Real Estate and Population Dynamics in the USA

- Group 2:
- Cameron Cullen
- Elena Lomako
- Liam ODonovan
- Kaelan Purcell

Presentation Focus: Analyzing Population Trends and Residential Real Estate Dynamics

Our project agenda revolves around two key objectives:

1. Population Analysis:

Identify states and counties experiencing the highest and lowest population growth rates. This encompasses factors like the initial population, births, deaths, and migration.

2. Real Estate Assessment:

Compare population growth trends in major geographic regions with the dynamics of the residential real estate market. We will explore factors such as mortgage rates, the availability of homes for sale, and the turnover of residential real estate inventory.

By addressing these objectives, we aim to gain valuable insights into the interplay between population changes and the real estate market in different areas. Specifically we are looking to answer the following questions:

1. How does population growth impact residential real estate sales?
2. How does population growth impact residential real estate sale prices?
3. How does population change impact the rental vacancy rate?
4. How can the growth rate in average prices and population be used to predict future house prices in the selected states?

Our Data Sources

Census Data: We acquired a CSV file containing information spanning from 2010 to 2020.

FRED National Data: Database for a range of economic data, in our case, rental data across states

Zillow Public Data: Database on residential sales, average sale price, inventory level among others.

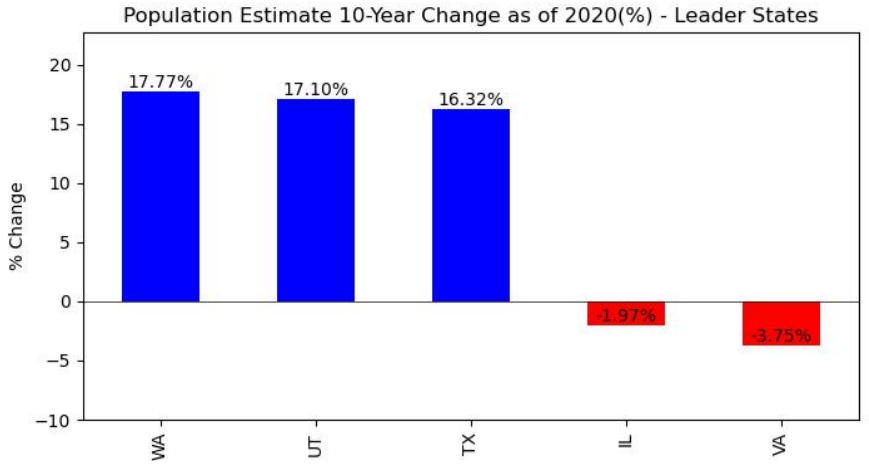
Census Findings

We focused our analysis on states with the highest population growth over a 10-year period, which included Washington, Utah, and Texas, as well as states with the lowest population growth, namely, Illinois and Virginia.

- After examining Census population data, we found that Washington (18%), Utah (17%), and Texas (16%) saw the most substantial population growth between 2010 and 2020, while Illinois and Virginia experienced the smallest increases.
- We conducted a similar analysis for counties, revealing significant growth in McKenzie County, North Dakota (137% increase), and Loving County, Texas (115% growth) over the same 10-year period. Conversely, Alexander County in Illinois showed a decrease of 33%, and notably, Concho County in Texas experienced a decrease of 31%.

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
WA	605282	620290	635737	651559	663603	677014	687576	697079	704147	708253	712816
IL	12840545	12867783	12883029	12895778	12885092	12859585	12821709	12779893	12724685	12667017	12587530
TX	25241897	25645504	26084120	26479646	26963092	27468531	27914064	28291024	28624564	28986794	29360759
UT	2775413	2814797	2854146	2898773	2938327	2983626	3044241	3103540	3155153	3203383	3249879
VA	1854265	1856606	1857446	1854768	1850569	1843332	1832435	1818683	1805953	1795263	1784787

	State	Popestimate 10-Year Change 2020(%)
0	WA	17.765934
1	UT	17.095330
2	TX	16.317561
49	IL	-1.970438
50	VA	-3.746929



