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HONORS THESIS

Understanding Real Estate Market Dynamics: The Covid-19 Effect

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ABSTRACT

The covid-19 pandemic has led to significant shifts in consumer trends, including in the real estate market. Through multivariable regression, this study investigates how covid-19 has impacted the demand as well as pricing for houses in the United States. The findings contribute to the literature in a few major ways. First, they provide a current look at the impact of coronavirus on the housing market by analyzing monthly, state-level data from before and during the pandemic. Secondly, they provide clarity and supplement journals and research currently in the works. This is the first national study that looks at the effect of covid-19 on house prices from a state-level view. Recognizing the developments in the real estate market due to covid-19 helps determine their potential impacts on the future. Multivariable regression analysis shows, as hypothesized, covid-19 cases had a statistically significant negative impact on median house prices in 2020. States experiencing low covid cases saw an increase in median house prices over 10% greater than states experiencing high covid cases when evaluating regressions from pre-covid to during covid. Additionally, variables previously affecting house prices including, but not limited to, median square feet, income, unemployment, and crime rates have less of an impact on median house price than they used to.

INTRODUCTION

This thesis focuses on the impact covid-19 has had on the United States housing market. The real estate and housing market play a key role in the economy. Around 65 percent of homes are owner-occupied and make up a substantial source of wealth (Stupak 2019). Furthermore, the housing market makes up a considerable portion of economic activity, so any changes result in a broader impact on the overall economy (Stupak 2019). Specifically, spending within the housing market accounted for 17.5 percent of GDP in 2020 (Congressional 2021). The 2019 coronavirus pandemic has resulted in drastic shifts in real estate trends, including the mass exodus from city living and increased demand for suburban and rural homes (Keates 2020). Recognizing these developments and their potential impacts both now and in the future will enable economists to forecast potential economic downfalls more effectively. This thesis explores the question of how covid-19 has impacted median house prices in the United States.

The Wall Street Journal and *Realtor.com* have published numerous real estate articles during the covid-19 pandemic. While these articles are not peer-reviewed, they point towards shifts in real estate trends that inspired this thesis. One article analyzes the rising demand for mountain towns. It suggests the increase in demand was a result of homebuyers' stronger desire for additional space and the "great outdoors" due to pandemic uncertainty and social distancing (Keates 2020). In a similar way, there was an analysis of snowbirds, people who traditionally move to warmer places during cold months, increasing their preference towards ski towns. August 2020 represents an all-time high for the number of online views for ski-town homes, with views representing 2.16 percent of all home shopping interests (Speianu 2020).

Taylor (2020) analyzes the impacts that increased demand has had on recent home buyers and sellers during coronavirus. Heightened interest for larger homes outside of cities, as well as less inventory, have resulted in bidding wars and increased prices. She finds that these factors have led to fewer choices for buyers, as well as a decrease in home inspections and other due diligence. Furthermore, homebuyers are taking on additional risks by moving to places they know very little about. She concludes that numerous homebuyers are experiencing remorse after discovering unfavorable conditions with their recently purchased homes.

Hale (2020) examines the overall increase in United States home sales through an analysis of regional and metro level statistics. She finds home inventory decreased by 39.6 percent over 2020 and homes were on the market for an average of 13 fewer days in 2020 than in 2019. To a similar degree, Bedo (2020) analyzes metropolitan real estate markets compared to suburban and rural areas through an in-depth investigation of nearly 20,000 zip codes. His analysis reveals suburban community housing rankings outpaced urban areas. He found on average suburban zip codes saw an improvement of 404 ranking spots compared to urban zip codes with an average improvement of only 87 spots.

Hale (2020) wrote another article where she similarly analyzes zip code level data. The purpose of her research is to investigate the zip codes with the hottest real estate markets. She finds an overall rise in demand for East Coast homes with seven of the top ten zip codes on the East Coast. Additionally, she finds an overall shift in demand away from cities (Hale 2 2020).

This thesis explores these trends using regression analysis. It supplements and provides data to further understand the effects of covid-19 on the real estate market.

REVIEW OF LITERATURE

Due to the recent occurrence of covid-19, there have not been many peer-reviewed sources published as of 2021. As a result, most peer-reviewed articles included are from previous years with a focus on determinants of housing prices and demand, with a few from covid-19. This allows for a discussion on what has changed and what has remained the same since the start of covid-19.

