15 to 17 years from 1998 to 2001, reflecting the countervailing influences of the long time owners finally selling out and the ultra-fast and fast trading of churners.

Literature Review, Theory, and Hypotheses

Neighborhood development literature has looked at a number of neighborhood development dimensions (Aaronson, 2001). A number of theories attempt to explain the dynamic process of neighborhood development, particularly the population sorting based on certain neighborhood characteristics such as race, ethnicity, income, and housing values. A number of sorting mechanisms have been proposed. As possible sorting mechanisms, Epple and Romer (1991) discuss government redistributive policies; Benabou (1993) discusses local complementarities in production; Fernadez and Rogerson (1996) discuss desired level of taxation and education spending.

This literature has largely ignored the issue of how long residents remain in their homes, the ultimate determinant of residential stability. We refer to this as the residential holding period decision, which is different from the tenure choice, the choice between renting or owning one's residence.[3]

[3] See, for example, Eppli and Childs (1995). Below we use the word 'home' to include all owner–occupied housing units, both single–family units and condominiums.

Berkovec and Goodman (1996) examine turnovers as a measure of demand on existing homes rather than as a measure of residential stability.

It is generally agreed that Proposition 13 contributes to residential stability. Stohs et al. (2001) derive the value of the property tax cap embedded in Proposition 13 and show that the disincentives to move are sizable. By showing that California's homeowners are significantly less mobile than their counterparts in Illinois and Massachusetts they also provide evidence that Proposition 13 produced an unintended consequence of reducing residential mobility.

Recently, Wasi and White (2005) extend the study of the lock-in effect of Proposition 13, which Stohs et al. discuss. They note that as long as property values increase more than 2 percent per year, homeowners gain from remaining in the same house because their taxes are lower than they would be on a different house of the same value. They further note that the lock-in effect of Proposition 13 becomes stronger over time.

For example, a buyer A purchases a house for $100,000 in 1975. Suppose further that the property tax rate is 1%, property value increases at the rate of 10% per year and the inflation rate is 2%.[4] In 2005 buyer A's taxes would have risen to $1,811. In 2005 buyer B would pay $1,744,940 for an identical house and receive a property tax bill of $17,449. Therefore, buyer A's annual property subsidy is $15,638 (= $17,449 – $1,811). Noting that this tax subsidy is an approximate perpetuity growing at the rate of 2% we find that the present value of this tax subsidy as of 2005 is $390,950 using the risk-free rate of 6% as discount rate. That represents 22.4% of the value of the house in 2005.

In fact, when Proposition 13 was initially adopted, the property tax rate fell and this reduction was capitalized into the price of housing in a manner consistent with the calculation in the above example. Rosen (1982) reports that housing values in the San Francisco metropolitan area rose by approximately 40% and similar increases presumably occurred elsewhere in California.

Wasi and White (2005) further document that from 1970 to 2000 the average tenure length of owners increased by 0.66 years, relative to that of owners in the comparison states. Furthermore, they document that the response to Proposition 13 increases sharply as the subsidy rises: owners with the lowest annual subsidy of $250 (typical of Fresno) increased their tenure length by less than one year, but owners with higher subsidies of $1000 and $1700-

[4] This example is modified from that by Wasi and White (2005).

$2600 (typical of Los Angeles/Orange County and San Francisco/San Jose, respectively) increased their tenure by 1.2 years and 2 to 3 years, respectively.
However, Proposition 13 can provide incentives for residential speculation. The underlying economic intuition for this is that Proposition 13 is an implicit tax subsidy for the existing homeowners forced upon the incumbent homeowners as noted by Wasi and White. It essentially works like an infinitely-lived option which becomes worthless upon selling the underlying asset (the house) and it should discourage residential sales in principle as noted by Stohs et al. One would expect that there are many sensible and aggressive tax arbitrage operations that will go on in the market around this tax friction.

The best known form of a risk arbitrage occurs in a tender offer known as merger risk arbitrage (Mitchell and Pulvino, 2001). After the takeover announcement, the market price of the target stock is typically lower than the bid price. This difference is known as the arbitrage spread. If arbitrageurs believe that the deal will be closed then arbitrageurs take a long position on the target stock to make capital gains equal to the arbitrage spread.

Buying a home in an up market and timing to sell the home as quickly as possible to minimize the cost of carry can be considered as property tax induced risk arbitrage. An arbitrageur (homebuyer) bets on an increase in the asset (home) value, takes a long position in the target (home) despite the unfavorable property tax position, is exposed to risk making the arbitrage operation risky (home price may drop), and expects to close the position as soon as target gains has been realized to minimize the cost of carry, of which property tax is significant (ultra-fast trading, flipping or churning of homes). The holding period is determined by maximizing the difference between the capital gains and the cost of carry.