Total Population vs Resi Home Sales

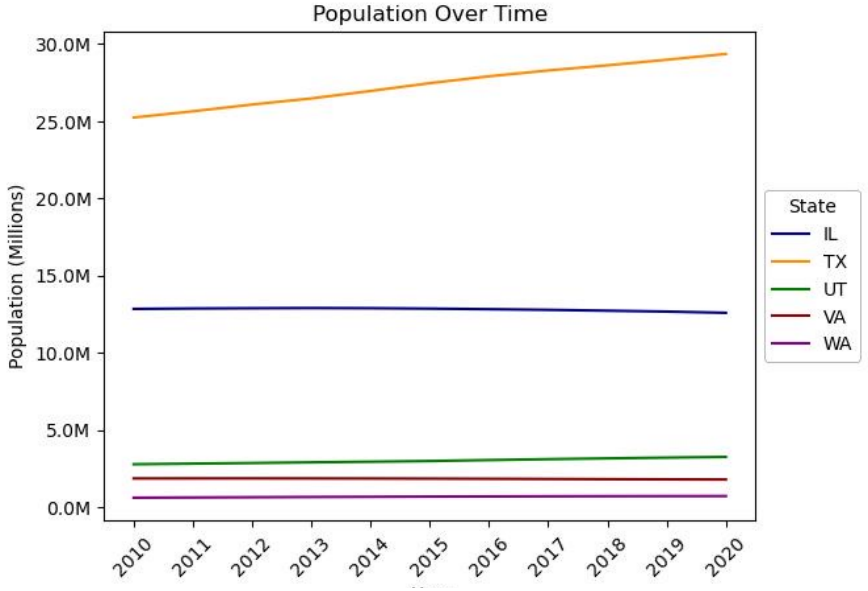
Total Population

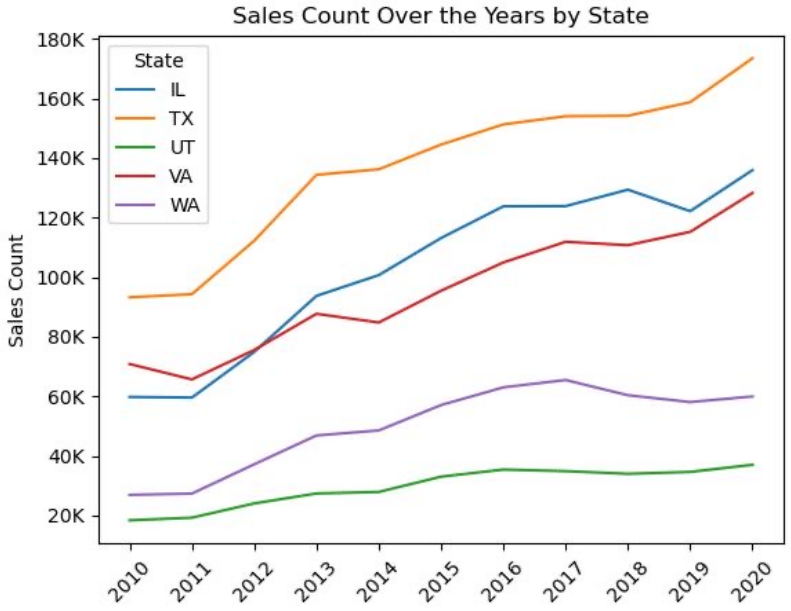
State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
WA	605282	620290	635737	651559	663603	677014	687576	697079	704147	708253	712816
IL	12840545	12867783	12883029	12895778	12885092	12859585	12821709	12779893	12724685	12667017	12587530
TX	25241897	25645504	26084120	26479646	26963092	27468531	27914064	28291024	28624564	28986794	29360759
UT	2775413	2814797	2854146	2898773	2938327	2983626	3044241	3103540	3155153	3203383	3249879
VA	1854265	1856606	1857446	1854768	1850569	1843332	1832435	1818683	1805953	1795263	1784787

Home Sales

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IL	59779.0	59571	74902	93725	100689	113144	123797.0	123867	129384	122175	135944.0
TX	93241.0	94298	112232	134382	136227	144533	151306.0	154065	154210	158770	173511.0
UT	18356.0	19235	24019	27369	27877	33008	35399.0	34867	33972	34607	36991.0
VA	70839.0	65667	75558	87705	84784	95447	104942.0	111890	110752	115225	128283.0
WA	26889.0	27330	37158	46846	48530	57052	63002.0	65469	60361	58065	59939.0

