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The Paycheck Protection Program's Effect on Real Estate Prices

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Abstract

This paper investigates the relationship between the Paycheck Protection Program (PPP) and real estate price increases. The Paycheck Protection Program was established by the Small Business Association in 2020 to provide forgivable loans to businesses to aid with potential losses from COVID-19 impacts. I leverage zip code level data across the United States and a fixed effects panel data model to quantitatively measure the PPP's influence on housing and rental prices. I find a positive and significant relationship between the number of PPP loans disbursed and housing and rental rates. Specifically, a 1% change in the number of PPP loans in a zip code is associated with a 0.02731% change in house prices and 0.0016% change in rental prices. This signals that the large increase in liquidity from PPP funds is associated with investments or discretionary spending, leading to an increase in inflation, and thus as a byproduct, real estate inflation. Furthermore, this relationship is stronger in higher income areas, suggesting that spending habits that differ by income levels influences real estate prices. I conclude by showing how these findings relate to policy decisions, especially those made during times of economic shocks.

Contents

1 Introduction

The COVID-19 pandemic caused financial stress across the country due to unemployment concerns, reduction in discretionary spending, and general instability. To combat these effects, the government implemented many fiscal policies to assist against the negative impacts of the pandemic. The requirement of having immediate turnaround, high impact, and quick distribution put pressure on policymakers, which when combined with the unforeseen nature of this pandemic, created a challenge for policymakers (Hafiz, Oei, Ring, and Snister, 2020).

This paper examines one of those policies, the Paycheck Protection Program (PPP), and its impact on inflation, specifically real estate inflation. The Paycheck Protection Program was established by the Small Business Association to financially aid small businesses to pay for their payroll, rent, and other operating expenses during COVID-19. One main goal of the program was to keep unemployment low, as the funds could be used to keep employees on payroll even during times of low revenue. The PPP aimed to provide forgivable loans to any business that could prove that they were financially affected by COVID-19. There were not many strict guidelines for approval and over 95% of all money borrowed was forgiven.[1]

Existing literature around the PPP looks at its effectiveness in preventing unemployment, distribution, and equality of approvals, which is referenced in Section 2.3. I expand upon the literature by connecting the PPP to increases in real estate prices. By analyzing the relationship between the PPP loans and real estate prices, this paper aims to contribute its findings to encourage proper policy considerations and emphasize the consequences of stimulus-based policies. Additionally, previous literature has not studied fiscal policies during widespread

[1]Update: 11.5 million PPP loans were forgiven. here's why. Update: 11.5 million PPP loans were forgiven. Here's why. | Pandemic Oversight. (2021, November 18). Retrieved December 4, 2022, from https://www.pandemicoversight.gov/data-interactive-tools/data-stories/how-many-paycheck-protection-program-loans-have-been-forgiven

pandemics, which are unique in how they impact every industry and every region.

Additionally, if the PPP loans were associated with an increase in real estate prices, I aim to see if these effects are stronger or weaker in high-income areas versus low-income areas.[2]

Previous literature has shown how real estate price increases can further wealth inequalities. This is because wealthier individuals generally own houses and out of state investment properties, meaning that price increases directly increase wealthier individuals' wealth. Conversely, when rental rates go up, lower income individuals, who are more likely to rent, get disproportionally affected as their cost-of-living increases (Nieuwerburgh, 2021). The PPP aimed to support low-income businesses by specifically allocating funds for low-income regions and aiming to keep unemployment down during a worldwide pandemic. However, without analyzing the consequences of this program, the success of this goal cannot be determined. I aim for my results to aid in this analysis, giving a more holistic view of the Paycheck Protection Program which may aid in future policy considerations.

I hypothesize that the PPP loans do, in fact, contribute to real estate inflation, implying that at least a subsegment of these funds were used for discretionary spending which led to an increase in prices. I also predict that these price increases will be stronger in higher-income areas than in lower-income areas. This is because lower-income areas generally have a higher marginal propensity to consume (MPC), meaning lower-income areas are less likely to use the influx of cash from the PPP loans to bolster their savings or investments (Gelman, 2021). Conversely, higher-income areas are more likely to do this, meaning more investments in real estate leading to an increase in prices.

I measure real estate increases by looking at changes in house prices and

[2] Low-income defined as less than $38,000 and high-income defined as above $100,000 in yearly income.

rental prices, segmented by zip code from April 2020 to July 2021. I gather data from Zillow's Home Value Index and Observed Rent Index, PPP loan information from the Small Business Association, and income data from the Internal Revenue Services to work on my analysis. I then build a regression model by employing a fixed effects panel data model estimated by ordinary least squares to analyze these relationships.

This model finds a significant relationship between the number of PPP loans distributed in a zip code and real estate price increases. Holding all else fixed, a 1% change in the number of PPP loans in a zip code is associated with a 0.027% change in house prices. Similarly, holding all else fixed, a 1% change in the number of PPP loans in a zip code is associated with a 0.0017% change in rental prices.

After analyzing and interpreting the results of these models, in Section 6, I explore additional dynamic panel specifications to understand if the results are robust. I then segment the data by income levels to compare the effects of the PPP in low-income areas vs. high-income areas. I relate these results to implications around policy making and policy makers decisions in Section 6.4. By doing so, I suggest that policy makers, in addition to drafting policies, must also place an emphasis on ensuring proper oversight exists to enforce the policies correctly. Otherwise, we may see unintended negative consequences such as an increase in income inequality, cost of living, and inflation across the country. This is especially important as it can cause certain policies to have a net negative impact instead of a positive one. Finally, I conclude the paper in Section 7 by summarizing the results and implications form the model and relate the findings to existing literature on fiscal stimulus and inflation.

2 Literature Review

This section reviews the past literature relevant to governmental stimulus, inflation, consumer spending, and the Paycheck Protection Program. These topics aid in the hypothesis development and connecting my results to larger implications on governmental policies.

2.1 Governmental Stimulus Leading to Inflation

In the past, there has been evidence of governmental lending or stimulus leading to an increase in housing prices, causing real estate inflation. Chakraborty, Chhaochharia, Hai, Vatsa (2022) discuss how governmental stimulus may lead to real estate inflation, which can ultimately affect overall inflation. Their paper looks at the Community Reinvestment Act (CRA) and finds that house prices increase more when individuals received CRA lending. The Community Reinvestment Act was a policy that required the Federal Reserve and other federal banking regulators to help financial institutions meet credit needs for their local community, especially in low- and moderate-income areas.

Specifically, Chakraborty, Chhaochharia, Hai, Vatsa (2022) found that a one percent increase in CRA lending (conditional on human capital), is correlated with a 0.22% average increase in house prices in each area. This study starts to correlate how governmental policies tie to inflation. It's also important to note that real estate inflation is directly tied to overall inflation as well. The paper finds that residential services contribute to nearly 40% of the Consumer Price Index core measure, showcasing a connection between real estate inflation and overall inflation. Thus, this study can be used as a previous example of governmental policy affecting real estate inflation, and how real estate inflation ties to larger macroeconomic inflation.

