RoofStock: Time to Sell

BUDT758W - Project Group #3

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- **Real Estate Market Analysis**

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- **Predictive Model Construction**

- **Strategis & Conclusion**

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01

Project Overview

Recommendations For Sellers

Choose the right time to enter the single-family house market.

Set the first list price prudently & Price the house based on recent comparable sales in local area.

Consider using a professional real estate platform, like Roofstock.

PART

02

The future outlook of single-family homes is strong

TOTAL HOME SALES IN THE U.S.(2018)

5.96M units

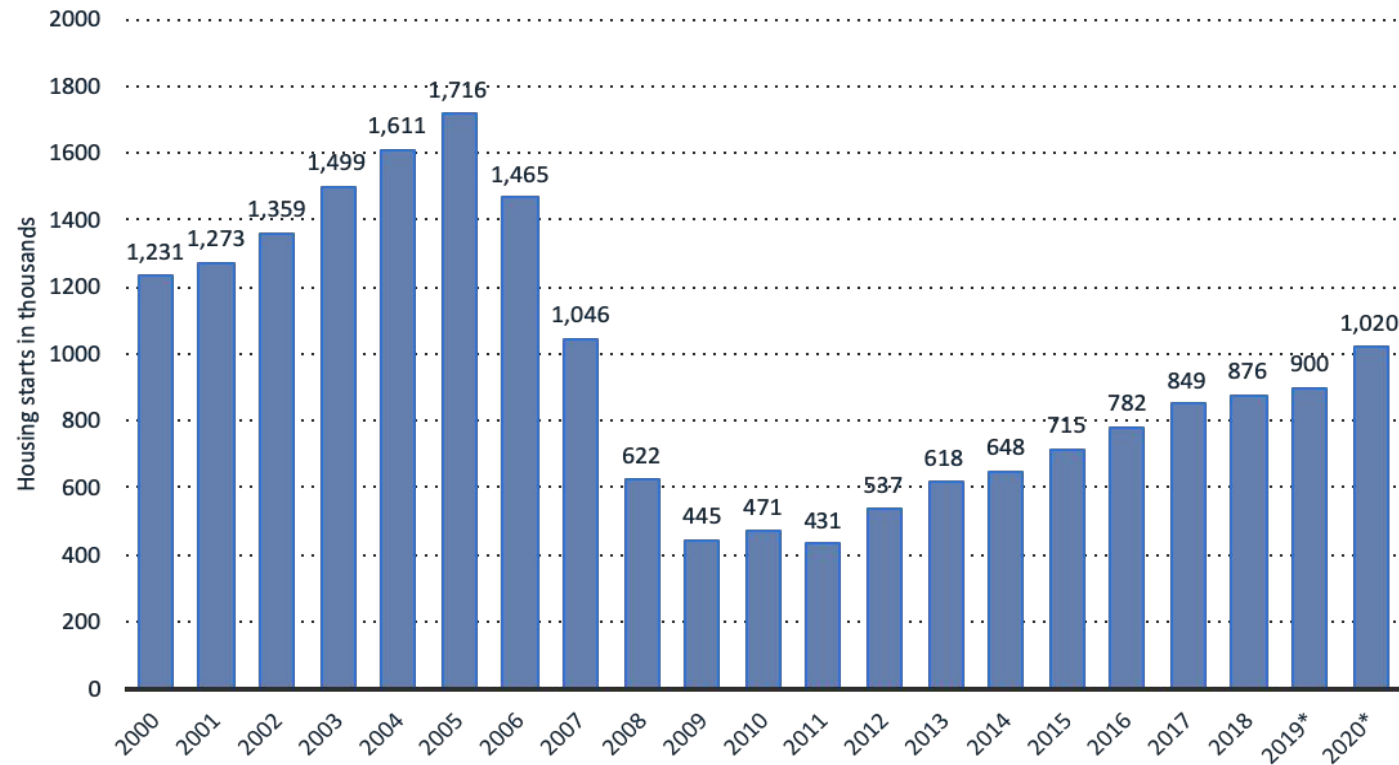MEDIAN PRICE OF EXISTING HOMES IN THE U.S.(2019 Q3)

277.1K USD

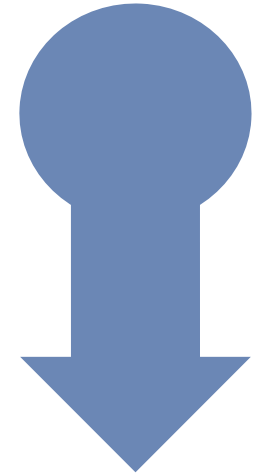NUMBER OF SINGLE-FAMILY HOMES vs MULTIFAMILY HOMES IN THE U.S.(Aug 2019)

218.78M vs 38.26M units

The rebound of new single-family homes supply has been slower after the Great Depression

Number of single-family housing unit starts in the U.S. 2000-2020(in thousands)

Housing Starts

A Strong Indicator of Economic Strength

The demand for single-family homes is on the rise

Most common type of home purchased in 2018

Detached Single-family house — 82%

Townhouse/Row house — 8%

Duplex/Apt/Condo in 2-4 units building — 3%
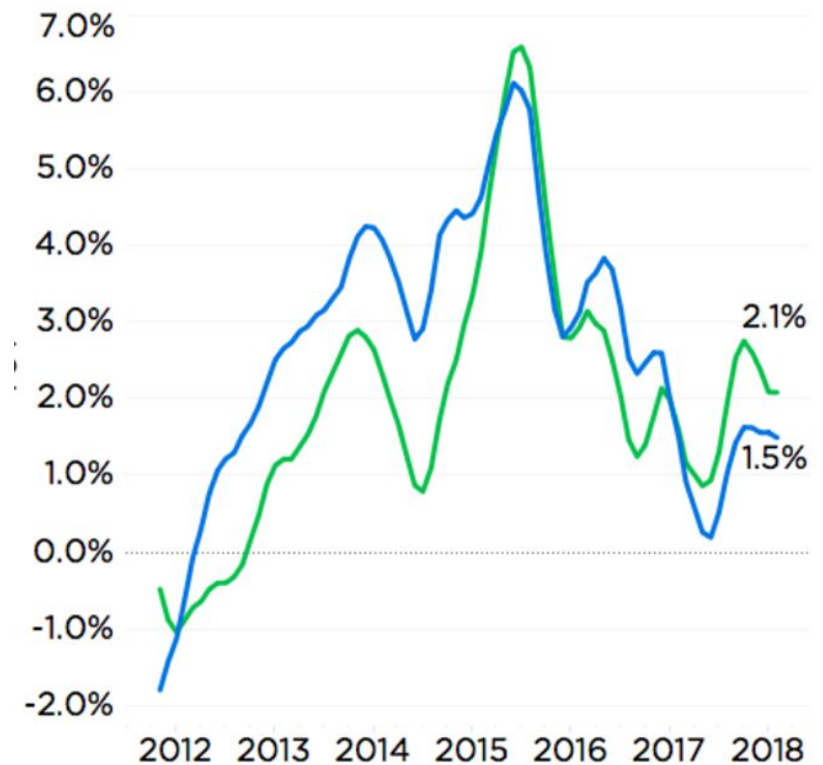
Apt/Condo in building with 5 or more units — 1%

Other — 6%

Source(s): National Association of Realtors

Multifamily rents are climbing more slowly than single-family rents

2.1%

1.5%

7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%

2012 2013 2014 2015 2016 2017 2018

Source(s): Zillow Rent Index

Constrained supply and high demand lead to increasing single-family home prices

Supply

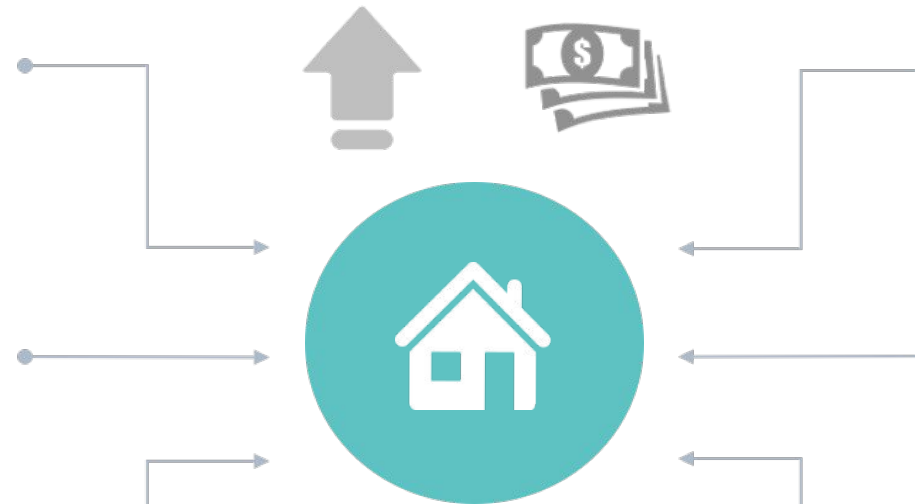**The price of single-family home will increase if supply doesn't meet demand.**

Demand

The housing boom in the early 2000s created an excess supply of homes.

People want more affordable options and are looking at multifamily units instead.

A shortage of single-family homes in the future.

Single-family rents are growing at a noticeably faster annual pace.

More and more high-income families are choosing to invest in single-family units.

Overseas buyers enter the U.S. market to invest in real estate.

Single-family home sellers need jump into the housing market with a realistic asking price

Median sales price of existing single-family homes by region 2002-2018
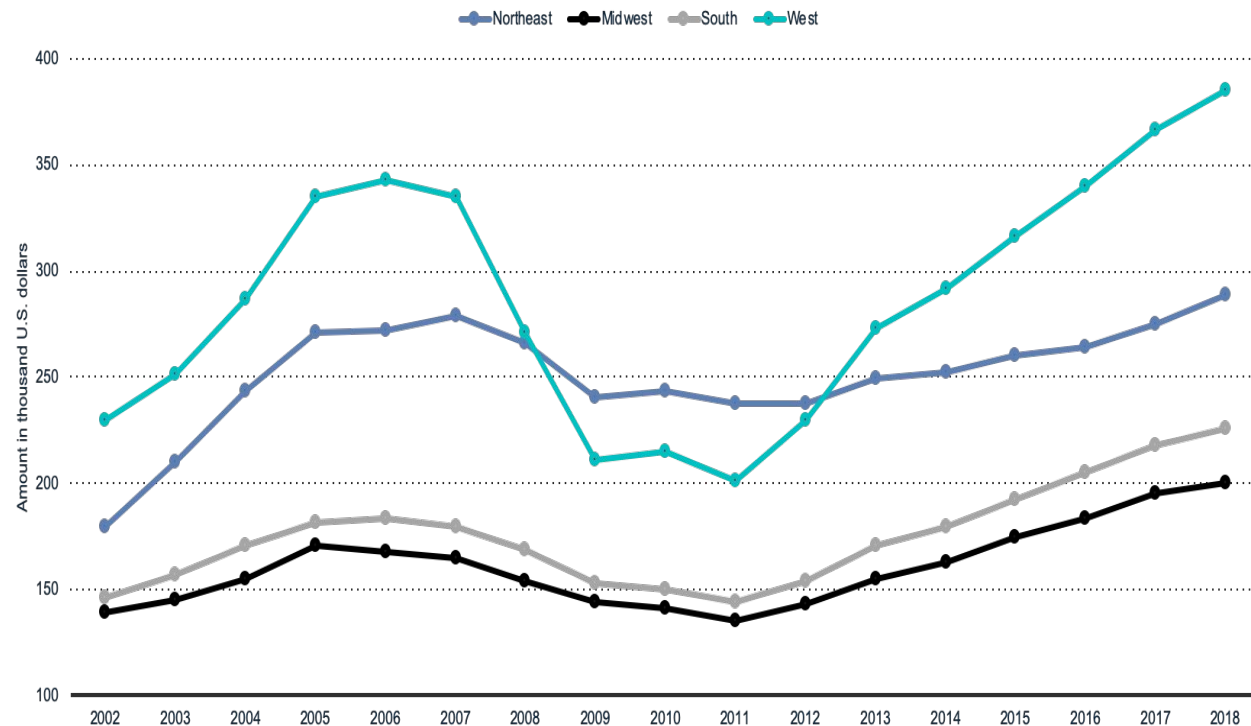
- Overall, the median sales price for an existing single-family home in the West region of the U.S. is the highest but the most likely affected by the macro economy.

- With the recovery of economy since June 2009, the single-family homes market has returned to a more normal pace and been ticking up.