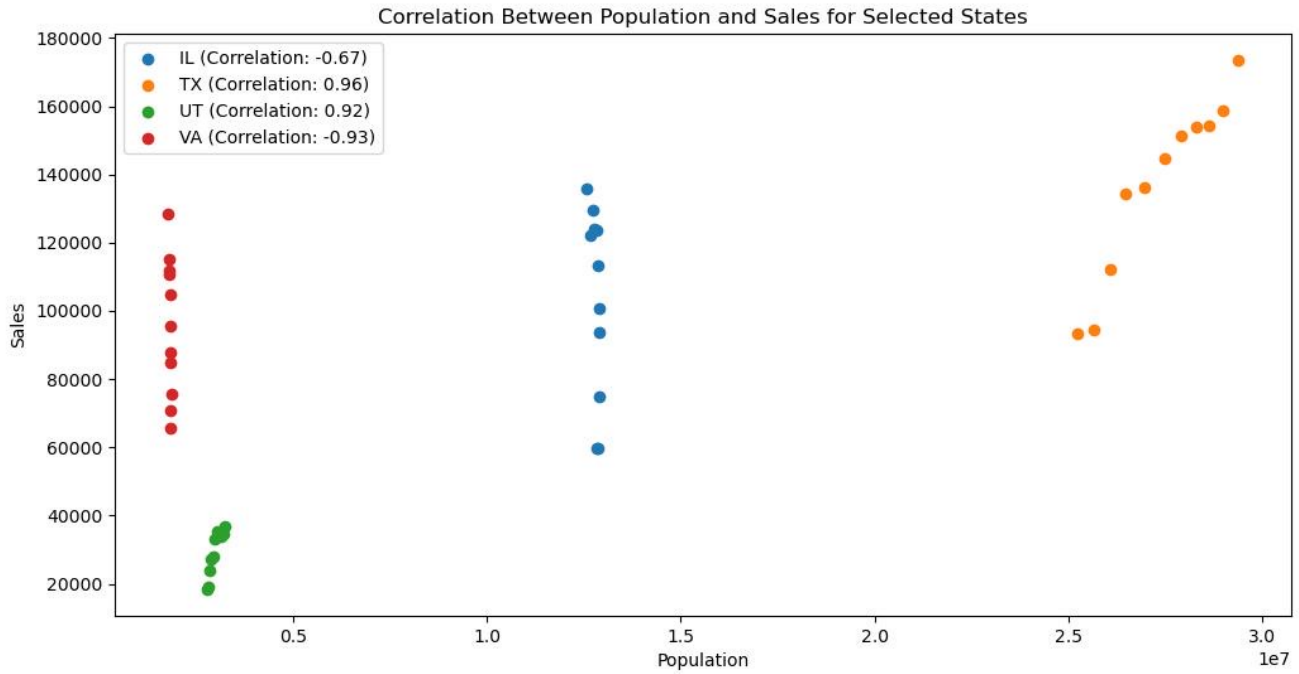
Plotting the total population numbers against total residential home sales numbers did not yield significant insights. It is evident that residential sales have increased across all states, and the same can be observed for population.





Correlation Insights: Total Population & Residential Home Sales

- Washington (WA) and Texas (TX) show a very strong and positive correlation between population and sales, suggesting that as population increases, sales increase significantly.
- Utah (UT) exhibits a very strong positive correlation, indicating that population growth is closely tied to higher sales in the state.
- Illinois (IL) and Virginia (VA) demonstrate strong negative correlations, implying that as population increases, sales tend to decrease notably in these states.
- In summary, population changes exert a significant influence on sales across these states, although the nature and strength of this correlation differ, ranging from positive to negative. These results offer insights into the population-sales dynamics specific to each state. However, it's important to note that these findings do not reveal a common pattern shared by all the states, indicating that regional market dynamics play a crucial role in shaping these relationships.