In a Proposition 13 risk arbitrage operation, property tax is an important part of cost of carry. In essence home owners realize capital gains, that is, they sell the property before the high property tax can make meaningful damage to their capital gains. To stay ahead of the tax “penalty”, they churn as fast as possible. We predict that (H1) *the larger the property tax per square foot is, the more likely the homeowner will be to sell his/her house and the shorter the residential holding period will be.*

In an up market the benefit of locking in large capital gains may induce home owners to sell their existing houses, foregoing the tax option from selling the old home. We predict that (H2) *the larger the capital gain is, the more likely the homeowner will be to sell his/her house and the shorter the*

residential holding period will be.

We illustrate the Proposition 13 risk arbitrage operation using an example of a hypothetical homebuyer who buys a small condominium in Orange County for $500,000 with zero down payment, expecting a price increase of 15%. We also suppose that the homebuyer will close down the risk arbitrage position in exactly one year. Suppose further that the home buyer (the risk arbitrageur) incurs a set-up cost consisting only of the closing cost, which is 1% of the purchase price ($5,000). Suppose finally that the interest rate of the mortgage loan is 6%. As the risk arbitrage is closed, the homebuyer pays the financing cost for a year ($30,000), the property tax at 1% of the purchase price ($5,000), and the commission at 3% of the sale price (or 3.45% of the purchase price or $17,250). Since the net investment is $5,000 and the net proceeds are $22,750, the return on equity is 455%.[5] The high property tax is not an impediment anymore. It is arbitraged away. In this sense this is Proposition 13 risk arbitrage operation. In fact, the larger the property tax is, the greater is the incentive to try this type of risk arbitrage operation.[6]

Confronted with Proposition 13, market participants (homebuyers, lenders, and real estate agents and investors) will realize after some thinking that churning is an "optimal" response for incoming home buyers and for the incumbent homeowners at the margin, who become de novo home buyers and as result a rational bubble in residential market can happen with a sharp and sustained rise in residential prices and in a downturn the price fall will be more severe than otherwise. The price movements will be more severe in a tight supply market.

We now turn to testing the main hypotheses (H1 and H2) using residential holding periods of sold homes over the 1993 to 2001 period in five counties of Southern California (Los Angeles, Ventura, Orange, Riverside, and San Bernardino counties).

[5] $22,750=$500,000× (0.15–(0.06+0.01+0.0345)) or $75,000– ($30,000+$5,000+$17,250)

[6] Existing academic literature on merger risk arbitrage finds that risk arbitrage generates substantial excess returns. Dukes et al. (1992) and Jindra and Walking (1999) document annual excess returns over 100% in cash tender offers. More recently, using a sample of cash and stock mergers, Baker and Savasoglu (2002) document that risk arbitrage generates annual excess returns of 12.5%.

Data

Prior to filtering, the data includes 1,521,896 sales records of housing units (HUs) in Los Angeles and Ventura counties from 1993 to 2002 and in Orange, Riverside, and San Bernardino counties from 1997 to 2002.[7] These counties comprise the greater Los Angeles Consolidated Statistical Metropolitan Area (CSMA #4472) according to the U.S. Census Bureau classification system. They function as a social/political and economic unit, with several million people commuting from one county to the other for work, pleasure or family visits. For example, about 279,000 vehicles per day pass through the RT–57 and RT–91 interchange. This interchange is in NE Orange County and is one of only two gateways to Orange County from Riverside, San Bernardino, and eastern Los Angeles counties.[8]

Proper analysis requires that not all of the original 1.5 million records can be used. First consider the fact that sales records are not standard across counties or are not always meaningful. In addition, because we are analyzing the residential holding period of sold homes, we require that each useable record have a prior sale date. We list below the sample selection criteria where we show the numbers of original records eliminated in parentheses. Sales records are not included in the final sample for which: [9]

1. Census Tract number is missing (112,636);
2. Prior sale date is missing (426,818);
3. Sale date equals the prior sale date (10,218) or the time from the previous sale is less than 10 days (9,918);
4. Time from the previous to the current sale greater than 58.28 years (imposed later);
5. Price is less than $50,000 (27,908) or greater than $8,000,000 (136);
6. Previous sale price is less than $10,000 (14,264) or greater than $8,000,000 (6);
7. Total square feet of the housing unit is zero (5,585. Orange County has 46,867 records without the square feet included. Since this is a large proportion of the total for Orange County these records are not omitted at the outset – and are included in the total of 883,941 listed below);
8. Annualized return upon sale is greater than 500% (23,837);
9. Total return upon sale is less than –80% (6,629).