Determinants of Housing Prices and Demand

Stadelmann (2010) examines the determinants of housing prices in Switzerland using a Bayesian approach from 1998 to 2004. He uses model averaging to investigate which community-specific variables have the greatest impact on home prices. Stadelmann analyzes comparable homes from 169 different communities for his research. He finds that housing prices are mostly influenced by location-specific factors, municipal taxes, health and social well-being, and cultural expenditures. Location-specific factors include closeness to local shopping centers, air quality, and distance to the city center. Socioeconomic factors, including demographics, are found to be less important in predicting home prices.

Kauko (2006) examines the attractiveness of a Holland location within a housing market. He uses cross-country evidence to determine housing consumer preferences based on profiles created through an analytic hierarchy process. He compiles hedonic regression models in existing literature and determines accessibility/proximity, social factors of the neighborhood, service infrastructure, municipality, and supply-side friction have the greatest impact on residential area attractiveness. Specifically, distance to work has a negative impact on residential area attractiveness, and the level of public transport systems has a positive impact under accessibility and proximity. For social factors, socioeconomic status has a positive impact while externalities caused by social disturbances have a negative impact. Service infrastructure includes a positive impact on residential area attractiveness for the availability of services, low density, and pleasantness. Municipality relates to the attractiveness of the municipal image and government policy. Supply-side friction involves a negative impact on housing shortages and land constraints. He finds accessibility and proximity are more important in suburban locations than urban locations. However, social factors are relatively unimportant in suburban areas but are important in urban locations. Lastly, service infrastructure is moderately important in all profiles.

Janssen (1994) examines market conditions and the cyclical response in the Netherlands housing market on not only price but transaction number. He studies the period from 1976 to 1979 with annual data for the Netherlands as a whole. He analyzes the mechanisms of both internal and external dynamics. In his theory, the mechanisms for internal dynamics are a combination of slow demand reactions to changes in price, long productions times for primary suppliers, and a "disproportionately large secondary market". External dynamics are changes in outside factors that affect the housing market. He finds that the nominal mortgage rate, index of consumer confidence, index of willingness to purchase luxury goods, index of the economic climate, index of housing rents, and changes in construction costs were statistically significant external factors. Additionally, he finds changes in volume are more statistically correlated to changes in market conditions than prices. These external dynamics are typically cyclical in nature. Specifically, the housing market cycle tends to be contained in the time scale of the business cycle.

Gilber (2003) takes a consumer marketing approach and examines the human influences that consumers have on real estate demand. Rather than analyzing real estate by physical attributes, she focuses on consumer perception. Gilber identifies the extensive consumer decision-making process

in the real estate market. The process first starts with a consumer realizing a need which then transfers into information search, evaluation of alternatives, and finally, decision rules. During the information search, consumers rarely rely only on past knowledge when deciding on a home to purchase. Instead, there is often extensive research. However, there are constraints on a consumer's ability to research extensively, including information availability and quantity, as well as time. Due to the existence of too many possible alternatives, the second phase involves setting limits. During this second phase consumers determine the destination they want to move to, then they select a particular home. The reduced alternatives are known as the consideration or evoked set. The final stage involves simplified methods of comparing alternative homes and ultimately selecting a house to purchase. Gilber argues that market analysts should incorporate information revolving around consumer attitudes, perceptions, and preferences into economic models to help reduce unexplained variance in housing consumption behavior.

Roulac (1996) examines the real estate market cycle, forces that transform society's relationship to places, and structural changes. He discusses how the housing market is significantly influenced by the overall economy. Roulac finds that investors often make decisions on the assumption that current trends will continue for a long time. Additionally, he finds that the real estate cycle is ultimately the result of human behavior and organizational action and interaction. Roulac argues that behavioral stability and learning processes are essential to understanding economic thinking.

Historical Epidemics

Covid-19 is not the first pandemic or epidemic that has affected the world. There is a historical study analyzing the impact of the SARS virus on the housing market and home prices.

Wong (2006) analyzes the 2003 Hong Kong Severe Acute Respiratory Syndrome (SARS) epidemic and its effect on the housing market. SARS was considered the first "serious and contagious illness of the 21st century", with three hundred Hong King resident deaths during the March-June 2003 epidemic. For the study, SARS risk is measured at an estate-level infection rate, new reports, and government infection announcements. Through regression analysis, the study finds that estates directly affected by SARS experienced an average price decline between 1 and 3 percent. An outbreak of SARS caused a 1.6 percent decrease in price for all estates.

Impact of Covid-19

Due to the recent occurrence of covid-19, there has been a limited number of peer-reviewed sources published on covid-19 and the housing market. However, the few sources available provide some additional insight into the impact of covid-19 on the real estate market.

