Empirical Study of Impact from Covid-19 on Real Estate Market in the U.S.

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Abstract —The outbreak of Covid-19 pandemic shocked the global economy substantially, which makes people feel ambiguous about the future trend. In the real estate market, some people lost jobs and have less money to invest while others have more money to invest because of less spending. This research focuses on the impact from Covid-19 on the real estate market in the United States, collecting data from 50 states to measure the degree of the impact, including the Housing Price Index to present the value change of houses, New Confirmed Cases to present how severity the pandemic is in that state, 30-year mortgage fixed rate to present the internal adjustment of real estate market, and real GDP per capita to present the shock on the economy. However, the empirical study does not show a considerable effect from the pandemic on the real estate market, although there is a negative relationship between the two. Compared to the effect of mortgage rate, pandemic plays a tiny role in the change of the Housing Price Index. When new confirmed cases within a state increase by 1,000, the Housing Price Index decreases by 0.0203, but the 30-year mortgage rate increases by 1, the index decreases by 49.05. From the model in the article, the policy for controlling coronavirus in each state would relieve the effect from the pandemic, but a lower mortgage rate is a stimulus to the real estate market.

Keywords: Covid-19 Pandemic; Real Estate Market; Impact Degree; Policy Implication

1. INTRODUCTION

Since the first case was found in November 2019, novel coronavirus spread into every corner in the world within 5 months. Because of its highly contagious property, the pandemic has impacted the global economy dramatically. Countries took measures to prevent viruses from being imported into their own country immediately, such as travel restrictions and embargos. Besides, many stores, factories and other businesses are locked down to stop the spreading of the virus. Indeed, these measures have a great effect on controlling the virus. However, they do have negative effects on the national economy in many fields, like cross-national trade, financial and real estate markets.

Research on the impact from Covid-19 pandemic on the real estate market from different perspectives. The Professor in Economics Department of Fudan University says that the pandemic has substantially impacted the real estate market [1]. The Chinese government takes strict restrictions on people's travelling, many workers cannot reach their position timely which causes heavy delays in real estate projects. Also, Zhao mentions that many enterprises have high liabilities, it could worsen the situation because of the isolation policy, which reduces the sales quantity of housing. Based on the situation, real estate enterprises must reduce the price to stimulate the demand.

The same thing happened in the United States, Ling etc. pays their attention to the impact on commercial real estate prices [2]. The effect depends on which kind of the real estate it is. The outbreak of the Covid-19 pandemic has a negative effect on retail and residential industries, but the health care and pharmacy stuff are positively related. In general, Covid-19 shocks the real estate market, the increase of 1 standard deviation of new cases causes 0.24 to 0.93 percent reduction. Thus, a different portfolio of assets investment could compensate for the risks from the pandemic.

The main response in the real estate market from the pandemic impact is the turnover reduction, but it also reduces the returns. Tanrivermis focuses on the change of social structure and has a positive view in the future [3]. Because of the travel ban, the tourism faces challenges, the reduction of retail and accommodation lowers the returns. Besides, the increasing cost because of virus control makes it worse. However, people get used to the working style quickly. Homework through Zoom or other meeting methods helps people relieve the pressure from pandemic. The progress in technology makes buying stuff at home. Tanrivermis believes that social structure has changed through e-business, the reduction of number of stores in the city but the increase of demands of storage. Hence, the pandemic reduces fungible jobs.

While the pandemic has adverse effect on real estate market in the real estate market, it did lower the returns, but firms with broader geographic scope have the ability to offset the shock [4]. Xiaoling Chu focuses on real estate firms to lessen the effect from COVID-19 pandemic by adopting diversified strategies. The paper built up model to find the relationships between firms return and active confirmed cases, and the empirical analysis shows that diversified strategies have the capacity to reduce the negative effect and stabilize the whole market.