- For home sellers, it is unrealistic to expect the same or higher prices as before the year of 2007 for the same property during the great depression (2007-2009).

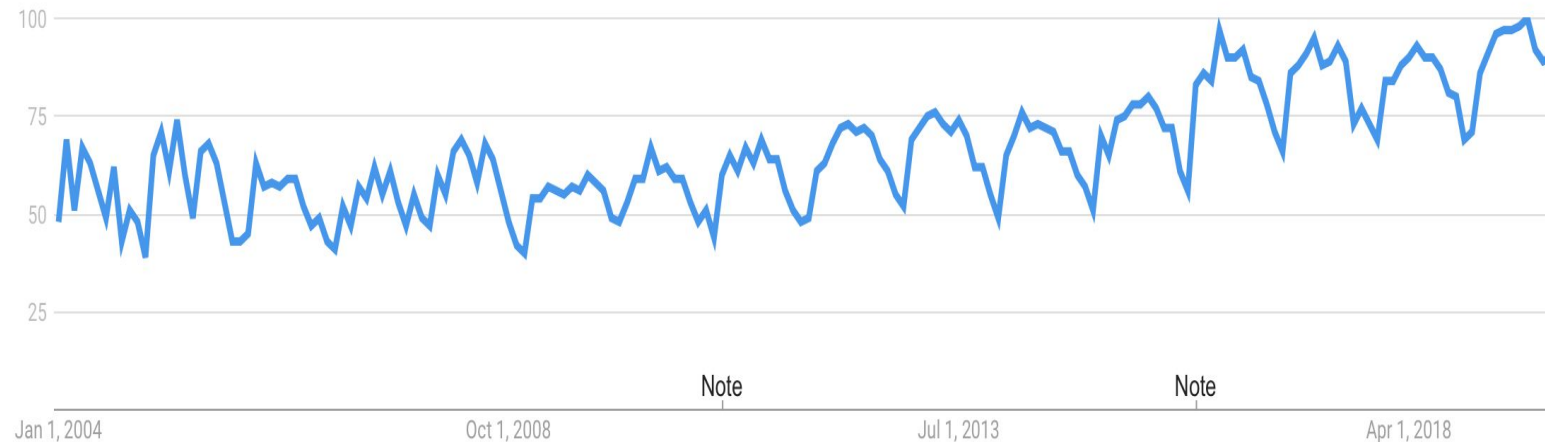# Better to avoid selling single-family homes in winter

Google Trends | Single-family detached home

Interest over time*

100
75
50
25

Note   Note
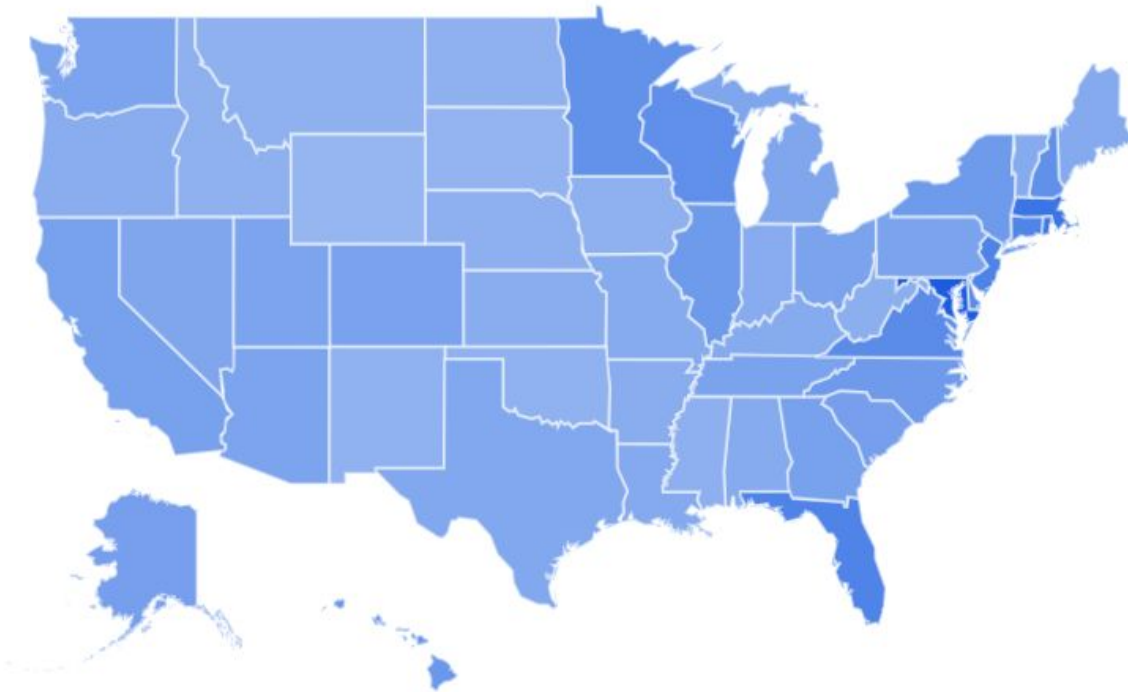
Jan 1, 2004   Oct 1, 2008   Jul 1, 2013   Apr 1, 2018

* Numbers represent search interest relative to the highest point on the chart for the given region and time.

Search Interest For Single-family Homes—Seasonally

- The number of search for the keyword "Single-family detached home has shown an overall upward trend since 2004.

- Every December has the lowest search volume during the whole year.

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Maryland shows the greatest interest in single-family homes

Interest by subegion*

Search Interest For Single-family Homes — Regionally

Region	Value
Maryland	100
Massachusetts	80
Rhode Island	68
Connecticut	66
New Jersey	62

* Values are calculated on a scale from 0 to 100, where 100 is the location with the most popularity as a fraction of total searches in that location, a value of 50 indicates a location which is half as popular.
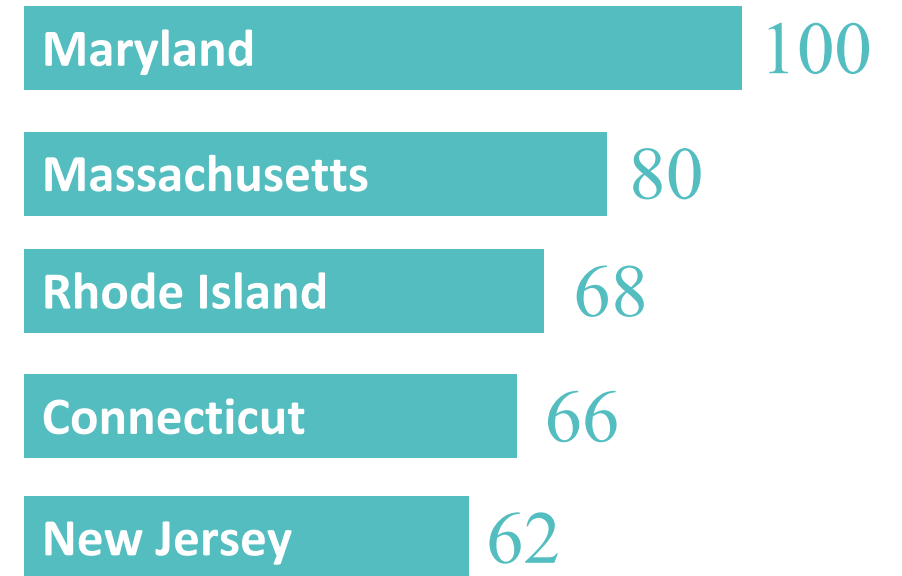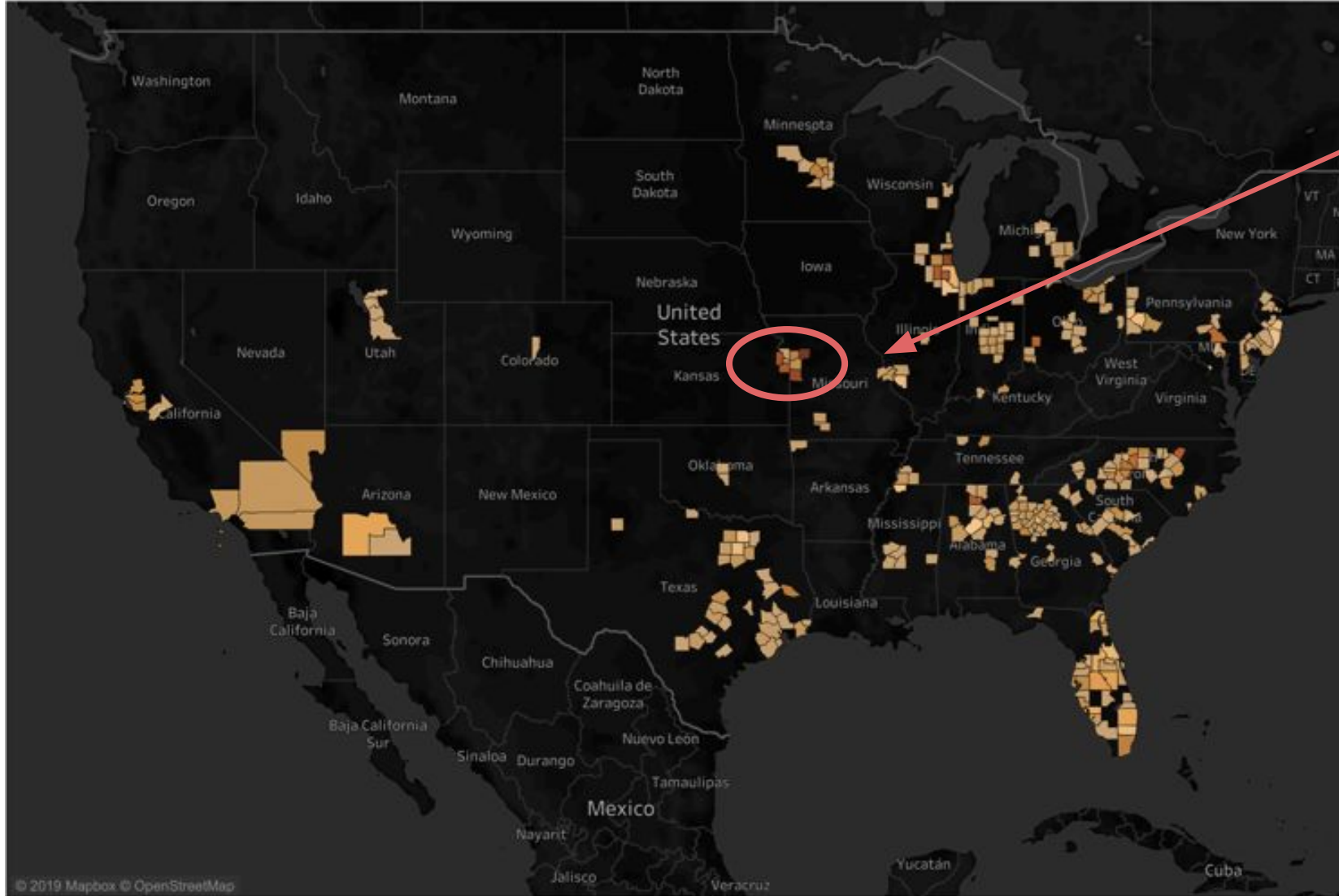
PART

03

Data Description Analysis

- **What is happening in Roofstock market?**

- **Who are the users ?**

- **What are cared by buyers?**

- **What are cared by sellers?**

The Roofstock Market

Missouri:

