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The COVID-19 Pandemic and Its Effects on the United States Housing Market

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Abstract: *This research examines the impact of the COVID-19 pandemic on the housing market in the United States, with a specific focus on housing prices and their relationship with COVID-19 infection rates. The study utilizes a panel-data regression model, using monthly county-level data spanning from January 2020 to December 2022. Two separate models were employed, one for urban counties and another for rural counties, determined by population data. These models employ a fixed effects regression approach with robust standard errors and incorporate various independent variables to explore the association between county-level economic activity, unemployment rates, long-term interest rates, COVID-19 infection cases, and national housing market prices. The findings of this investigation reveal that the prices of homes in the United States were influenced by both the number of COVID-19 infection cases and the economic factors under consideration. Interestingly, urban counties experienced more pronounced fluctuations in housing prices compared to their rural counterparts. Moreover, there was a noticeable shift in housing demand, with a preference for less densely populated areas over densely populated ones. The outcomes of this study offer insights into spatial disparities and their implications for the real estate market.*

1. INTRODUCTION

Shelter, a fundamental necessity for all living beings, stands as one of humanity's most essential needs. In the context of modern living standards, the demand for space, comfort, and amenities in our homes continues to rise (Balemi et al., 2021). Yet, in today's complex world, everything comes at a cost. Beneath the apparent simplicity of this statement lies a multifaceted web of factors that influence housing prices. Countless studies have delved into this subject, yielding a plethora of related factors that underpin the dynamics of housing costs. These factors range from macroeconomic indicators, such as the well-being of the population, the state of the national economy, and the impact of large-scale social and political events (Ansell, 2019; Bratt, 2002; Coates & Matheson, 2011; Davis & Heathcote, 2005; Piazzesi & Schneider, 2016; Shamsuddin & Campbell, 2022). At the local level, housing prices can fluctuate due to buyer preferences, regional regulations that either stimulate or hinder housing demand, and the specific location and surrounding amenities of the housing units, all influenced by population density and social and cultural factors (Aladangady, 2017; Glaeser et al., 2012).

The outbreak of COVID-19 ushered in a period of global economic turbulence as societies worldwide grappled with the profound challenges posed by the pandemic. Numerous studies have explored the ramifications of COVID-19 across various economic domains, including the surge in the U.S. unemployment rate, which peaked at 14.7% in April 2020 as the pandemic took

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hold (Couch et al., 2020; Gallant et al., 2020). The impact of COVID-19 was also keenly felt in the housing market, as it ushered in price fluctuations, shifts in housing demand, and alterations in consumer preferences (Chetty et al., 2020; Guerrieri et al., 2020).

This paper's principal objective is to scrutinize the interplay between the all-transactions U.S. house price index, population well-being, interest rates, and the state of the country's economy during the implementation of COVID-19 protective measures. The authors also aim to investigate whether the aforementioned independent variables exert a substantial influence on the U.S. house price index, the dependent variable. Moreover, the study also focuses on analyzing the presence of spatial patterns in the effects of the pandemic across different regions. Hence, the topic will shed light on the geography of housing market changes during times of crisis. The examination of the impact of the COVID-19 outbreak on the housing market will provide insights into how unforeseen events can disrupt and reshape this critical sector of the economy. By comparing the impact of the outbreak on urban and rural counties, the study will illuminate how the housing market's response differs based on population density and location.

The remainder of this paper is organized as follows. In Section 2, the literature review presents and discusses concepts from prior research. Section 3 elaborates on the presentation of data and the methodology employed in the preparation of this work. Section 4 provides the results of our model. Lastly, section 5 concludes.