Intuitively, COVID-19 pandemic raises unemployment rate and reduces income, it has a drastically impact on demand side. Based on economics theory, while demand reduces, the price of product will decrease. Andrius Grybauskas measured the price in apartment market during May to August 2020 [5]. The empirical result shows that the pandemic reduced the selling and rent price of apartment, but the effect is minor. Majority of properties were not affected. Unfortunately, this paper does not provide evidence of why the appearance of apartment market, we need to do further exploration.

There are also analogous researches exist in the academic, the SARS pandemic which happened in 2002 to 2003 had considerable impact on worldwide development and caused drastic regression. Alan Sis and Y.C. Richard Wong paid their attention on Hong Kong market, the datasets they utilized show three aspects, local consumption and export service related to tourism and air travels, influenced severely by SARS [6]. However, the effect did not last for a long time. The fears and panic caused by the virus were controlled quickly, and the economy back to normal rapidly.

Based on many previous explorations, study in this text is based on the previous research and does some extensions. The article narrows the scope of the impact, focusing on how the pandemic affects the single-family home values based on 50 states in the U.S. First, finding the correlation between family home value and new confirm cases in each state. Next, some measures the government takes to stimulate the real estate market, which is a stimulus in the market. Adding the factor into consideration could measure the effects both from externally and internally, as the response of the market. Third, local GDP could be an indicator of how severity the impact of pandemic on local economy, and it could have effect on real estate market subsequently. Last, running the regression with the datasets, finding the quantitative relationship among the variables.

2. DATA DESCRIPTION

The main purpose of the research is to figure out how Covid-19 pandemic affects real estate market. The established model is meant to measure the degree of the impact on real estate market. The model contains four variables, HPI (Housing Price Index), NC (New confirmed Cases), MR (Mortgage Rate) and GPC (Real GDP per Capita). Because it is an unexpected pandemic, some data of the variable is not updated every day. Moreover, from the beginning of the pandemic to the reaction of the market, there is interval between them. Hence, daily data is not suitable for the research. Based on these aspects, the passage selects quarterly data, the time span is from the last two quarters in 2019 to the first two quarters in 2021, although the pandemic has not started since March 2020 in the U.S., including last two quarters in the model can specify the trend from the shock and measure the impact more precisely.

The endogenous variable HPI, Housing Price Index, is quarterly index measure the trend of a residential house price change from a start data, while the HPI is then. The source of the data is from FHFA, the Federal Housing Finance Agency, which measures the housing value changes in 50 states, including public and private houses. HPI reflects the true value of houses, from the perspective of supply and demand, and it excludes jumbo mortgage, it is suitable to be taken into the model.

Because the purpose is to measure the degree of the impact from the pandemic, finding variables to quantify the outbreak of the virus is the main job of the research. The cumulative cases within a state might be a suitable variable to use, but it cannot measure other factors which may have effect on how severe the pandemic is. Government policy could make a considerable contribution to disease controlling, also policies are different from state to state. From this point, taking cumulative cases into model is not the best choice, since the index cannot reflect the real situation that the state is. Fortunately, there is another measure could be taken into consideration, New Confirmed Cases, which reflects other factors that may affect the trend of the pandemic. Thus, New Confirmed Cases is a better indicator than cumulative cases.

Besides, Mortgage Rate would be an effective instrument to measure the influence other than the pandemic on the real estate market. The mortgage rate is a kind of interest while homebuyers want to purchase a real estate but do not have enough money, then they need to borrow money from banks to afford it and return the money in limited years. Mortgage rate shows the ratio of interest a homebuyer needs to repay to bank and the money they borrowed. There are two majorities of fixed mortgage rate in the U.S. market, 15- and 30- year. But most

homebuyers in the U.S. select the latter. According to Freddie Mac (Federal Home Loan Mortgage Corporation), the percent of homebuyers who chose a 30-year fixed-rate mortgage is 90. Mortgage rate does have effect on the real estate market, a lower loan interest rate will stimulate the demand in the real estate market. Because there are large percent people in the United States selected 30-year fixed-rate, the article takes the rate as a variable in the empirical study.

