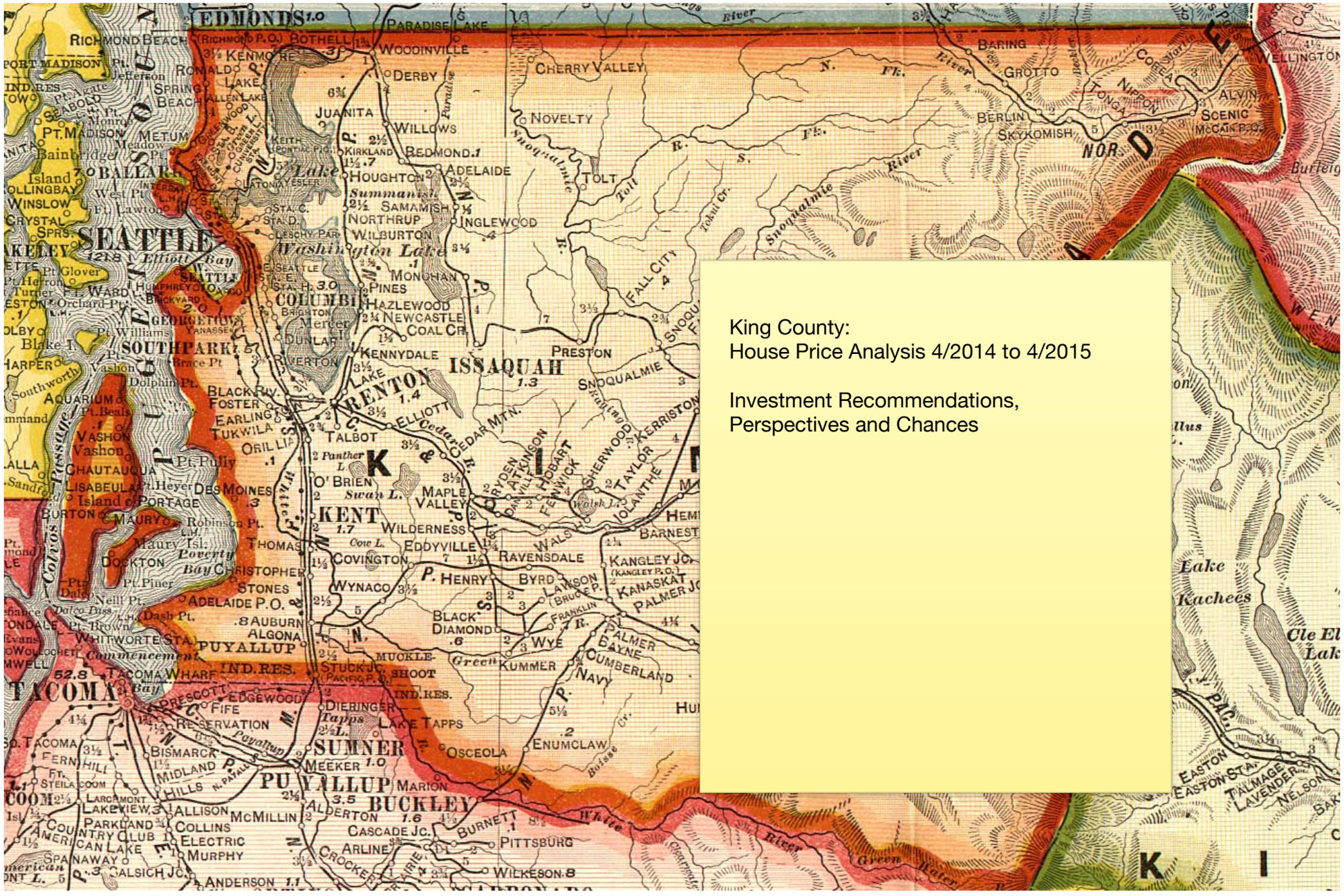
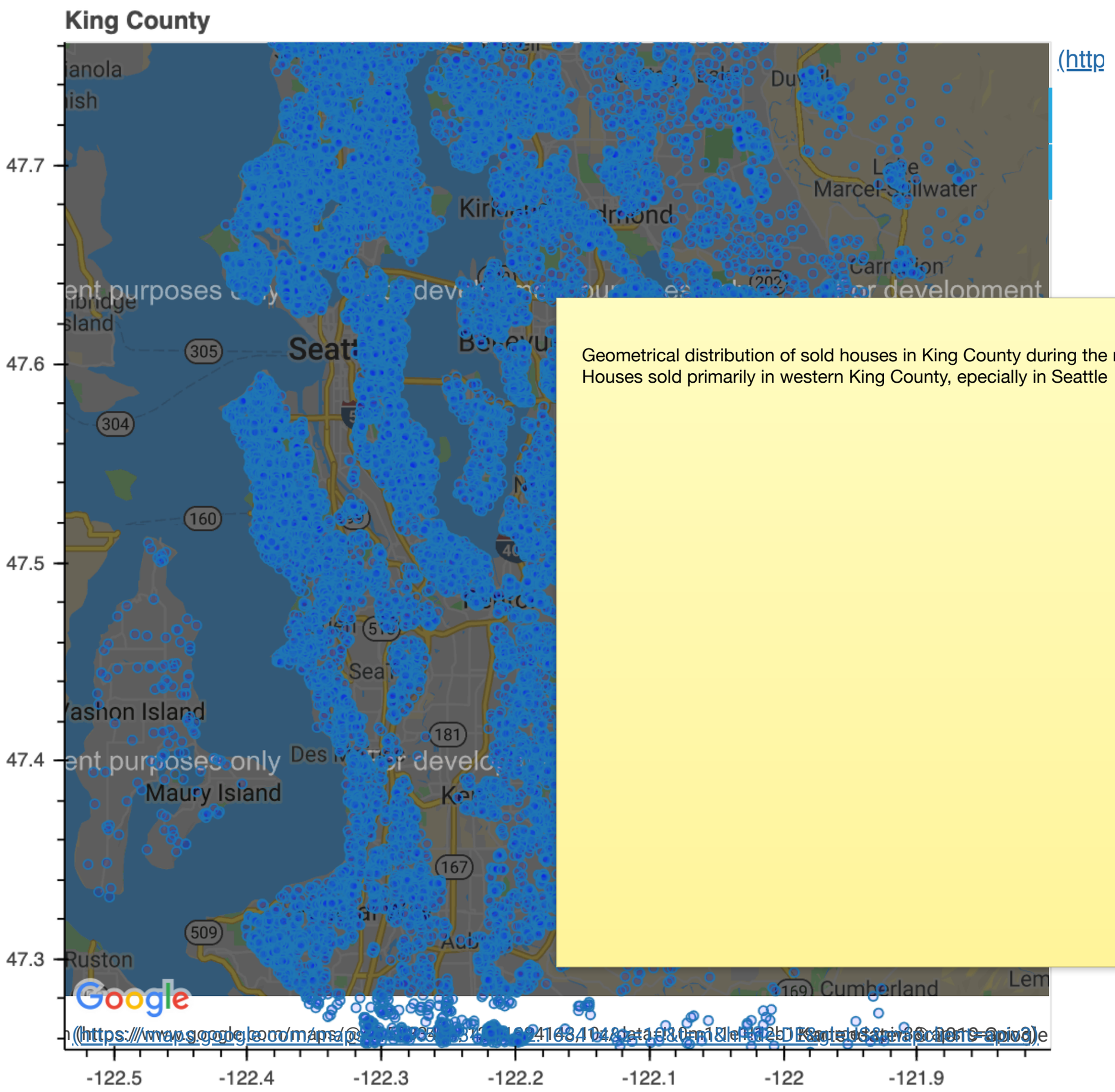