Zhao (2020) analyzes economic policy and its impact on the housing market at a zip code level in the United States. Zhao uses regression analysis as well as different economic models to analyze a variety of real estate trends. The dependent variable is the demand score, which is measured by online views per property. Independent variables include the 30-year fixed mortgage rate, median family income, median square footage, and median price. Zhao finds from April to August in 2020, the median housing price growth rate grew faster than any four-month period prior to the global financial crisis. Additionally, he finds the lower interest rates resulted in a home demand increase that was much more than in the past. He concludes that these are a result of fear of missing out and coronavirus fundamental changes in consumer behavior. Additionally, he finds that the increase in housing demand is especially strong at the two ends of the income distribution.

Garner (December 2020) explores the changes in consumer behavior and financial well-being during the coronavirus pandemic. She uses a household pulse survey conducted by the bureau of labor statistics to analyze consumer behavior changes. She found younger respondents struggled more to meet expenses. The data revealed 64.7 percent of millennials reported some difficulty with expenses. She also found that protective (pandemic-avoidance) behaviors were reported as more likely than relaxed consumer behavior changes. Additionally, she found the protective changes were concentrated in some states, but not in others. When respondents were asked why they changed their spending habits, 48.5 percent were concerned about being around public or crowded places or high-risk people and 30.5 percent were concerned about the economy. Garner analyzes state-level consumer behavior changes. She found that in general, states with higher populated areas are more likely to have protective consumer behavior changes.

Huws (2020) explores the rapid advancement of algorithmic management in urban locations due to the coronavirus pandemic. She finds that the increase in digital use for interactions resulted in a transformation of public spaces and has impacted cities socially, economically, and politically. Specifically, she discusses the displacement of work as well as the overall effect on urban

populations, working conditions, and job security. Additionally, she finds that these changes may bring long-term negative shocks to tourism as well as to ethnic minorities.

Overall, published literature provides insight on the determinants of house prices, as well as the impact of covid-19 on the housing market. However, this thesis differs from current literature because it analyzes the effect of covid-19 on house prices from a state-level analysis through multivariable regression. There is also an investigation of certain trends through the control variables used in the regression. This thesis provides clarity and supplements journals that are in the works. The world has significantly changed, and it is essential to recognize these developments, as well as why they are occurring and their potential impacts on the future.

RESEARCH DESIGN

Data

The study explores whether covid-19 has impacted median house prices in the United States. The research primarily consists of public record analysis and academic journals.

Multivariable regression was run using Stata on a dataset with monthly, state-level data ranging from 2016 to 2020. The dependent variable is median housing prices, the explanatory variable is covid-19 cases, and controls include various housing, demographic, and economic variables. The control variables are guided by significant determinants of home prices in previous literature.

Literature provides some helpful insight on significant determinants of home prices. While most literature focuses on a single home's price determinants, these determinants are still applicable at a larger scale and were used to guide the control variables in the study's econometric models. The model's control variables can be divided into three major categories: housing variables, demographic variables, and economic variables.

In terms of housing variables, total listing count, median square feet, and median days on the market were included. Various other housing variables were considered for the model, but due to collinearity, they were excluded. The total listing count indicates the total number of active and pending listings in a specific state. It was included because it is an indication of supply, which has a large impact on price. A rise in total listings should result in less pressure on the price (Dunn

2021). Median days on the market represents the time a property is initially listed and when it officially closes. There is typically an inverse relationship between median days on market and housing prices. This is an indicator of the market demand in a state and likely has a large impact on the final price of a home. In general, the longer a home is on the market, the lower the final sales price will be. The median days on market also impacts the price people decide to initially list their home at. Median square feet represents the average square footage of houses in a state. On average, homes with greater square footage have a higher price.

Demographic variables include state population density, crime rate, and state total consumer income. Traditionally, people are attracted to higher population locations, like cities. In general, housing prices grow faster for homes in metropolitan areas than lower population areas (Gorman 2007). The demand resulting from population size is an essential factor that should be considered when looking at median housing prices. Additionally, crime rates have been found to be a significant determinant in the demand for houses in a specific location, meaning it impacts the median price (Maximino 2020). State total consumer income will also likely have an impact on price due to both the impact of the cost of living and the income incentive for people to move there (Özmen 2019). It was hypothesized that pre-covid, population, crime rate, and total consumer income would have a greater impact on the overall median price for a state than they would during covid, due to shifting consumer priorities.

Economic variables include the state unemployment rate. The 30-year fixed mortgage rate was originally included, but due to collinearity, it was removed from the regression. State unemployment rates will have a significant impact on people's ability to afford a home within that state as well as others' demand for homes in a location (Rogers 2013). Job availability is a large component in the attractiveness of a real estate location. It was predicted higher unemployment will result in less demand for a location and in turn lead to lower prices.

