# **United States Housing Market Analysis**

--- Based on Zillow Dataset



1 Introduction of Project



2 The Overall Trend of Housing Market



**3** Housing Market Healthiness



4 Housing Affordability Trend



**5** Summary





- Dataset & Data Source
- Project Objective

#### **Dataset:**

For dashboard 1: (cleaned with Python)

- US national homes value with date from 1996 to 2020
- List of regions of the United States
- US homes value with housing type of 1, 2, 3, 4, 5+ bedroom

For dashboard 2: (cleaned with python and tableau prep)

- US housing sales by county from 2013 to 2020
- US listings number by county from 2013 to 2020

For dashboard 3&4: (cleaned with Excel)

- Zillow house price by state and county in 2017 and 2018
- Rural, urban and suburban county of each state
- Average personal income by county in 2017 and 2018, downloaded from United States Census Bureau website.

#### Data source:

Zillow website, Kaggle, United States Census Bureau website

### **Project Objective:**

- Understand the overall trends of housing market
- Analyze the housing market healthiness condition
- Acquire insights about housing affordability at state, region and county level



- National housing value trends
- Top costly states
- Comparison between different housing types
- Comparison between south and north region

#### Dashboard

Left three graphs:

Show the **time trends** of national avg price, **top 5** costly states, **comparison** between east and west region.

Right two graphs:

Introduce the **states difference** by showing
top 15 expensive states,
and specifically, price
map varies by year.

The slider controls the timeline of East vs West graph and house price map

#### The overall trend of Price

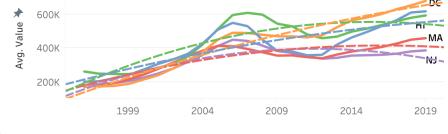
National housing average value with time trends