http://www.usgwarchives.net/maps/washington/wa-crams/king.jpg

KING COUNTY

House-Price Analysis 4/2014 - 4/2015



(http

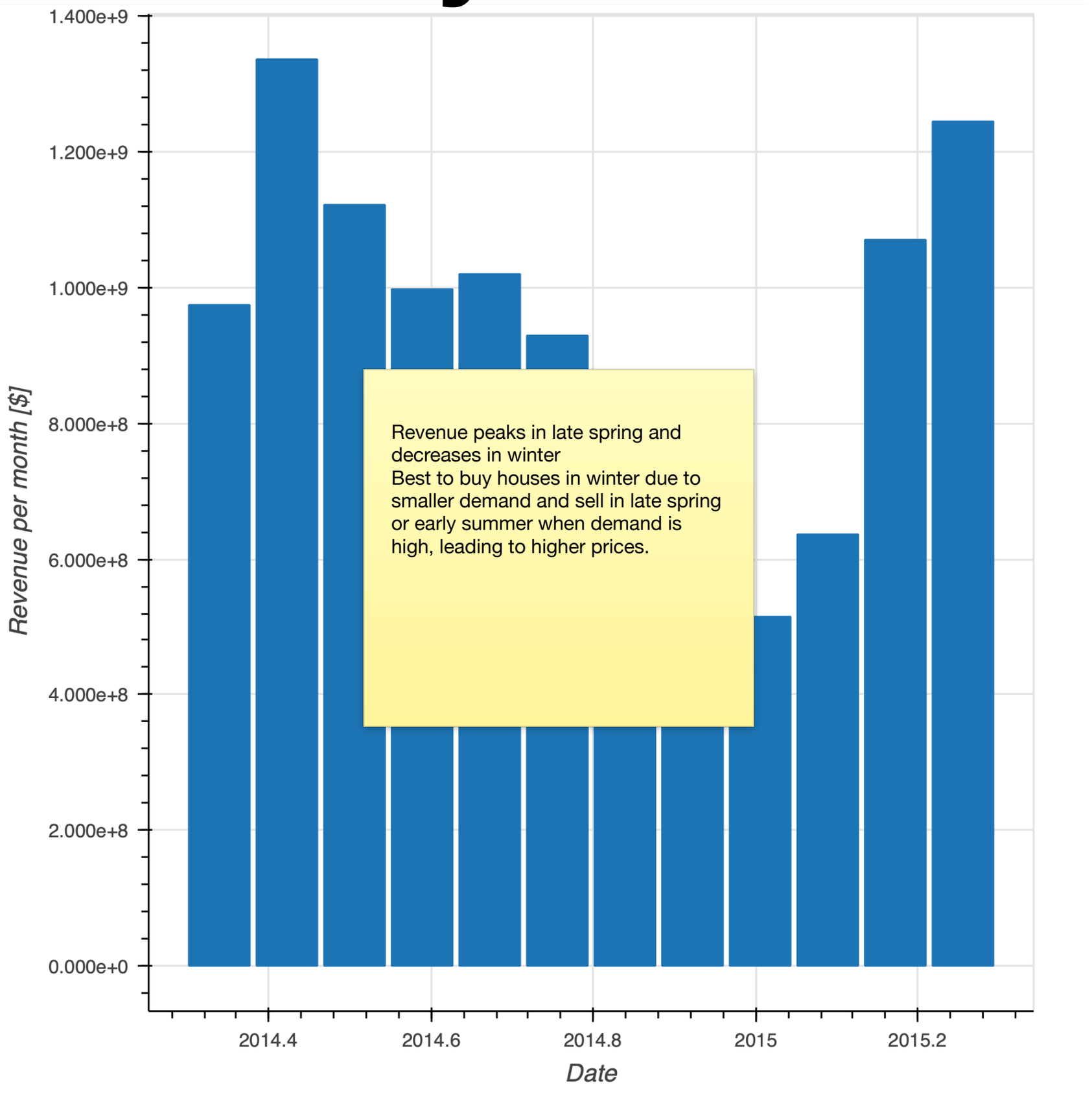
Geometrical distribution of sold houses in King County during the mentioned period
Houses sold primarily in western King County, epecially in Seattle

Key

Number of house sales 21_600
Total revenue 11.7 billion $
House price 540 \pm 367 k$
Growth by 0.86% from April 2014 to April 2015
Price per ft^2: 264 \pm 110 with strong 7.44 % growth
Living area substantially decreases by -4.5%
Age of house 42 \pm 29 years