2. LITERATURE REVIEW

Adams and Füss (2010) examined the long-term impact and short-term dynamics of macroeconomic variables on international housing prices. The authors resorted to the application of a panel data analysis due to the lack of adequate and frequent data on the housing market resulting in a low number of observations for each country, thereby bypassing the data restrictions faced during analysis of single-market time-series data. The authors based their choice of variables for the estimation process on the static equilibrium model of Dipasquale and Wheaton (1996). The three variables chosen were as follows: economic activity, long-term interest rate, and construction costs. The dataset used consisted of quarterly real house prices from 1975Q1 to 2007Q2 for 15 countries: Australia, Belgium, Canada, Denmark, Finland, France, Great Britain, Ireland, Italy, Netherlands, New Zealand, Norway, Spain, Sweden, and the USA. The authors conducted a cointegration analysis on their panel data as follows: First, using panel unit root tests, the variables are tested for any possible stationarity. Next, the authors made use of panel cointegration tests to detect the long-term equilibrium relationships. Finally, the short-term dynamics of the data were estimated using cointegration-vector estimation methods. The authors concluded that macroeconomic variables have a significant impact on house prices, particularly stating that for a 1% increase in economic activity, the housing prices in the long-run increase by 0.6%. Tripathi (2019) examined the global relationship between macroeconomic factors and housing price increases, utilizing a panel dataset with data primarily sourced from the OECD and the World Bank. The study covered 43 countries from 1970 to 2017, employing random-effect models and feasible generalized least squares regression. The analysis considered various macroeconomic variables, such as rent price, price-to-income ratio, price-to-rent ratio, urban population, GDP per capita, inflation, total population, real interest rate, annual GDP growth, broad money, real effective exchange rate index, and employment in services. The model incorporated country and year-fixed effects, utilizing five regression models. The findings indicated that several factors, including rent, price-to-income ratio, price-to-rent ratio, urbanization, per-capita GDP, inflation, population aged 15-64,

GDP growth rate, broad money, and real exchange rate, had a positive and statistically significant impact on real house prices.

Li and Zhang (2021) studied spatial patterns in U.S. real estate market price changes, analyzing data such as Zillow Home Value Index (ZHVI), U.S. County and ZIP code data, data on major cities, and a COVID-19 cases dataset. ZHVI, a seasonally adjusted measure of home value, was used. The research employed Spatial Autocorrelation Analysis, Cluster and Outlier Analysis, and Hot Spot Analysis using Moran's I and Getis-Ord's Gi. The study compared housing price changes pre-COVID (2011 – May 2020) with those during the COVID-19 pandemic (May 2020 – May 2021). The findings revealed varied spatial impacts, with changes influenced by Americans' cautious approach, particularly avoiding densely populated areas with higher COVID-19 infection levels. Yörük (2020) examined the early impact of the COVID-19 pandemic on the U.S. housing market using daily data from fifty major cities from February 15 to April 19, 2020. The data included daily confirmed coronavirus cases and deaths, county population data, 2016 Presidential election results, and daily housing data. The study employed event study and difference-in-difference models, with separate analyses for counties with a Democratic majority due to potential differences in compliance with COVID-19 policies. The findings revealed a significant decline in new home listings and pending home sales, reaching over a 60% drop in mid-April 2020 compared to the same period in the previous year. Liu and Su (2021) investigated how the COVID-19 pandemic affected housing demand locations. The study utilized monthly data on home sales, listings, inventory, home price index (HPI), and rent data. Their regression analysis incorporated spatial and time variables, including interactions between time and neighborhood characteristics. The logarithm of the average case rate was also considered. The findings revealed a shift in housing demand away from densely populated areas, attributed to decreased need for proximity to telework-compatible jobs and the waning appeal of consumption amenities. The study also noted that cities with higher pre-COVID-19 home values experienced a more significant decline in housing demand.

Apergis (2003) investigated the impact of macroeconomic variables—money supply, employment, and mortgage interest rates—on real housing prices of new house sales in Greece. The study aimed to test the hypothesis that interest rates significantly influence housing prices. Using an error correction vector autoregressive (ECVAR) model, the analysis incorporated Greece's national quarterly data from 1981 to 1999. Key variables included the housing price index, a mortgage interest rate proxy, a consumer price index, and an employment index. The results indicated that real housing prices do respond to specific economic factors. Apergis found, through variance decompositions, that the housing mortgage rate had the highest explanatory power over the variation in real housing prices, followed by inflation, supporting his hypothesis on the relationship between interest rates and housing prices. Andrews (2010) examined the impact of housing supply rigidity, tax relief on mortgage debt financing, and transaction costs on real house prices. The study utilized panel data from OECD member countries spanning 1980-2005. The model incorporated variables like real house prices, long-term interest rates, household disposable income, inflation, construction costs, real rents, and housing stock. Structural factors included a Financial Reform Index, NAIRU for structural unemployment, and immigration/natural population increase. The findings indicated that real house prices correlate positively with real household incomes while having a negative correlation with structural unemployment and real interest rates. Ferrero (2015) aimed to demonstrate that domestic credit and preference shocks caused the U.S. housing boom in the 2000s. The research also sought to establish that a combination of expansionary monetary policy and controlled exchange rates globally explained low global real interest rates. The study

employed a two-country model with time-series data for the "home" (US) and "foreign" countries for the 2001-2011 period. The author's study came to the conclusion that domestic factors can explain the full increase in US housing prices (2001-2006), as well as result in substantial current account deficits. However, the author's analysis concluded that the euro area's housing prices and loan rates were more sensitive to monetary policy changes.