State	
WA	0.947718
IL	-0.674785
TX	0.961749
UT	0.917333
VA	-0.928514

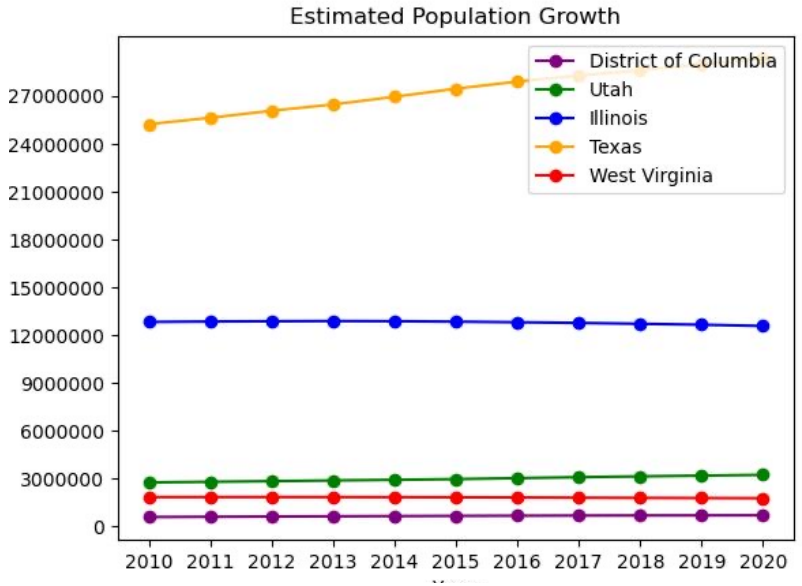
Total Population vs Resi Home Sales Price

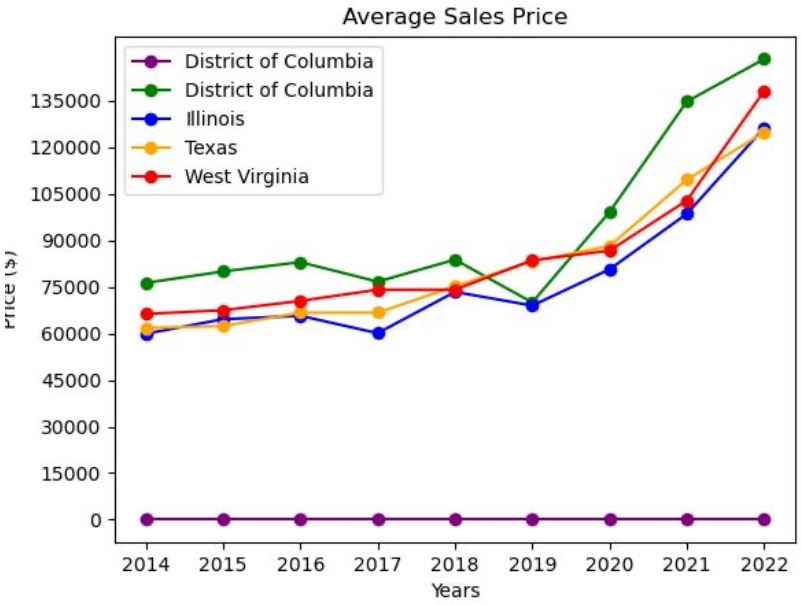
Total Population

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
WA	605282	620290	635737	651559	663603	677014	687576	697079	704147	708253	712816
IL	12840545	12867783	12883029	12895778	12885092	12859585	12821709	12779893	12724685	12667017	12587530
TX	25241897	25645504	26084120	26479646	26963092	27468531	27914064	28291024	28624564	28986794	29360759
UT	2775413	2814797	2854146	2898773	2938327	2983626	3044241	3103540	3155153	3203383	3249879
VA	1854265	1856606	1857446	1854768	1850569	1843332	1832435	1818683	1805953	1795263	1784787

Home Sales Price

STNAME	2014	2015	2016	2017	2018	2019	2020	2021	2022
District of Columbia	X	X	X	X	X	X	X	X	X
Illinois	59900	64600	65700	60100	73400	69000	80700	98600	126300
Texas	61800	62400	66700	66700	75200	83300	88200	109600	124900
Utah	76300	80000	83000	76700	83800	70000	99200	134800	148500
West Virginia	66300	67500	70500	74100	74100	83600	86700	102900	138200





Plotting the total population against total sales price for residential homes did not yield significant results. The only place where population decreased was West Virginia. However, the data does not show that there is a significant relationship between home sales price and population.