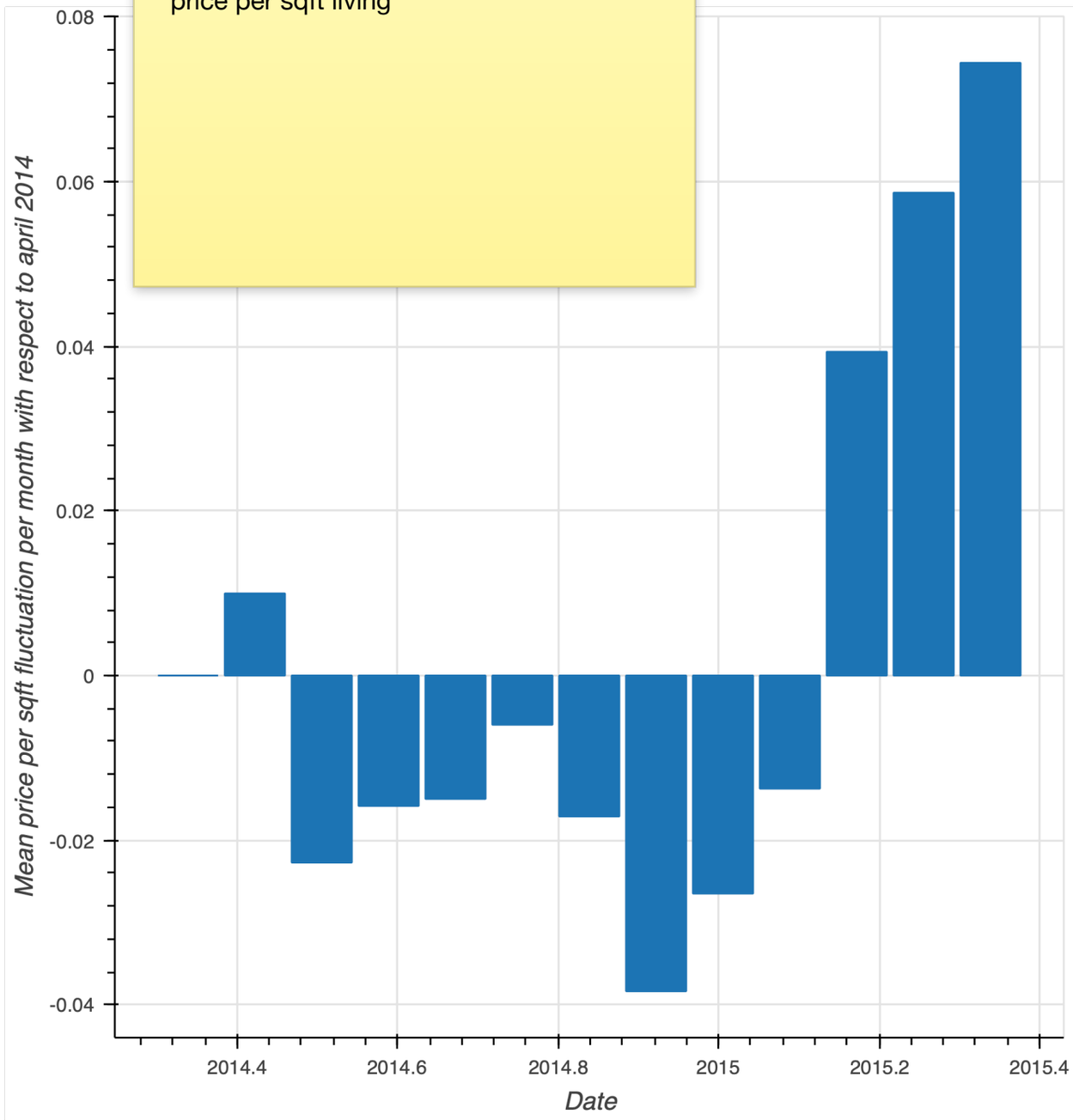
	Mean		
House Sales	21.6k		
Total Revenue	11.7 G$	-	-
House Price	540 k$	367 k$	0.86 %
Price per ft^2	264 $	110 $	7.44 %
Living area [ft^2]	2080	918	-4.5 %
Age of house [yr]	42	29	-