2.2 Distribution of PPP Loans

The Paycheck Protection Program was designed as first-come, first-serve application, meaning that many of the funds were allocated to early applicants. However, to combat potential inequalities, the PPP set aside $60 billion (out of $321 billion total), for banks with assets of less than $10 billion. They hoped this would help distribute funds to lower income areas. Schweitzer and Borawski (2021) examine if these loans truly reached these moderate to lower income (LMI) communities. While 27% of total PPP loan dollars were given to these LMI area, Schweitzer and Borawski point out that this is simply one metric to examine effectiveness by. Thus, they go deeper in their research and ultimately find that while the PPP program did reach LMI communities, it did not to the extent that it did in more wealthy areas. Data about the businesses' demographics, size, revenue, etc. was not available during this paper and thus, the paper used the address of a business as a proxy to categorize businesses as Low, Moderate, Middle, or Upper Income. After doing this, they merged PPP loan information to gain insights into the distribution of PPP loans. The upper income level had only 29% of all population but received 40% of all small loans.[3] As such, it's evident that if a business was in a wealthier area, they were more likely to receive a PPP loan, even if they were smaller.

Conversely, the lower income level had 6.5% of the population, but received only 4.6% of all small loans. Knowing that certain regions were disproportionally benefitted and harmed will further add to the hypothesis development for this paper because the analysis can be segmented by income regions as well. Additionally, because real estate is an asset and contributes to one's level of wealth, seeing's the effects of these loans in relation to real estate can add to research on wealth inequalities.

[3]Small loans are categorized as loans to businesses that had a revenue of less than $1M

2.3 Effectiveness of PPP Loans

In addition to looking at the distribution of the PPP loans, it's important to gauge its effectiveness in general. The PPP loan was designed to fund "payroll costs, including benefits, and may also be used to pay for mortgage interest, rent, utilities, and worker protection costs."[4] Thus, when gauging the loan's effectiveness, it must be gauged on the loan's ability to fund the above-mentioned costs. A key qualifier for the loans was the entity must have been "affected by COVID-19." The vague terminology used on the SBA website makes it difficult to evaluate if businesses were effectively approved, as there is not a clear approval criterion.

As such, Tasci, Njinju, and Braitsch (2021) focus on if the PPP was effective in meeting its goal. The paper examined if the PPP loans lessened the employment loss caused by the pandemic. Their research shows that the PPP loans did help in limiting unemployment numbers. This effect was seen strongest at the beginning of the pandemic and lessened as time went on. Research found that a PPP loan that was the equivalent of one week of payroll reduced state-level unemployment by 1.5 to 2.3 percentage points. This research allows us to look at the positive impacts of the PPP loans as well, helping incorporate a more holistic view on the program rather than strictly from an inflation standpoint.

2.4 Endogeniety of PPP Loans

In completing the analysis of the PPP loan's effects on real estate prices, there exists a large endogeneity problem. It's crucial to understand more about potential variables that may have also affected real estate prices. Balemi, Fuss, and Weigand (2021) examine the pandemic's overall effects on real estate markets. Initially, due to risk of liquidity, real estate prices took severe drops, especially in large cities such as New York City. This combined with more uncertainty with

[4] PPP loan forgiveness. (n.d.). Retrieved December 5, 2022, from https://www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program/ppp-loan-forgiveness

the pandemic led to a real estate recession. However, this also meant that many individuals were fiscally savvy during the pandemic, leading to larger saving accounts. Thus, once the pandemic started to decline, there was an uptick in the housing market. This combined with low interest rates and a higher desire for individual houses led to certain areas having a housing boom. As such, when designing the models, controls for this uptick in housing prices should be considered.

2.5 Marginal Propensity to Consume

The link between PPP Loans and rising real estate prices lies in consumer spending behavior. The idea being that individuals will spend the new influx of cash from the PPP loans leading to increased liquidity in markets that cause eventual price increases.

To further study this phenomenon, I look to Gelman's (2021) research on the marginal propensity to consume (MPC) to understand consumer spending. The study looks at if an individual's financial level affects their MPC. Gelman finds that those with lower financial resources tend to have a higher MPC than those with higher financial resources. This study is unique in its way of understanding the importance of temporary circumstances versus long-term characteristics of individuals when explaining differences in MPC. These temporary circumstances are relevant in motivating our secondary hypothesis. My secondary hypothesis looks at if the relationship between the PPP loans and real estate prices differ based on a region's wealth. This study looks at the spending habits for individuals in different consumers, and how lower-income individuals are more likely to spend their money on goods while wealthier individuals are more likely to save or invest. Real estate is a popular method of investing, meaning that it's possible for differences to exist in real estate price increases based on income level. This difference should be taken into account through my secondary hypothesis.

3 Hypothesis Development

I wish to expand upon current literature by researching the question:

Did the Paycheck Protection Program loans lead to an increase in real estate prices?

While existing literature investigates the overall pandemic's effects on real estate, or previous fiscal stimuli, I plan to extend current research by looking specificaly at the relationship between PPP loans and real estate. Furthermore, previous literature was focused on crises that are not at a mass scale, but rather concentrated in a certain region, market, or industry. The COVID-19 pandemic and the PPP were supplied to a larger audience, spanning across various areas, income levels, and industries. Thus, my contribution to fiscal stimuli consequences can be looked at a larger-scale, more general lense. My null hypothesis is that the PPP loans did not affect real estate prices. The alternative hypothesis would be that the PPP loans did affect real estate prices, specifically that the PPP loans led to an increase in real estate prices.

My secondary hypothesis aims to look at different income level areas and how inflation differs based on region's wealth. As such, the secondary hypothesis is:

Does a region's wealth affect the degree that the Paycheck Protection Program loans affected real estate price increases?

My null hypothesis is that no, a region's wealth does not change the degree that the PPP loans affected real estate inflation. The alternative is yes, the wealthier a region is, the more real estate inflation occurred.

For the first question, the alternative hypothesis is what I believe to be more likely given the explained literature. It's clear that the PPP loans were effective in distributing funds to small businesses. The equality of these distributions is questionable, but funds were still given out to all regions. Additionally, these funds were used to pay for individual's payroll, support businesses, etc. when their revenue may be negatively affected due to COVID-19. Thus, businesses were given "forgivable" loans to support themselves. However, the criteria for businesses to qualify was extremely vague, and there was not much oversight in the approval process (Haifz, Oei, Ring, Shnister, 2020). Thus, it's probable that at least a fraction of these loans were given and forgiven to businesses who did not "need" the funds. This occurrence is even more likely when looking at the inequality in distribution of funds (Schweitzer and Borawski, 2021). This is because higher income businesses presumably have more funds to support themselves in times of crises, yet they were disproportionately given more loans. Thus, if the loans were incorrectly used, this extra influx of liquidity into the market might have been used for real estate investment or for discretionary, both which effect inflation and thus real estate inflation. Past research into fiscal policies also supports this as it shows how past governmental programs have led to inflation.