Rental Vacancy Change Overtime

Rental Vacancy From 2011 to 2020

Year	States	Yearly Rental Vacancy Change 2011(%)	Yearly Rental Vacancy Change 2012(%)	Yearly Rental Vacancy Change 2013(%)	Yearly Rental Vacancy Change 2014(%)	Yearly Rental Vacancy Change 2015(%)	Yearly Rental Vacancy Change 2016(%)	Yearly Rental Vacancy Change 2017(%)	Yearly Rental Vacancy Change 2018(%)	Yearly Rental Vacancy Change 2019(%)	Yearly Rental Vacancy Change 2020(%)
0	District of Columbia	-0.6	-0.6	-0.1	-1.2	-1.1	0.4	1.3	0.8	-1.9	2.2
1	Virginia	-0.6	-0.4	-2.2	0.1	-0.8	0.4	-0.3	-0.2	0.5	-0.5
2	Utah	-0.8	1.3	-1.0	1.9	-3.5	0.6	0.5	-0.8	-1.6	1.5
3	Illinois	-0.8	-0.7	0.1	-0.4	-1.7	0.1	0.4	-0.6	0.1	0.4
4	Texas	-1.0	-1.9	-0.3	-0.6	0.1	-0.2	0.4	-0.9	0.6	-0.9

Rental Vacancy Over The 10-Year Period from 2010 to 2020

Year	States	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
0	District of Columbia	9.0	8.4	7.8	7.7	6.5	5.4	5.8	7.1	7.9	6.0	8.2
1	Virginia	10.5	9.9	9.5	7.3	7.4	6.6	7.0	6.7	6.5	7.0	6.5
2	Utah	7.2	6.4	7.7	6.7	8.6	5.1	5.7	6.2	5.4	3.8	5.3
3	Illinois	11.0	10.2	9.5	9.6	9.2	7.5	7.6	8.0	7.4	7.5	7.9
4	Texas	13.3	12.3	10.4	10.1	9.5	9.6	9.4	9.8	8.9	9.5	8.6

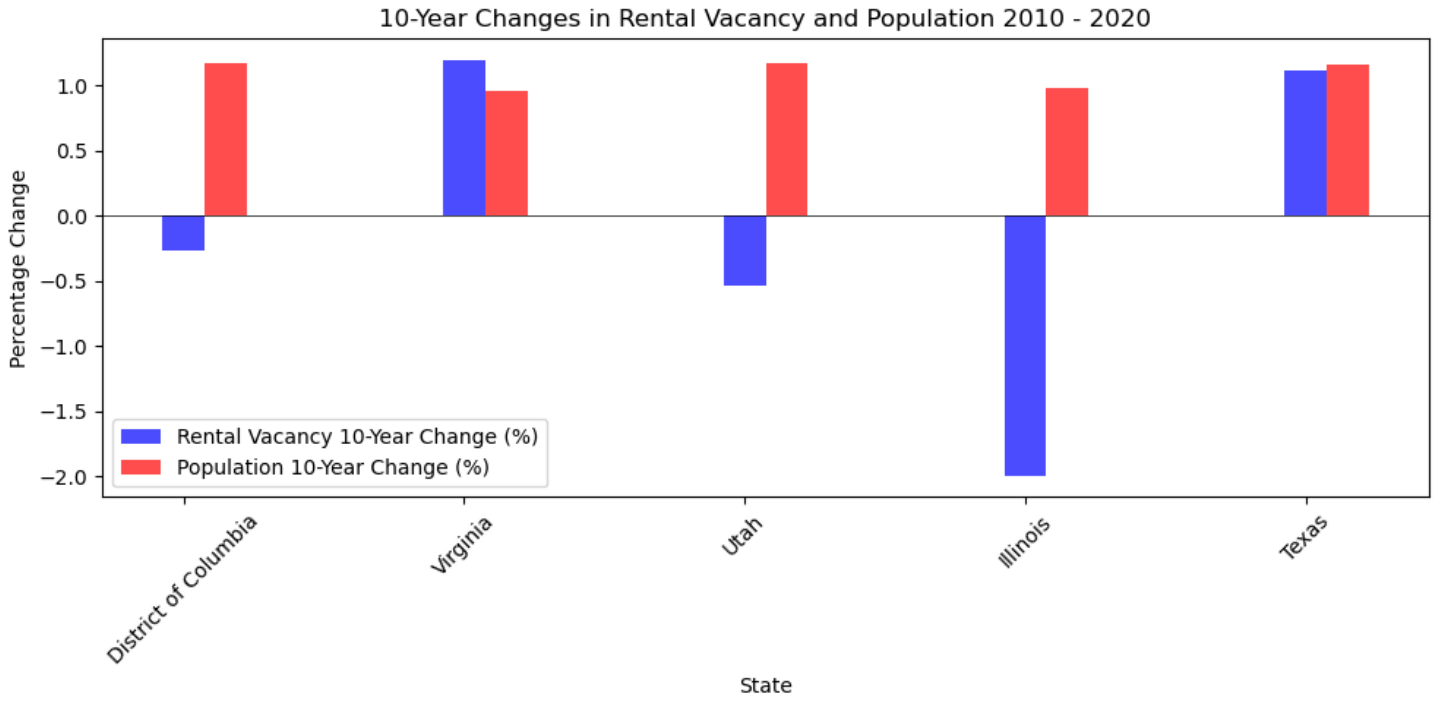
The tables presented illustrate the rental vacancy rates between 2010 and 2020 and the changes observed during this period. One notable observation from this data is that the rental vacancy rates in DC and UT varied significantly yearly, while the other states demonstrated relatively stable rates throughout the period. Moreover, Texas and Virginia experienced an increase in rental vacancies over the course of these ten years.

