Fiscal Stimulus Payments, Housing Demand, and House Price Inflation

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Abstract

This paper studies the impact of the fiscal stimulus payments on the housing market during the 2020-2021 COVID-19 pandemic. Exploiting the variation in the share of local population eligible for the historic $900 billion economic impact payments and expanded child tax credits, the paper finds that house prices grew significantly faster in areas where residents received a larger amount of stimulus payments. This relationship cannot be explained by changes in non-transfer income, population growth or migration, exposure to the shift to remote work, pre-2020 per-capita income or house price levels, or differential housing trends. The estimates indicate that a 10 percentage-point increase in the share of households eligible for the full $8,000 payments is associated with a 1–2% increase in house prices from 2019 to 2021. A regression kink design exploiting the phase-out of payments above specific income thresholds shows a positive effect of stimulus payments on home-ownership rates. Overall, these results highlight an important housing channel in the transmission of fiscal stimulus payments.

Keywords: Stimulus payments, fiscal policies, housing demand, house prices, homeownership, inflation

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I thank Jensen Ahokovi, Tom Cui, Walter D'Lima, Dave Denis, Dan Greenwald, Matt Gustafson, Charlie Hadlock, Gaurav Kankanhalli, Cameron LaPoint, Antoinette Schoar, Eva Steiner, Shawn Thomas, Eric Zwick, and participants at CEIBS, the 2023 CMU/Pitt/PSU Finance Conference, 2023 AREUEA National Conference, and 2024 Urban Economics Association North America Meeting for helpful comments and discussions. I also thank Alex Adams and Ledia Guci at the BEA for their help with the BEA regional income data.

1 Introduction

The U.S. housing market experienced a sharp boom during the COVID-19 crisis of 2020 and 2021. The house prices climbed at a record pace, reaching peak annual growth rates of nearly 20% in the second half of 2021 (Figure 1). The pace of house price growth represents a sharp break from pre-pandemic levels and eclipses the growth rates during the housing boom leading up to the 2008 financial crisis. This recent boom was unusual and surprising to many because it happened at a time when the pandemic wreaked havoc on people's lives, employment, income, and economic activities.

What explains the strong housing demand during this period? One possible explanation is that despite the damages that COVID-19 had on the economy, U.S. household finances remained healthy during the pandemic. Indeed, the household sector had strong balance sheets entering into the crisis, and crucially, the government provided unprecedented support for households through various stimulus and relief programs. These fiscal transfers led to an increase in household income despite the job and income losses from shutdowns and other COVID-19 related shocks.[1] The rise in household income and liquidity contributed to an increase in household spending and savings, with some suggesting that the fiscal transfers played an important role in driving the recent surge in inflation.

In this paper, I study whether the fiscal stimulus transfers provided during the pandemic helped fuel the demand for housing and the sharp appreciation of house prices. The investigation is useful for understanding the drivers of the recent housing boom and, more broadly, the impact of fiscal transfer payments on consumer expenditure and the overall economy. This is particularly relevant as stimulus payments have become an increasingly important policy instrument for economic stabilization. Notably, housing consumption has been largely omitted in the large body of research examining the impact of transfer payments on consumer spending. While recent research emphasizes the importance of spending on durable goods as payment size increases, there remains disagreements about whether these payments can meaningfully impact housing transactions (e.g., Beraja and Zorzi, 2023; Berger et al., 2023; Laibson et al., 2023).

The paper examines the impact of the over $900 billion economic impact payments

[1] Blanchet et al. (2022) find that after accounting for taxes and cash transfers, real disposable income for the bottom 50% of the income distribution was nearly 20% higher in 2021 than in 2019. See also Barnes et al. (2022).