Real GDP per capita is an indicator that reflects the local economy. The prosperity in the real estate market contributes to the growth of GDP, there is a positive relationship between the market and GDP growth. Moreover, while in a prosperous condition which is reflected by a high growing GDP, personal income and future expectation increases, people will put part of their income or debt on the real estate market. Thus, the growth of GDP derives from the contribution of the real estate market, and high GDP leads to the prosperity of the real estate market, they are interrelated.

The pandemic in the U.S. shocks the economy, many people lost their jobs, so that personal income reduced. Based on the situation, purchasing power would be reduced. The ratio of people spending on food and the total expenditure will increase. Facing uncertainties in the future, more people are willing to spend less on necessities other than real estate, which reduces the demand. Indeed, personal disposable income would be a great regressor in the model. However, the latest available data of the variable is in third quarter 2020, which causes many missing values. Thus, the model takes the unemployment rate instead to measure the purchasing power reduction indirectly.

TABLE 1. VARIABLES DEFINITION

Index	Variables	Definition
HPI	Housing Price Index	The index represents the true value change through years
NCper1000	NC per 1000 (New Confirmed Cases in Each State per 1,000 People)	Number of quarterly confirmed Covid-19 cases increasement of 50 states in the U.S. divided by 1000. The index means how many patients in 1000 people.
MR	30-Year Fixed-Rate	Interest rate which shows the ratio of interest homebuyers need to pay to the banks and the money they borrowed
GPC	Real GDP per Capita	Gross domestic product within a state per people
UR	Unemployment Rate	Ratio of labor who are seeking for a job and total labor force

Because the established model contains 4 variables, the data sources have two sections: national data and domestic data. FHFA (Federal Housing Finance Agency), Freddie Mac (Federal Home Loan Mortgage Corporation), U.S. Bureau and WHO (World Health Organization) are the main databases used to gather data. After data cleaning and manipulation, there are 408 observations in the data set. Table 1 shows the statistics

result of the collected data, it includes the mean, standard deviation, skewness and 7 percentiles of the 4 variables. As a main effect the passage means to measure, quarterly new confirmed cases in California reached the highest point which is 1,479,015 in the last quarter of 2020. The peak of Housing Price Index happened in the District of Columbia, second quarter 2021, it was 993.85.

TABLE 2. SUMMARY STATISTICS OF 4 VARIABLES IN THE RESEARCH

	mean	SD	skewness	min	p5	p25	p50	p75	p95	max
Housing Price Index	464.20	150.16	1.10	234.58	289.54	352.99	423.34	544.18	756.54	993.85
NCper1000	83.54	169.71	4.30	0.00	0.00	0.05	16.95	94.73	374.59	1479.02
30-Year Mortgage Rate	3.21	0.35	0.22	2.76	2.76	2.91	3.12	3.59	3.70	3.70
Real GDP	417838.03	537253.52	3.08	30803.80	50659.80	92259.15	242092.65	552277.45	1751310.80	3290169.60
Unemployment Rate	100.70	53.48	0.18	1.00	13.00	61.00	93.50	143.50	193.00	206.00
Observations	408									

Source 1: U.S. Federal Housing Finance Agency
Source 2: Freddie Mac
Source 3: U.S. Bureau of Economic Analysis
Source 4: WHO

3. EMPIRICAL FINDING

The research means to measure the effect of Covid-19 on the real estate market in the United States. The hypothesis is that the novel coronavirus harms the real estate market in the U.S., and with the increase of confirmed cases, the price of a house will reduce. In some states, New Jersey or Florida, there is no strict restriction for people to wear masks, the pandemic could not be well controlled, that even worsens the market situation. According to some economic literatures, there is some evidence to prove Covid-19 has impacted the real estate market. Because some enterprises delayed their delivery date, the supply reduced, once the pandemic is controlled efficiently within a country, and the demand recovered, the market will recover rapidly. Controlling the spreading of the virus could be an effective way for rehabilitating the prosperity [1]. However, there is some negative perspectives on the future. The pandemic shocks country's economy, some jobs were eliminated. Labors who could work at home are not affected dramatically, e-business help market remain prosperous, the demand of storage increases. Some people lose their job permanently. Hence, the future of the real estate market is ambiguous [3].