Rental Vacancy vs Population Change

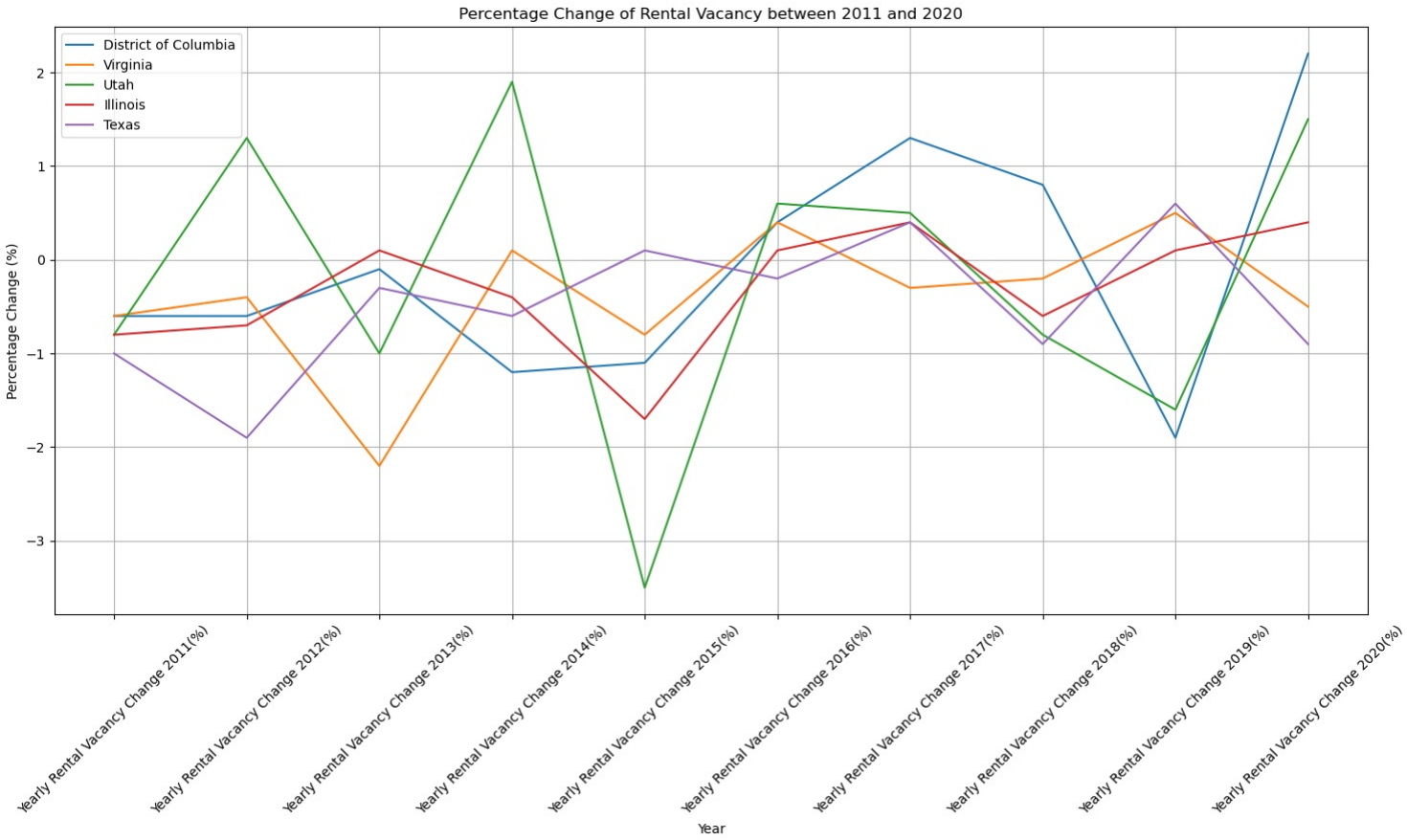
- The bar chart displayed on the left illustrates the correlation between rental vacancy and population change. The data reveals that DC, UT, and IL support the hypothesis that rental vacancy decreases when the population increases. The state of Illinois stands out with a significant 2% decrease in rental vacancy over the past ten years.