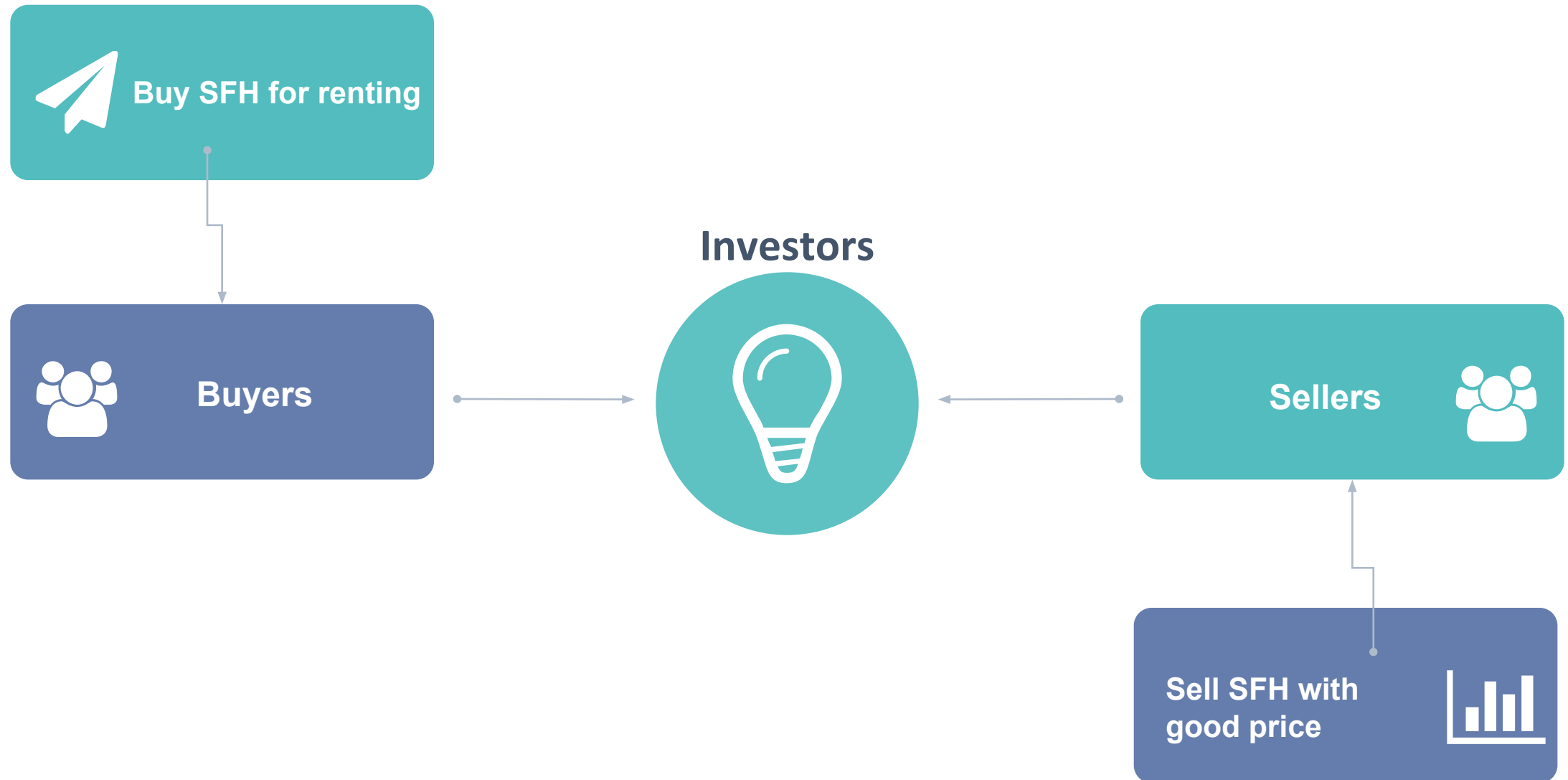**(longer time to receive a offer)**

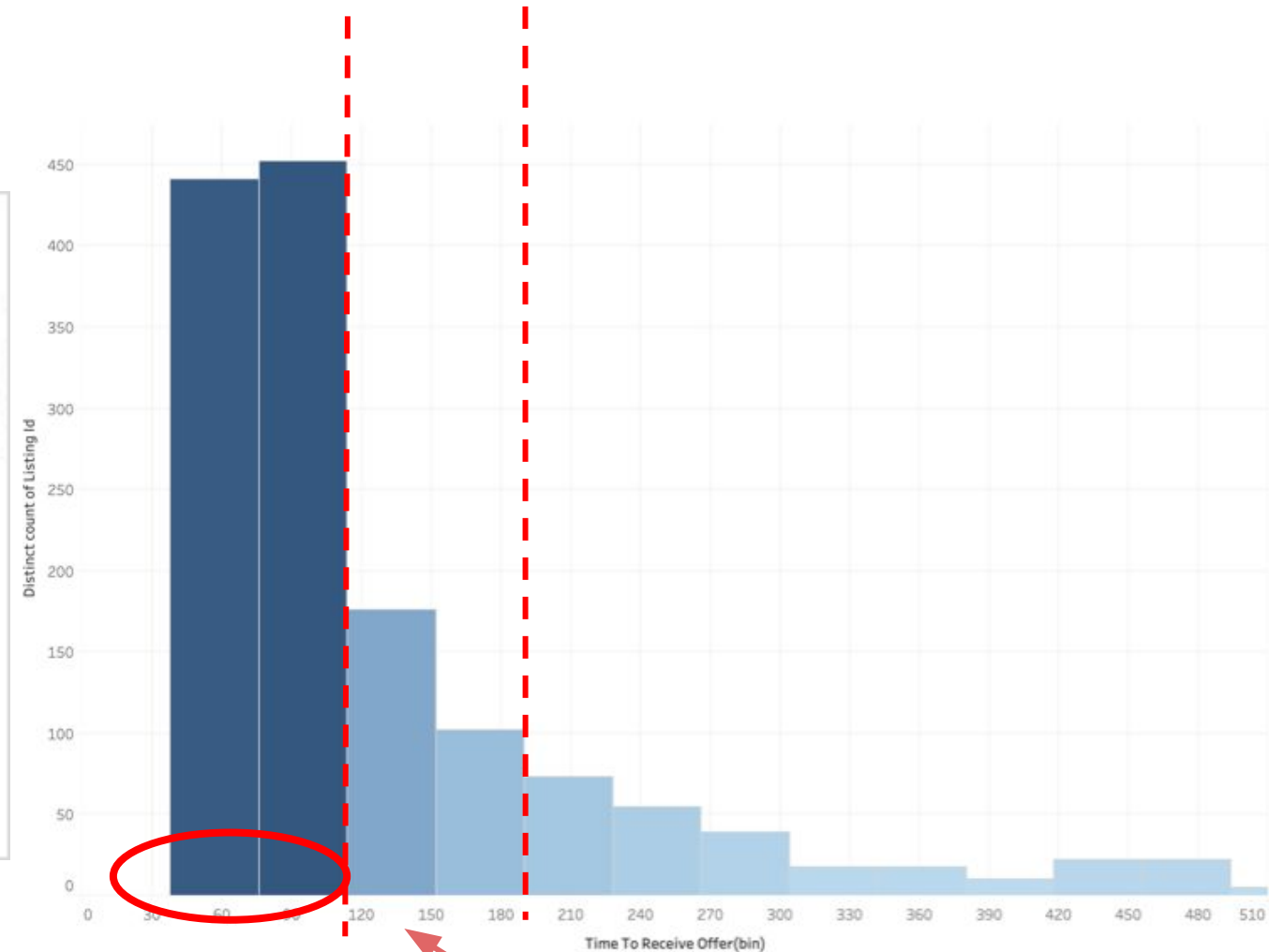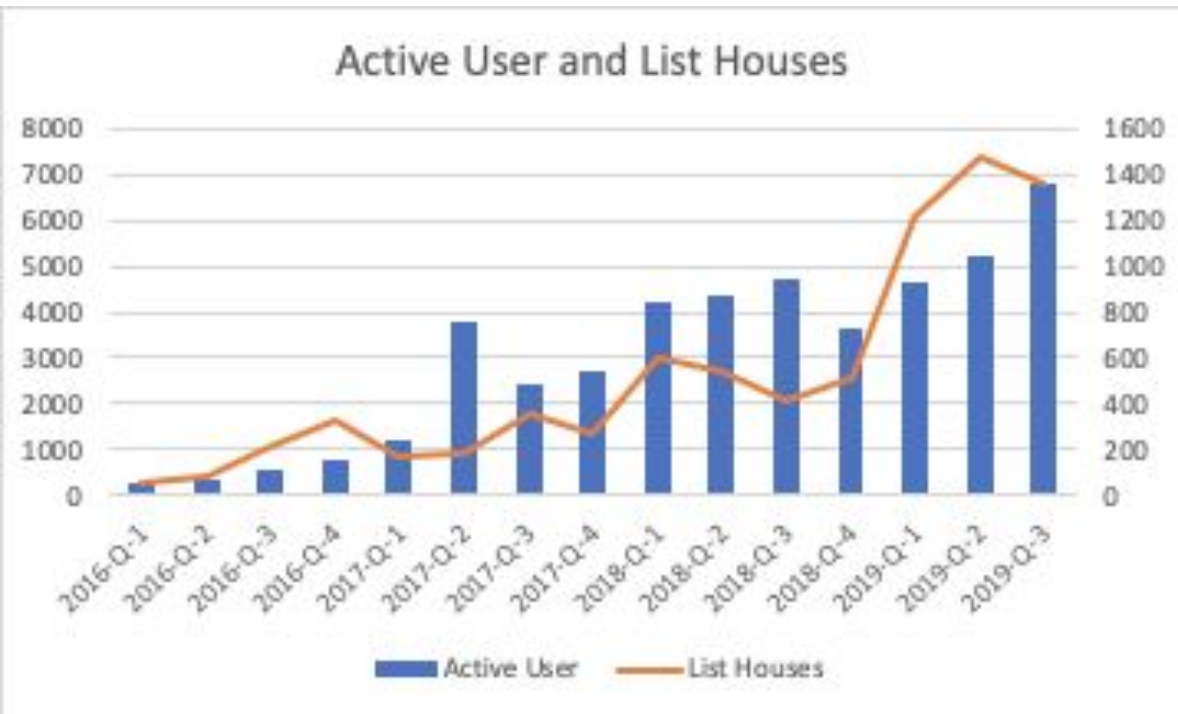Poverty rate--13.4% (RANKED: 30TH)

Assets and Savings--8.6% (RANKED: 34TH)

Health Insurance Coverage--21.2% (RANKED: 39TH)

Affordable Housing--80.0 units (RANKED: 7TH)

Map based on Longitude (generated) and Latitude (generated). Color shows average of Time To Receive Good Offer. Details are shown for State and County. The view is filtered on Latitude (generated) and Longitude (generated). The Latitude (generated) filter keeps non-Null values only. The Longitude (generated) filter keeps non-Null values only.

The Roofstock Users

Buy SFH for renting

Buyers

Investors

Sellers

Sell SFH with good price

The Roofstock Market

Active User and List Houses

The trend of distinct count of Listing Id for Time To Receive Offer(bin). Color shows distinct count of Listing Id. The data is filtered on Time To Receive Offer(bin), which excludes -38 and 0. The view is filtered on Time To Receive Offer(bin), which keeps non-Null values only.

Most list house receive offer with 90 days.

What are cared by roofstock investors?

House Condition

Bedrooms,
Bathrooms,
Neighborhood,
School,
Year Build,
Features

Cost

Insurance Cost,
Property Tax,
Repair Cost

Return

Cap rate,
Cash on cash return,
Total Return

Good Offer

House Condition--Neighborhood and School
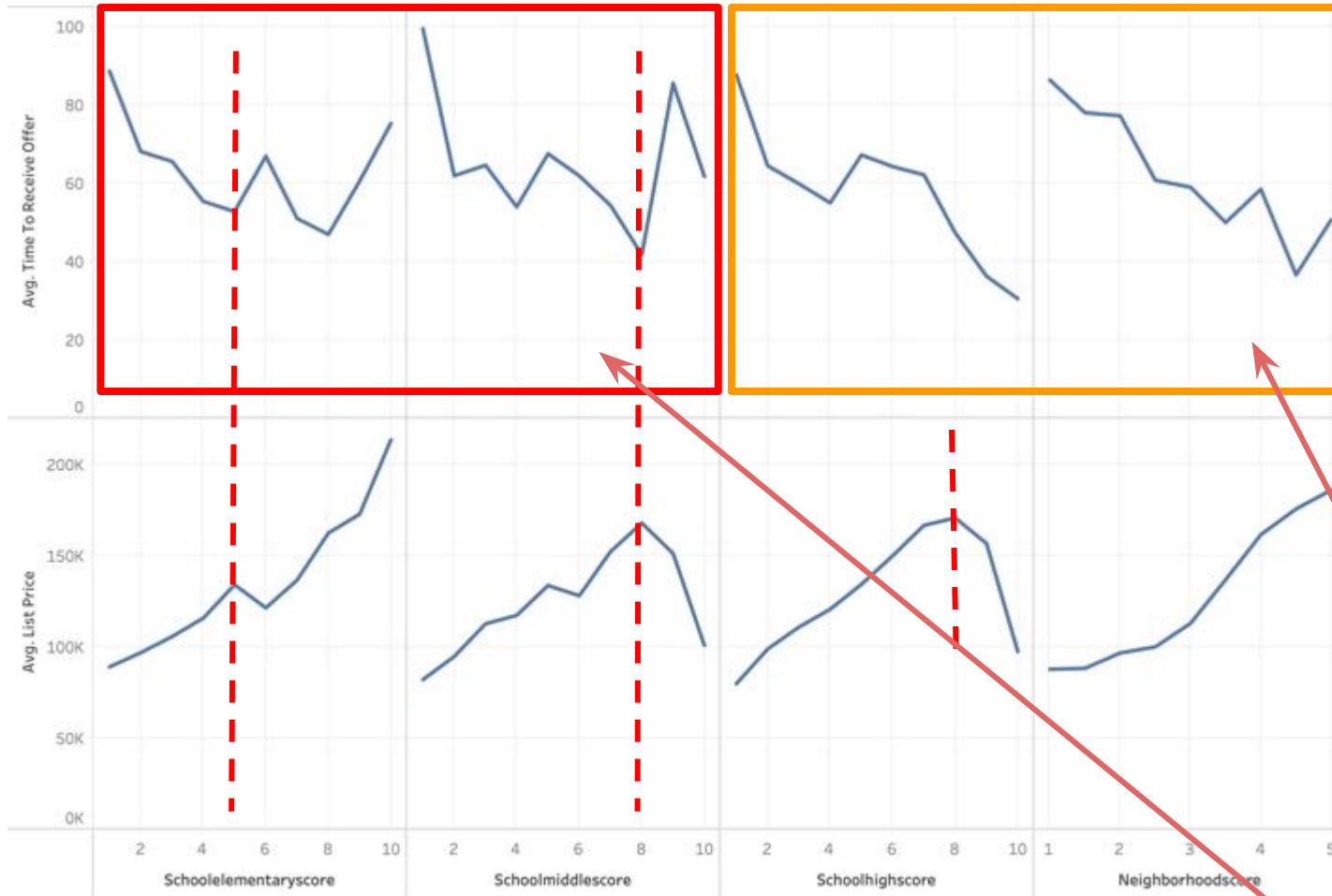
Neighborhood:
The neighborhood in which investors buy will determine the types of tenants and vacancy rate.