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[7] We thank the California Association of Realtors (CAR) for providing us with the real estate transaction data.

[8] "Unclogging America's Arteries 1999–2004," American Highway Alliance, www.highways.org

[9] Details for how many records are deleted for each of these restrictions by county and year can be provided upon request.

After imposing these restrictions, 883,941 records remain.

We explain the rationales for these restrictions next. The census tract number and the prior date are required simply to gather necessary census data and to be able to calculate the residential holding period. Reasonable residential holding periods of sold homes (where the residential holding period of sold homes equals the number of years from the prior sale to the current sale) are required to reduce measurement error as much as possible. Negative, extremely small or extremely large holding periods are likely to result from the poor or mistaken recording of facts (restrictions 3 and 4). Extremely small or large prices are likely to result either from non–housing unit sales (e.g., land) or from larger tracts of property (multiple unit properties) and should not be included (restrictions 5 and 6).

And at least one important measure of a home's value is the price per square foot (Price/Ft^2). If the total square feet are recorded as equal to zero, the sale may not be of a housing unit (despite the fact that it is recorded as such). Consequently, such sales should not be included (restriction 7). Finally, aside from being unrealistic, extreme annualized or total returns most likely would have a detrimental impact on the statistical properties of any potential analysis. These extreme observations are eliminated from the start (restrictions 8 and 9). Yet even an annualized return of 500% or large total returns may be viewed as extreme (although they could result from very large gains over short periods of time). Such observations are either excluded after the fact (prior to statistical analysis) or can be analyzed for their impact on the stability of the statistical results.

After imposing the restrictions discussed above 679,691 records remain. The descriptive statistics for this sample appear in Table 1. Note that virtually all of the means are different from the medians, which is typical for housing data. As a result, the analyses below typically use the medians. The current research focuses on the variable, the residential holding period of sold homes, which has a mean of 6.17 years for all HUs. It indicates that among the universe of all owner occupied Housing Units sold during the sample period, residents remained in their homes for a tenure period of 6.17 years.[10] The residential holding period of sold homes variable is important, because ex ante it has a uniform value across time and geographical units. Significant cross-sectional variations in the residential holding period of sold homes occur presumably because of underlying economic or demographic changes.

[10] The mean of 6.17 for residential holding period of sold homes should *not* be interpreted as suggesting that all households have "tenure" of 6.17 years on average. This interpretation is mistaken because the sample being analyzed is only of HUs that have sold, not of all HUs in the population.

Table 1: Descriptive statistics for regression variables and other sales data in Southern California

The descriptive statistics are for a total of 679,691 sales of residential housing units (HUs) in Los Angeles, Ventura, Orange, Riverside and San Bernardino Counties; from 1993 to 2001 for Los Angeles and Ventura counties and for 1997 to 2001 for the other counties. All variables are as recorded in the data provided by the California Association of Realtors (CAR). The variables are defined as: **Residential Holding Period** is the time in years between the previous sale of the HU and the current sale. **Property Tax/Ft^2** equals the Property Tax scaled by Total Ft^2. **Annualized Return** is calculated as the (Price/Previous Price)$^{1/SaleTime}$ – 1. **Housing Unit Age** is the age of the HU calculated from Year Sold minus Year Built. **Price/Ft^2** equals the Price scaled by Total Ft^2. **Pool** is a dummy variable, with the mean of 12.8% indicating that that percent of all HUs have pools. **Unemployment Rate, Average Wage** and **Change in Average Wage** are monthly time-series for the Western Region of the United States. **Total Ft^2** is the Total Square Feet of the housing unit sold. **Price** is the current selling price for the HU. **Previous Price** is the selling price of the HU for the previous time that it sold. **Tax Amount** is the amount of real estate taxes paid. **Year Built** is the year that the HU was built. **Total Return** is the total return for the seller (Price/Previous price –1). Observations for which **Year Built** or **Price/Ft^2** are missing are not included.