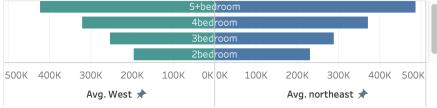
House price map in 2020



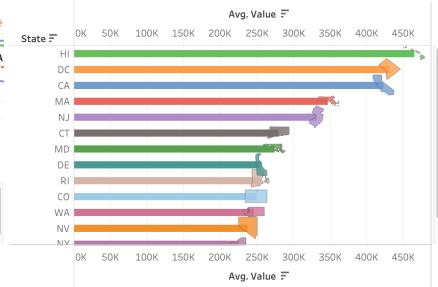
top 5 most expensive states time trends



East vs West 2020



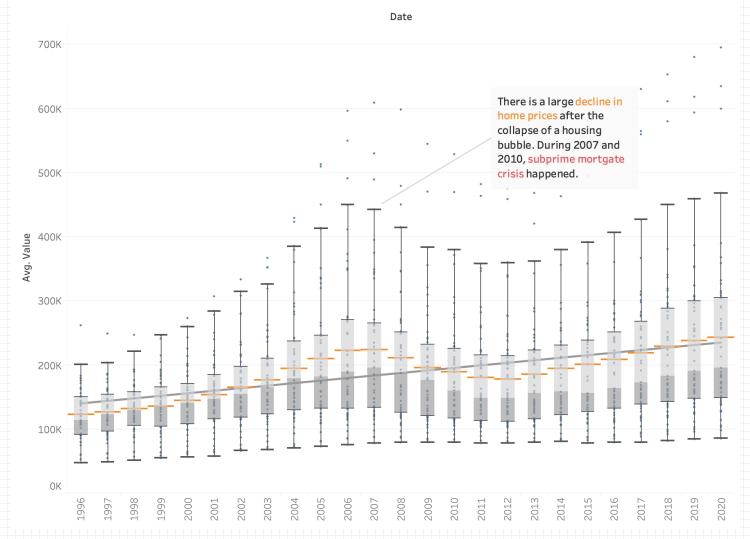
top 15 expensive housing states



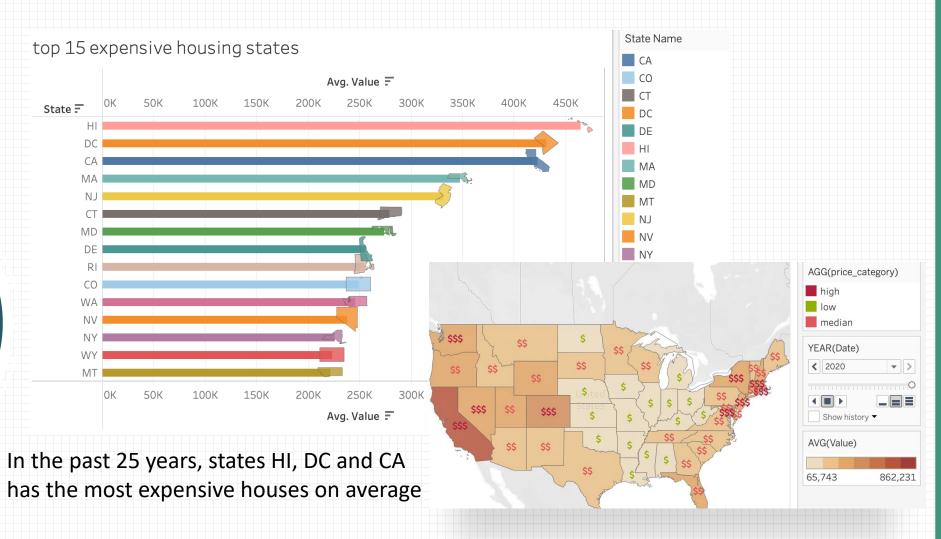
# Sheet1: National Housing Price Trend

- The graph shows us the average housing price from 1996 to 2020.
- Tooltip:
- There is a housing bubble during 2003 2006, when average price increases sharply, but housing collapse followed closely. And subprime mortgage crisis happened at this time
- Trend Line:
- Even with the fluctuation of housing price, on the whole picture, the housing price has a steady growth, basically because of inflation.
- Price Gap Change:
- Price Gap increased largely during housing bubble. Also, recently, price gap has a clear trend of increase





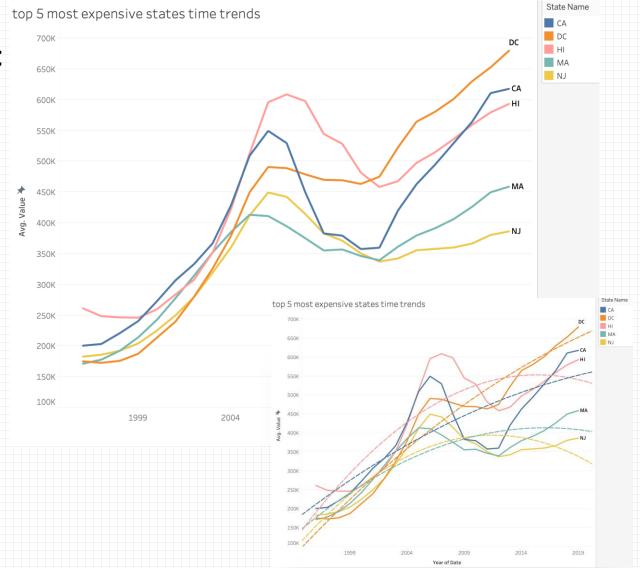
Sheet2: Top 15 states of the highest average housing value in the past 25 years



From the filled map combined with symbol map, we can have a clearer view that in general, states near the ocean is more expensive, like CA, MA, DC, while states in the central region is less expensive, shown as only one-dollar sign.

# **Sheet3: Top 5 states of the highest average housing value Time Trend**

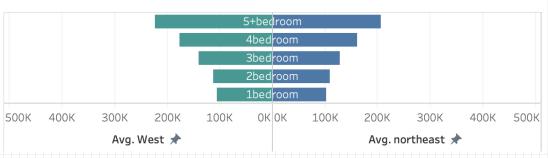
- DC is growing fastest in the past 25
  years. Financial crisis has a relatively
  small influence on it. And in recent
  several years, its average price keeps
  the highest in USA.
- Hawaii suffered most from subprime mortgage crisis. The housing bubble is extremely large and did not recover well.
- CA collapsed a lot, but it recovers
   quickly with a quite large positive slope.
   However, the price grows slowly from
   2018.



# Sheet4: Comparation between east and west region

- ☐ Overall housing types:
- In general, the more bedrooms, the higher the price.
- The price gap between different housing types is enlarged over time
- ☐ Growth comparation:
- At 1996, housing in west region is slightly more valuable than east.
- After subprime mortgage crisis, east region exceeded the west region.
- Until 2020, houses in east region still has a higher value than west region.