Similarly, for the second research question, I predict the alternative hypothesis to be true. Past research showed how there was an inequitable distribution of PPP loans, where higher income areas received a disproportionally larger amount of loans relative to those in moderate- and low-income areas. Thus, these already wealthy areas were receiving more funding. Additionally, higher-income areas generally have a lower MPC, meaning their spending habits are focused more on saving and investing than lower income areas (Gelman, 2021). Real estate is often an investment vehicle, meaning higher-income areas are more likely to use extra funds from PPP loans to purchase real estate. This can lead to an increase in demand, causing price increases.

4 Data Overview

4.1 Sample Selection

To measure real estate inflation, I propose to create two different models, one measuring changes to house prices and one measuring changes to residential rental rates. To create the zip code level data set used for the analysis, data is gathered from the following sources: PPP Loan information directly from the Small Business Administration[5], housing price data from Zillow's Home Value Index Dataset (ZHVI), rental data from Zillow's Observed Rent Index (ZORI)[6], and income data from individual tax returns from the Internal Revenue Services[7]

4.2 Data Transformation

4.2.1 Year, Month, and Zip Code Data

To effectively merge the four different data sets together, each data frame needed to be formatted in the same way, with indices being by date (month-year) and 5-digit zip codes. Given that each data set used slightly different variations of date or zip code formatting, I took advantage of Python's split and melt functionally to create a standardized index format, which would aid in the eventual merge.

4.2.2 House Prices and Rental Prices Data

Rental and house price data downloaded from Zillow were zip code based and aggregated by month. Due to large outliers and a standard deviation slightly larger than the mean, they were then transformed to natural log values instead.

[5]"PPP FOIA - U.S. Small Business Administration (SBA): Open Data." U.S. Small Business Administration (SBA) | Open Data, 2 Oct. 2022, https://data.sba.gov/dataset/ppp-foia.

[6]Housing Data." Zillow Research, 8 Nov. 2022, https://www.zillow.com/research/data/.

[7]https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-statistics-zip-code-data-soi

To see if our results were robust to price lags, I merged price lags for one, two, and three years into the data set.

4.2.3 PPP Loan Data

Similarly, PPP loan data was also summed based on zip code and the unique date identifier. This data consisted of total count of loans given and total dollar amount of the loans for a given zip code in a specific month-year. Outliers also existed in this raw data with standard deviation being 3 to 8 times the mean values, so natural log values were used. To measure if individuals consumed the funds when given, I included lagged PPP values. These lags were based on 1-, 2-, and 3-month lags and represented businesses waiting to spend their loan amounts instead of spending immediately.

4.2.4 Income Data

Finally, to test my secondary hypothesis, income data was obtained from the IRS which was available by zip code per year. These values are repeated across date identifiers that had the same year, but different months. The IRS data included total income in a zip code per year and number of returns from that zip code per year. This is leveraged to create an extrapolated average income per individual per zip code in each year by dividing the two values.

4.3 Summary of Values

Summary statistics for the variables used in the regression models are shown below. Many of the variables had large ranges with relatively high standard deviations. As such, natural logs were used. Table 1 outlines the mean, standard deviation, minimum, and maximum values of the variables and their respective natural logs to motivate the reasoning to use natural log values.

Variable	Summary Statistics Mean	Std. Dev.	Min	Max
House Price	253852.1	257800.1	1	7132356
Natural Log House Price	11.76	2.43	0	15.78
Rental Price	1766.19	1077.77	31.65	37888.66
Natural Log Rental Price	7.41	0.35	3.45	10.54
PPP Count	18.12	63.44	0	4104
Natural Log PPP Count	2.41	1.66	0	8.32
Forgiveness Amount	1523913	8136011	1	868000000
Natural Log Forgiveness	5.92	6.58	0	20.58
Average Income	62.41	47.54	18.84	2212.45
Natural Average Log Income	11.43	2.31	0	16.28

Table 1: Mean, Std. Dev., Min, and Max for key variables

4.4 Data Description

After the data was finally merged, two final data sets were produced: one for rental pricing and one for house pricing. The housing data set included a total of 438,448 observations which represented 27,403 zip codes from April 2020 to July 2021. The rental data set included a total of 43,860 observations which represented 3,159 zip codes spanning from April 2020 to July 2021.

Both data sets overlapped in variables outside of the respective housing or rental price variables. 1-, 2-, 3-, and 4-year lags were included for house prices and rental prices in a given zip code. PPP Loan forgiveness amounts were included as a measure of the total dollar amount of forgiven loans in a zip code. PPP loan counts represented the number of loans given in a zipcode. This variable was crucial as it distinguishes areas that had a few large loans vs. areas with many small loans. PPP loan count could also then be used to extrapolate the average loan amount in a zip code as well. Total adjusted gross income in a zip code was obtained from the IRS in addition to number of IRS returns, which together is used to find the average income by zip code.

4.4.1 Variables Over Time

The graph below (Figure 1) shows the average house prices from 05/2019 to 10/2021. Starting from 07/2020 a large price acceleration is seen, which is a similar timeline to shortly after the PPP loans were distributed and close to the start of the COVID-19 pandemic.

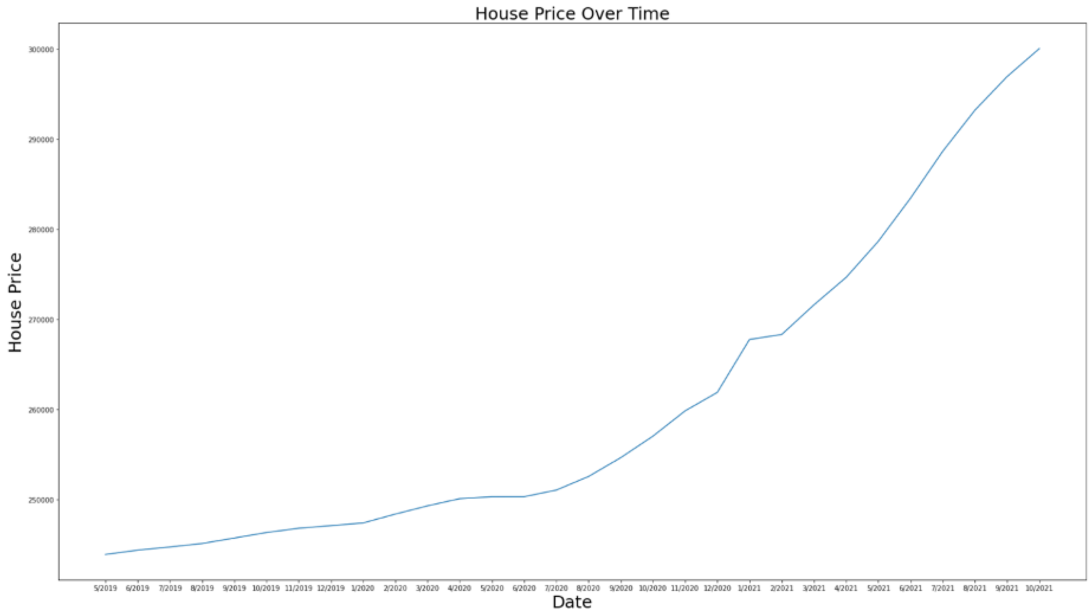

Figure 1: House Prices Over Time

The graph below (Figure 2) shows the average rent prices from 05/2019 to 10/2021. It's evident that as soon as the pandemic and PPP loans hit, there was a decrease in rent prices until about 03/2021. After this, rent prices significantly increased, much higher than previous levels.