Panel A: Regression variables

Variable	Mean	Median	Std Dev	Min	Max
Residential holding period	6.17	4.33	6.38	0.03	99.96
Property tax/Ft^2 ($)	1.37	1.27	3.37	0	1555.41
Annualized return (%)	15.6	3.6	58.2	–100.0	499.9
Housing unit age	31.99	29.00	20.53	0	188
Price/Ft^2 ($)	142	124	337	0	148,750
Pool (%)	13.8	0.0	34.5	0.0	100.0
Unemployment rate (%)	6.02	6.00	1.85	2.00	10.50
Average wage ($)	13.09	13.21	1.04	10.95	14.79
Change in average wage ($)	0.003	0.002	0.004	–0.005	0.015
S&P 500	1051.82	1133.58	323.35	438.78	1517.68
Fixed 30-yr mortgage rate (%)	7.69	7.66	0.58	6.78	9.35

Panel B: Other sales data

Variable	Mean	Median	Std Dev	Min	Max
Total Ft^2	1,606	1,440	1,249	1	702,531
Price ($)	227,139	174,000	206,897	40,000	7,646,818
Previous price ($)	179,623	142,000	173,385	10,000	8,000,000
Tax amount ($)	2,177	1,801	1,754	0	167,759
Year built	1966	1970	21	1812	2001
Total return (%)	74.1	17.1	249.4	–80.0	38,877.3

Table 1 reports descriptive statistics of regression variables in Panel A and other sales data in Panel B. We employ three types of regression variables: transaction level variables, regional labor market variables and national economic variables. Transaction level variables include **Residential Holding Period** (dependent variable), **Property Tax per Square Foot, Annualized Return, Housing Unit Age, Price per Square Foot and Pool**. Three regional labor market variables, **Unemployment Rate, Average Wage and Change in Average Wage**, are extracted from the Bureau of Labor Statistics. We use two national economic variables, the monthly **S&P 500** and the average rate on a **Fixed 30–Year Mortgage Rate** as indicators of the change in household wealth and of the relative price of a mortgage.

The time series means by month and county for the economic variables along with the sales transaction variables are displayed in Table 2. This table provides an interesting glance at the differences across counties. The median residential holding period of sold homes, for example, ranges from 2.57 years in Riverside County to 6.79 years in Orange County, while the median year built of the homes in Los Angeles County is 1958, but in Riverside is 1985. Since there is a large difference across counties, we control for the county fixed effects in our regression analyses.

Table 2: County means and medians

The sales transaction variables are calculated from the 679,691 observations of sales in Southern California, and because they are defined in Table 1, are not defined again here, except to note that the median values are reported, with the exception of the number of monthly sales transactions per county. The economic variables include **Labor Force**, **Employment Count** and **Unemployment Count** in numbers of persons by county, the **Average Wage** in dollars, the **Monthly Change in the Average Wage** for the Western Region of the United States, the **CPI** (Consumer's Price Index) and the **Monthly percentage Change in the CPI** by county. Although the Average Wage values are for the Western U.S., the statistics differ because of differing time periods, ranging from: 108 months for LA and Ventura Counties, from 1993–2001; 60 months for Orange and San Bernardino Counties, from 1997–2001; to 58 months for Riverside County, 1997 to October 2001. The United States Bureau of Labor Statistics is the source for the economic variables. Complete descriptive statistics are available upon request.

	LA (108 months)	Orange (60 months)	Riverside (58 months)	SB (60 months)	Ventura (108 months)
Sales variables					
Monthly sales (#)	3,639	1,746	1,324	969	575
Median residential holding period	3.60	6.79	2.57	3.02	4.40
Median sales price ($)	172,792	237,514	135,175	116,291	207,180
Median taxes paid ($)	1,850	1,967	1,513	1,360	2,019
Median year built	1958	1969	1985	1981	1978
Median Ft^2	1,401	1,477	1,542	1,434	1,585
Median prior price ($)	145,678	170,847	120,549	100,073	174,670
Median total return (%)	12.57	27.84	11.11	14.42	12.70
Median annualized return (%)	2.73	4.78	2.27	3.23	2.65
Median price Ft^2 ($)	128.06	155.60	87.12	82.21	134.73
Economic variables					
Labor force	4,513,585	1,466,872	694,048	758,608	390,700
Employment count	4,186,674	1,424,762	652,144	718,842	365,986
Unemployment count	326,912	42,109	41,904	39,767	24,714
Unemployment rate (%)	7.29	2.87	6.08	5.27	6.37
Average wage ($)	12.61	13.49	13.45	13.49	12.61
Monthly change in wage (%)	0.28	0.31	0.31	0.31	0.28
CPI	161.3	167.4	167.1	167.4	161.3
Monthly change in CPI (%)	0.17	0.19	0.21	0.19	0.17
S&P 500	892.84	1,179.94	1,181.19	1,179.94	892.84
Fixed 30-yr mortgage rate (%)	7.76	7.55	7.57	7.55	7.76

Empirical Results

In order to test the proposed hypotheses formally, we use regression models and report the results in Tables 3 and 4. To test H1, we calculate property tax per square foot, which is a measure of the cost of carrying the house (during the risk arbitrage operation). We predict a negative relationship between property tax per square foot and the residential holding period. To test H2, we calculate annualized return, which is a measure of the incentive to forego the value of living in an old house with low property tax (the tax option) and sell the house. We predict a negative relationship between annualized return and the residential holding period. We control for the sales in the 1st quarter. General research results indicate that people tend to sell homes during the summer (3rd quarter) and that those who sell during the 1st quarter may be "forced" to sell and thus have lived in their homes for shorter periods.