Schools:
If investors are hoping to rent to families, they also want to have a look at the local school district. Parents are more likely to choose areas that have well-ranked schools.

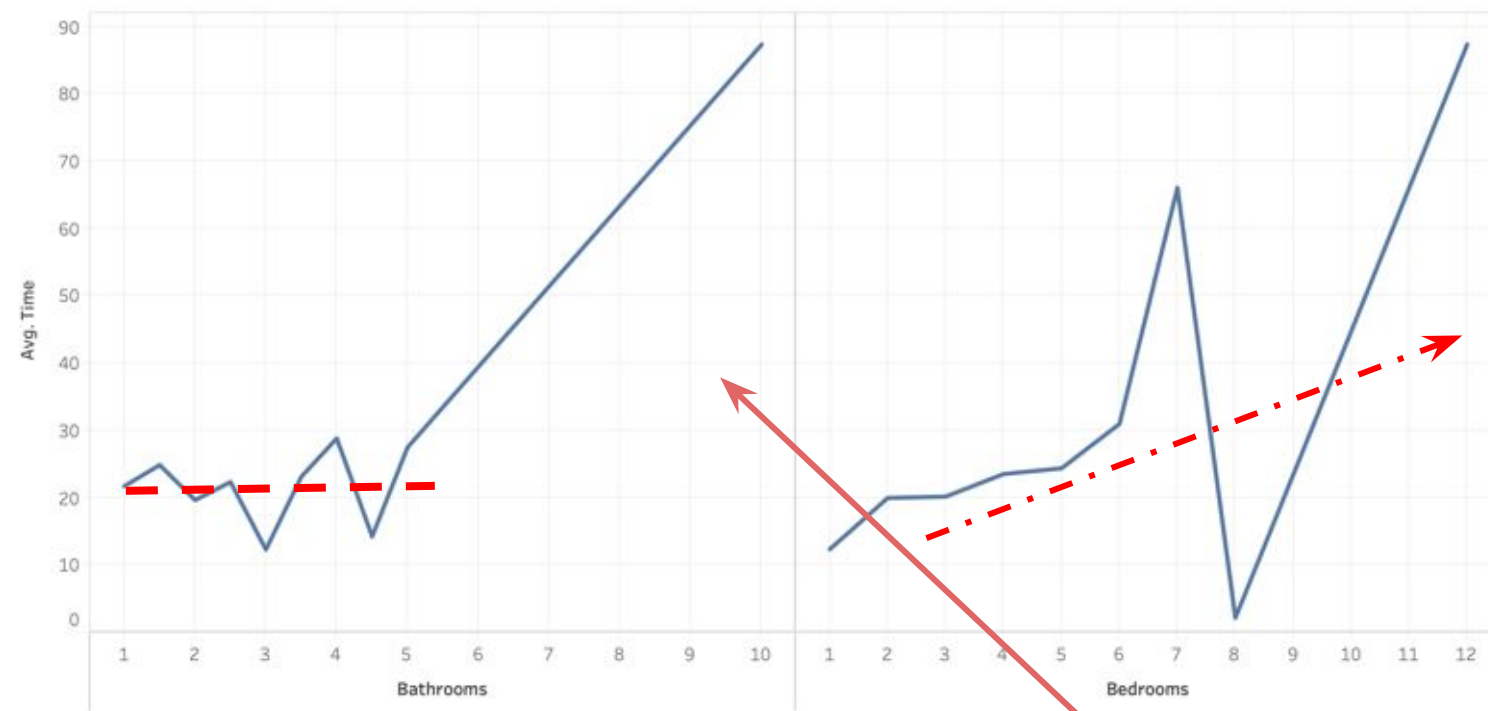Average time to receive a offer decrease when grades increase.

Average time to receive a offer decrease when grades increase just at certain level.

House Condition--Build year, Bathrooms and Bedrooms
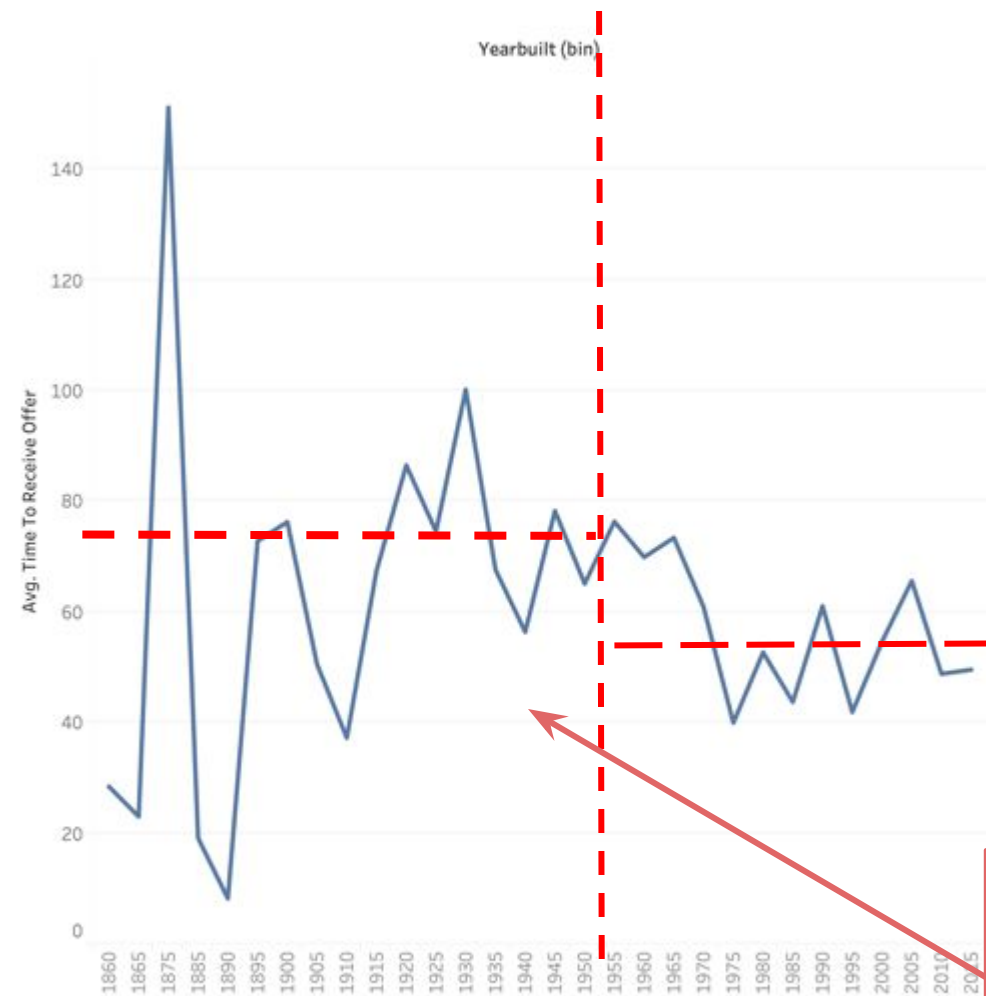
The trend of average of Time To Receive Offer for Yearbuilt (bin). The view is filtered on Yearbuilt (bin) and average of Time To Receive Offer. The Yearbuilt (bin) filter excludes Null, 1880, 19440 and 19460. The average of Time To Receive Offer filter keeps non-Null values only.

The trends of average of Time for Bathrooms and Bedrooms.

Average time to receive a offer is stable within a range of intervals.
Newer houses have short time to receive a offer.

Number of bedrooms influence the time to receive a offer greater than number of bathrooms.

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House Condition--Features

Featured and guaranteed house will receive offer quicker.
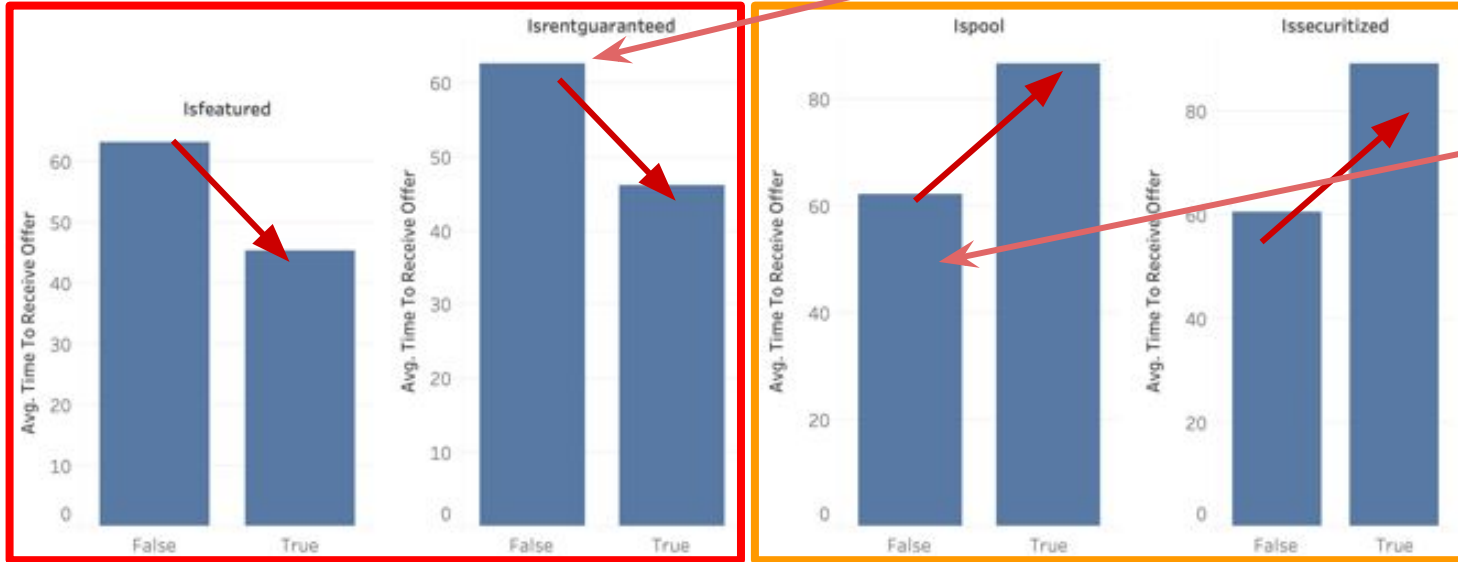
Houses with pool and securitized don't receive offer quicker.

Why?

Buy houses for renting investment!

Pet deposit, rent insurance required and tenant background check don't influence the time to receive the offer greatly.