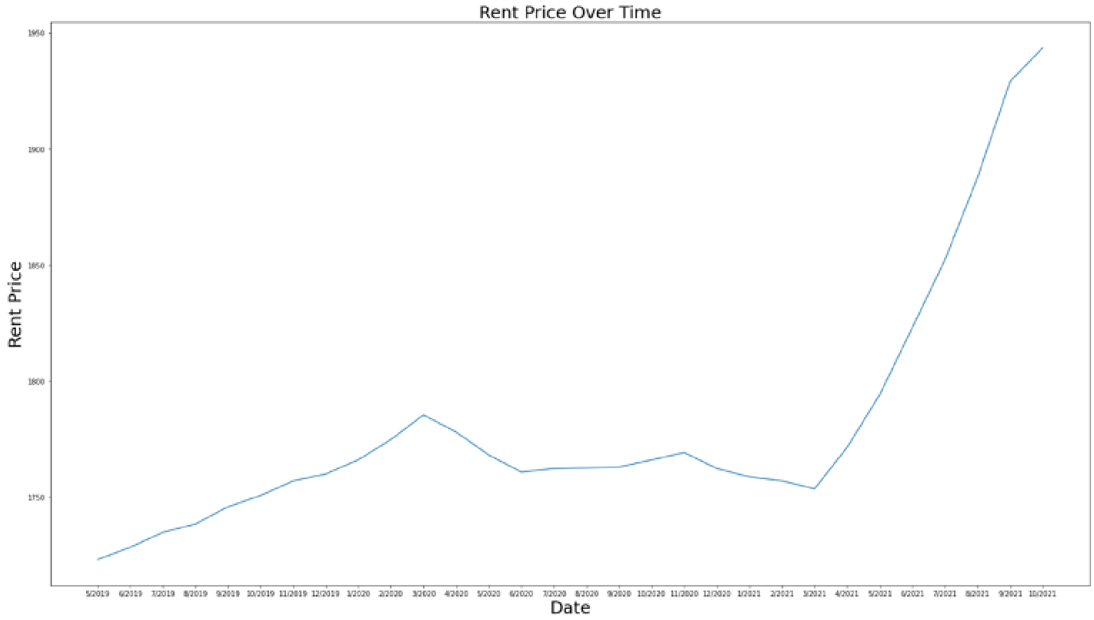

Figure 2: Rental Prices Over Time

The graph below (Figure 3 outlined the total dollar amount of PPP loans approved over time per month. The gap in loans from 9/2020 to 12/2020 represents the time between Phase 1 PPP loans being complete and Phase 2 PPP loans not starting yet. The spike during 5/2021 or 6/2021 aligns closely with the spike in rental rates we see above.

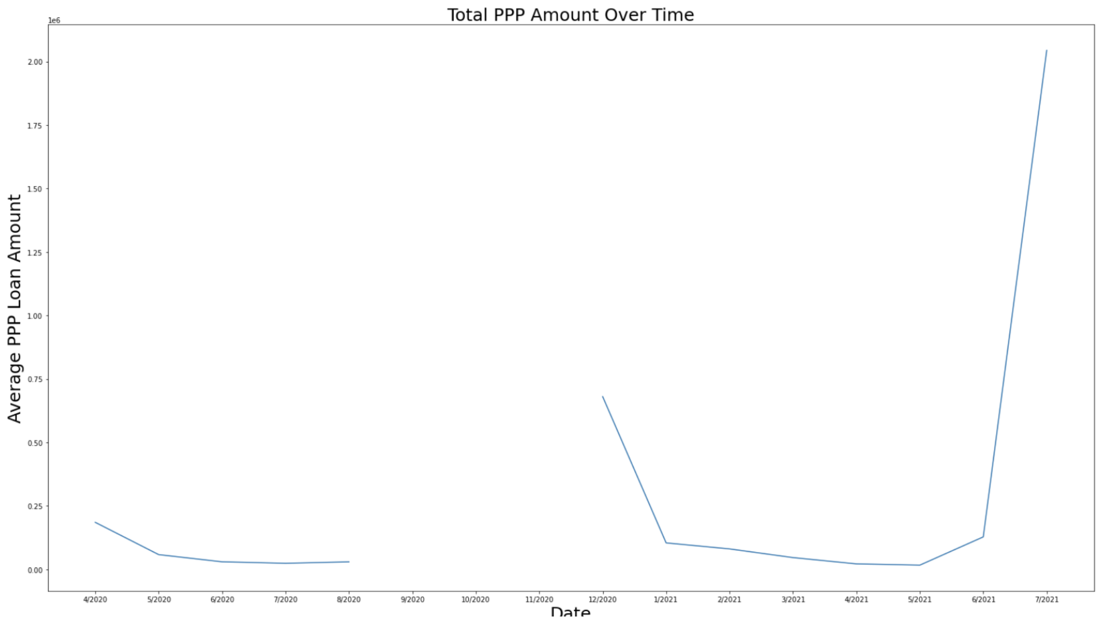

Figure 3: Total PPP Amount Over Time

4.4.2 Heat Map Analysis

The below map (Figure 4) highlights the total dollar amount given to different states. Ohio is a clear outlier, and further research shows the state disproportionally distributing its funds to large companies, meaning large loan amounts.[8]