We also control for the age of a home primarily because we suspect that there will be a simple mechanistic correlation between older homes and longer holding period. For instance, homes built within the past 20 years cannot have a residential holding period greater than 20 years. However, the age of a house may influence the move or stay decision. While there is a natural appeal to well–developed and older neighborhoods, there is also a very real benefit in purchasing a new(er) home. On balance, we expect a positive relationship between housing unit age and residential holding period. We control for the wealth effect on the residential holding period by using the price per square foot (Price/Ft^2) of a home as a measure of household wealth. We also use the existence of a pool as a measure of household wealth. A pool is an indicator of wealth, in that it is very expensive both in initial cost and in upkeep in relation to the actual use that they receive. Finally, we control for the county fixed effects using Orange County dummy, Riverside County dummy, San Bernardino County dummy and Ventura County dummy. Los Angeles County is the default county, which in Table 2 shows a shorter residential holding period than Orange County, but a longer holding period than Riverside County, San Bernardino County and Ventura County.

We analyze the data with three separate regressions of residential holding period on the proposed explanatory variables, one with all observations and then one each for single–family residences only and condominiums (non–single family units) only. We report the results in Table 3. Consistent with H1 we document that the property tax per square foot reduces the residential holding period at the rate of about one year for one dollar per square foot increase. The regression coefficient of **Property Tax/Ft^2** is –1.051 for single-family homes and –0.409 for condominiums indicating that for a dollar increase in property tax per square foot homeowners are likely to sell

their house about a year earlier than otherwise. A median sized single family home (about 1,500 square foot from Table 2) is liquidated one year earlier for an increase of $1,500 in property tax while a median sized condominium is liquidated a half year earlier for an increase of $1,500 in property tax.

Table 3: OLS regressions of the residential holding period of sold homes on Proposition 13 tax arbitrage variables

The dependent variable is residential holding period of sold homes, the time in years between the previous sale of the HU and the current sale. The Proposition 13 tax arbitrage variables are **Property tax/Ft^2**, which is the property tax divided by Total Ft^2 and **Annualized return**, which is calculated as the (Price/Previous price)$^{1/\text{Saletime}}$ – 1. The remaining variables are: **1st quarter** is a time dummy for Quarter 1 taking the value of 1 if the sale occurred in the first quarter. **Housing unit age** is the age of the HU calculated from year sold minus year built. **Pool** is a dummy variable for housing units with pools. **Price/Ft^2** equals the price scaled by total Ft^2. The column labeled **single-family** includes observations for only single-family residences (SFRs), while the column labeled **Condominiums** includes observations for all housing unit sales that are not SFRs and are primarily condominiums. Heteroskedasticity-consistent ***t*-statistics** are reported in parentheses below the parameter estimates, using White's (1980) estimation technique. *** indicates significance at the 1% level.

Variables	All Sold Homes	Single–Family	Condominiums
Intercept	6.082	6.515	3.968
	(338.00)***	(289.91)***	(105.91)***
Property tax/Ft^2	–0.956	–1.051	–0.409
	(–140.75)***	(–139.48)***	(–24.28)***
Annualized return	–1.980	–2.039	–1.535
	(–155.35)***	(–146.80)***	(–47.87)***
1st quarter	–1.024	–1.048	–0.907
	(–55.82)***	(–50.43)***	(–25.02)***
Housing unit age	0.016	0.007	0.116
	(42.02)***	(17.94)***	(64.34)***
Price/Ft^2	0.009	0.010	0.004
	(137.28)***	(135.84)***	(24.85)***
Pool	0.516	0.458	
	(24.16)***	(20.17)***	
Orange County	2.163	2.120	0.711
	(95.42)***	(84.02)***	(12.99)***
Riverside County	–1.730	–2.042	–1.093
	(–69.44)***	(–71.13)***	(–22.68)***
San Bernardino County	–0.900	–1.110	–0.266
	(–32.79)***	(–36.64)***	(–3.72)***
Ventura County	–0.183	–0.280	–0.103
	(–6.82)***	(–8.69)***	(–2.37)***
# Observations	679,691	561,388	118,303
F-statistic	7440.75***	6,749.25***	1,036.79***
Adjusted R^2	0.099	0.107	0.073