The data was consolidated to create a one-panel dataset to run linear regressions in Stata.

Housing data came from *Realtor.com*. This data includes median listing price, total listing count, median square feet, and median days on market. The state populations are gathered from the United States Census. Coronavirus data is taken from the Center for Disease Control and includes a seven-day moving average of coronavirus cases by state per 100,000 people. The crime rate is

pulled from the Federal Bureau of Investigation's Crime Data Explorer and is reported yearly at a state level. Median household income data is collected from the Bureau of Economic Analysis and is quarterly by state. Monthly unemployment rates by state are pulled from the Bureau of Labor Statistics. Other supplemental research was compiled from a variety of literary journals including some from the *Social Science Research Network, The Wall Street Journal,* and the *Journal of Housing Economics*.

The CDC provides a covid data tracker with all previous reports of death and cases at a state-level. Users can filter by state, daily or cumulative count, and raw totals or per 100,000 people This thesis includes a seven-day moving average for new covid cases per 100,000 people.

Summary Statistics

The study included 2,700 observations and eight variables, as seen in Table A. In 2020, the explanatory variable, covid cases, had a mean of 17.74 people per 100,000 people. Between 2016-2019 the dependent variable, median listing price, had a mean of $286,899. In 2020 the median listing price mean increased to $328,536. Additionally, total listing count decreased from 34,176 to 29,305 from pre covid to during covid. For additional summary statistics, look at Table A. Table B displays the difference between variable means from pre covid to during covid.

Methodology

A multivariable regression analysis was run on the data set. To allow for the comparison of coefficients, regression analyses were run for before and during covid. The dependent variable is state median housing prices, the explanatory variable is covid-19 cases, and controls include various housing, demographic, and economic variables.

To test whether covid-19 affects median house prices in the United States, the following regressions were used:

1. $\log(\text{median housing price})_{it} = \beta_0 + \beta_1(\text{Covid})_{it} + \varepsilon_{it}$

2. $\log(\text{median housing price})_{it} = \beta_0 + \beta_1 \log(\text{total listing count})_{it} + \beta_2 \log(\text{median square footage})_{it} + \beta_3(\text{median Days on market})_{it} + \beta_4 \log(\text{Income})_{it} + \beta_5 \log(\text{Crime})_{it} + + \beta_6 \log(\text{Population Density})_{it} + \beta_7(\text{Unemployment})_{it} + \beta_8(\text{Covid})_{it} + \varepsilon_{it}$

3. $\log(\text{median housing price})_{it} = \beta_0 + \beta_1 \log(\text{total listing count})_{it} + \beta_2 \log(\text{median square footage})_{it} + \beta_3(\text{median Days on market})_{it} + \beta_4 \log(\text{Income})_{it} + \beta_5 \log(\text{Crime})_{it} + + \beta_6 \log(\text{Population Density})_{it} + \beta_7(\text{Unemployment})_{it} + \beta_8(\text{Covid})_{it} + \text{State Dummies} + \varepsilon_{it}$

4. log(median housing price)it = β0 + β1(High Covid)it +εit

5. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ β8(High Covid) +εit

6. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ β8(High Covid)it + State Dummies +εit

7. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ State Dummies +εit

The subscript *it* refers to the state *i,* in year *t.* To allow for interpretation for non-logged independent variables, due to the dependent variable being logged, the coefficients are exponentiated then turned into a percentage during analysis.

RESULTS

The various regressions listed above are categorized into three sections for the analysis. These include Covid Cases, High Covid, and State Dummy, the explanatory variables used in the different regressions to determine the impact of covid-19 on median listing prices. The regressions were run, and the results are as follows:

Covid Case Regressions

The first regression looks at median house price as a function of covid cases per 100,000 people in the year 2020. As seen in Appendix B (Regression 1) the covid-19 case coefficient was -0.00088. This coefficient is interpreted as, for every unit increase in covid cases per 100,000 people, there should be a -0.088 percentage change in a state's median house price. However, the result fell just short of statistical significance, so the coefficient is not statistically different from zero. For additional details, refer to Table C, column 1.

The next regressions look at median house price as a function of covid cases per 100,000 people and control variables pre-covid and during covid. The results show adjusted R-squares of 0.2114 and 0.2120 respectively, indicating 21% percent of the variation in the data can be accounted for by the model. This is higher than the previous regression indicating a stronger model. As seen in Table C, column 2, covid cases, is statistically significant at the 5 percent level. The coefficient is

-0.0011. This coefficient can be interpreted as, for a unit increase in covid cases per 100,000 people, there should be a negative 0.11 percentage change in a state's median house price. Refer to Table C, column 2, for a complete view of the regression.