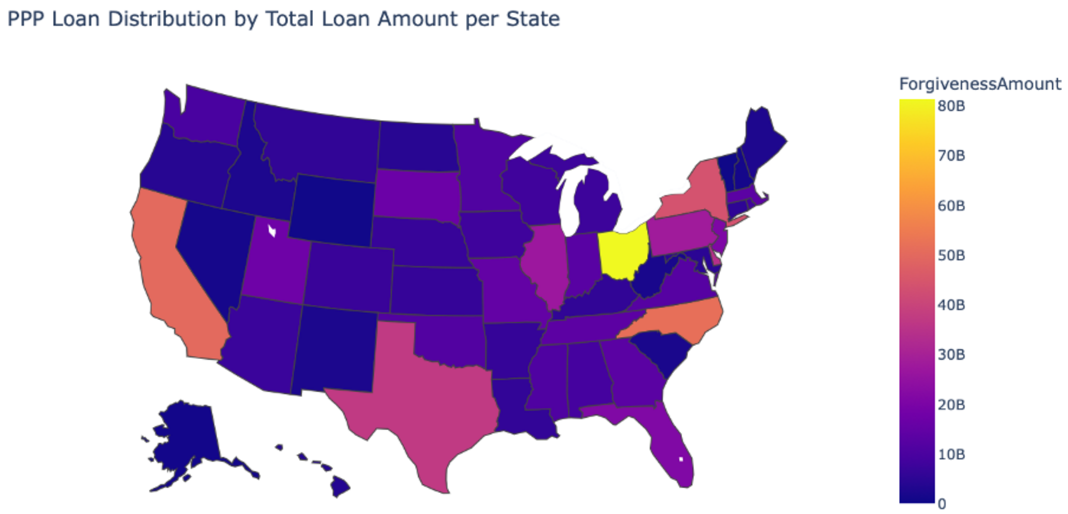

Figure 4: Total Amount of PPP Loans by State

The map below (Figure 5) shows the average loan amount given to each state. Hawaii was known to receive a loans of high value due to the large proportion of tourism businesses present that lost significant revenue.

[8]https://www.news5cleveland.com/news/local-news/investigations/most-of-ohios-18-billion-in-paycheck-protection-program-loans-went-to-only-15-5-of-recipients

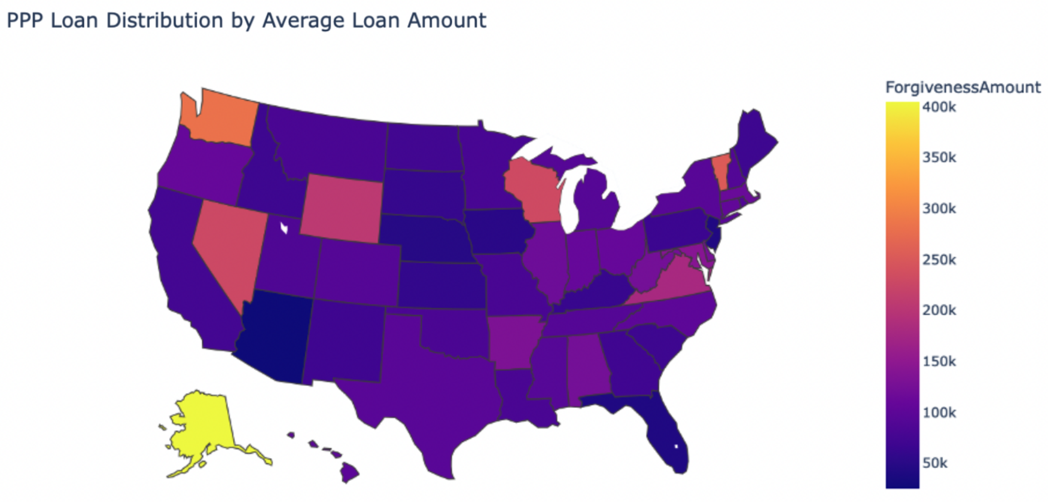

Figure 5: Average Amount of PPP Loans by State

The map below (Figure 6) shows the number of loans given to each state. Ohio recieved a large amount of manufacturing loans and California recieved a large amount of loans due to having multiple majoir cities with small businesses.

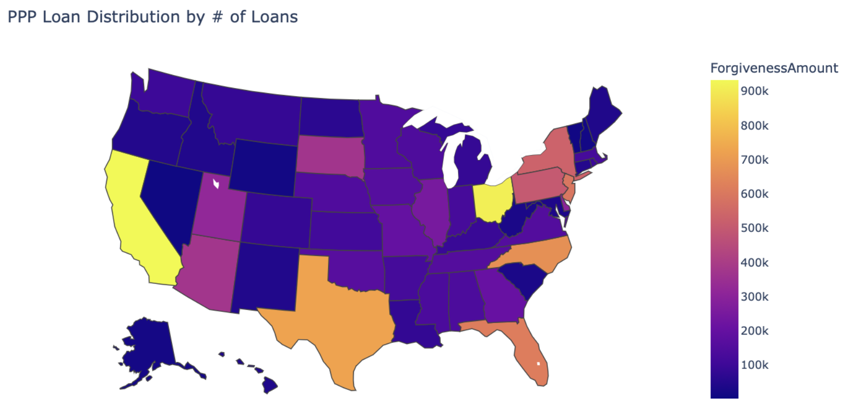

Figure 6: Number of PPP Loans by State

The map below (Figure 7) shows the average income in each to each state. We see coastal cities generally having higher income values due to more large cites and jobs.

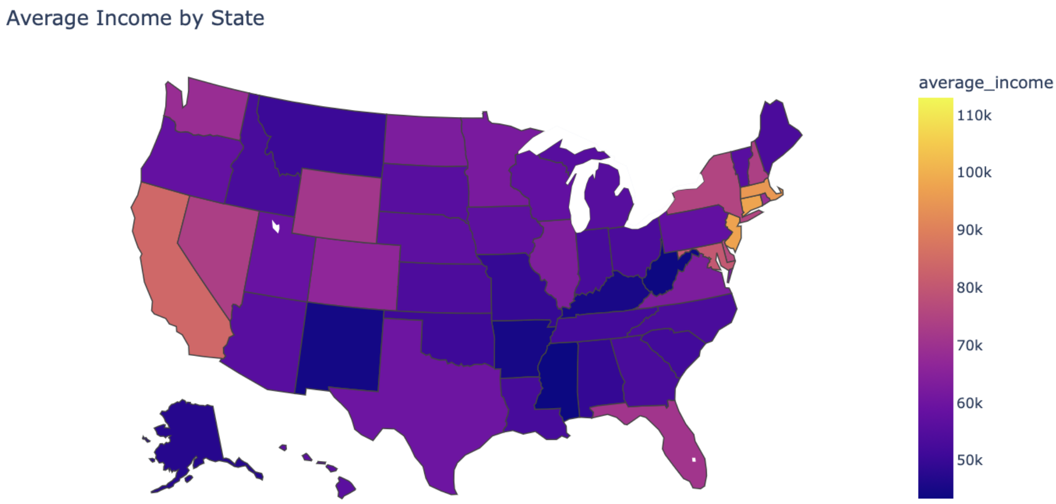

Figure 7: Average Income by State

5 Methodology

This paper aims to identify the effects and relationships between PPP loan data and real estate data (house prices and rental prices). To quantitatively measure if a relationship exists and if present, the degree of the relationship, I employ the use of a fixed effect panel data model.

Given that both of the final merged data sets were in panel form (time-series by month-year, summed by zip code), a simple multi-variable linear model would not control for heterogeneity in the data due zip code differences. This control is especially important as there may be exogenous shocks in certain zip codes that are not present in others. Thus, a model that controls for zip code level heterogeneity is needed.