Table 4: OLS regressions of the residential holding period on regional labor market and national economic variables

The dependent variable is the **Residential holding period of sold homes**. The independent variables include those defined previously: **Property tax/Ft^2, Annualized return, 1st quarter, Housing unit age, Price/Ft^2, and Pool**. Regional labor market variables are **Unemployment rate, Average wage, and Change in average wage** which are monthly time-series of Western Economic Region. The economic variables are the log of the month–end **S&P 500** index and the average **Fixed 30-yr mortgage rate** for the month. ***t*-statistics** are reported in parentheses below the parameter estimates. *, **, and *** indicate significance at the 10%, 5%, 1% level, respectively.

Variable	Residential holding period	Residential holding period
Intercept	–0.442 (–1.87)*	4.743 (44.86)***
Property tax/Ft^2	–0.892 (–131.35)***	–0.901 (–133.01)***
Annualized return	–1.951 (–154.78)***	–1.952 (–154.85)***
1st quarter	–0.929 (–50.71)***	–0.963 (–52.73)***
Price/Ft^2	0.009 (127.25)***	0.009 (129.25)***
Unemployment rate	–13.532 (–13.06)***	
Average wage	0.630 (46.68)***	
Change in average wage	–2.979 (–1.65)*	
S&P 500		0.002 (100.73)***
Fixed 30 year mortgage		–5.350 (–4.20)***
Orange County	1.202 (36.17)***	1.587 (69.02)***
Riverside County	–2.620 (–106.50)***	–2.632 (–107.03)***
San Bernardino County	–1.829 (–63.12) ***	–1.720 (–62.65)***
Ventura County	–0.476 (–17.29) ***	–0.369 (–14.17)***
# Observations	679,691	679,691
F-statistic	7619.55***	8343.27***
Adjusted R^2	0.086	0.109

Consistent with H2, we document that the larger the capital gain is, the more likely the homeowner is to sell his/her house reducing his/her residential holding period. The regression coefficient of **Annualized return** is negative and very significant (–1.980 with p-value essentially zero). The effect in single-family houses is larger than in condominiums. The regression coefficient of **Annualized return** is –2.039 for single-family houses indicating that for a 100% annual gain in property value a single family home is liquidated two years earlier than otherwise. The regression coefficient of **Annualized return** is –1.535 for condominiums indicating that for a 100% annual gain in property value a condominium is liquidated one and a half years earlier than otherwise.

We examine the potential influence of repeat sales bias on our empirical tests. Given the considerable interest shown to the repeat sale bias in real estate price indices in the real estate market efficiency literature (e.g., Jud and Seaks, 1994; Cho, 1996) we attempt to flesh out the potentially distorting effect of using repeat sales data in our study. Clearly, those housing units which do not get sold do not get observed and are not reflected in our cross-sectional analyses. However, those homes which are never sold would tend to have even lower property taxes per square foot since they were acquired before the beginning of the sample period. The inclusion of these unobserved cases would add support to our prediction on the effect of property tax per square foot on holding period (H1). Therefore, the sample selection bias actually works against accepting H1 and making the test that uses repeat sales only a more rigorous test than the test that uses the full sample. The effect of the repeat sales bias on the capital gains effect hypotheses (H2) would be by and large neutral since there is no reason to believe that those homes which did not get sold during the sample period appreciated more or less on an annual basis than those which were sold.

Results on the control variables are also consistent with our expectation. Sales in the first quarter show a shorter holding period by almost a year reflecting forced sales reducing the holding period. We also find that wealthier families stay longer in their houses as shown by the positive regression coefficients of **Price/Ft^2** and **Pool**.

We document a positive relationship between the age of the home and the residential holding period as expected, indicating that families remain longer in older homes. In fact, when we calculate the holding period by year built, we find that the mean residential holding period of sold homes built in 1980 equals 5.9 years, for homes built in 1990 equals 4.2 years and for those built in 2000 the residential holding period equals 1.7 years. Hence the positive relationship as exhibited in Table 4 partially reflects a mechanistic relationship between the housing unit age and the residential holding period.