Monthly Revenue

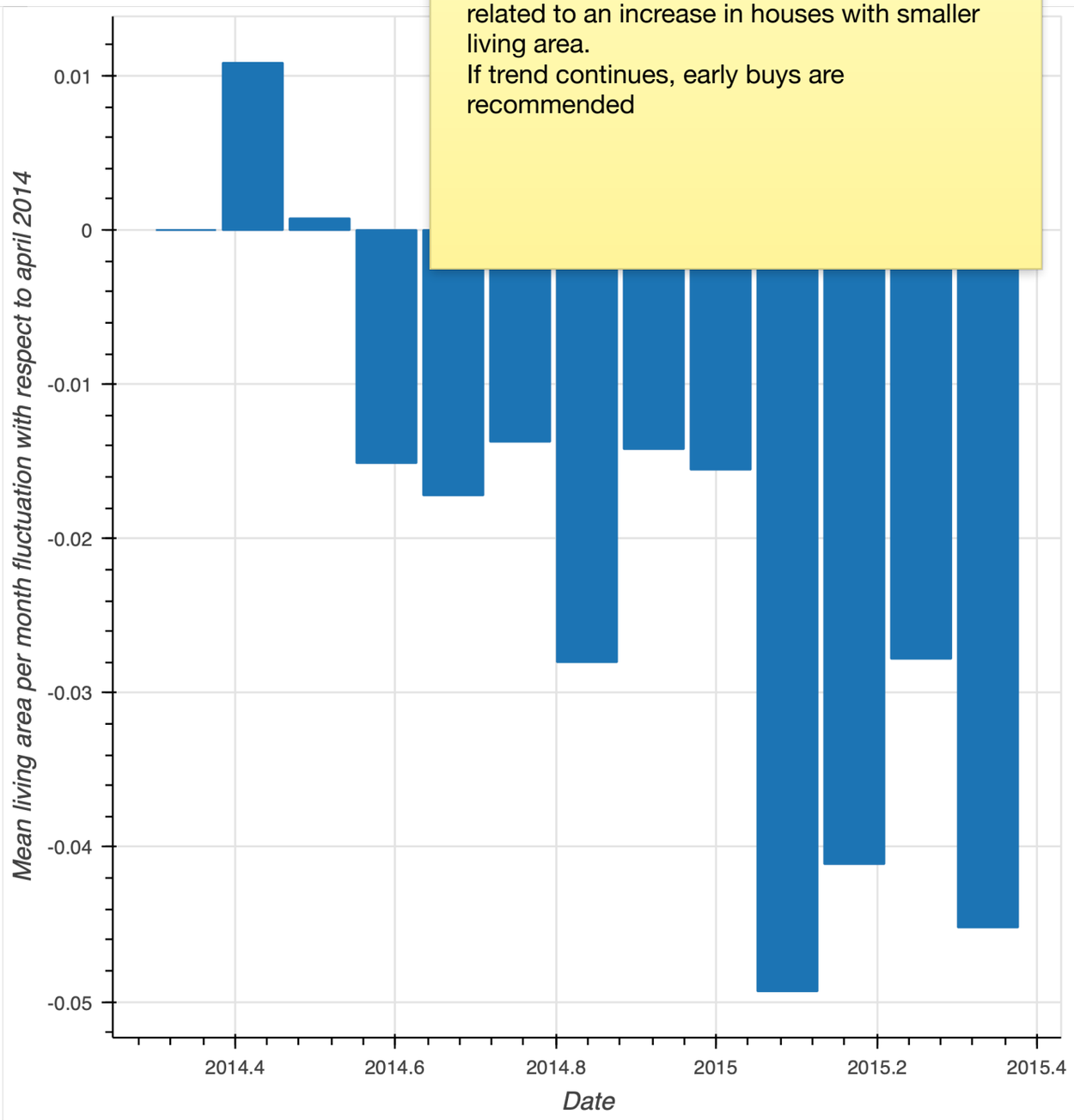


Monthly Fluctuations

Sudden increase of price per sqft living in early 2015 relative to April 2014
Cause is unclear and more data is required to understand market evolution.
Trend implies substantial growth in house price per sqft living

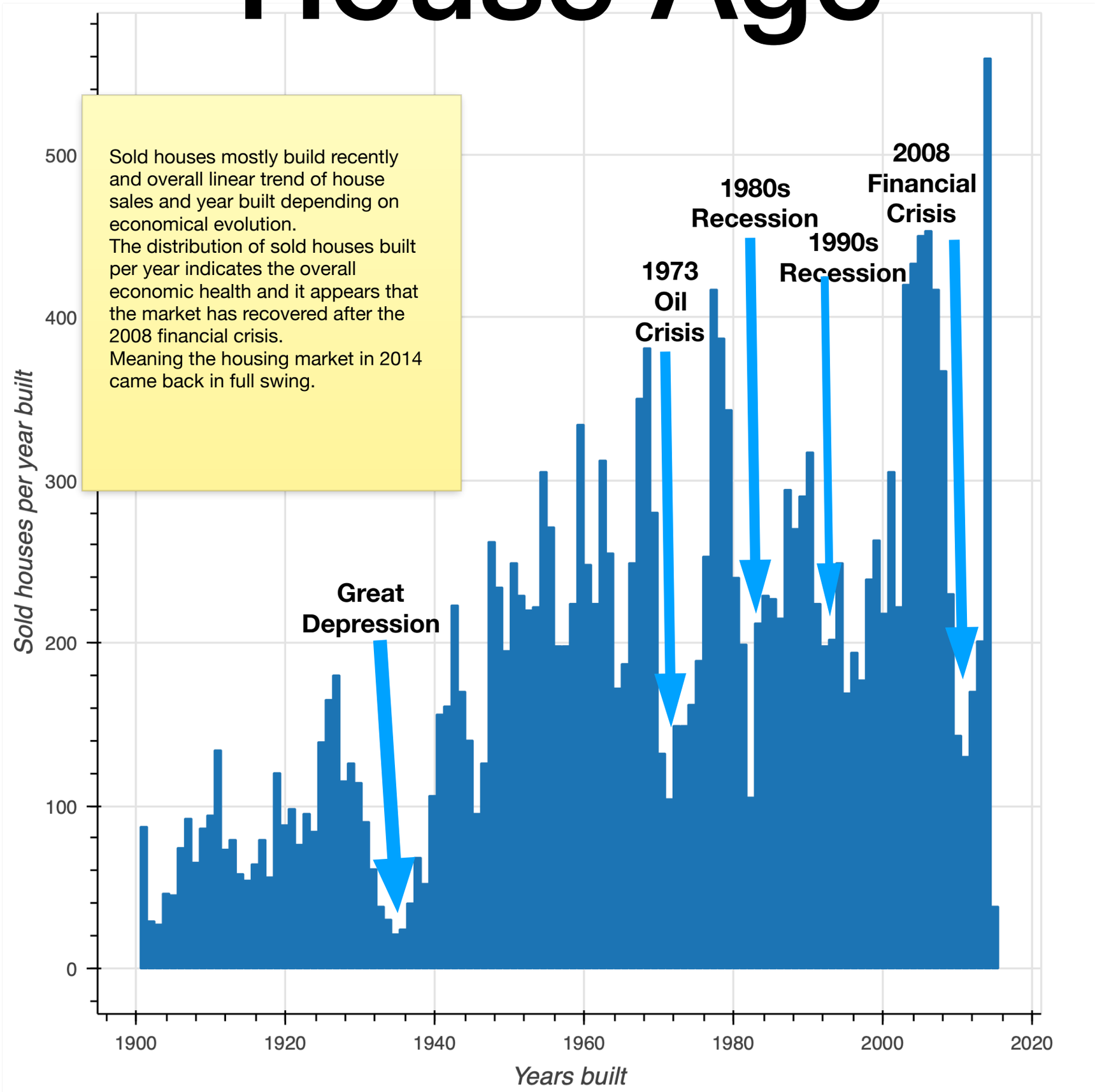


Substantial decrease of sqft living area throughout relative to April 2014.
Note that house prices barely change and the change in price per sqft_living is primarily related to an increase in houses with smaller living area.
If trend continues, early buys are recommended