Hsu et al. (2018) investigated the impact of unemployment insurance (UI) on the housing market using time-series and cross-sectional data on UI benefits from 1991 to 2010. Their study concluded that more generous UI benefits correlate with a decline in mortgage delinquency and default rates, acting as a stabilizer for the U.S. housing market. Head and Lloyd-Ellis (2012) explored the relationships between geographical mobility, unemployment, and the value of owner-occupied housing. Employing a multicity stationary equilibrium model, their complex dataset included panel data from 1999-2000 and the 2008-2010 periods for 274 cities, categorized as large or small. The study revealed that the illiquidity of owner-occupied housing negatively influenced owners' willingness to move for distant job opportunities, leading to significant variations in house prices, rents, and unemployment rates across cities. Mohan et al. (2019) assessed the impact of macroeconomic indicators on housing prices using data from 1999 to 2017 in the Town of Amherst, New York. The indicators included crude oil price, 30-year mortgage interest rate, Consumer Price Index, Dow Jones Industrial Average, and unemployment rate. Housing prices were measured using the Home Price Index (HPI), treated as a self-affecting variable. The study employed a vector autoregression model, conducting unit root and cointegration tests. Results indicated that current changes in house prices significantly influenced expectations of future changes. Unemployment rate was the second-largest contributor, explaining 5.8% of the variation in housing prices after 12 months.

Based on the literature, our hypotheses are as follows:

Hypothesis One: Economic activity has a significant positive impact on US housing market prices.

Hypothesis Two: The number of COVID-19 infection cases has a significant positive impact on US housing market prices.

Hypothesis Three: Unemployment has a significant negative impact on US housing market prices.

Hypothesis Four: The level of COVID-19 influence is different in urban and rural county areas.

3. DATA AND METHODOLOGY

This study aims to identify factors influencing changes in the U.S. housing market, with a specific focus on the impact of the COVID-19 outbreak. The research analyzes spatial patterns of the pandemic's effects on housing markets, comparing urban and rural areas. Monthly data from January 2020 to December 2022, obtained from various online sources, is used at county levels in the United States. Two regression models are employed: A U.S. county-level panel data model, further categorized into urban and rural counties based on population data from the U.S. Census Bureau (2023). Both models use the Zillow Home Value Index as a dependent variable, along with proxies for economic activity, new COVID-19 cases, long-term interest rates, and unemployment rates. Both urban and rural county models use the same variables, which are explained thoroughly in the following table.

Table 1. Data Summary

Data	Data Type	Measurement Scale	Data Source
Zillow Home Value Index	Quantitative	Weighted Average	Zillow
County Economic Impact Index	Quantitative	Index	Argonne National Laboratory
New COVID Confirmed Cases	Quantitative	Total New Cases	USA Facts
County Unemployment Rate	Quantitative	Ratio	U.S. Bureau of Labor Statistics

Source: Own processing

A multiple regression analysis was conducted to find the regression equation and draw conclusions about the effects that the selected independent variables have on the dependent variable, the Zillow Home Value Index. The US county model's regression equation is presented as follows for both the urban and the rural model:

$$ZHVI_{it} = \alpha_i + \delta_t + \beta_1 CEII_{it} + \beta_2 COVID_{it} + \beta_3 UNRATE_{it} + \varepsilon_{it} \quad (1)$$

Based on all the diagnostic tests, the study uses a fixed model with robust standard errors.

Lastly, counties were *categorized as urban or rural* based on their resident population as of April 2020. The categorization was conducted based on the following criteria:

1. The 5 most populous (top 5) counties in each state were included in the urban county model (urban group).
2. Counties with a resident population of over 1 million were included in the urban county model, ignoring the limit of 5 counties per state.
3. The 5 least populous (bottom 5) counties in each state were included in the rural county model (rural group). However, when data was unavailable for a bottom 5 county, the next least populated county was taken.
4. The population cutoff point for counties to be categorized as urban or rural was set at around 125,000. This would aid in lowering heteroskedasticity in the model.
5. Categorization as urban or rural is mutually exclusive.
6. For states with less than 10 total counties, the same rules apply.
7. In cases where any of the top 5 counties had a resident population under 125,000, the authors used their own discretion to either include or exclude the county from the rural group. Post-exclusion, the state could be represented by 4 or less urban counties.
8. In cases where any of the bottom 5 counties had a resident population over 125,000, the authors used their own discretion to either include or exclude the county from the rural group. Post-exclusion, the state could be represented by 4 or less rural counties

After the categorization of approximately 3000 US counties, a total of 461 counties were chosen between the two groups: with the urban group containing a total of 229 counties, and the rural group containing 232 counties.