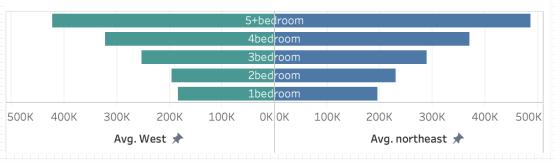
#### East vs West 1996



#### East vs West 2011



#### East vs West 2020

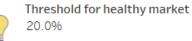




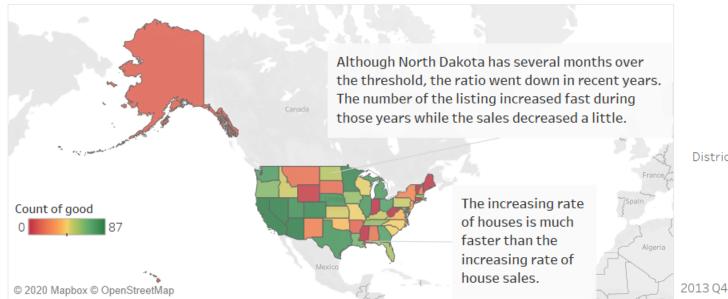
- Overview of house market healthiness
- Scorecard of healthiness status
- Relationship between healthiness status and sales

Show histo.

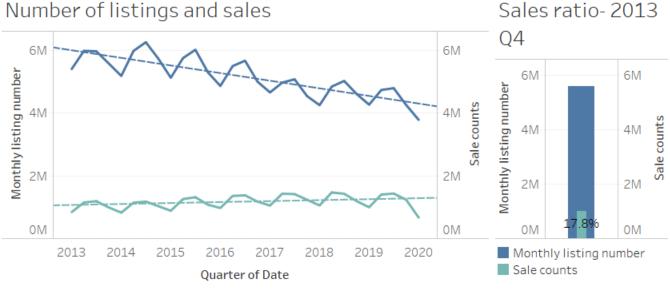
#### How is the house market health?



How many months the state has a healthy housing market?