(EIPs) and expanded child tax credit (CTC) payments,[2] which provided historic transfers of income from the federal government to households. The three rounds of EIPs alone amount to $11,400 for a family of four eligible for the full payments. In addition, the expanded CTCs made fully refundable by the 2021 American Rescue Plan provided an additional $6,000-$7,200, with half disbursed in advance during 2021. As discussed in the paper, these amounts are substantial relative to the median household savings and the typical down payments of recent home buyers, and could raise housing demand by easing household budget and borrowing constraints. A 2021 Redfin survey found that stimulus money is the second-most common way of accumulating money for a down payment among prospective first-time home buyers, after savings directly from paychecks.[3] From a borrowing constraint perspective, large transfer payments effectively relax down payment constraints, which existing quantitative housing models have shown to have a substantial positive effect on house prices (e.g., Favilukis et al., 2017; Greenwald and Guren, 2021; Gupta et al., 2023). In addition, mortgage interest rates declined during this period, which, as shown by Greenwald and Guren (2021), can significantly amplify the effects of relaxing credit constraints.

I find that there is a strong positive correlation between the 2020-2021 house price growth and the average amount of stimulus payments received by local population across metropolitan statistical areas (MSAs). This positive relationship persists when controlling for changes in other transfer payments and non-transfer income, changes in unemployment rate, population growth and migration, and exposure to the shift to remote work. The estimates indicate that a 10 percentage-point increase in the share of population eligible for the full $3,200 payments is associated with a 1–2% increase in house prices from 2019 to 2021. Equivalently, given an average household size of 2.5, a 10-percentage-point increase in the share of households eligible for $8,000 payments corresponds to a 1–2% increase in house prices.

I conduct several additional analyses to account for potential confounding factors. First, I include an area's per-capita income prior to the pandemic as an additional control. The estimation shows that cities with a larger fraction of population eligible for stimulus payments experienced faster house price growth, even among cities with compa-

[2]EIPs, at a total of over $800 billion, represent the lion's share of transfer payments examined in the paper. For simplicity, in what follows, I will use the term "stimulus payments" or "payments" to refer to the total EIPs and child tax credit payments.

[3]See https://www.redfin.com/news/homebuyer-survey-stimulus-down-payment/.

rable average income levels. Moreover, the result cannot be explained by differential house price levels or house price trends prior to the pandemic. Second, the positive relation between house price growth and stimulus payments holds across MSAs within the same states. This result helps rule out alternative explanations involving state-level common shocks such as pandemic policies and responses. Third, the faster house price growth in high payment areas is not due to changes in the number of housing units or home listings, suggesting that changes in housing supply do not account for the findings.

I next explore the association between stimulus payments and a broader set of housing outcomes. I first show that the greater housing demand driven by stimulus payments translates to an increase in homeownership. Areas with greater stimulus payments experienced a larger increase in homeownership from 2019 to 2021. The estimation indicates that a $1,000 increase in per-capita payments is associated with an increase in homeownership rate by 0.4 percentage points. Furthermore, data from the American Community Survey (ACS) public use microdata sample show that households in the bottom income quintiles experience an increase in homeownership during 2020–2021 relative to high income households, who were less likely to qualify for stimulus payments. These results suggest that the payments stimulated housing demand partly by enabling first-time home buyers to transition into homeownership.

To more cleanly identify the effects of stimulus payments, I leverage the phased reduction in payments for incomes above certain limits and implement a regression kink design. Although there are limitations in using the ACS income data for this test, the estimation using the 2021 microdata shows a significant decline in the slope of the income-homeownership relationship for households with income above the eligibility thresholds. This pattern is not observed before the pandemic or around placebo thresholds in 2021. These findings are consistent with a causal effect of stimulus payments on housing demand and homeownership rates. The estimates suggest that households with incomes exceeding the limit by $10,000 (resulting in a reduced payment of $1,600 compared to the full $6,400 for a childless couple) exhibit a 0.8-1.9 percentage point decline in homeownership, relative to those at the income cap.

Lastly, I use home purchase mortgage data to examine the relation between stimulus payments, housing transactions, and mortgage terms. I create a proxy for home purchase activities at the MSA level using the number of originated home purchase mortgages on properties located in an MSA. I find that the number of housing transactions grew signif-

icantly faster in areas with greater stimulus payments. This relationship is not a result of greater mortgage credit supply in high-payment MSAs. MSAs with greater payments experience a relative increase in mortgage denial rate, and there is no differential change in either loan to value ratio or loan to income ratio (LTI) across MSAs with different stimulus payments. However, there is a notable divergence in the LTI ratios across different income groups. Borrowers in lower income brackets experienced a significant increase in their LTI ratio compared to higher income borrowers from 2019 to 2021. This is consistent with the idea that stimulus payments enabled down payment constrained borrowers to obtain larger loans relative to their regular income.