Basically, most economic literature points out that Covid-19 impacted the real estate market, but figuring out the degree of effect is more important. Moreover, government policies for reducing the impact from the pandemic need to be taken into consideration.

The research aims to find the relationship between the coronavirus and housing prices. Through empirical analysis, the estimators in the model could provide a clear answer to the question. The critical dependent variable Y in the model is Housing Price Index and the primarily independent variable X is New Confirmed Cases per 1000 people in each state. At the same time, there are many other independent variables which may have an effect on the real estate market and are taken into the model. In conclusion, the model is the following:

$$HPI = \beta_0 + \beta_1 NC + \beta_2 MR + \beta_3 GPC + \beta_4 UR + u$$

From the regression model the passage established, the endogenous variable Y is explained by four exogenous variables, where βs are the constant and coefficients in front of variables and u is the error term. The coefficients provided through empirical analysis could well explain the degree of the impact from coronavirus and quantify it.

TABLE 3. CORRELATION FOR THE FOUR VARIABLES IN THE MODEL

	Housing Price Index	NCper 1000	30-Year Mortgage Rate	Real GDP	UR
Housing Price Index	1				
NCper1000	0.0977534	1			
30-Year Mortgage Rate	-0.1049872	-0.4668607	1		
Real GDP	0.2577969	0.5295641	-0.0038363	1	
UR	0.0724343	0.3281476	-0.4693481	0.06505	1
N	408				

Source 1: U.S. Federal Housing Finance Agency
Source 2: Freddie Mac
Source 3: U.S. Bureau of Economic Analysis
Source 4: WHO

Table 2 shows the correlations among the variables taken into the model, there is not a negative relationship between HPI and New Confirmed Cases as the hypothesis. Unemployment Rate is not correlated with the HPI either. However, negative relationship happens between 30-year Fixed Rate and Housing Price Index, and it squares with expectation. Also, with the increase of confirmed cases, more people lost their jobs. The results in the correlation table are not consistent with the hypothesis, but rejecting them is unreasonable. Correlation table just reflects the relationship between two variables, there could be some other factors that could have an

effect on the result. Ignoring other factors will get biased results, which means the further regression is necessary.

The empirical findings of the relationship between the two variables the article focuses on are consistent with the hypothesis, it is negative. Table 3 is the side-by-side table which shows the 6 random-effect GLS regression results. Regression 1 gets a positive result which is same as the correlation, and its result differs from other regressions, which means omit variable bias exists. After having another 5 regressions, the relationships are clear. Besides, adding more factors into the model does not change the standard deviation of the coefficients dramatically, so that there is no multicollinearity among the variables. However, the Unemployment Rate is not a significant indicator that is taken into the model. The regression results in (4) and (5) show a positive relationship between unemployment rate and HPI. The results cannot be denied, but it is not statistically significant, it is not a convincing regressor. Thus, the regression result would be like the third and new model is like the following:

$$HPI = \beta_0 + \beta_1 NC + \beta_2 MR + \beta_3 GPC + u$$

TABLE 4. REGRESSION RESULTS FOR IMPACT FROM PANDEMIC ON REAL ESTATE MARKET

	(1) HPI	(2) HPI	(3) HPI	(4) HPI	(5) HPI	(6) HPI
New Confired Cases per 1000 People	0.0510***	-0.0157**	-0.0203***	-0.0191***	0.0326***	-0.0161***
	(0.0124)	(0.00676)	(0.00697)	(0.00663)	(0.0104)	(0.00622)
30 Year Rate		-49.00***	-49.05***	-50.56***		-48.56***
		(3.526)	(3.478)	(4.074)		(4.127)
Real GDP			0.000169***	0.000175***	0.000126***	
			(0.0000382)	(0.0000405)	(0.0000330)	
Unemployment Rate				-0.0253	0.107***	0.00750
				(0.0201)	(0.0217)	(0.0233)
Constant	459.9***	623.0***	553.1***	557.5***	398.2***	620.8***
	(20.93)	(29.07)	(29.57)	(30.36)	(22.11)	(29.83)
Observations	408	408	408	408	408	408
rmse	24.08	18.80	17.94	17.89	23.19	18.80