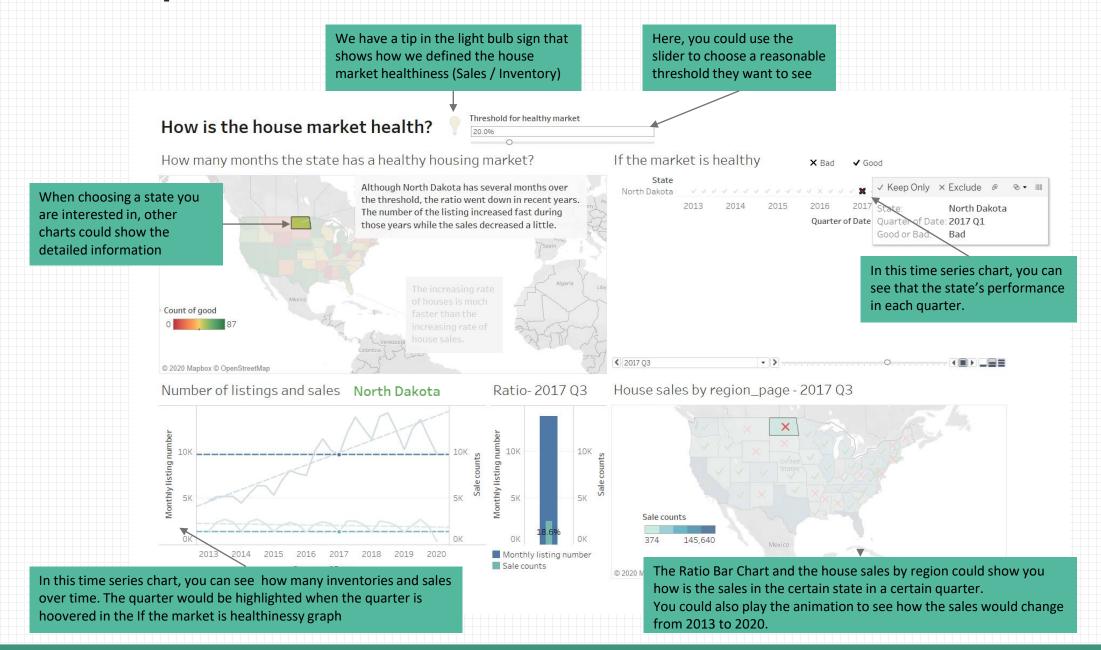






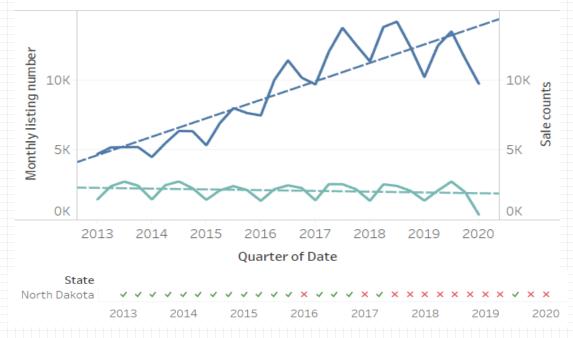


## How to exploit the House Market Healthiness dashboard?



How many months the state has a healthy housing market? **Sheet 1: Housing Market Overview** State: North Dakota Although North Dakota has several months over Sales/Inventory ratio: the threshold, the ratio went down in recent years. The number of the listing increased fast during Sales/Inventory ratio ☐ Introduction of the graph: those years while the sales decreased a little. This map shows that how many months the Threshold for healthy market state's value of the market healthiness has achieved our threshold. 0.0 The increasing rate The **tooltip** shows the details that the total of houses is much 2016 2018 2020 faster than the Year of Date trend of the housing market heath. increasing rate of house sales. ☐ Interesting facts What is very special in the graph is that State:Louisiana Sales/Inventory ratio although Louisiana and North Dakota have Mexico a relatively decent score for the housing Threshold for healthy market Sales/Inventory market healthiness, their healthiness scores decreased dramatically in recent years. You could move your mouse to the 0.0 state you are interested in, and it would show you how the market 2014 2016 2018 2020 healthiness change over years. Year of Date

#### Number of listings and sales North Dakota



# 60K 40K 40K 20K 20K 20K 20K 20K 20K 20X 2019 2020

2017 Q3

2016 Q3

Number of listings and sales Louisiana

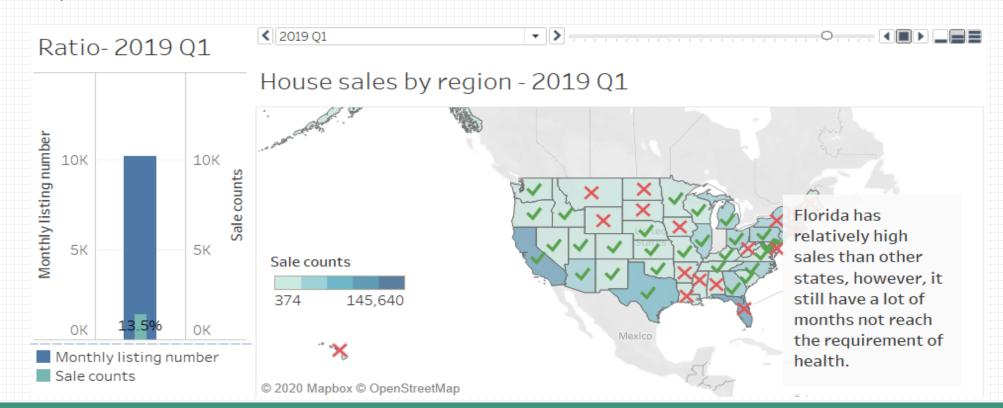
State Louisiana

# Sheet 2&3: House Market Detail at State Level

- ☐ Introduction of the graphs:
- The scorecard shows that the performance of those states over past quarters. Green if the healthiness score reaches the threshold, otherwise red.
- The line graph shows that the number of inventories and sales for selected states.
- ☐ Interesting facts
- North Dakota's listings increased
   dramatically in recent years while the sales
   decreased, which makes sense since North
   Dakota's population decreased and aged in
   recent years.
- Louisiana's listings increased dramatically in the end of 2018 and the sales decreased a little during the same period.

## Sheet 4&5: Relationship between House Market Healthiness and Sales

- ☐ Introduction of the graph:
- The **bar chart** shows the number of monthly listings and the sales of the selected states in the certain quarter. We also show the ratio in the graph.
- The **filled map** shows that the sales and the healthiness condition in each states.
- ☐ Interesting facts
- Although Florida has relatively high sales than other states, however, it still has a lot of months not reaching the requirement of healthiness.