A conventional method for measuring the economic impact is to calculate the change in the dependent variable for a standard deviation change in the explanatory variable. Using the standard deviations in Table 1 and the coefficient estimates (betas) in Table 4, we find that one standard-deviation increase in property tax per square foot (from $1.37 to $4.74) reduces the length of time that the residents held their homes by 3.22 years while one standard-deviation increase in annualized return (from 15.6% to 73.8%) reduces the length of time that the residents held their homes by more than a year.

As a part of robustness check, we examine the influence of regional labor market variables as well as national economic variables. All the main results hold as shown in Table 4. As for the regional labor market variables, results are consistent with the received economic theory. Unemployment rate is negatively related to residential holding period. This is consistent with the positive wealth effect of labor market participation on residential holding period. Average wage is positively related to residential holding period. This is consistent with the positive wealth effect of wage on residential holding period. Change in average wage is negatively related to residential holding period. But, this is only marginally significant.

We analyze the impact of two economic series on the residential holding period. The monthly series include the S&P 500 and the average 30-year fixed mortgage rate. We report the results in Table 4. Even when we control for these economic variables, we find that the property tax per square foot reduces the residential holding period at the rate of one year for one dollar per square foot increase (H1); the larger the capital gain is, the more likely the homeowner is to sell his/her house reducing his/her residential holding period (H2).

As for the national economic variables, results are consistent with the received economic theory. S&P 500 is positively related to the residential holding period. This is consistent with the positive wealth effect of an appreciating stock market on the residential holding period. The rate on the 30-year fixed mortgage is negatively related to the residential holding period of sold homes. As mortgage rates increase, the residential holding period of sold homes decreases and does so significantly. Reductions in mortgage rates presumably provide an opportunity to buy newer and larger homes presumably reducing the time that people remain in their homes. This result is consistent with Quigley (1987) who finds that high interest rates act as a barrier to residential mobility and Poteban (1989) who reports that high interest rates induce homeowners to invest in home improvements rather than moving elsewhere.

Proposition 13 has some additional implications on the aggregate time series behavior of residential holding periods, which we discuss below. Table 5 shows the frequency distribution of the aggregate holding periods for the 1993-2001 period in the five counties of Southern California.

Table 5: Percent frequency of the residential holding period of sold homes for the 1993-2001 period in the five Southern California counties

The five counties are Los Angeles, Ventura, Orange, Riverside, and San Bernardino Counties; from 1993 to 2001 for Los Angeles and Ventura counties and for 1997 to 2001 for the other counties. The residential holding period of sold homes shown in the first row is the time in years between the previous sale of the HU and the current sale. The total number of observations is 679,691.

Year	0-1	1-2	2-4	4-6	>6	Row average
1993	41.06%	12.29%	11.34%	12.11%	23.20%	3.18 yrs
1994	34.72%	8.36%	10.50%	12.59%	33.83%	5.79 yrs
1995	38.24%	9.29%	9.46%	8.92%	34.09%	6.14 yrs
1996	40.37%	7.61%	9.35%	8.73%	33.94%	7.47 yrs
1997	39.10%	6.09%	9.58%	9.37%	35.86%	13.24 yrs
1998	29.05%	7.12%	11.53%	11.22%	41.08%	15.54 yrs
1999	17.63%	9.81%	14.06%	12.21%	46.30%	16.09 yrs
2000	16.10%	8.98%	17.15%	12.28%	45.49%	16.69 yrs
2001	13.49%	8.65%	19.98%	12.69%	45.20%	15.86 yrs
Column average	26.03%	8.38%	13.60%	11.32%	40.67%	

In an up market incoming home buyers may buy a housing unit and sell it to stay ahead of the bite from the property tax subsidy cutting into the capital gains. We call this type of trader type I churners. In an up market one can optimally sell the existing house and buy up in hopes of larger capital gains, which can offset the loss of the tax option from selling the old home. With a generous tax subsidy both on capital gains and financing, a mild degree of optimism in the market may tip marginal homeowners to sell. If they purchase a bigger house, they are in the same shoes as the type I churners and we call this type of trader type II churners. A homeowner may churn the second principal residence in an up market. We call these type III churners.

The presence of type I, II and III churners ensures that there will be a sharp peak of ultra fast and fast trading through an up market. Similarly, in the aftermath of the burst bubble (down market) the churners sell out unwinding their tax arbitrage operations leading to a sharp peak in the ultra fast and fast trading. We find some evidence of fast trading activity from frequency analysis. There is a sharp peak of ultra fast trading (holding period of less than a year) and fast trading (holding period between one and two years) throughout the up market. Furthermore, 41% of trades are ultra fast trades.