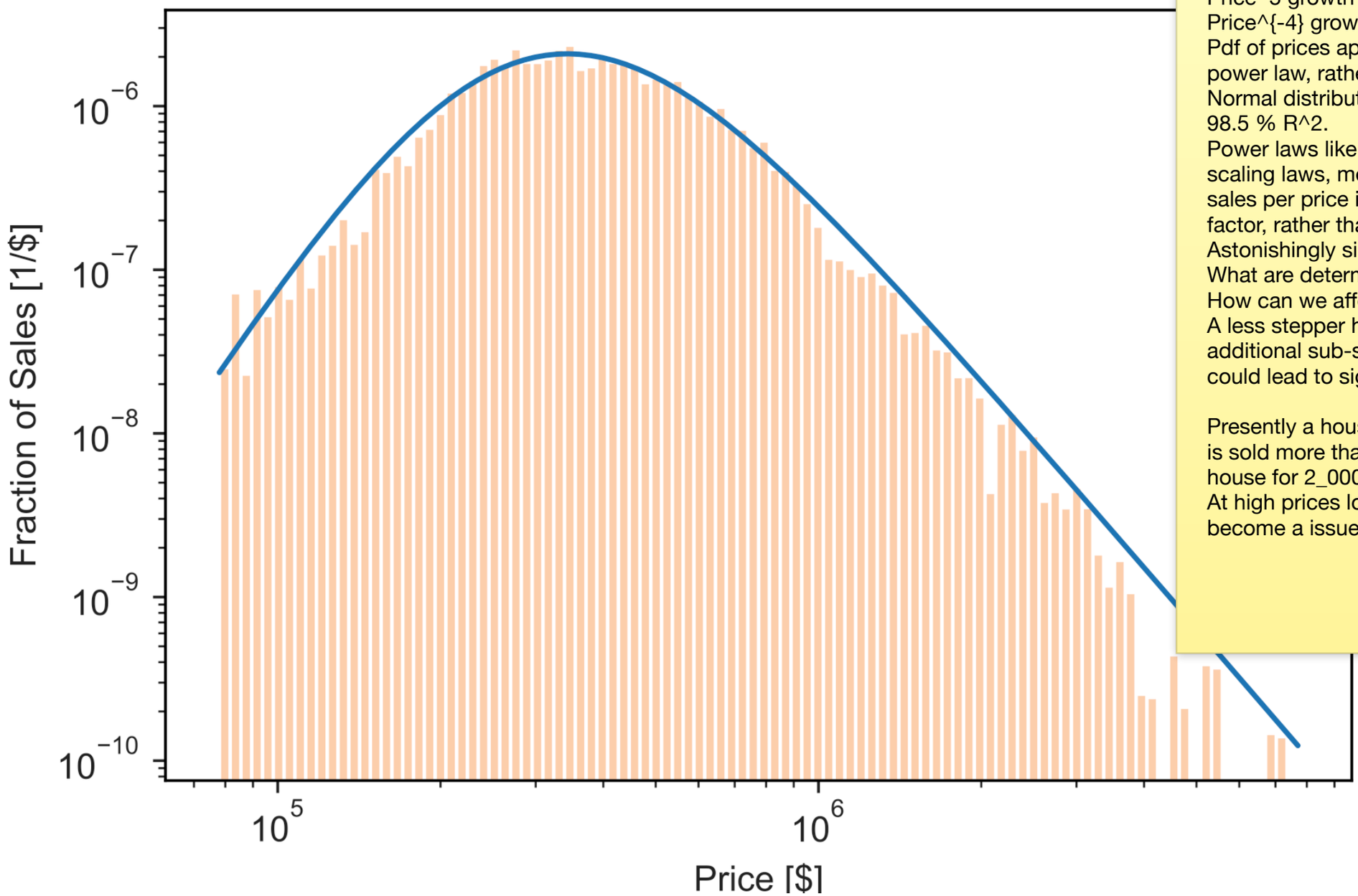


House Age

Sold houses mostly build recently and overall linear trend of house sales and year built depending on economical evolution.
The distribution of sold houses built per year indicates the overall economic health and it appears that the market has recovered after the 2008 financial crisis.
Meaning the housing market in 2014 came back in full swing.



Sales per Price



Price^5 growth for small prices and Price^{-4} growth for large prices.
Pdf of prices appears to follow a broken power law, rather than a Gaussian or Log-Normal distribution and the model has a 98.5 % R^2.
Power laws like these indicate universal scaling laws, meaning the distribution of sales per price is determined by one major factor, rather than several different factors.
Astonishingly simplistic for large prices
What are determining factors
How can we affect distribution
A less stepper high price slope or an additional sub-slope in the distribution could lead to significantly larger revenues.

Presently a house that costs 4_000_000 $ is sold more than 10 times less than a house for 2_000_000 $.
At high prices low number statistics become a issue