As a result, the model uses a fixed effects panel data regression model estimated by ordinary least squares. By using a fixed effects regression, the model mean differences by the average value within each zip code. Both models are looking at the effect of PPP loans on real estate prices within each zip code. Thus, the model can control for potential heterogeneity biases that are present in zip codes.

The house price model is represented as:

$$y_{it} = \alpha_i + x'_{it}\beta + \eta_t + \epsilon_{it} \tag{1}$$

i represents an individual zip code and t represents each unique date identifier (month/year). y_{it} represents the outcome variable, which is the natural log of house prices. x'_{it} represents the independent variable, which is the natural log of the number of PPP loans. α_i represents the zip code level fixed effect, and η_t represents the date level fixed effect. Finally, ϵ_{it} represents the error term.

The rental price model is represented as:

$$y_{it} = \alpha_i + x'_{it}\beta + \eta_t + \epsilon_{it} \tag{2}$$

i represents an individual zip code and t represents each unique date identifier (month/year). y_{it} represents the outcome variable, which is the natural log of rental prices. x'_{it} represents the independent variable, which is the natural log of the number of PPP loans. α_i represents the zip code level fixed effect, and η_t represents the date level fixed effect. Finally, ϵ_{it} represents the error term.

6 Results

In this section, I estimate the fixed effects panel data models (see equations 1 and 2). The results are shown in table 2, while additional specifications are presented in table 3.

	(1)	(2)
VARIABLES	Model 1	Model 2
ln_PPPCount	0.02731***	0.001658***
	(0.002256)	(0.0002752)
Constant	11.502***	7.376***
	(0.0108)	(0.00168)
Observations	383,642	43,860
Groups	27,403	3,159
R-Squared Within	0.0186	0.2916
R-Squared Between	0.0789	0.0185

Standard errors in parentheses

***p<0.01, **p<0/05, *p<0.1

Table 2: Regression Output for equations 1 and 2

6.1 Initial Findings

In the primary models, we see a statistically significant positive relationship between the count of PPP loans and housing data (Table 2). Because both PPP loan information and housing data are naturally logged, we can interpret the results as the following:

Holding all else fixed, a 1% change in the number of PPP loans in a zip code is associated with a 0.02731% change in house price. Similarly, holding all else fixed, a 1% change in the number of PPP loans in a zip code is associated with a 0.0017% change in rental prices. These results suggest that we should reject the null hypothesis, and thus, the PPP did in fact contribute to an increase in housing inflation, both with house prices and rent prices.

Because the model leverages log values and mean difference to analyze pricing changes over time, these values can be used as a proxy for inflation. The mean difference allows for the analysis to strictly focus on changes from the average values within each zip code, signaling that inflation may be present.

These results align with previous literature on governmental programs as we see a positive relationship between the number of PPP loans and real estate pricing. Specifically, when comparing the CRA to the PPP, the overall results are the same despite the 20+ year difference between the programs. This implies that although financing channels and scope may have changed across the programs, there are parallels in both program's function and consequences. The results suggest that the increased liquidity from the PPP loans did in fact affect the real estate market. The results also show a significantly higher effect for house prices vs. rental prices. This may because rental prices are usually signed in 6-month+ lease term, meaning that prices are locked in those terms leading to less short-term price fluctuation. Additionally, as the exploratory analysis shows, rental prices took a steep decline during the first half of the pandemic which may be causing the smaller magnitude from the PPP loans.

6.2 Dynamic Model Comparison

In developing the model, various specifications were considered to develop a model that best fit the research question.

First, I considered a dynamic model, where lags of the PPP variable were used.

Thus, instead of regressing housing data at time t and PPP loan information at time t, I tried lagging PPP loan information. Thus, I attempted models that included 1-, 2-, and 3-month lags for PPP loan data for both house price and rental price models. To compare the performance of these models, I used the Akaike information criterion (AIC) and Bayesian information criterion (BIC) to evaluate which model performance the best. Results from these tests are presented in Table 3. Statistically insignificant models ($p > 0.05$) were not included in the table.

Model	AIC	BIC
Housing Model with contemporaneous PPP	1255879	1256041
Housing Model with 1-Month PPP Lag	1255950	1256144
Rental Model with contemporaneous PPP	-148631.5	-148483.8
Rental Model with 1-Month PPP Lag	-142150.1	-142012

Table 3: Model Comparison for PPP Lags

Overall, the model without PPP loan lags performed the best for both models. The best quality model is ones with the lowest AIC and BIC scores, within each of the housing models and rental models respectively. The differences between housing models are not as significant compared to those with rental models, where the model is of significantly higher quality when using PPP Loan counts that are not lagged. The model comparison result is also in alignment with previous literature which states that individuals tend to consume or spend when they get funds instead of waiting (Gelman, 2021).

6.3 Robustness

To explore robustness of the results, I add lagged housing prices.

The final merged data set includes lagged house prices and rental prices for 1, 2, 3, and 4 years. However, intuitively it made sense to include only one lag, and I assumed the 2-year lag would produce the best results. This is because a 1-year housing lag would include the PPP loan and other COVID-19 related shocks into the model. 3- and 4-year housing data would not have as much relation to present housing information.

The new model to test if the results were robust to a 2 year lag in housing prices is seen in equation 3.

$$y_{it} = \alpha_i + x'_{it}\beta + \eta_t + y'_{it-2}\gamma + \epsilon_{it} \tag{3}$$

i represents an individual zip code and t represents each unique date identifier (month/year). y_{it} represents the outcome variable, which is the natural log of rental prices. x'_{it} represents the independent variable, which is the natural log of the number of PPP loans.y_{it-2} represents the natural log of house price by 2 years. α_i represents the zip code level fixed effect, and η_t represents the date level fixed effect. Finally, ϵ_{it} represents the error term.

The new model to test if the results were robust to a 2 year lag in rental prices is seen in equation 4.

$$y_{it} = \alpha_i + x'_{it}\beta + \eta_t + y'_{it-2}\gamma + \epsilon_{it} \tag{4}$$

i represents an individual zip code and t represents each unique date identifier (month/year). y_{it} represents the outcome variable, which is the natural log of rental prices. x'_{it} represents the independent variable, which is the natural log of the number of PPP loans.y_{it-2} represents the natural log of rental prices by 2 years. α_i represents the zip code level fixed effect, and η_t represents the date level fixed effect. Finally, ϵ_{it} represents the error term.

The final regression results for these models are shown in table 4.

VARIABLES	(3) Model 3	(4) Model 4
ln_PPPCount	0.00491***	0.001724***
	(0.0.0018)	(0.000257)
ln_HousePrice_lag2	0.1929***	–
	(0.09093)	–
ln_RentalPrice_lag2	–	-0.1692***
	–	(0.00219)
Constant	11.502***	7.376
	(0.0108)	(0.00168)
Observations	410,232	43,860
Groups	25,819	3,159
R-Squared Within	0.022	0.3826
R-Squared Between	0.8018	0.4901

Standard errors in parentheses

***p<0.01, **p<0/05, *p<0.1

Table 4: Regression Output for equations 3 and 4

These results still show a positive and significant relationships between the number of PPP loans and the real estate prices. Thus, our model results are robust to the addition of lagged house prices. By testing for this robustness, there is added strength to the model's results due to a consistency in results even when more variables are added.