- Housing affordability trend
- Housing affordability in 2018

#### Dashboard

## Housing Affordability Trend Analysis (2017-2018)

\*Housing affordability = Income/Price

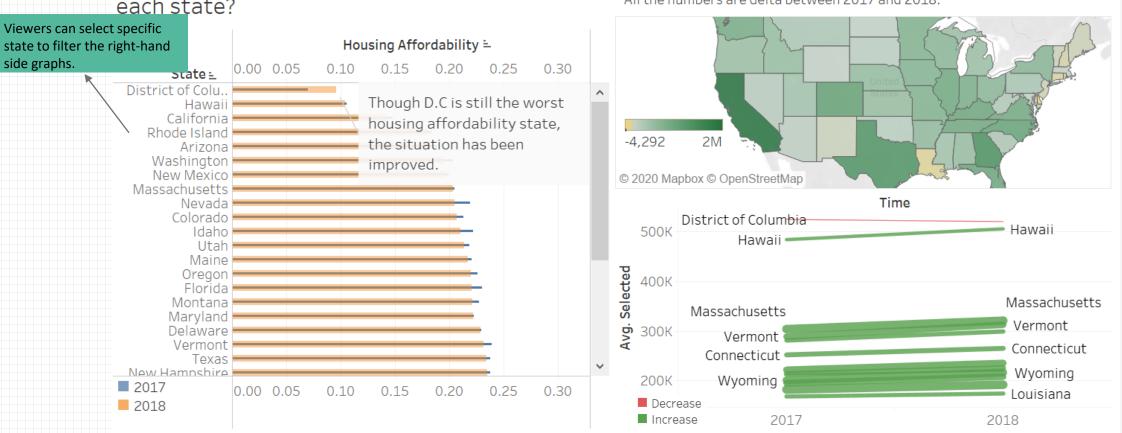
What is the housing affordability trend in each state?



\*All the numbers are delta between 2017 and 2018.

Viewers can choose from price, sales and price/sales.
This parameter control both two graphs in the right-hand side.

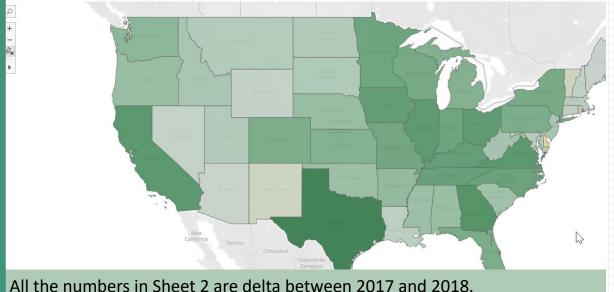


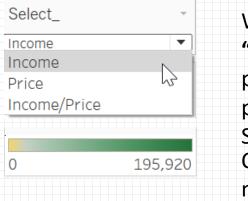


## **Sheet 1 Housing Affordability\* Trend (2017 – 2018)**

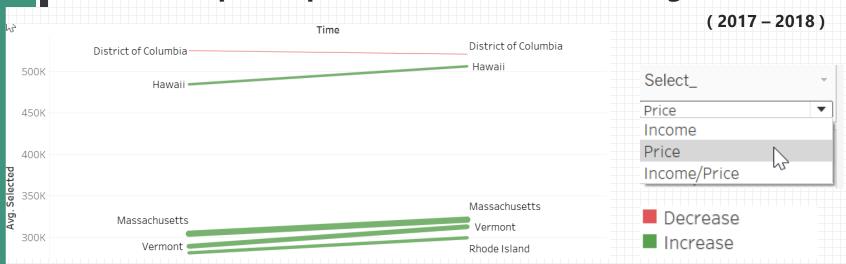


### **Sheet 2 Map of Income & Price Change** (2017 - 2018)





### **Sheet 3 Slope Graph of Income & Price Change**



- ☐ Introduction of the graphs: We set up a parameter called "Select\_", which include income, price and income/price. This parameter could control both Sheet 2 and Sheet 3. Compared to sheet 2, sheet 3 can not only show the rate of change(the wider the line is, the bigger change it is), but can also show the **baseline**(data in 2017).
- ☐ Interesting facts: By viewing income map and price map, we can find that both income and price of most states have greatly increased.

We can see that Hawaii's housing price is still increasing while D.C. is decreasing. Hawaii can be the next worst housing affordability state.