Table C, column 3, B looks at median house price as a function of covid-19 cases, control variables, and state dummy variables. The results reveal a covid-19 coefficient of 0.030 with statistical significance at the 1% level. These results indicate covid-19 has a significantly significant positive 0.03% effect on the state median house price for every unit increase in covid cases per 100,000 people. This result is not what was expected by the hypothesis.

Additionally, this regression reveals certain trends with the control variables. For one, the total listing count changed from a negative impact to a positive impact on median listing price from pre covid to during covid. This is an indicator of supply. Traditionally, it is expected an increase in supply should put downward pressure on demand, and therefore price (Dunn 2021). However, during covid, this was not the case. This is likely due to the fear of missing out (Zhao 2020). The more houses on the market with a high list price, the more likely someone would not want to miss out on the opportunity of listing their home at a similar or even higher price. Additionally, it was a seller's market, so they had additional control and could increase prices with the demand to support it. Secondly, prior to covid, unemployment had a significantly negative impact on the median listing price, which is expected (Rogers 2013). However, during covid, the impact was no longer significant. This shift is likely because unemployment has less of an impact on the desirability of a state since working from home became much more common. Few people had to worry about finding a new job as a result of a move during covid-19. It was also found that square footage had less of an impact on home prices during covid. This was because buyers seemed to care less about the physical attributes of a home, and more about its location. For additional regression results, refer to Table C.

<u>High Covid State Regressions</u>

To see if covid-19 has an impact at a less granular level, Table D, column 1, looks at median house price as a function of states with a high number of cases in 2020. This is a dummy variable called high covid that looks at a state's median covid cases per 100,000 compared to the median covid-cases for all the states. If a state is above the median for covid cases, it is considered a high covid

state in the regression. If a state is below the median for covid cases, it is considered a low covid state in the regression. The results include an adjusted R-squared of only 0.059 indicating only 5.9 percent of the variation in the data can be accounted for by the model. This number is relatively low meaning the model is not very strong. However, a state considered a high covid state, meaning the average state covid cases per 100,000 people is above the median, has a statistically significant impact on the median house price at the 1 percent level. Specifically, if a state is considered a high covid state in 2020, the model estimates this would have a negative 14.69 percent impact on the median house price in that state compared to states with a low number of covid cases.

Column 2 in Table D looks at median house price as a function of high covid states and control variables pre-covid and during covid. The explanatory variable, high covid, is statistically significant at the 1 percent level both pre-covid and during covid. The coefficient pre-covid is -.1557 and during covid -.0853. These values can be interpreted as negative 14.42 percent and negative 8.18 percent. The coefficient becomes less negative, going against the hypothesis.

Table D, column 3, looks at median house price as a function of high covid states, control variables, and state dummy variables. The results reveal a covid-19 coefficient of -0.2015 before covid and -0.3113 during covid. However, the coefficient for pre-covid is not statistically significant and the coefficient during covid is statistically significant at the 10 percent level. The effect of being considered a high covid state became statistically significant during covid and had a negative impact on price.

There were shifts in control variables similar to the trends discussed in the previous regressions with covid cases as the explanatory variable. Total listing count changed from having a negative impact on price to having a positive impact on price during covid. Square footage transitioned from having a positive statistically significant change on the listing price to not having a statistically significant impact during covid. This regression also showed a state's total consumer income had less of an impact from pre-covid to during covid. A possible explanation involves the stimulus checks provided during covid. On average, people were able to save more money, so many people experienced less financial stress. Furthermore, similar to the explanation for the impact of unemployment, many people were able work remotely rather than finding a new job

with a new salary. They were not as concerned about projected income in a state they wanted to move to.

State Dummy Variable Regressions

The final regression is quite different than the other six regressions. The regression analysis includes pre-covid and during covid views. Rather than include a covid variable, two regressions were run, one for the years 2016-2020 (pre-covid) and one for 2020 (during covid) with the hopes of capturing covid in its entirety without limiting it to a single explanatory variable. Both regressions include the control variables and state dummy variables. The state dummy variables are used to calculate the changes in state coefficients from pre-covid to during covid with the idea that significant changes would be a result of covid related factors. A t-test was run, and all state coefficients were found to be significantly different from pre-covid to during covid, besides Indiana (high covid state), and Ohio (low covid state). The states are then separated into high covid and low covid states and the median change from pre-covid to during covid is calculated for both high covid states and low covid states. These medians are then compared. The regression had an adjusted R-square of 0.9871 meaning 98.71 percent of the variance in the data can be explained by the model. This indicates the model is very strong. The results reveal low covid states saw an increase in median house prices 11.1 percent greater than states categorized as high covid, as seen in Table E and F. When Indiana and Ohio are excluded from the calculation, this value increases to 11.4% percent.