Note: Robust standard errors are displayed in parenthesis.
Significance levels: * p<0.10; ** p<0.05; *** p<0.01
Source 1: U.S. Federal Housing Finance Agency
Source 2: Freddie Mac
Source 3: U.S. Bureau of Economic Analysis
Source 4: WHO

The final regression function among the variables is the following:

$$\text{HPI} = 553.1 - 0.0203\text{NC} - 49.05\text{MR} + 0.000169\text{GPC} + u$$

The empirical results showed in Table 4 provide organized and clear answers to the question, when New Confirmed Cases increases by 1, 1000 people get infected by novel coronavirus, the Housing Price Index would reduce by 0.0203. Indeed, the relationship is negative, but the effect from the pandemic is not considerable compared to 30-year mortgage fixed rate, which increases by 1, the HPI reduces by 49.05. 30-year Fixed Rate is a percentage factor, increases 1 means 1% to 2%. Based on a substantial amount of deposit or loan, interest changes considerably. As mentioned in the pretext, high GDP leads to the prosperity of the real estate market, but there is not a big contribution from GDP per capita to the real estate market. The HPI increases by 0.000169 while GDP per capita increases 1. Overall, the result from the regression is consistent with the hypothesis, but it does not have as big an effect as people thought. Government could take policies to control the situation in the market. Thus, the outcomes raise questions to the initial thoughts and provide ideas for policy makers.

The established model in the research has some shortcomings, which renders some problems for more precise outcomes. Personal income may be a significant indicator for measuring the impact, but the latest data of the variable is unavailable, many missing values would render a more inaccurate result. Moreover, New Confirmed Cases is not a perfect indicator used in the model. Same number of patients in a state with low population density means different compared to a high population density state. Case ratio, which is the ratio between number of cases and total population, is better than the variable used in the model. Still, data of recent total population within a state is not available, so a precise case ratio cannot be reached. Thus, there are some improvements that need to take in the research.

4. CONCLUSION

The research provides a valuable source for policy makers to deal with problems in the real estate market. An unexpected pandemic has a huge effect on the market and shocks the economy dramatically, but there are some effective methods that could reduce the impact. Through the empirical outcomes, lowering the 30-year mortgage fixed rate could offset the impact from Covid-19 effectively. From this view, people tend to accept liabilities to make an investment, and some of the money will flow into the real estate market. Then the demand goes back, stabilizing the situation.

The pandemic was unexpected and happened suddenly, countries are not prepared for this challenge. Many enterprises with high liabilities are not have enough funds to defend this kind of crisis, and bankrupt consequently. Back to normal track, high liability is not good for an enterprise. Keeping debt at bay is good for the development of enterprise, it amplifies revenue while reduces the cost. However, higher liabilities come with high risk. While the debt cannot be paid in time because of some sudden occasions, it would lend to the bankruptcy of the enterprise. To prevent bankruptcies from happening, policymakers should keep liability of enterprise at a containable range to reduce the risks and rise the ability to face challenges.

The mechanism is easy theoretically, but it is much more complicated in real life. For example, policymakers would like to stabilize the pandemic situation through lowering the mortgage rate. It is a stimulus in the real estate market, but the people who are having debt. They need to repay money to banks at original rate. Based on this view, lowering rate is not a good way to abate the impact. Many factors are not included in the model and could be more significant to measure the degree of the impact. Policymakers are supposed to find the key determinations to mitigate the adverse effect. And the research initiated from an economic perspective, Covid-19 impacts not only the economy but the individual's body and psychology. The main purpose of controlling virus is to keep citizens living more healthily and stably.

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