As the up market gathers momentum the aggregate residential holding period may rise quickly as an increasing number of the incumbent home owners at the margin are induced to sell their residences to lock in the gain despite the large option value of not selling the house. We find some evidence of rising aggregate holding period during the up market. In the first four consecutive years of the home price increase the aggregate residential holding periods of sold homes rise monotonically from 3.18 years in 1993 all the way up to 13.24 years in 1997.

As the up market matures the aggregate residential holding period may stay high but stop rising, reflecting the countervailing influences of the long time owners finally selling out and the hectic property flipping of churners. We find some evidence of a fast rise in the average holding period at the early stage of the housing boom and leveling off of the average holding period as the housing boom matures. For the subsequent four years (1998 to 2001) after consecutive rises in home prices the residential holding period of sold homes stays high at about 15 to 17 years but stops rising.

In the aftermath of the burst bubble the aggregate residential holding period may fall precipitously as the churners sell out unwinding their tax arbitrage operations in the down market bringing down. We find some evidence of a sudden dramatic drop in the average residential holding period in a down market. In the aftermath of the burst bubble in 1992 the aggregate residential holding periods of sold homes was at a low of 3.18 years in 1993.

The time series behavior of aggregate residential holding periods of sold homes over 1993 to 2001 period in the five counties of Southern California is consistent with the implications of the Proposition 13 risk arbitrage argument.

Conclusions

As noted by Stohs et al. (2001) Proposition 13 is a tax option which deters homeowners from selling thus limiting their residential mobility. As noted by Wasi and White (2005) Proposition 13 in California is a very generous tax subsidy given to incumbent homeowners. By effectively forcing new home buyers to provide a property tax subsidy for the existing home owners, it can create incentives for incoming residential buyers to churn residential properties in an up market to stay ahead of the tax bite from the Propostion13 thus contributing to the residential market speculation. We call this type of short term trading Proposition 13 risk arbitrage trading.

Confronted with Proposition 13 market participants (homebuyers, lenders

and real estate agents and investors) may conclude that churning is an "optimal" response for incoming home buyers primarily and the incumbent homeowners at the margin. This tax driven trading may add to the underlying residential market speculation. As a result a "rational" bubble can add to the overall residential market bubbles with a sharp and sustained rise in residential prices. In a downturn the price fall will be more severe than otherwise. The price movements will be more severe in a tight supply market.

We investigate the time-series and cross-sectional variations of the residential holding period in Southern California as measured by the number of years that people remained in their residences, conditioned on the fact that they have sold those residences. Residents who sell their homes remained in them for an average of 6.17 years, with a median of 4.33 years.

The cross-sectional variations of the aggregate residential holding period are consistent with the predictions of the Proposition 13 risk arbitrage argument. We document that the larger property tax per square foot reduces the residential holding period at the rate of one year for one dollar per square foot increase. Finally we also document that the larger the capital gain is, the more likely the homeowner is to sell his/her house reducing his/her residential holding period.

The time series variations in the aggregate residential holding periods of sold homes over 1993 to 2001 period in the five counties of Southern California are also consistent with the implications of the Proposition 13 risk arbitrage argument. We document that there is a sharp peak of ultra fast trading (holding period of less than a year) and fast trading (holding period between one and two years) throughout the up market. In the aftermath of the burst bubble the aggregate residential holding periods of sold homes drop to 3.18 years consistent with the churners selling out unwinding their tax arbitrage operations in the down market. As the up market gathers momentum the aggregate residential holding periods of sold homes from 3.18 in 1993 all the way up to 13.24 years in 1997 consistent with an increasing number of the incumbent home owners at the margin being induced to sell their residences to lock in the gain despite of the large option value of not selling the house pushing up. As the up market matures the residential holding period of sold homes stays high at about 15 to 17 years consistent with the countervailing influences of the long time owners finally selling out and the trading activities of churners.

Our findings have implications for future debates about Proposition 13 in California. Demonstrating the underlying speculation in the residential market ultra-fast trading and fast trading of residential units is very conspicuous in California. Proposition 13 induced churning can worsen

residential market speculation. Our findings suggest that Proposition 13 can exacerbate the underlying residential market speculation as some home buyers attempt to carry out risk arbitrage to undo property tax distortions caused by Proposition 13.

One-time property tax relief given to the homeowners in the form of limited property tax increase such as Proposition 13 appears to have unintended consequences. Other jurisdictions may benefit from policy lessons of Proposition 13 in California that laws designed to provide property tax relief by limiting the increase in property tax create a disincentive to move. Furthermore, they may make churning residential properties rational adding a tax based rational bubble to the underlying speculative bubbles in housing markets.

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