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Cost

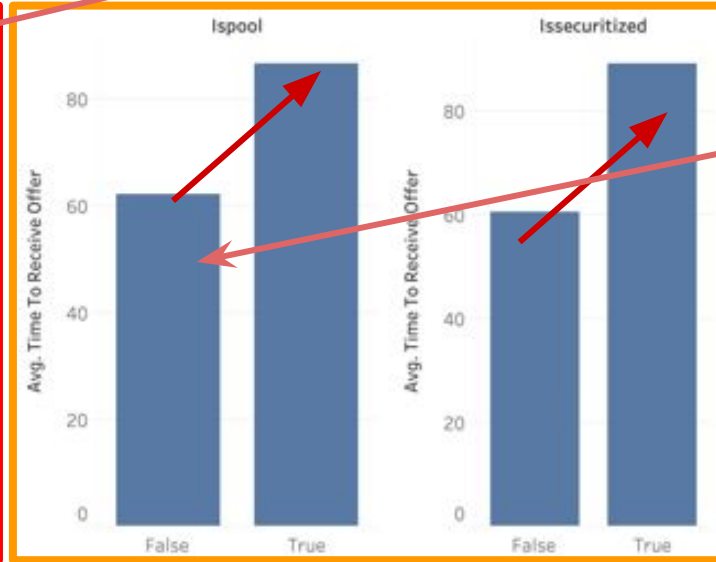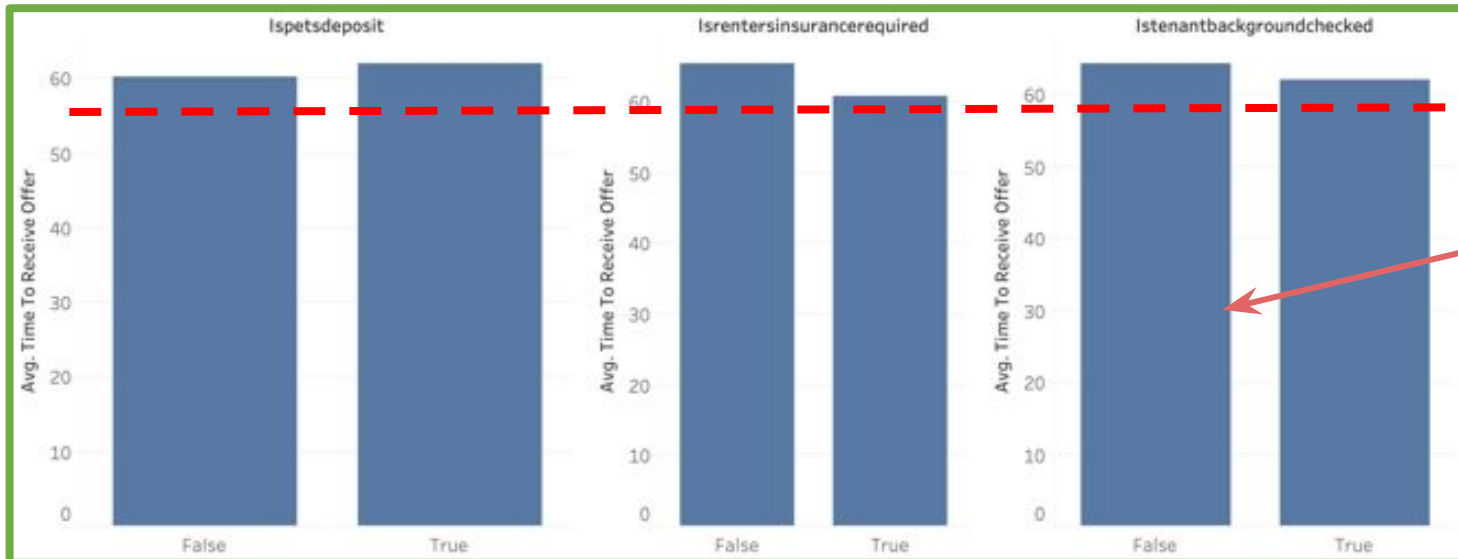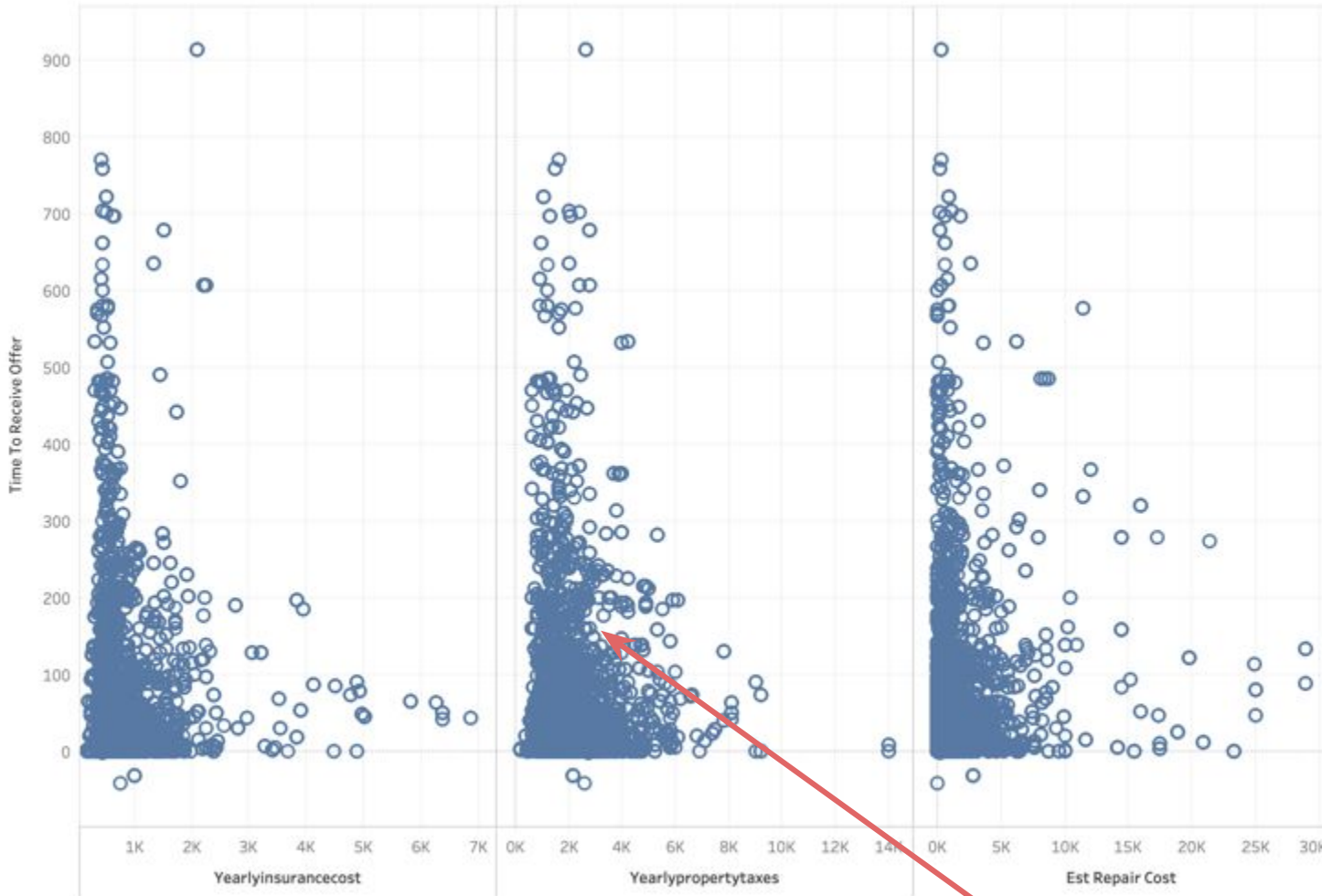Yearlyinsurancecost, Yearlypropertytaxes and Est Repair Cost vs. Time To Receive Offer. The data is filtered on Computed Cap Rate, which keeps non-Null values only. The view is filtered on Yearlyinsurancecost, Time To Receive Offer, Est Repair Cost and Yearlypropertytaxes. The Yearlyinsurancecost filter keeps non-Null values only. The Time To Receive Offer filter keeps non-Null values only. The Est Repair Cost filter keeps non-Null values only. The Yearlypropertytaxes filter keeps non-Null values only.

Insurance Cost:
Eat into profits.
or
Pay a smaller premium each month but faced with a higher deductible.

Property taxes:
Eat into profits.
As a general rule, higher property taxes in metropolitan areas, and lower taxes in more rural places.
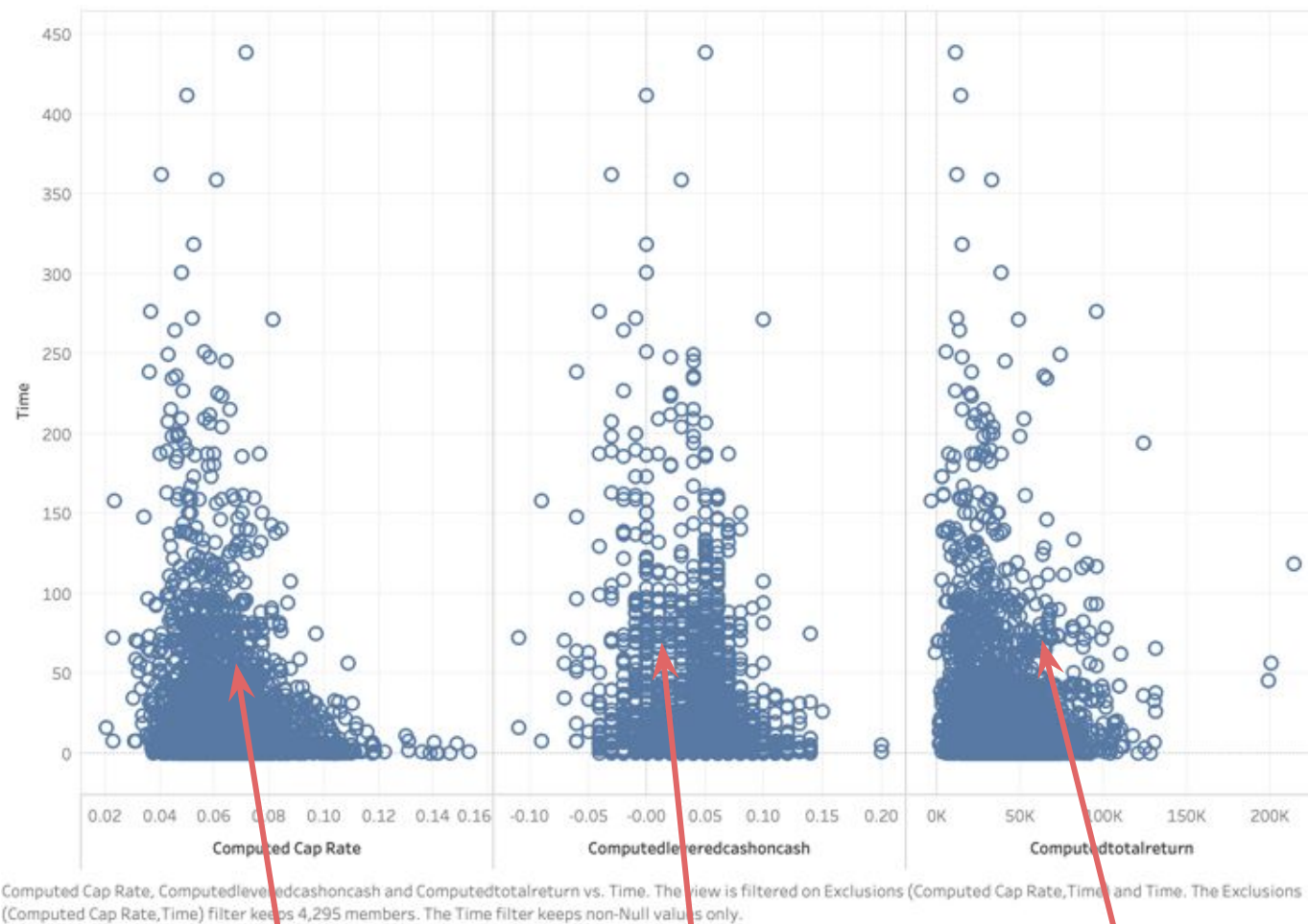
Repair Cost:
Investors should prepare in a sizable amount of extra cash as a cushion to replace major parts of the house, including the roof, HVAC system and water heater.

- Always concentrate to lower cost
- No significant patterns

No traditional linear regression

Return

Computed Cap Rate, Computedleveredcashoncash and Computedtotalreturn vs. Time. The view is filtered on Exclusions (Computed Cap Rate,Time) and Time. The Exclusions (Computed Cap Rate,Time) filter keeps 4,295 members. The Time filter keeps non-Null values only.