6.4 Income Level Analysis

The secondary hypothesis aims to test the relationship of PPP loans and real estate prices in different income brackets, specifically comparing high income areas to those in lower income areas. As part of this analysis, we broke the sample intro three groups: low income, moderate income, and high income. When creating the three income buckets, I aimed to represent the bottom 10% of average household income in low income, middle 80% in moderate income, and top 10% of average household income in high income, all respective of each data set. Because the rental and housing data sets were different with rental data including a much lower number of zip codes, these brackets were slightly different for each model. However, the poverty threshold was included in both low-income brackets and median average income in both moderate-income brackets.[9] The exact values of these buckets are shown below in Table 5 for House Prices and Table 6 for Rental Prices.

[9]Bureau, U. S. C. (2022, September 13). Poverty thresholds. Census.gov. Retrieved December 4, 2022, from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html

House Price Model			
VARIABLES	[$0-$38,000]	[$38,001-$100,000]	[$100,001+]
ln_PPPCount	0.01636***	0.0239***	0.0618***
	(0.0058)	(0.0027)	(0.00557)
Number of Zip Codes	1,927	21,761	2,714
% of Sample	10.6%	79.4%	9.9%

Standard errors in parentheses

***p<0.01, **p<0/05, *p<0.1

Table 5: Regression Output for Model 1 Segmented by Income Brackets

	Rental Price Model		
VARIABLES	[$0-$39,000]	[$39,001-$140,000]	[$140,001+]
ln_PPPCount	0.000905**	0.0011***	0.00227***
	(0.00046)	(0.00325)	(0.000864)
Number of Zip Codes	311	2,531	317
% of Sample	9.8%	80.1%	10.03%
Standard errors in parentheses			
***p<0.01, **p<0/05, *p<0.1			

Table 6: Regression Output for Model 2 Segmented by Income Brackets

I estimate the same regression model where the sample is restricted for each bracket. The results are shown in Table 5 and 6. These results imply that for higher income areas, the increase in house prices and rental prices associated to PPP loans are larger. Thus, we can reject the null hypothesis and accept the alternative hypothesis that high income areas had more housing inflation relative to low-income areas in association to the PPP loans. The difference in coefficients can be seen most strongly when comparing the bottom 10% of incomes (low-income) with the top 10% of incomes (high-income) where the relationship between PPP Loans and Housing Prices is 3.7 times as strong and between PPP Loans and Rental Prices is 3.9 times as strong.

These results align with my earlier intuition developed from literature around the MPC and real estate investment. These PPP funds allowed for more capital and liquidity to enter businesses and their owners and employees. Higher-income individuals are more likely to save when given a sudden lump sum of funds (Gelman, 2021). One mechanism for this is through real estate investment, which increases demand for housing unit, putting upward pressure on prices. However, in lower-income areas, there is a higher likelihood of those individuals to spend their newly received funds on consumption goods such as food, clothing, etc. Thus, while this spending may lead to inflation, it does not tie as closely to real estate inflation as higher-income areas do.

6.5 Implications of Results

All the models run have shown common trend of the number of PPP loans having a positive relationship with the price of real estate (house and rental prices) in a given zip code. This finding supports the alternative hypothesis, meaning that the PPP loans were associated with an increase in housing prices. Thus, we show how governmental policies have direct ties to tangible economic effects. Furthermore, the degree of this inflation is almost 4 times larger when looking at high income areas than low-income areas for both house and rental prices.

Previous literature and research on the effectiveness of the PPP primarily focuses on the PPP's ability to effectively distribute funds, finding that higher income areas were given disproportionally larger amounts of PPP loans than lower income areas (Schweitzer and Borawski, 2021). The findings from the above models extend upon this research showing that the number of PPP loans had a larger influence on higher income areas than low-income areas.

This study aims to provide a look into potential consequences and the real-world impact that the PPP had. While previous literature shows that inflation negatively effects economic growth (Mischenko, Mischenko, Ivanov, and Naumenkove, 2028), this does not immediately mean that the PPP loans had a net negative impact. Rather, I aim to look deeper at how these loans affected wealth inequality.

In a study by (Nieuwerburgh, 2021), it is found that increases in house and rental prices affect renter's welfare more so than a homeowner's welfare. In fact, increases in home prices benefit the homeowner due to an increase in wealth. The opposite is true for renters as their cost of living has now gone up due to increased rental prices. "Younger and older renters, who tend to be poorer, suffer the largest welfare reduction. Owners, on the other hand, benefit from capital gains on housing, resulting in an average welfare gain of 0.43%," (Nieuwerburgh 2021). Based on this, it's clear that the PPP had negative effects when looking at its impact on increasing wealth inequality and gaps.

While these findings should be considered when evaluating the Paycheck Protection Program, inflation and income inequality are not the only metrics that should be considered. It's important also important to look at the PPP's benefits in supporting small businesses and reducing unemployment. Specifically, had the PPP not existed, the workforce may have seen unemployment rates rise by 2%, which may have caused even more income inequality. Thus, I argue, that these consequences outlined in this paper must be taken into consideration in evaluating the PPP, but not be the only ones considered.

In developing policies, especially ones that aim to economically benefit the public, it's crucial that the government is fully aware of the long-term consequences of its policies, including the PPP. These results signify that there were significant negative effects in relation to economic growth and wealth inequality due to the PPP. Policies such as the PPP present a risk for our economy and beg the question if it's implementation and short-term benefits were worth the risk. Thus, while the government should support its residents during times of crises, it must do so with comprehensive analyses of what potential implications may be. The balance between necessary support and "free money" is a fine line. Analyzing the effects of past polices can aid in navigating this balance.

6.6 Assumptions and Potential Errors

In evaluating and interpreting the results of these models, it's crucial to also recognize the limitations of the study. Specifically for this study, the limitations exist in the assumptions and potential errors in data analysis.

First, our regressions were limited in data. There was a large discrepancy in the amount of zip codes available in the house prices data set vs. rental prices data set. The house prices data set covered a total of 27,403 zip code regions while the rental prices data set covered only 3,159. Because of this, we had limited amounts of data to go off when regressing upon rental prices. This was especially present when looking at some of the statistically insignificant results from the rental models. Thus, if this study were to be expanded, I would urge the researcher to try and find housing data sets that cover more zip codes.

Additionally, during the COVID-19 pandemic, many economic shocks were affecting our economy. While the models aimed to control for this endogeneity problem trhough fixed effects, it's possible that there were still endogenous factors in the error term. During such a large crisis, it is extremely difficult to isolate the specific effects of a single policy. Thus, it may not be possible to fully isolate for only the effects of the PPP Loans but knowing that an endogeneity bias may exist can help when applying the results.