Overall, the paper provides novel evidence that stimulus payments have a positive impact on household housing demand and house prices. Extrapolation from the cross-sectional estimate suggests that the fiscal transfer payments were an important contributor to the house price surge during the pandemic. The findings suggest that housing consumption and investment could be an important channel through which the fiscal transfer payments stimulate the economy.

A number of studies examine the household spending response to the pandemic stimulus payments, with a focus on the initial impacts of payments in 2020 (Cox et al., 2020; Coibion et al., 2020; Parker et al., 2022; Chetty et al., 2023; Baker et al., 2023). These studies generally find that there was a consumption response to the stimulus payments and that the response was negatively related to household income and liquidity. Prior studies have also examined consumer spending responses to previous fiscal stimulus payment programs such as the tax rebate of 2001 and the stimulus payments of 2008 (e.g., Shapiro and Slemrod, 2003; Johnson et al., 2006; Agarwal et al., 2007; Parker et al., 2013). Housing demand and housing transaction activities have generally been omitted in this literature. Recent quantitative models of fiscal stimulus highlight the significance of durable goods purchases (e.g., Beraja and Zorzi, 2023; Berger et al., 2023). While Beraja and Zorzi (2023) conjecture that stimulus checks are likely too small to matter for home purchases, Berger et al. (2023)'s model predicts that even relatively small cash transfers, such as $1,000 per household, can have a sizable impact on the demand for owner-occupied housing due to the financial constraints faced by marginal buyers.

Existing studies of the housing market during the pandemic generally focus on the effect of remote work and population migration (e.g., Mondragon and Wieland, 2022; Gupta et al., 2022; Stanton and Tiwari, 2021; Brueckner et al., 2021; Gamber et al., 2022;

Howard et al., 2023). There has been very limited empirical evidence on other possible explanations of the housing boom. Griffin et al. (2023) find that areas with greater paycheck protection program (PPP) loan fraud experienced faster growth in house prices. Diamond et al. (2023) argue that the post-Covid inflation driven by fiscal and monetary stimulus boosted housing demand by inflating away existing mortgage debt of constrained homeowners. There is a large literature studying the housing boom prior to the 2008 financial crisis, with a focus on the roles played by cheap credit and shifts in expectations. More broadly, the paper fits into the literature studying the impact of income and credit on housing demand and house prices. Section 2.2 discusses some of these studies.

The paper is also related to the literature examining the impacts of other government pandemic relief programs such as the PPP (e.g., Granja et al., 2022; Bartik et al., 2020; Autor et al., 2022; Denes et al., 2021), unemployment insurance (e.g., Ganong et al., 2020; Larrimore et al., 2022; Ganong et al., 2022), and the assistance for state and local governments (e.g., Clemens et al., 2022). These studies generally focus on evaluating the costs and effectiveness of these programs. Some of these programs, especially PPP and the unemployment insurance that are comparable in size to the EIPs, also bolstered household finances during the pandemic, and thus were likely to have supported the housing demand during this period. The payments made through these programs were directly tied to an area's exposure to COVID-19 and related restrictions, and as a result it is more difficult to identify their effects using variation across areas. This paper's analyses control for these other transfers when focusing on the effects of stimulus payments.

2 Stimulus payments and housing demand

This section provides more details on the three rounds of EIPs and the expanded CTC. It then discusses the potential channels through which the payments could impact housing demand and some related literature.

2.1 Stimulus payments

Since the onset of the COVID-19 pandemic in early 2020, the federal government provided unprecedented support for families, businesses, and local governments.[4] At a total cost

[4]See the summary of these economic relief programs by the Department of the Treasury https://home.treasury.gov/policy-issues/coronavirus.

of more than $5 trillion, the fiscal policy response is about four times as large as the 2009 American Recovery and Reinvestment Act passed to help the U.S. economy recover from the global financial crisis (Romer, 2021). This paper focuses on the three rounds of direct payments to individuals totaling over $800 billion, known as the economic impact payments, as well as the over $100 billion expanded child tax credits. These payments provided significant income and liquidity support for individuals irrespective of whether they suffered from income losses during the pandemic.