Concentrate between 6%-10%

Concentrate between 5%-10%

Concentrate between 50k-100k

Cap rate:
Cap Rate = NOI (Rental Income – Operating Expenses) /Purchase Price × 100%
The general range is 6 to 12%.

Cash on cash return:
Cash on Cash Return = Annual Cash Flow/Total Cash Invested
The general range is 6 to 12%.

Total Return:
ROI = (Gain from Investment – Cost of Investment)
Average return on investment is 8.6%.

Residential real estate has an average ROI of 10.6%.

Commercial real estate has an average ROI of 9.5%.

Good Offer

Good rate:
Good rate= Offer Price/List price

0.7   0.9
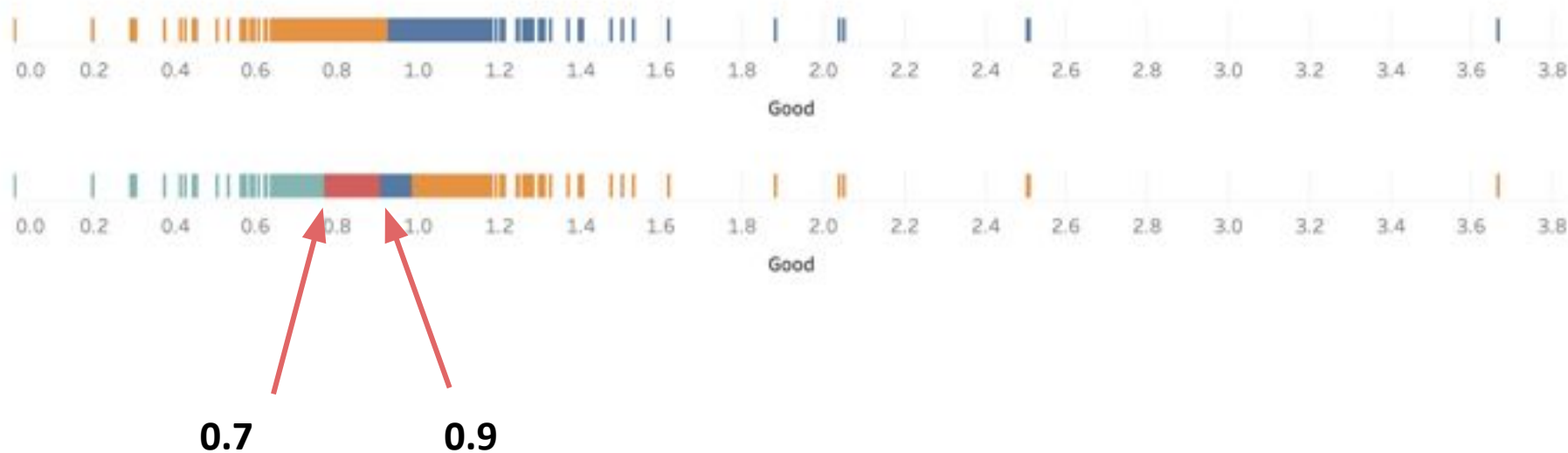
PART

04

Model Construction

1. Understand the Problem

2. Data Exploration & Data Preparation

3. Data Modeling & Validation

4. Model Implementation

Model Construction: Understand the Problem

- **What do we want to predict?**
  - *Time till Good Offer*
  - *Function(List_Price, FMV, Good_Offer) = Time till good offer*
- **Assumption:**
  - *Time to sell is a function of the delta between FMV and list price*

Model Construction: Data Modeling & Validation

Linear Regression v.s *Survival Analysis*

- **No strong linear relationship**
- **Unable to deal with censored data**

Model Construction: Data Modeling & Validation

Survival function: $S(t) = Pr(T > t)$

- the survival function defines the probability the event has not occurred yet at time t,
- or equivalently, the probability of surviving past time t

Hazard function: $lim(\delta t \to 0)Pr(t \le T \le t + \delta t \mid T > t) \iff h(t) = -S'(t)/S(t)$

- the probability of the death event occurring at time t,
- given that the death event has not occurred until time t

Cumulative Hazard Function: $H(t) \iff S(t) = exp(-H(t))$

- the probability of failure at time t given survival until time t
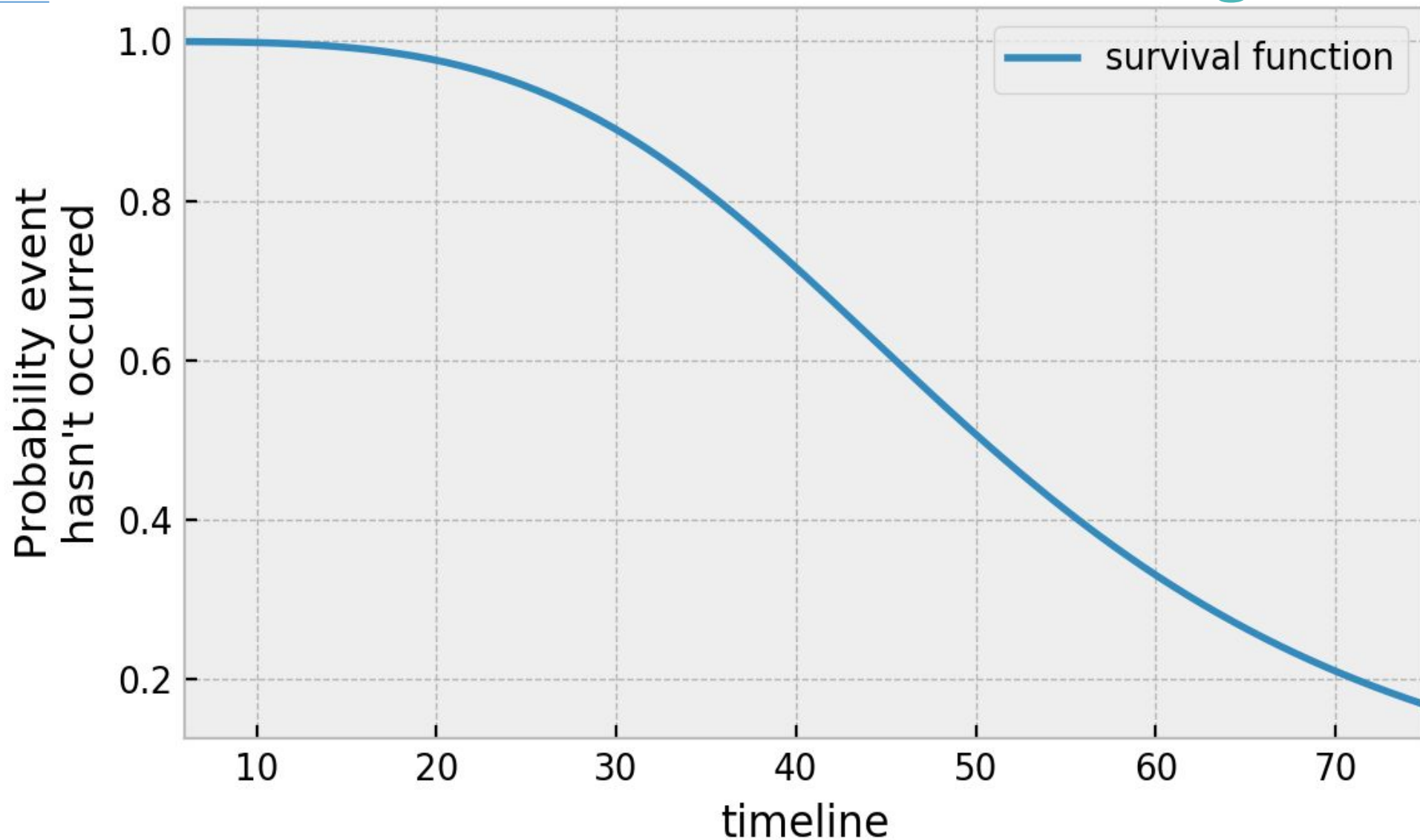
ref: https://lifelines.readthedocs.io/en/latest/Survival%20Analysis%20intro.html#survival-function

Model Construction: Data Modeling & Validation

Survival function: defines the probability the event has not occurred yet at time t

ref: https://lifelines.readthedocs.io/en/latest/Survival%20Analysis%20intro.html#survival-function
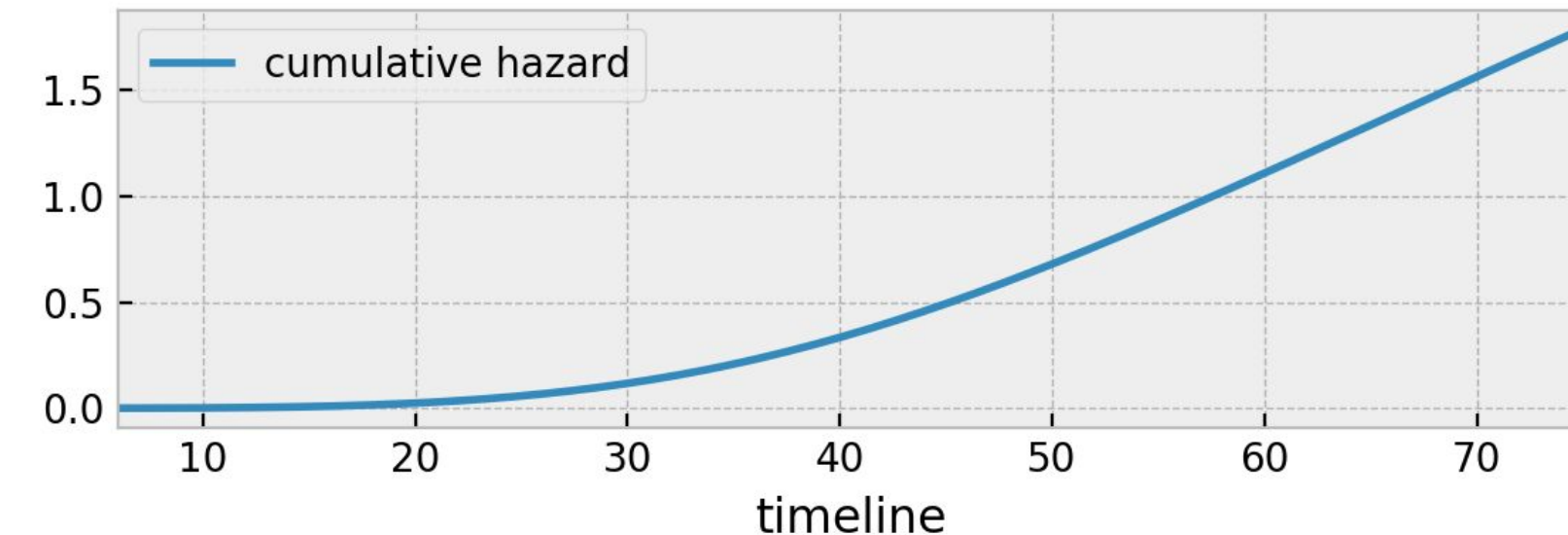
Model Construction: Data Modeling & Validation
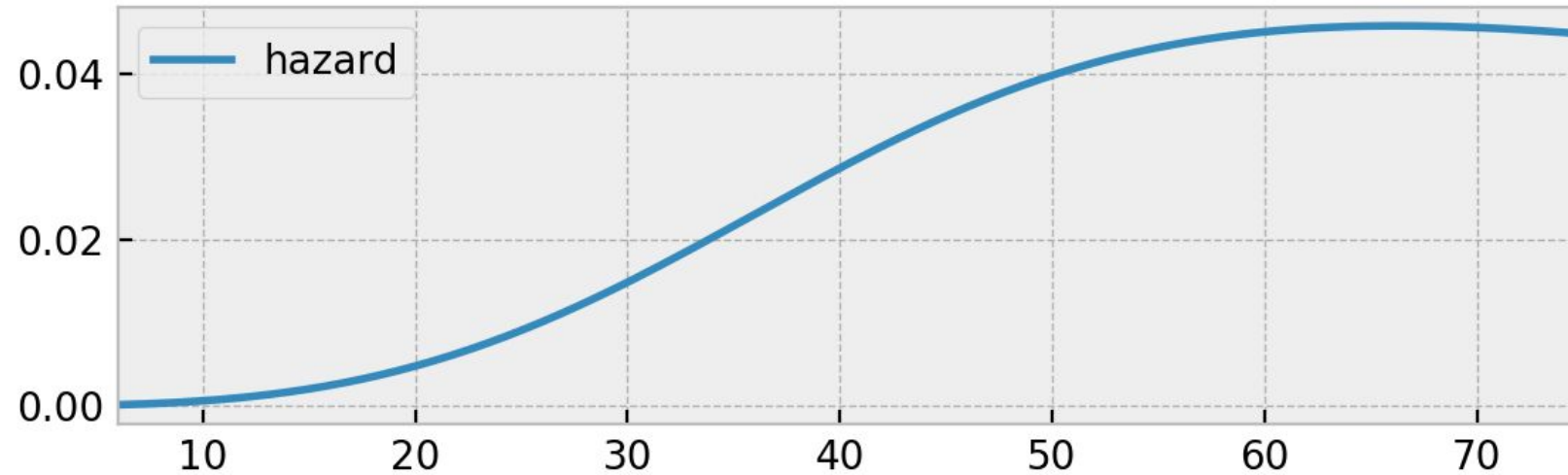
Hazard function:

the probability of the death event occurring at time t

$h(t,x) = h_0(t) * exp(b_i * x_i)$

Cumulative Hazard Function:

the probability of failure (event) at time t, given survival until time t

ref: https://lifelines.readthedocs.io/en/latest/Survival%20Analysis%20intro.html#survival-function