- However, VA and TX tell a different story. It could be due to the fact that people are opting to buy houses instead of renting, or there might have been some developmental projects undertaken in the last decade to cope with the surge in population.

- Overall, our analysis shows population change does not impact.



Rental Vacancy vs Population Change



Percent Change in House Values Over Time

State	% Change 2010 to 2011	% Change 2011 to 2012	% Change 2012 to 2013	% Change 2013 to 2014	% Change 2014 to 2015	% Change 2015 to 2016	% Change 2016 to 2017	% Change 2017 to 2018	% Change 2018 to 2019	% Change 2019 to 2020
TX	-3.117714	0.319461	5.121844	7.927038	8.307423	7.667817	6.564546	6.229096	4.554346	5.330033
IL	-8.437514	-5.890979	3.133894	7.892404	3.924880	4.938284	4.623869	4.444455	2.677677	3.438291
VA	-3.259745	0.583216	4.732625	3.236675	2.252560	2.898232	3.519659	3.716650	3.719112	5.738963
WA	-9.007489	-5.746659	6.846758	7.757520	7.962252	11.155974	10.971412	10.404267	5.213656	8.706544
UT	-7.582020	0.907647	10.690633	6.559761	6.186868	9.441646	8.634343	9.413689	7.770784	8.937087

Applications of Analysis

- $\triangle H = x * \triangle P\%$

Formula can be used to predict future prices of houses in selected states as the population increases or decreases

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TX	138130.885125	133824.359667	134251.876067	141128.048258	152315.322375	164968.800842	177618.305925	189278.141825	201068.458783	210225.811775	221430.916233
IL	164836.884733	150928.749667	142037.569400	146488.876867	158050.371092	164253.659250	172364.972058	180334.902075	188349.806525	193393.205783	200042.627158
VA	220257.314142	213077.486575	214320.188850	224463.159700	231728.301608	236948.121667	243815.428008	252396.899625	261777.610183	271513.411717	287095.465392
WA	260447.924925	236988.106900	223369.209142	238662.758392	257177.070367	277654.157350	308629.182708	342490.162267	378123.752950	397837.825842	432475.752083
UT	205231.194483	189670.523475	191392.061500	211853.084067	225750.139142	239717.002625	262350.233333	285002.453175	311831.698417	336063.466117	366097.750325

$\triangle H$ = price of house in selected state – base year price of house in selected state = 221,430 – 138,130 = 83,300

$\triangle P\%$ = percent population change in selected state - base year percent population change in selected state

$\triangle H / \triangle P\%$ = x (the predicted change in the price of houses determined by the estimated change in pop

83,300 / 17.765934 = $4688.7487 (for every one percent increase in population the house price increase by that much)

Questions?