Similar control variable trends can be seen in this regression to those previously discussed. First off, the total listing count had a negative coefficient prior to covid. This means a greater number of houses on the market, supply, would typically lower the listing price. However, in 2020, the coefficient changed from a negative to a positive indicating more houses on the market would typically increase the listing price. Secondly, median square feet was statistically significant in 2016-2019 with a coefficient of 0.143. However, during 2020 this coefficient was no longer significant. Again, income was statistically significant in both pre-covid and during covid. However, the impact on price decreased from 1.01 in the regression from 2016-2020 to 0.44 in 2020. Crime is statistically significant in both pre-covid and during covid regressions. However, the coefficient becomes more negative in 2020. It changes from -0.05 to -0.20. Lastly,

unemployment is statistically significant in both pre-covid and during covid regressions. However, it has less of an impact on price in 2020 than it did in 2016-2019.

Discussion

There are important takeaways from the statistically significant variables in all the regressions run. For one, covid has had an impact on median house prices. This is likely because people are trying to move away from the harm of covid. People have started to appreciate more space and prefer not to live in high-risk areas (Keates 2020). Secondly, variables that have previously had a significant impact on state median house prices have become less impactful or are impactful in a different way. This points to a shift in consumer trends. People's priority shifted due to a focus on covid rather than other factors that were previously significant. Total square feet, income, and unemployment are less important to consumers and in effect have a lower impact on median house price. Square feet likely had less of an impact because people were more concerned with the location of a home than its physical characteristics (Taylor 2020). Income and unemployment were not as relevant because working from home was an option for many people, so they would not have to look for a new job in the state they were moving to. Crime on the other hand became more of a concern, especially when violent crime grew significantly at the start of the pandemic. The positive effect of total listing count is likely due to the significant increase in house listing prices and the fear of missing out. Demand was high in many locations, and when someone sees how much other houses in their town are selling for, they want to meet or beat that price and not miss out and demand remained high to support these high prices.

CONCLUSION

This study found that covid has impacted the real estate market and median house prices. States experiencing low covid cases saw an increase in median house prices over 10 percent greater than states experiencing high covid cases when evaluating regressions from pre-covid to during covid. This could significantly impact these states' economies both then and in the future. It could also encourage the administration of these states to make significant changes to encourage people to move back or visit as tourists. Furthermore, agents, developers, and others working in the real estate market will likely have to change their strategies and position themselves in a way that better encompasses the shifts in consumer trends to remain successful. While this study uncovered

significant findings, additional research should be conducted at a more granular level. Specifically, at a county or town level. Analysis at this level could better reflect the full impact of covid-19 on median house prices since many people may have moved within the same state.

TABLES AND APPENDICES

Table A - Summary Statistics

Pre-Covid	Obs.	Mean	Std. Dev.	Min	Max
Median Listing Price	2,100	286,899	104,778	134,300	699,050
Total Listing Count	2,100	34,176	37,502	2,368	218,161
Median Square Footage	2,100	1,859	321	641	2,807
Median Days on Market	2,100	77	23	30	211
Consumer Income	2,100	350,106	432,216	31,459	2,673,410
Crime	2,100	374	150	112	892
Population Density	2,100	202	262	1	1,200
Unemployment	2,100	3.9	0.9	2.0	6.9

During Covid	Obs.	Mean	Std. Dev.	Min	Max
Median Listing Price	600	328,536	117,111	159,950	730,050
Total Listing Count	600	29,305	34,918	1,685	204,957
Median Square Footage	600	1,879	307	568	2,635
Median Days on Market	600	68	20	36	172
Consumer Income	600	393,088	488,398	35,134	2,872,481
Crime	600	384	153	109	838
Population Density	600	298	724	1	4,951
Unemployment	600	7.2	4.0	2.0	29.5
Covid	600	17	24	0	155

Table B - Summary Statistics: Difference in Means for Pre versus During Covid

	Difference
Median Listing Price	41,638 ***
Total Listing Count	-4871 ***
Median Square Footage	19.4
Median Days on Market	-8.8 ***
Consumer Income	42,982 ***
Crime	10.4
Population Density	96.6 ***
Unemployment	3.3 ***

Note: (* 10% significance, ** 5% significance, *** 1% significance)

Table C - Regression: Covid Cases

1. log(median housing price)it = β0 + β1(Covid)it + εit

2. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ β8(Covid)it + εit

3. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ β8(Covid)it + State Dummies +εit