7 Conclusion

As COVID-19 impacts started to negatively affect small businesses, the Small Business Association released the Paycheck Protection Program, aiming to assist small businesses with meeting payroll and basic operating expenses through forgivable loans. This program aimed to support these businesses during the shock of COVID-19 while keeping unemployment numbers down.

However, the distribution of these loans was shown to be inequitable, with higher income areas receiving more loan amounts. Furthermore, more than 95% of loans were forgiven, with that number rising as more forgiveness requests are being processed by the SBA. Research has shown that these loans may have potentially used for fraudulent reasons. This combined with evidence that loan requests were not properly evaluated signals that it's possible that PPP loan funds were used improperly.

By adding an influx of funds to the markets, consequences must be seen, some which I hypothesize are seen through real estate inflation. Thus, this paper looks at the relationship of PPP loans and real estate data (house prices and rental prices). The findings show a positive relationship between the number of PPP loans given in a zip code and the housing and rental prices in that area. Furthermore, this relationship is stronger in higher income areas, supporting previous literature on the marginal propensity to consume for different income levels (Gelmen, 2021). This disparity between income areas also shows how there was a misalignment in impacts of the PPP loans, where higher income areas might have had a larger surplus in funds, adding to larger income inequality.

These findings relate to larger policy implications, specifically around the pros and cons of immediate shock-related fiscal policies and creating blanket policies for all types of consumers or businesses. While time and urgency are a large concern when developing policies such as the Paycheck Protection Program, it's crucial that proper oversight in planning and verifications is made. Not having this oversight leads to situations where businesses are fraudulently using these funds, which in term negatively affects the consumer due to inflation concerns. Especially when these policies create an increase in income disparity, policymakers should put more of an emphasis on looking into the impact of their decisions.

While a perfect solution does not exist and prioritizing those in a present danger aligns with previous governmental decisions, policymakers should not use that as a reason for lax oversight. Instead, a balance must be found, that still aids those affected by economic shocks, but does not have long term negative consequences.

8 References

Balemi, N., Füss, R., amp; Weigand, A. (2021, March 25). Covid-19's impact on Real Estate Markets: Review and Outlook - Financial Markets and portfolio management. SpringerLink. Retrieved December 4, 2022, from https://link.springer.com/article /10.1007/s11408-021-00384-6

Borawski, G., amp; Schweitzer, M. E. (n.d.). How Well Did PPP Loans Reach Low- and Moderate-Income Communities? Economic Commentary. Retrieved December 4, 2022, from https://www.clevelandfed.org/publications/economic-commentary/2021/ec-202113-reach-of-ppp-loans-in-lmi-communities

Buduson, S. (2021, January 27). Most of Ohio's $18 billion in Paycheck Protection Program loans went to only 15.5% of recipients. News 5 Cleveland WEWS. Retrieved December 4, 2022, from https://www.news5cleveland.com/news/local-news/investigations /most-of-ohios-18-billion-in-paycheck-protection-program-loans-went-to-only-15-5 -of-recipients

Chakraborty, I., Chhaochharia, V., Hai, R., amp; Vatsa, P. (2022, September 8). Government -directed bank lending, human capital, and housing price inflation. SSRN. Retrieved December 4, 2022, from https://ssrn.com/abstract=4198471

Coibion, O., Weber, M., amp; Gorodnichenko, Y. (n.d.). Monetary policy communications and their effects on household inflation ... University of Chicago Press Journal. Retrieved December 4, 2022, from https://www.journals.uchicago.edu/doi/full /10.1086/718982

Favilukis, J., amp; Nieuwerburgh, S. V. (n.d.). Out-of-town home buyers and City Welfare. Wiley Online Library. Retrieved December 4, 2022, from https://online library.wiley.com/doi/10.1111/jofi.13057

Gelmen, M. (2020, March 19). What drives heterogeneity in the marginal propensity to consume? temporary shocks vs persistent characteristics. Journal of Monetary Economics. Retrieved December 4, 2022, from https://www. sciencedirect.com /science/article/pii/S0304393220300350

Griffin, J. M., Kruger, S., amp; Mahajan, P. (2021, August 18). Did Fintech lenders facilitate PPP fraud? SSRN. Retrieved December 4, 2022, from https://papers.ssrn.com /sol3/papers.cfm?abstract$_{i}d = 3906395$

Hafiz, H., Oei, S.-Y., Ring, D. M., amp; Shnitser, N. (2020, March 18). Regulating in pandemic: Evaluating economic and financial policy responses to the Coronavirus Crisis. SSRN. Retrieved December 4, 2022, from https://papers.ssrn.com /sol3/papers.cfm? abstract_id=3555980

Housing Data. Zillow Research. (2022, November 8). Retrieved December 4, 2022, from https://www.zillow.com/research/data/

Khan, M., amp; Hanif, W. (2018, June 12). Institutional Quality and the relationship between inflation and Economic Growth. SpringerLink. Retrieved December 4, 2022, from https://link.springer.com/article/10.1007/s00181-018-1479-7

Kollar, J. S. and M. (2022, September 13). Income in the United States: 2021. Census.gov. Retrieved December 4, 2022, from https://www.census.gov/library/publications/2022/ demo/p60-276.html

Mishchenko, V., Mishchenko, S., Ivanov, V., amp; Naumenkova, S. (2018, July 5). Inflation and Economic Growth: the search for a compromise for the Central Bank's monetary policy. Retrieved December 4, 2022.

PPP FOIA - U.S. Small Business Administration (SBA): Open data. Dataset - U.S. Small Business Administration (SBA) | Open Data. (2022, October 2). Retrieved December 4, 2022, from https://data.sba.gov/en/dataset/ppp-foia

PPP loan forgiveness. (n.d.). Retrieved December 5, 2022, from https://www.sba.gov /funding-programs/loans/covid-19-relief-options/paycheck-protection-program/p pp-loan-forgiveness

Soi tax stats - individual income tax statistics - ZIP code data (SOI). Internal Revenue Service. (n.d.). Retrieved December 4, 2022, from https://www.irs.gov /statistics/soi-tax-stats-individual-income-tax-statistics-zip-code-data-soi

Tasci, M., Njinju, B., amp; Braitsch, H. (n.d.). PPP Loans and State-level Employment Growth. Economic Commentary. Retrieved December 4, 2022, from https://www. clevelandfed.org/publications/economic-commentary/2021/ec-2021 20-ppp-loans-and-s tate-level-employment-growth

Update: 11.5 million PPP loans were forgiven. Here's why. | Pandemic Oversight. (2021, November 18). Retrieved December 4, 2022, from https://www. pandemicoversight.gov/data-interactive-tools/data-stories/how-many-paycheck -protection-program-loans-have-been-forgiven