Indiana

Missouri

Kentucky

Minnesota

Mississippi

New York

Arkansas

Tennessee

South Dakota

Virginia

Alabama

Georgia

New Jersey

Suburban

Urban

Rurdhmachi A

Texas

West Virginia

Louisiana

Kansas

lowa

## Viewers can choose from price, sales and price/sales.

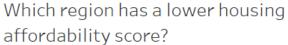
# Select Income

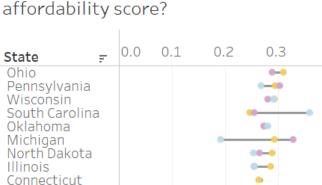
## Housing Affordability in 2018

0-0

0.2

0.3

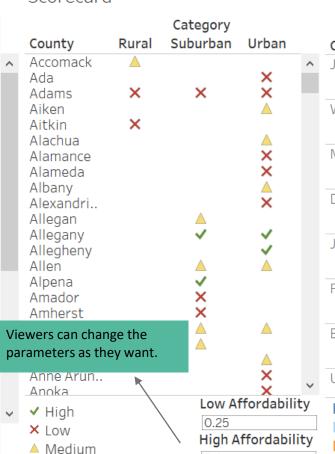




The difference

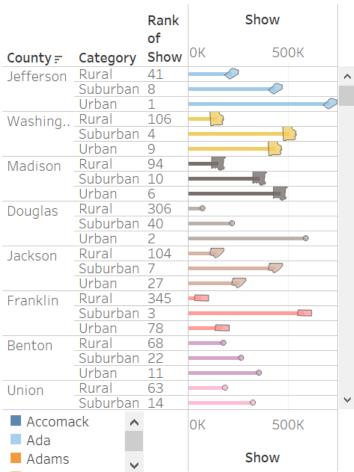
0.1



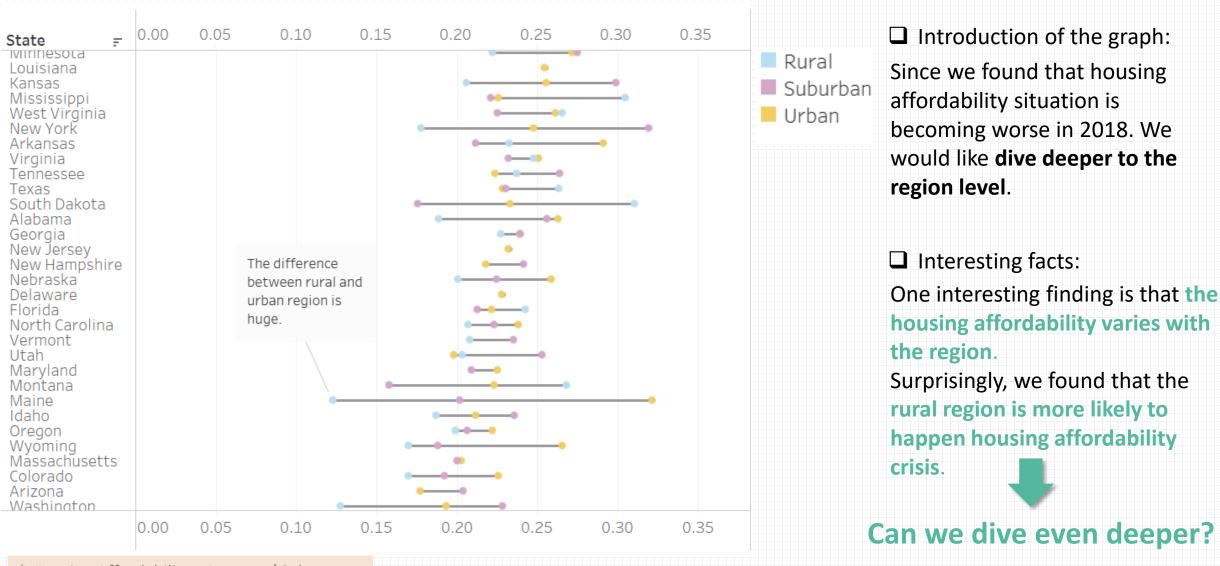


0.4

Top Income County of All



## **Sheet 4 Housing Affordability of Each Region (2018)**



<sup>\*</sup> Housing Affordability = Income / Sales

# Sheet 5 County Housing Affordability Scorecard (2018) Sheet 6 County Housing Affordability Rank (2018)

The state name will change based on viewer's selection

Michigan Housing Affordability Scorecard									
		Category							
County	Rural	Suburban	Urban						
Allegan				^					
Alpena		<b>~</b>							
Barry			×						
Bay Benzie	×		^						
Berrien			×						
Calhoun									
Cass		×							
Chippewa			×						
Clinton		<u> </u>							
Crawford Delta									
Dickinson			<u></u>						
Eaton			* * * * * * * * * * * * * * * * * * *						
Genesee									
Grand Tra			×						
Hillsdale		<u> </u>							
Huron		~							
Ingham Ionia		<u> </u>							
Isabella									
Jackson			$\overline{\mathbf{x}}$	~					
* Housing Af	fordabilit	y = Income /	Sales						

Select Low Affordability 0.25 Income Income High Affordability Price 0.4 Income/Price ✓ High Accomack Ada × Low Adams Medium ☐ Introduction of the graph:

Both left and right graphs highlight the result after we clicked a specific region of a specific state in sheet 4 (in this case, suburban in Michigan). Both graphs dive deeper to the county level.