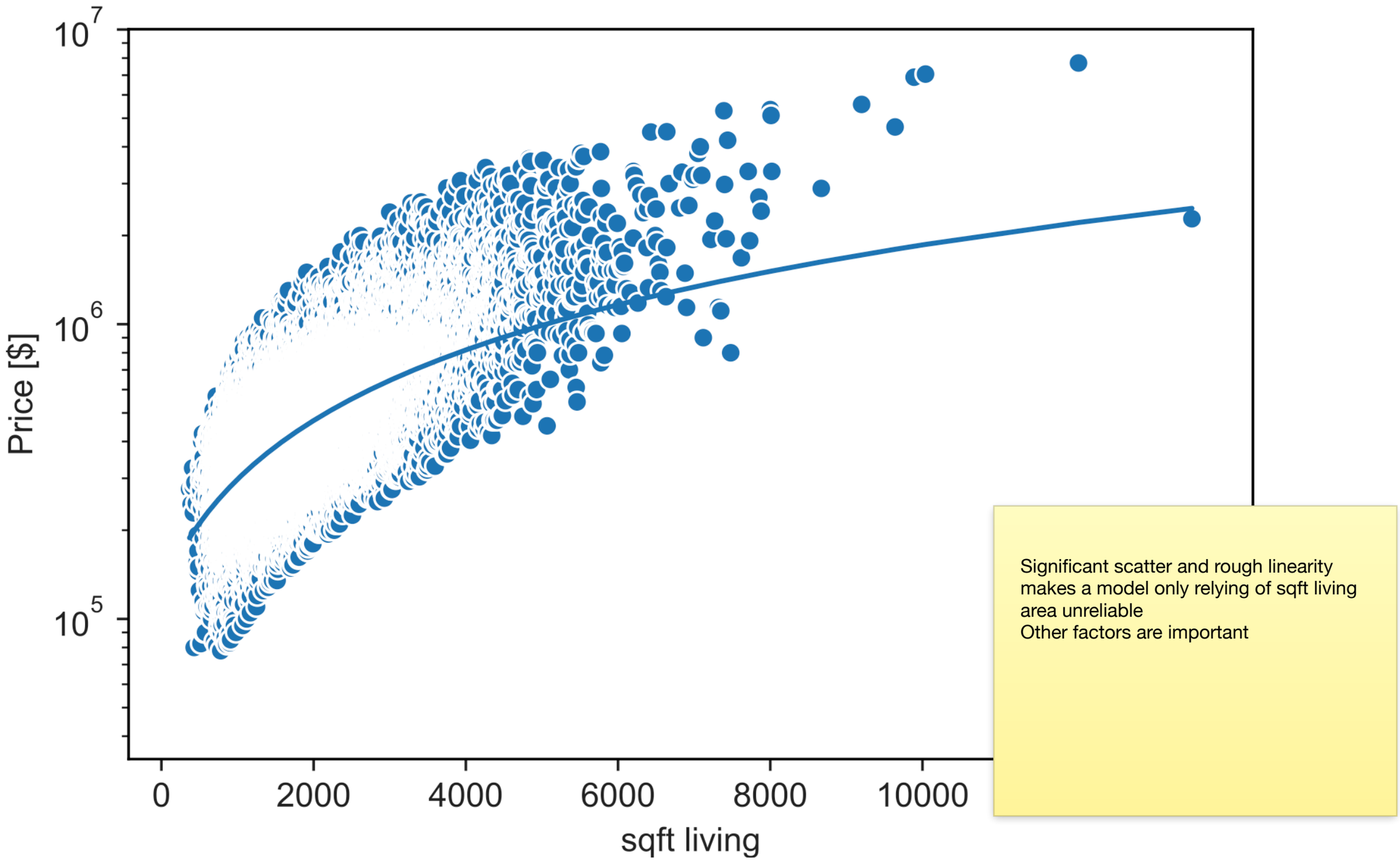
High priced houses sales scale with the fourth power in price
Example: A 2 M$ house is should 16 times more than a 4 M$ house

Price Model

$$\text{price} \approx p_0 + a \cdot \text{sqft\_living} + \mathbf{b} \cdot \mathbf{zipcode} + \mathbf{c} \cdot \mathbf{grade}$$

House price model
sqft_living
Zipcode
Grade
Are important factors
Analyze coefficients
We categorize different grades and zip code.
This simple and minimal model estimates the price with R^2 = 78%.