4. RESULTS AND MECHANISMS

This section of the paper will be heavily focused on the descriptive analysis of the dependent variable and the independent variables for the United States model during the specified period of January 2020 to December 2022. The authors will observe the statistics to identify themes and patterns in the data, to ultimately conclude whether a correlation between the factors exists.

By observing Figure 1, it is apparent that the ZHVI in the US housing market between January 2020 and July 2022 has been steadily on the rise, thereafter suffering a slight drop until December 2022. The constant increase in the value of ZHVI can be interpreted as an effect of the COVID-19 outbreak and pandemic, as well as the various policies undertaken to ensure public health and safety. The authors also show the average interest rates for 30-year fixed rate mortgages in the United States for the January 2020 to December 2022 period. Interest rates slowly decrease from January 2020 to December 2020, reaching a low of 2.68% in the latter month. For the next year, that is, until December 2021, interest rates hover around 3%. It is only at the beginning of January 2022 that they suffer a drastic spike, reaching 5.52% in June 2022, then falling during the summer months, only to increase at a faster pace starting from August 2022, reaching the highest point (6.90%) in October.

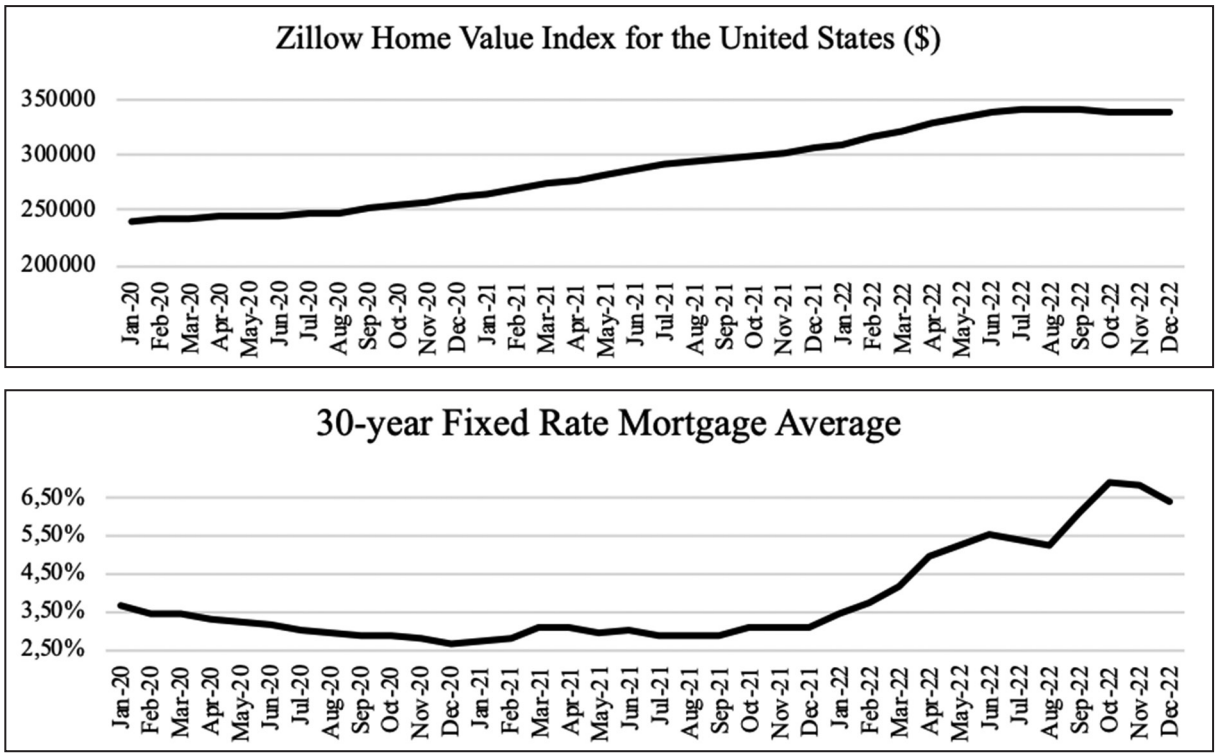

Figure 1. Zillow Home Value Index data and Mortgage Rate for the United States
Source: Own processing