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Model Construction: Data Exploration & Data Preparation

- **Data Source:**
  - *Buyers Info*
  - *Transactions History*
  - *Listing History*
  - *Offers History*

Listing History
- *Listing_ID*
- *Record_TS*
- *List_Price*
- *EST_Value*

Offers History
- *Listing_ID*
- *Offer_ID*
- *Record_TS*
- *Offer_Price*

Model Construction: Data Exploration & Data Preparation

- List For Sale
- List_Price: 100

2019-Jan-01

- List For Sale
- List_Price: 90

2019-Jan-10

- List For Sale
- List_Price: 85

2019-Jan-20

2019-Jan-04

2019-Jan-16

2019-Jan-27

Good Offer: 90%

- Offer New
- Offer Price: 80

- Offer New
- Offer Price: 60

- Offer Counter
- Offer Price: 83

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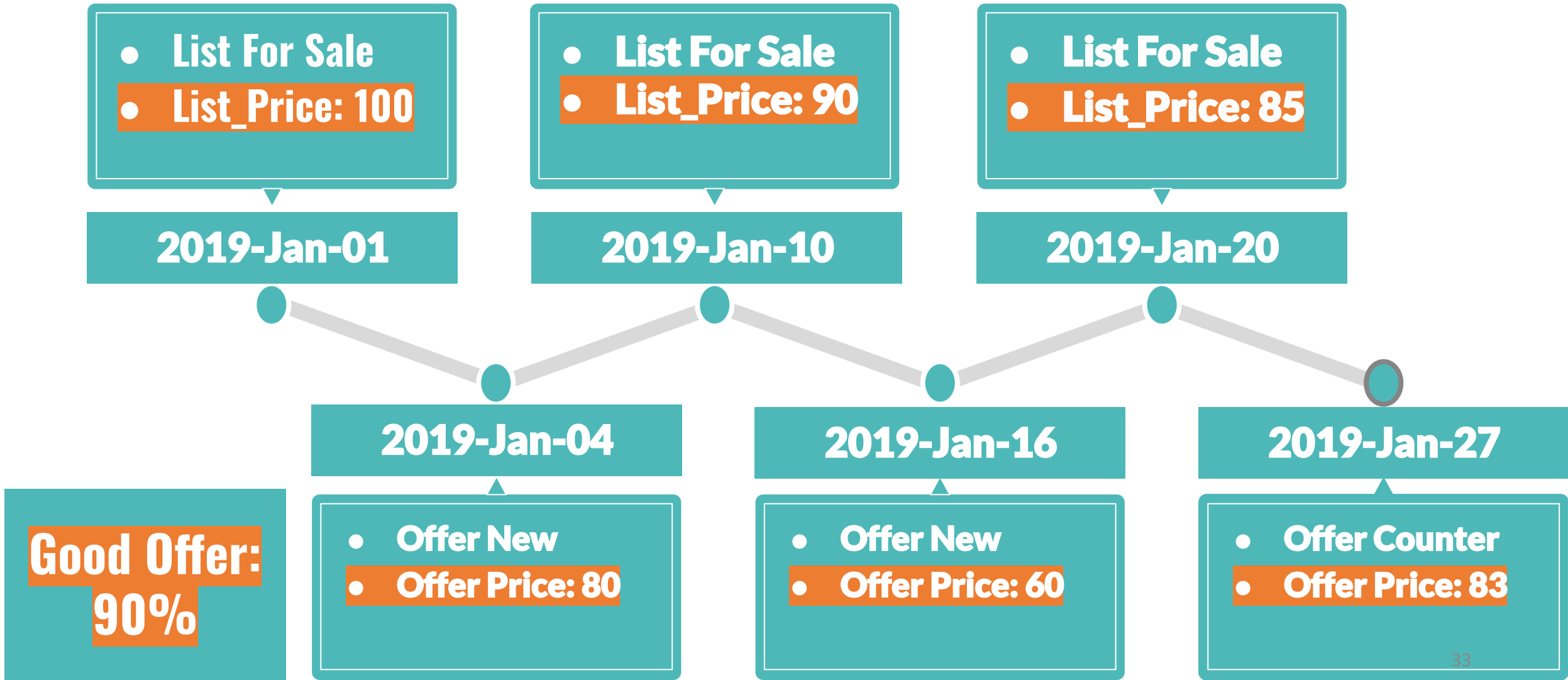
Model Construction: Data Exploration & Data Preparation

Clean and Create a New Data Set

List_ID	Begin_TS	End_TS	L_Price	EST_value	Perc	DOM	Event
1122	19-Jan-01	19-Jan-10	100	95	11.11%	10	False
1122	19-Jan-10	19-Jan-20	90	95	-5.26%	10	False
1122	19-Jan-20	19-Jan-27	85	95	-10.53%	7	True

Model Construction: Data Modeling & Validation

Feature Engineering

Domain Knowledge

- Occupancy
- Guaranteed Rent
- #Bed #Bath
- Neighborhood
- School Score
- Rootstock Exclusive
- Featured

- Cap Rate
- Gross Yield
- Cash on Cash
- Total Return
- EST Immediate Cost
- lease and Tenant
- Inspection

ef: https://lifelines.readthedocs.io/en/latest/Survival%20Analysis%20intro.html#survival-function
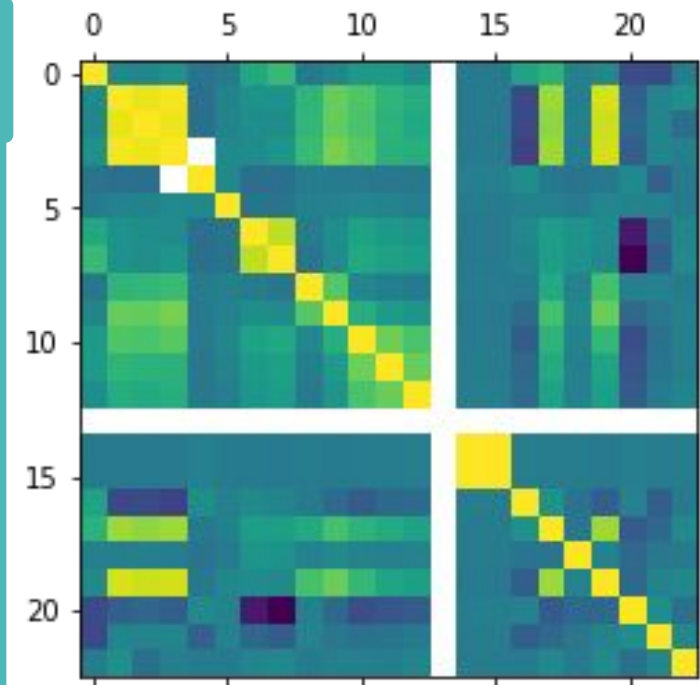
Model Construction: Data Modeling & Validation

Model Selection & Validation

- **Train/Test:** K-fold Cross-validation
- **Measure:** concordance statistic / C-index
  - *0.5 : expected result from random predictions,*
  - *1.o : perfect concordance and,*
  - *0.0 : perfect anti-concordance*
    - *(multiply predictions with -1 to get 1.0)*

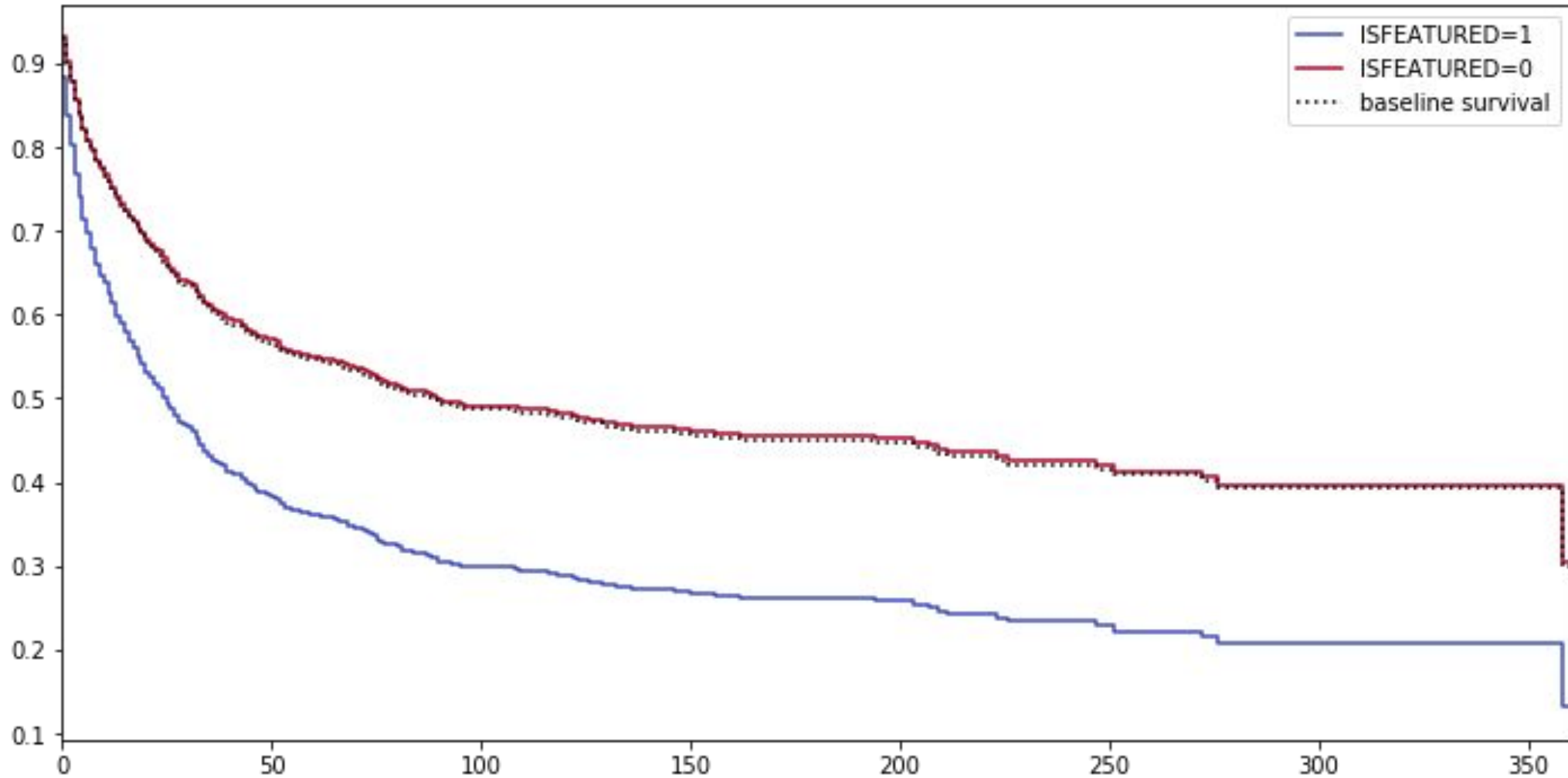## Selected Features:

- *List_Price*
- *Featured*
- *Rent Guaranteed*
- *Neighbours Score*
- **Cash On Cash Return**
- **Total Return**
- **EST_REPAIR_Cost**
- **PERC = List_Price/EST_Price**