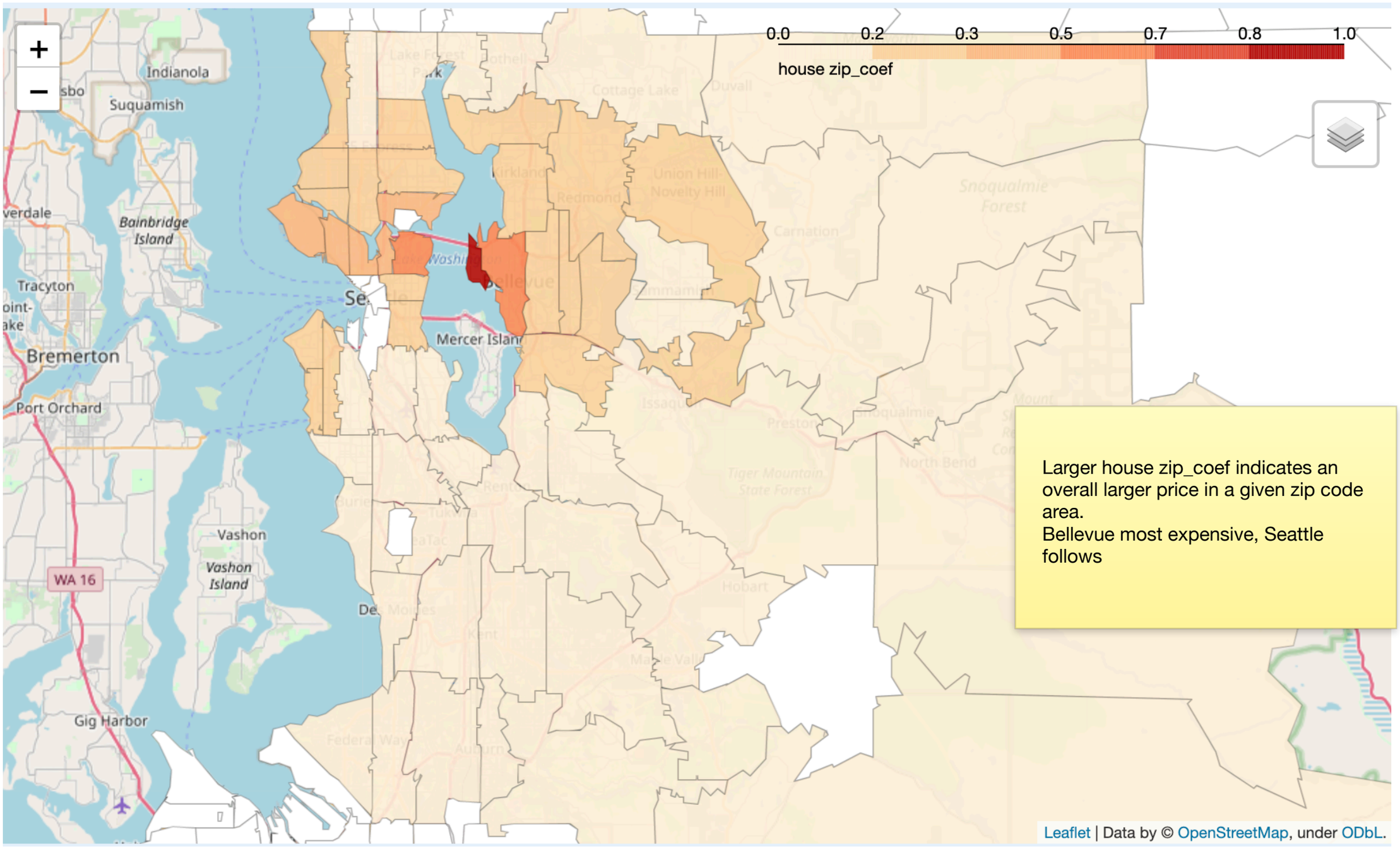
Sqft Living Dependence



Significant scatter and rough linearity makes a model only relying of sqft living area unreliable
Other factors are important

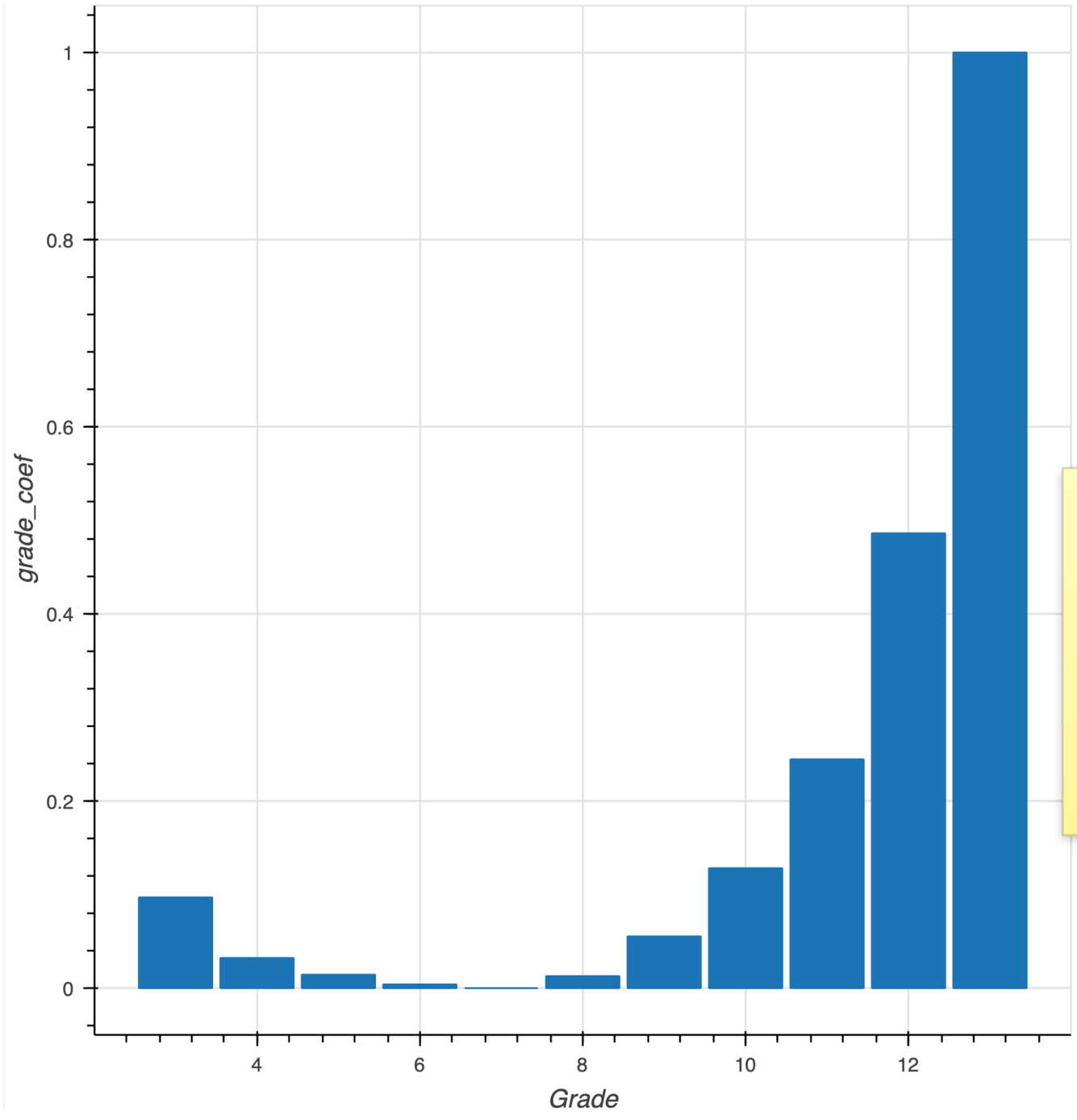
Shows p_0 and a

Zip Code Dependence



Shows b

Building Grade Dependence



Higher grade houses more expensive. Surprsingly also low grade houses have slightly higher house prices with respect to grade 7 houses in the present house price model

Shows c

Summary

- Monthly house sale revenue is lowest in w
  highest in late spring

- Total price per sqft living area increased s
  the beginning of 2015

- Avg. sqft living area per sold house decreases

- Financial crisis no longer strangles housing market

House sale revenue lower in winter and higher in late spring
Price per sqft living increased substantially in one year
And overall smaller houses have been sold.
Financial crisis impacts appear to have passed

Summary

- Sales per price follows universal scaling that dictates revenues
- House price is primarily affected by
  - Sqft living area
  - Zip code
  - King County house grading index

Universal scaling for sales per price
House price primarily driven by living area, zip code and King County grading index.

Recommendations

- In winter house demand lower means lower prices
  - Buy in winter, try to sell in spring
- Price per sqft living area has risen
  - Buy now or you may only afford smaller ho
  - House value may rise

Buy in winter, sell in spring
Substantial increase in price per sqft living should lead to earlier investment and rise in house value.