The Index of Economic Activity shows the month-to-month variation of 15 Census Bureau economic indicators. By observing Figure 2, it can be concluded that there was a sudden decline in economic activity during April 2020. This coincides with the beginning of the COVID-19 pandemic and the period when the US started taking drastic measures to ensure public safety, such as the nation-wide quarantine of non-essential workers and businesses. This temporary drop in the working population was without a doubt, a factor for the major decrease in economic activity observed. The rest of the data points are mostly positive, meaning that economic activity was able to recover over time, slowly but surely. Simultaneously, the figure shows that the unemployment rate starts at a low of 3.5% in January and February 2020. This was followed by a sudden spike in the unemployment rate in April 2020 to an extreme high of 14.7%. This drastic increase can be attributed to the fight against COVID-19, which was especially straining for both the population and the economy at the time (Falk et al., 2021). The graph shows that unemployment has been on a steady decrease since its spike and is now back at the lowest 3.5% it has been during the last three years.

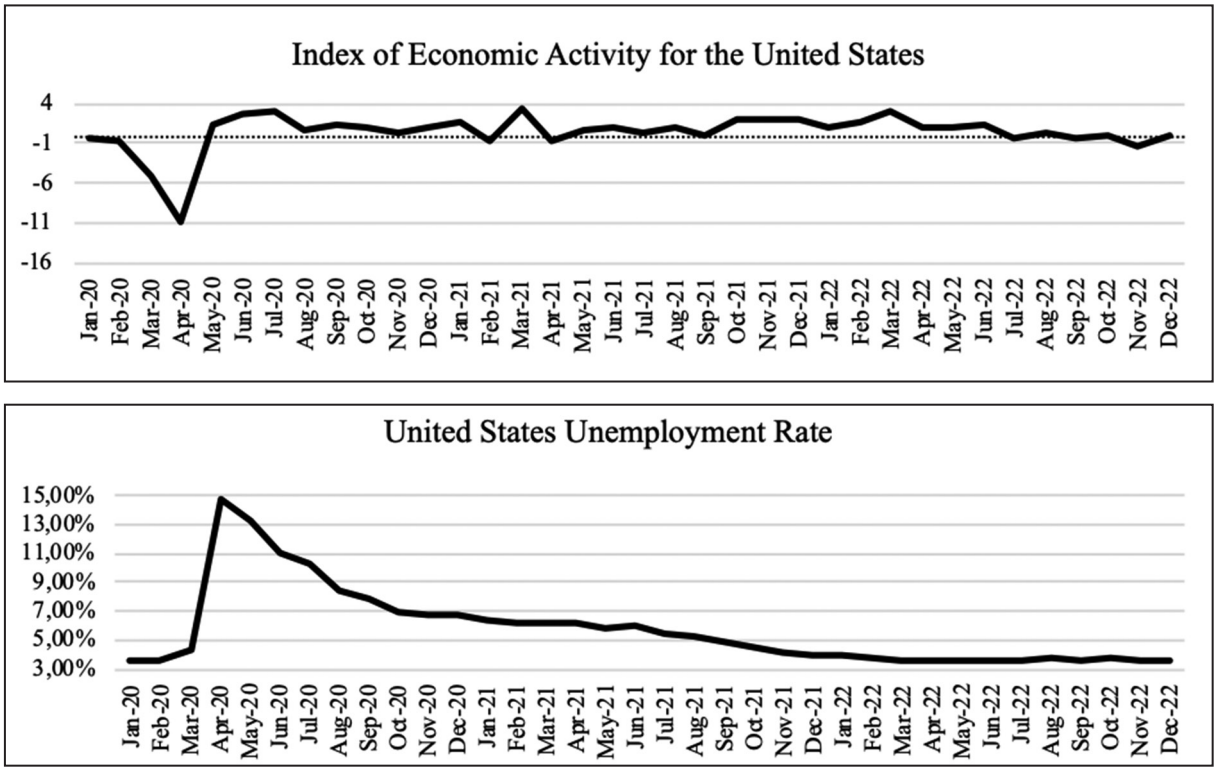

Figure 2. Economic Activity and Unemployment Rate for the United States

Source: Own processing

Urban County Regression Model

Based on all diagnostic tests, the urban county model must be adjusted to be a fixed effect model with robust standard errors. Furthermore, the data on the variables ZHVI and COVID must be converted to their logarithmic form to avoid heteroskedasticity. The urban county model includes data on 229 US counties over 31 monthly periods, ending up with a regression comprised of a grand total of 6526 observations. The rural county model includes data on 232 US counties over 31 monthly periods, ending up with a regression comprised of a grand total of 6081 observations. The results of both models are as shown below.