Covid Cases	**1**	**2**		**3**	
Variables	**During Covid**	**Pre-Covid**	**During Covid**	**Pre-Covid**	**During Covid**
Covid-19 Cases	-0.00088		-.0011**		.0003***
	.0006		.0005		.00008
lnTotal Listing Count		-.2513***	-.1502***	-.0396***	.0598***
		.0193	.0387	.0069	.0164
lnMedian Square Feet		.2639***	.0216*	.1427***	.0121
		.03836	.0710	.0135	.0327
Median Days on Market		-.0016***	-.0030***	-.0016***	-.0017***
		.0003	.0007	.0000	.0001
lnIncome		.2426***	.1980***	1.0232***	.3909***
		.0196	.0390	.0371	.0721
lnCrime		-.0637***	-.1730***	-.0499***	-.2115***
		.0197	.0309	.0163	.0679
lnPopulation		.0493***	.0144**	.0094	-.0231
		.0068	.0064	.1427	.0159
Unemployment		.0527***	.0057*	-.0074**	-.0010
		.0081	.0031	.0032	.0007
State Dummy (Y/N)	N	N	N	Y	Y
Observations	600	2086	595	2086	595
R-Squared	0.0042	.2114	.2120	.9871	.9886

Note: (* 10% significance, ** 5% significance, *** 1% significance)

Table D - Regression: High Covid States

1. log(median housing price)it = β0 + β1(High Covid)it +εit

2. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ β8(High Covid) +εit

3. log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ β8(High Covid)it + State Dummies +εit

High Covid	**1**	**2**		**3**	
Variables	**During Covid**	**Pre-Covid**	**During Covid**	**Pre-Covid**	**During Covid**
High Covid	-0.1589***	-.1557***	-.0853***	-.2015	-.3113*
	.0259	.0142	.0265	.9469	.1752
lnTotal Listing Count		-.2295***	-.1274***	-.0396***	.0325**
		.0188	.0389	.0069	.0149
lnMedian Square Feet		.2867***	.0586	.1427***	-.0145
		.0374	.0710	.0135	.0323
Median Days on Market		-.0023***	-.0030***	-.0016***	-.0019***
		.0003	.0007	.0000	.0002
lnIncome		.2155***	.1701***	1.0232***	.4385***
		.0192	.0396	.0371	.0719
lnCrime		-.0247	-.1535***	-.0499***	-.2003***
		.0195	.0316	.0163	.0687
lnPopulation		.0336***	.0137**	.0094	-.0152
		.0068	.0063	.1427	.0159
Unemployment		-.0632***	.0059*	-.0074**	-.0013**
		.0080	.0031	.0032	.0007
State Dummy (Y/N)	N	N	N	Y	Y
Observations	600	2086	595	2086	595
R-Squared	.0590	.2567	.2205	.9871	.9883

Note: (* 10% significance, ** 5% significance, *** 1% significance)

Table E - Regression: State Dummies

log(median housing price)it = β0 + β1log(total listing count)it + β2 log(median square footage)it + β3(median Days on market)it + β4log(Income)it+ β5log(Crime)it+ + β6log(Population Density)it+ β7(Unemployment)it+ State Dummies +εit

State Dummy	**Regression**	
Variables	**Pre-Covid**	**During Covid**
lnTotal Listing Count	-.0396***	.0325**
	.0069	.0149
lnMedian Square Feet	.1431***	-.0145
	.0134	.0323
Median Days on Market	-.0016***	-.0019***
	.0001	.0001
lnIncome	1.0149***	.4385***
	.0296	.0719
lnCrime	-.0499***	-.2003***
	.0163	.0687
lnPopulation	.0626***	-.0152
	.0086	.0159
Unemployment	-.0077**	.00013**
	.0031	.0007
State Dummy (Y/-)	Y	Y
Observations	2086	595
R-Squared	.9871	.9871

Note: (* 10% significance, ** 5% significance, *** 1% significance)

Table F - Average Difference Between State Dummies for High versus Low Covid States