In the left graph, we set up 2 parameters:
low and high affordability. Viewers could change the number as they want.
In the right graph, the parameter "Select\_" we set up before can still be applied.

Top Income County of Michigan								
		Rank of	Show =					
County	Category	Show	0K	20K	40K	60K		
Oakland	Urban	1				0	^	
Midland	Urban	2						
Washten	Urban							
Dickinson	Urban	4 5						
Grand Tr								
Kalamaz	Urban	6						
Clinton	Suburban	7			0			
Macomb	Urban	8			-			
Huron	Suburban	9			•			
Allegan	Suburban				-			
Barry	Suburban				-			
Livingston		12			-			
Lapeer	Suburban				0			
Benzie	Rural	14			-			
Bay	Urban	15						
Lake	Rural	16			0			
Eaton	Urban	17			0			
Cass	Suburban	18			0			
Mason	Suburban	19			0			
Kent	Urban	20			0			
Ottawa	Urban	21			-			
	Urban	22			-			
Alpena	Suburban	23			-		~	



# The Overall Trend of Housing Price

The price of house in East increased faster than West in recent years.

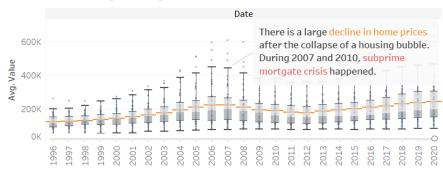
The health score for North Dakota and Louisiana decreased dramatically in recent years.

Most of the states' affordability have decreased because income increased more slowly than the house price

Rural region is more likely to happen housing affordability crisis.

#### The overall trend of Price

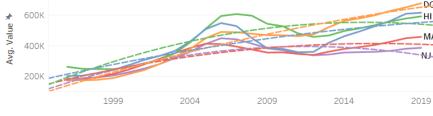
National housing average value with time trends



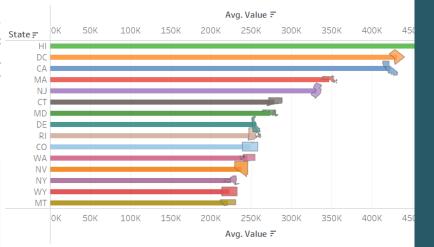
#### House price map in 2020



top 5 most expensive states time trends



top 15 expensive housing states



- Fast vs West 2020
- 5+bedroom

  4bedroom

  3bedroom

  2bedroom

  1bedroom

  500K 400K 300K 200K 100K 0K 0K 100K 200K 300K 400K 500K

  Avg. West ★ Avg. northeast ★

- We firstly showed the overall trend of the house price
- Then we used healthiness score to evaluate the housing market
- Next, we combined
   the house price
   and personal income to
   evaluate the affordability in
   each state
- Finally, we dived
   into region and county level
   data to extract more
   insights on housing affordab
   ility

# Housing Market healthiness Status

The price of house in East increased faster than West in recent years.

The health score for North Dakota and Louisiana decreased dramatically in recent years.

Most of the states' affordability have decreased because income increased more slowly than the house price

Rural region is more likely to happen housing affordability crisis.

#### How is the house market health?



How many months the state has a healthy housing market? If the market is healthy State Although North Dakota has several months over the threshold, the ratio went down in recent years. The number of the listing increased fast during those years while the sales decreased a little. Delaware The increasing rate District of Columbia of houses is much faster than the Count of good increasing rate of house sales. **Quarter of Date <** 2019 Q1 Alabama Alaska --Ratio-2019 Q1 Number of listings and sales House sales by region - 2019 Q1 6M Florida has 3M relatively high sales than other states, however, still have a lot of months not reach OM the requirement of Monthly listing number health. Sale counts © 2020 Mapbox © OpenStreetMap

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# Housing Affordability Trend

The price of house in East increased faster than West in recent years.