Table 2. Rural County Model Regression Results Using Robust Standard Errors

	(1)	(2)	(3)	(4)
	log(ZHVI)	log(ZHVI)	log(ZHVI)	log(ZHVI)
CEII	1.254547***	-0.7373339***	0.1810034***	0.0218516
	(0.1081069)	(0.1619337)	(0.0878663)	(0.1340244)
log(Covid)	0.0128799***	0.0544534***	0.0120562***	0.067882***
	(0.0009672)	(0.0035490)	(0.0013191)	(0.0045700)
UNRATE	-0.007241***	-0.0144012***	-0.0218581***	-0.0041309
	(0.0011855)	(0.0023942)	(0.0016420)	(0.0035608)
N	229	229	232	232
R^2	0.5327	0.0469	0.3573	0.0381

Note: Standard errors in parentheses ∗ p < 0.05, ∗∗ p < 0.01, ∗∗∗ p < 0.001

(1) and (2) are the fixed effect with robust error and pooled OLS regressions for the urban model, meanwhile (3) and (4) are the fixed effect with robust error and pooled OLS estimation for the rural model.

Source: Own processing

The study anticipates that all independent variables have a significant tendency to affect home values. Regarding the independent variables, every single of them: the county economic impact index, the logarithm of COVID-19 infection cases, and the unemployment rate are all significant at any level.

Regarding the urban model, the independent variables explain 53.27% of the variation of the dependent variable. The County Economic Impact Index, representing the level of economic activity within each county, has a significant positive impact on house values, increasing ZHVI on each side, both urban and rural. However, there is a higher effect of economic activity on the urban scenario rather than the later, due to the fact that the spatial economic differences in the US case are huge and the value of a house in an urban area is worth tenfold compared to a house in the rural area (Garriga et al., 2021; Nygaard & Parkinson, 2021). Hence, the authors conclude that the level of economic activity somehow affects US market house values as supported by the previous literature's findings (Adams & Füss, 2010). The COVID variable, representing the logarithms of the new monthly COVID-19 infection cases, also has a positive statistically significant impact on the dependent variable, with an estimated increase of 0.013% to ZHVI and with a 1% increase to the independent variable (c.p.) for both scenarios. This observation pleads the case of the pandemic having a positive effect on house prices, similar to other researchers' claims (Li & Zhang, 2021; Liu & Su, 2021). On the contrary, the unemployment rate was observed to have a negative impact on US housing market prices, seemingly decreasing ZHVI by 0.007% and 0.004% respectively, for a 1% increase in unemployment rates (c.p.). This impact was foreseen by previous studies, including Andrews (2010); a work which concluded that structural unemployment had a negative correlation with real house prices. These findings support this study's hypotheses 1, 2 and 3.

5. CONCLUSION

This study investigates the impact of the COVID-19 pandemic on U.S. housing market prices, considering economic indicators like proxies for economic activity, long-term interest rates, and unemployment rates. Utilizing panel data regression techniques, two county regression models were developed for urban and rural areas based on U.S. Census Bureau population data. The analysis reveals similar coefficient signs for both urban and rural models, indicating consistent effects of independent variables. The study observes that economic activity, measured as CEII, has over 10 times more impact in urban counties than in rural areas. This difference may result from pandemic-related policies and circumstances. Additionally, the findings support the notion that changes in Americans' preferences for less population-dense areas impact housing prices. The study concludes that economic activity and COVID-19 cases positively impact housing prices, while unemployment negatively affects prices in both urban and rural areas. However, urban areas exhibit greater volatility in response to economic activity changes, while rural areas are more sensitive to unemployment shocks. This study is valuable for policymakers and real estate stakeholders as it provides detailed insights into how the COVID-19 pandemic has influenced U.S. housing markets, offering a nuanced understanding of urban-rural dynamics and the different impacts of economic indicators. The findings contribute to informed decision-making, enabling tailored policy interventions and strategies for navigating post-pandemic real estate landscapes.

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