Recommendations

- Very expensive houses are rarely sold
  - focus on a portfolio that is in accordance with our distribution model to maximize sales and profits
- Do not invest in Bellevue as it is very expe
  saturated
  - Invest in south Seattle
- Grade 7 houses (solid) are overall the cheapest category
  - Raise prices of grade 6 - 8 houses

Very expensive houses are rarely sold
Adjust house portfolio according to our distribution model
Invest outside of Bellevue as investments will already focus on more expensive area that have a rather small overall volume
Invest in south Seattle
Grade 7 houses are cheapest 3 to 10 roughly comparable.
Raise prices of grade 6 - 8 houses

Future Work

- Resolving factors that dictate sales per price scaling law
  - Analyse scaling law for different subs
- Taking economical data account
- Resolving price relation for different zip
- Taking more years of data into account to predict temporal house price evolution
- Understanding the cause or significance of fluctuations

Study scaling law dependencies
For example dependence on zip code or grade
Economical data into account, like income distribution
Price relation for different zip code areas
More data, over several years
Understanding source of fluctuations

Thanks for the Attention

Thanks to all members of the Data Science Team and especially to Florian F. and Simon.

Any Questions?

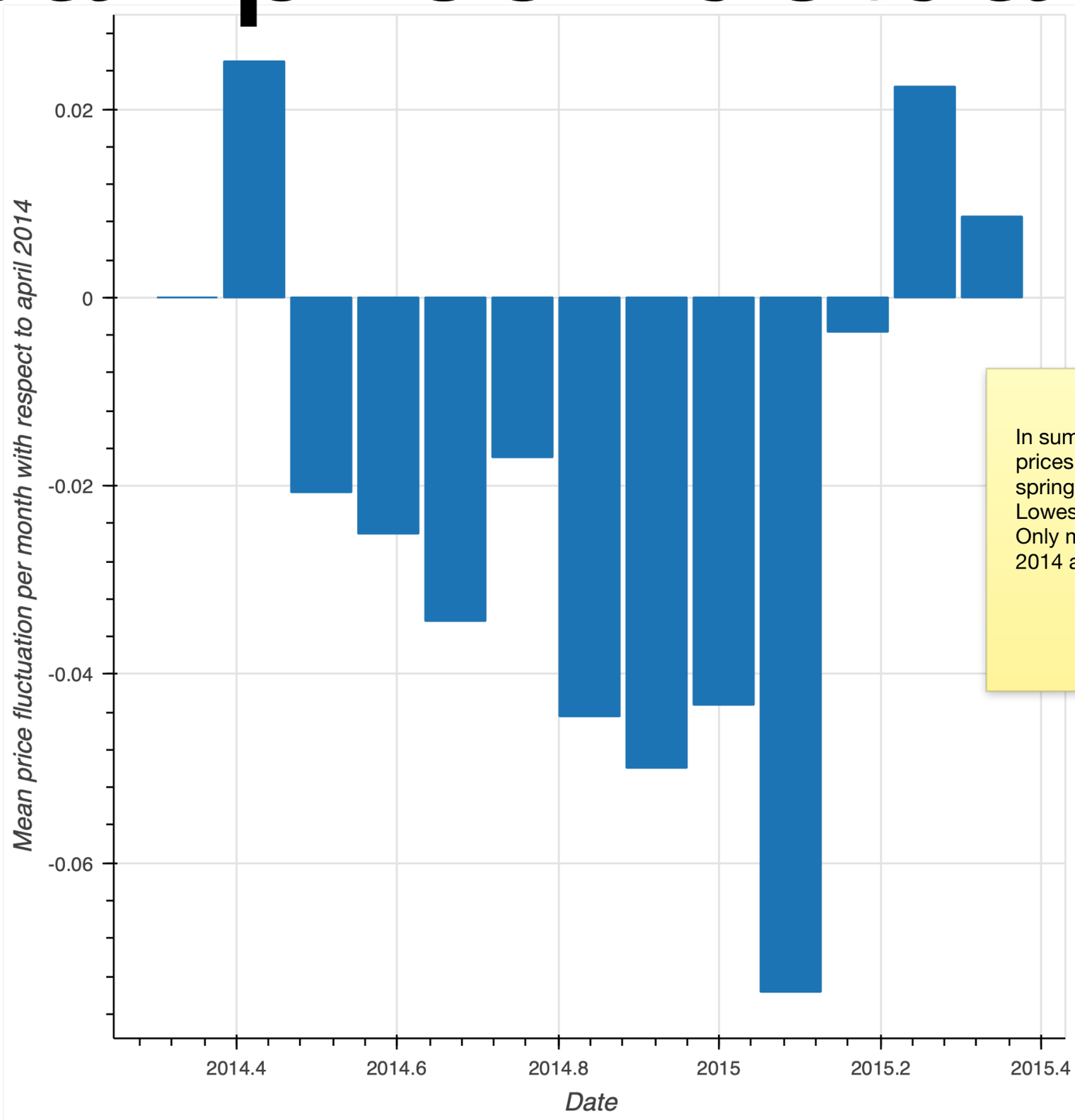
Sales per Price - Model

$$\mathrm{pdf}(x = \mathrm{price}) = A\frac{(x/E)^B}{\left(C + (x/E)^D\right)^4}$$

A determines height of distribution
E is a fixed scaling factor, corresponding to peak
B corresponds to small price power law
C corresponds to peak of spectrum
D is related to high price power law
The power law index 4 in the denominator sets respective high and low price scaling.
Technically also values of 3 to 5 are reasonable leading only to changes the different model parameters that lie within the standard deviation of each parameter.
Higher denominator power laws lead to a steeper scaling.

	Mean	Std. err.
	$4.48 \cdot 10^{-6}\ \$^{-1}$	$4.88 \cdot 10^{-7}\ \$^{-1}$
	5.22	0.26
	0.31	0.034
B-4D	-3.84	0.3
E	$5 \cdot 10^{5}\ \$$	-

Mean price fluctuation



In summer and winter mean house prices overall lowest, while in early spring prices overall highest.
Lowest prices in winter.
Only minor variation between April 2014 and April 2015 (< 1%)