- **Baseline Model: [No other Variable, only PERC]**
  - **C-index = 0.51 ~ 0.52**
- **Our Final Model:**
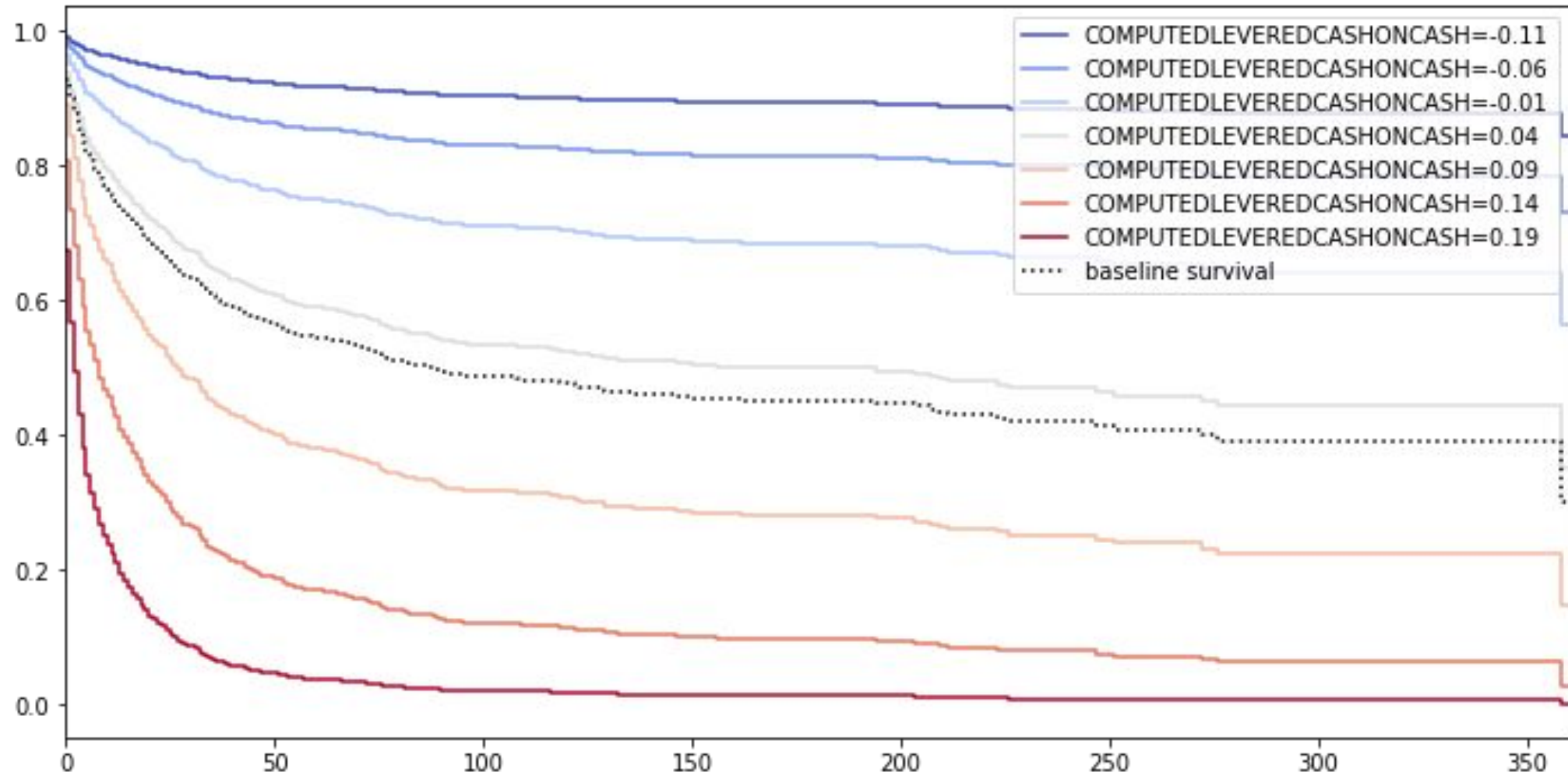 - **C-index = 0.64 ~ 0.66**

ref: https://lifelines.readthedocs.io/en/latest/lifelines.utils.html#lifelines.utils.concordance_index

Model Construction: Data Modeling & Validation

Understand the Model

Model Construction: Data Modeling & Validation

Understand the Model

Model Construction: Implementation

- **How could we use this model to help our clients?**

  - Smooth the process for sellers and set expectations

Model Construction: Implementation

- **How (much) can a patient seller push up the price?**

  - **Set list price with confidence**

PART
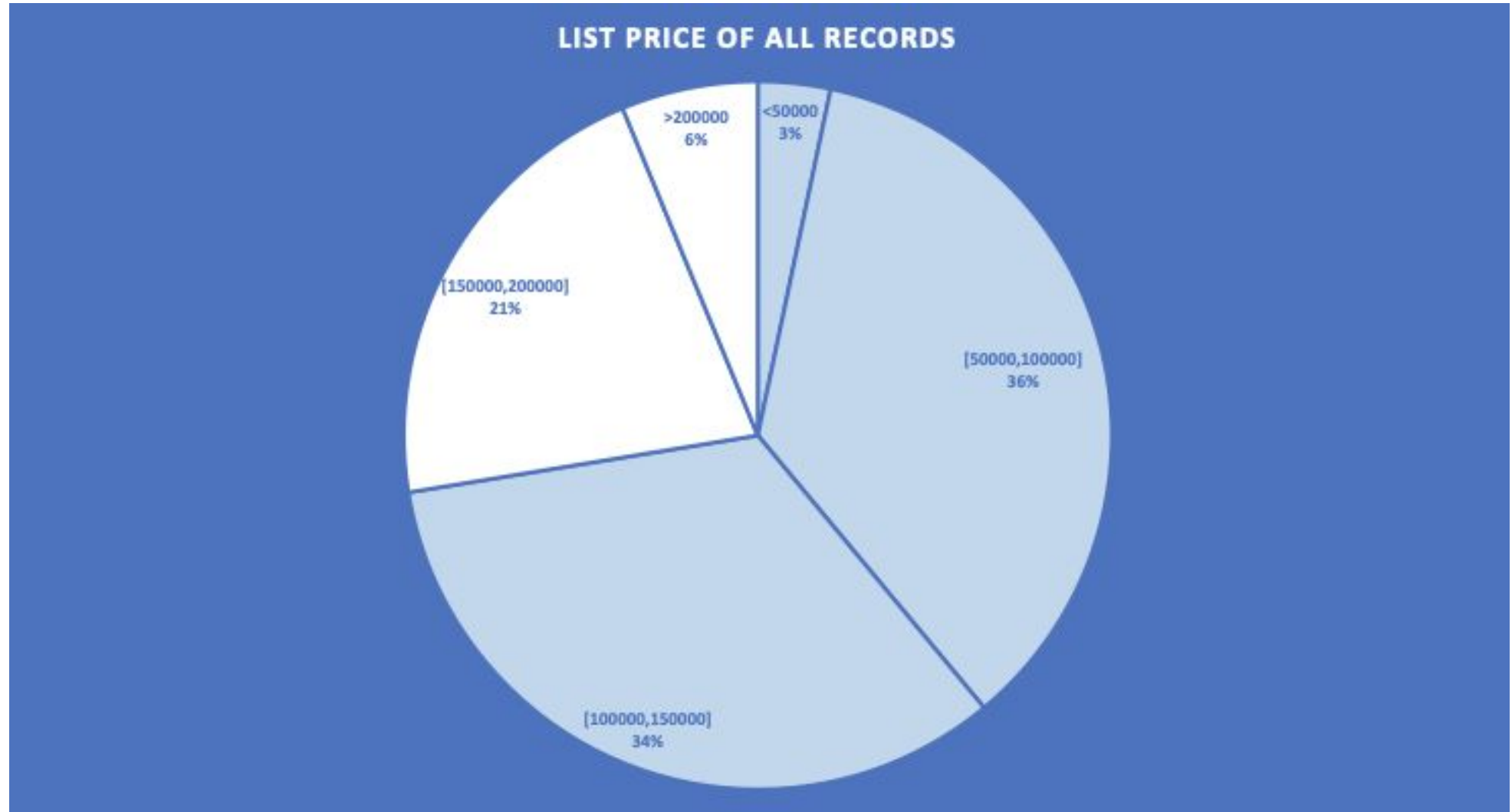
05

Price Overview

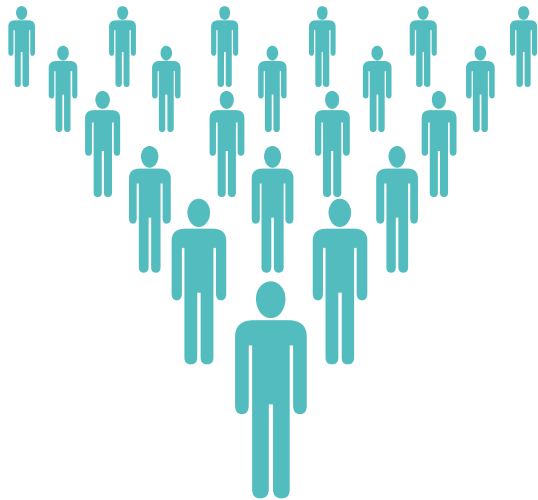|	US Single Family Median Sale Price (Mar 2018) : 229000		

	ALL_LIST	ALL_EST_VALUE	ALL_OFFER	TRANS_PRICE
Count	4503	4501	1381	2610
Median	119000	118500	95000	93000

Price Overview: List Price of All Records

LIST PRICE OF ALL RECORDS

>200000
6%

<50000
3%

[150000,200000]
21%

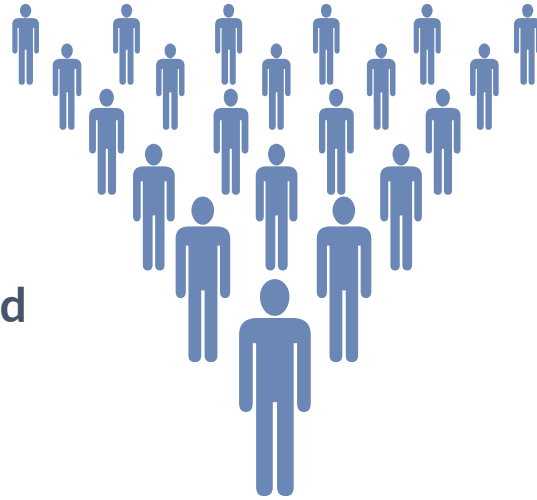[50000,100000]
36%

[100000,150000]
34%

Comparison groups: Set single list price & Change price repeatedly

76 %

- 2262 properties
- 34.83% of these properties received offer inquiries.

24 %

- 705 properties
- 21.28% of these properties received offer inquiries at their first list.

Comparison groups: Set single list price & Change price repeatedly

- **Sellers set single price:**
  - *offer/list 90.2%*
  - *list/est 102.0%*

- **Sellers changed price repeatedly:**

  At first list
  - *offer/list 85.8%*
  - *list/est 104.6%*

  At last list
  - *offer/list 89.4%*
  - *list/est 95.72%*

*$125054.279011 * (104.6% - 102.0%) = $3251.4*

Sellers Change Price Repeatedly: First List & Last List

	First list price	last list price
List price overall tendency	124422.0652	117231.5943
Offer price overall tendency	100041.6267	97902.98371
List > est	62%	36.45%
got offer	150	307
0.95offer	14.67%	24.43%
0.9offer	40.67%	56.35%
0.85offer	59.33%	73.62%
0.8offer	74.67%	88.27%

Comparison groups: Property value <=150k & Property value > 150k

Property value <=150k
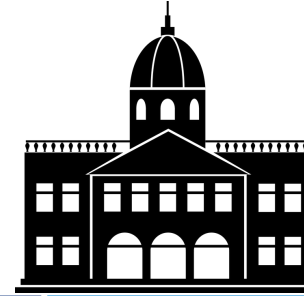
Property value > 150k

	First list price	last list price	First list price	last list price
List price	96929.80859	91841.84113	197354.8912	194126.2753
Offer price	81859.4	80349.46586	159783.2286	173262.051
got offer:	115	249	35	58
offer/list	85.78%	89.47%	85.83%	89.06%
list/est	106.18%	95.20%	99.36%	97.93%

Strategis & Conclusion

- Set the first list price prudently & Price against comparable sales in the market
- Find a balance between the high estimated value and the low estimated value (102%~95% of the average estimated value is suggested)
- Make a written schedule in advance if you plan to push up list price at first
- Choose strategy according to your property value & acceptable waiting time
- Keep the rock-bottom price in mind.
- Generally, sellers are satisfied with offer price around 89%~90% of their list price.

Thanks

Q & A