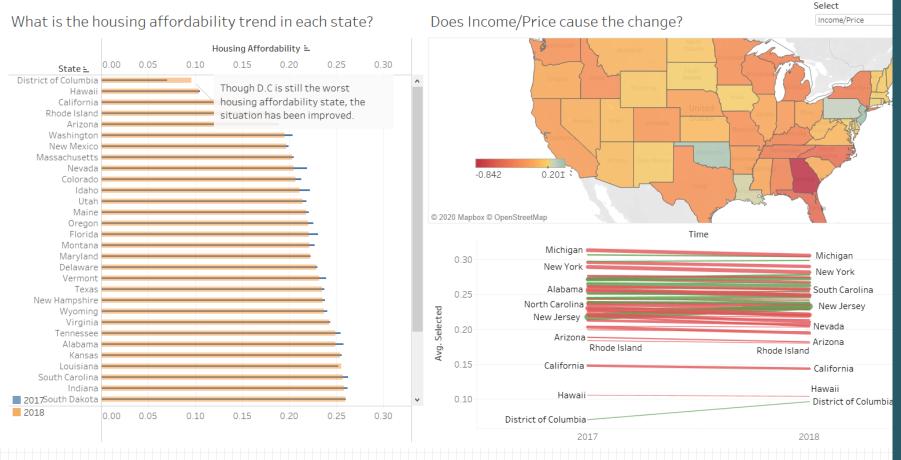
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#### Housing Affordability Trend Analysis (2017-2018)

\*Housing affordability = Income/Price



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# Housing Affordability in 2018

The price of house in East increased faster than West in recent years.

The health score for North Dakota and Louisiana decreased dramatically in recent years.

Most of the states' affordability have decreased because income increased more slowly than the house price

Rural region is more likely to happen housing affordability crisis.

#### Housing Affordability in 2018

Housing Affordability ₹

0.2

0.3

Medium

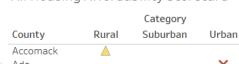
Which region has a lower housing affordability score?

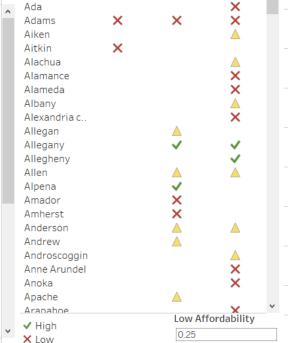
\_ 0.0 0.2 0.3 State Ohio 0-0 Pennsylvania Wisconsin 6-0 South Carolina Oklahoma **(D**) Michigan North Dakota 00-0 Illinois Connecticut Indiana lowa Missouri Kentucky Minnesota Louisiana Kansas Mississippi West Virginia New York Arkansas Virginia Tennessee Texas South Dakota Alabama Georgia New Jersey The difference

Suburban

Urban

All Housing Affordability Scorecard





High Affordability

Aiken

Income

Select

Show

Show

- Top Income of All
- Rank of 400K 600 Show County = Category Jefferson Rural 41 8 Suburban Urban Washington Rural 106 Suburban 4 Urban 9 94 Madison Rural Suburban 10 Urban 6 306 Douglas Rural \_\_\_ Suburban 40 Urban Rural 104 Jackson Suburban 27 Urban 345 Franklin Rural Suburban Urban 78 68 Benton Rural Suburban 22 Urban 11 Union Rural 63 Suburban 14 Accomack OK 200K 400K 600 Ada Adams

- We firstly showed the overall trend of the house price
- Then we used healthiness score to evaluate the housing market
- Next, we combined the house price and personal income to evaluate the affordability in each state
- Finally, we dived into region and county level data to extract more insights on housing affordab ility

# **Overall Housing Market Trend**

- There is a housing bubble during 2003 2006, when average price increased sharply.
- The range of the price increased largely during housing bubble. Also, recently, same change happened. We could have a bold guess that next housing bubble would come in coming decades.
- The house value increased faster in East region than in West region.

## Housing Market Healthiness Analysis

- CA is a great state with high healthiness score and high sales, which is a good place to do house investing.
- North Dakota has a healthiness market before, but in recent years, it has an increasing number of listings and a decreasing sales, which is not a good sign for the house investor there.

# Housing Affordability Trend

- The housing affordability situation is getting worse. The growth rate of housing price is faster than its of income level in most of the states. Hawaii can be the next worst housing affordability state.
- At region level, we surprisingly found affordability varies a lot with region and rural region is more likely to happen housing affordability crisis.



# Thank you!