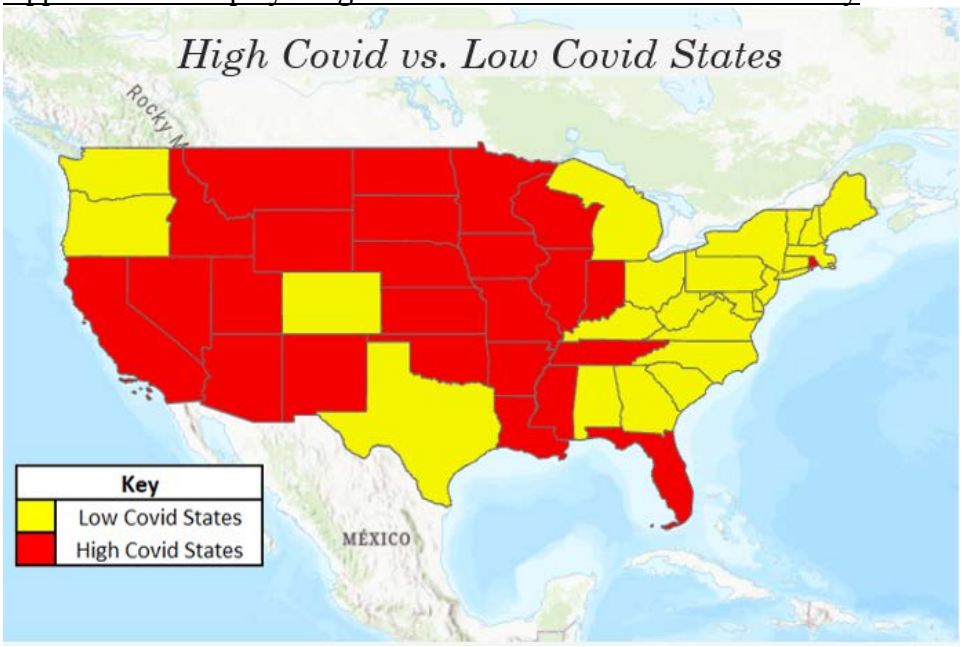
(Pre-Covid Versus During Covid)

High Covid States	Low Covid States
21.6	24.0
11.1%	

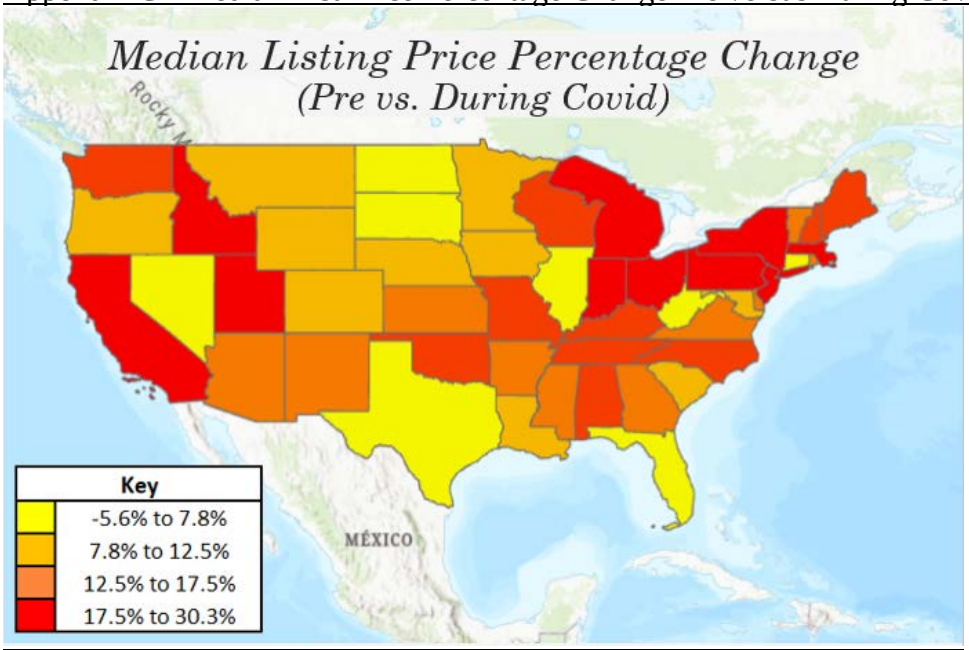
Appendix A - Regression Variable Definition and Sources

Variable	Definition	Source
Median Listing Price	Median listing price by state	Realtor.com
Covid-19 Cases	Weekly moving average, cases per 100000 people	CDC
High Covid States	States with average covid cases above the median	Realtor.com
Total Listing Count	Total of both active and pending listings in a state	Realtor.com
Median Square Feet	Median listing square feet in a state	Realtor.com
Median Days on Market	Median number of days a property spends on the market (time between initial listing and closing data)	Realtor.com
Consumer Income	State total consumer income (money a consumer earns from work and investments) in millions	Bureau of Economic
Crime	Violent crime per 100,000 people (violent crime are offenses involving for or threat of force	FBI UCR
Population Density	Number of people per square mile	US Census
Unemployment	Number of unemployed people as a percentage of the labor force	BLS

Appendix B - Displays High versus Low Covid States in the Study



Appendix C - Median List Price Percentage Change Pre versus During Covid



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