The first round of stimulus checks, authorized by the Coronavirus Aid, Relief, and Economic Security Act (CARES Act) in March 2020, provided EIPs of up to $1,200 per eligible adult and $500 per qualifying child under age 17. The payments were reduced for individuals with adjusted gross income (AGI) greater than $75,000 ($150,000 for married couples filing a joint return), with childless households with incomes up to $99,000 (or $198,000 if married and filing jointly) still eligible for payments. In total, these stimulus checks amounted to more than $270 billion.[5]

The COVID-19-related Tax Relief Act of 2020, enacted in late December 2020, authorized additional payments of up to $600 per adult and per qualifying child under age 17. The AGI thresholds at which the payments began to be reduced were the same as the earlier round, with the payments phasing out entirely for households with incomes above $87,000 for single filers without children or $174,000 for married couples without children. These payments totaled over $140 billion.

The American Rescue Plan Act of 2021, enacted in early March 2021, provided EIPs of up to $1,400 for eligible individuals or $2,800 for married couples filing jointly, plus $1,400 for each qualifying dependent, including adult dependents. The eligibility for the full amount was the same as prior rounds, but the phase-out occurred more quickly, with households with incomes above $80,000 (for single filers without children) or $160,000 (for married couples without children) receiving no payments. This third round of EIPs cost over $400 billion, nearly the combined amount of the first two rounds.

The American Rescue Plan Act also increased the child tax credit from $2,000 to $3,000 per child for children aged 6 to 17 and to $3,600 for children under 6. The Act also made the CTC fully refundable, allowing all eligible families to receive the full credit benefit. The Act mandated the Department of the Treasury to establish a program for making periodic advance payments of the CTC, with a total amount equal to 50% of the

[5]See IRS SOI Tax Stats – Coronavirus Aid, Relief, and Economic Security Act Statistics.

CTC for the 2021 tax year. In total, around $94 billion were disbursed in 2021 in the form of advance payments.[6]

Altogether, the three rounds of EIPs and the expanded CTC distributed a total of $914 billion or around $2,750 per person.[7] For a family of four with income below the threshold, they would be eligible for $11,400 EIPs plus an additional $6,000–$7,200 CTC, half of which can be received in 2021. This is a significant amount relative to an average family's annual savings out of income or total household savings. For example, according to the 2019 Survey of Consumer Finances, the median household had only $26,000 in non-retirement financial assets including deposits, bonds, and stocks. These stimulus payments, on top of the generous unemployment insurance and other stimulus programs,[8] help more than offset income losses from unemployment or other COVID-19-related shocks in 2020 and 2021. The disposable personal income per capita, according to the BEA, increased from $49,585 in 2019 to $53,038 in 2020 and further to $56,088 in 2021.

2.2 Stimulus payments and housing demand

Previous research on the consumption response to stimulus payments reports significant spending on both non-durables (e.g., Johnson et al., 2006) and durables (e.g., Parker et al., 2013). This spending behavior is interpreted as an indication that stimulus payments help ease household liquidity constraints. These studies also suggest that durable purchases could become more responsive as payments become larger because durables are lumpy and can be financed with external funds (Beraja and Zorzi, 2023). Underscoring the important role of borrowing constraints for housing demand, a large number of studies emphasize credit supply shocks driven by shifts in lending standards (down payments, loan-to-income ratio, etc.) as an important contributor to the housing boom prior to the

[6] See IRS SOI Tax Stats – Advance Child Tax Credit Payments in 2021. These advance payments are somewhat smaller than the total cost of the expanded CTC. The Joint Committee on Taxation estimates that the one-year expansion of the CTC would cost about $110 billion.

[7] Figure A1 plots the total EIPs and advance CTC payments received by individuals in different AGI groups: those with AGI below $20,000 (including those with zero or negative AGI and those who did not file a tax return in 2019 or 2020), between $20,000 and $50,000, $50,000 and $75,000, $75,000 and $100,000, $100,000 and $200,000, and over $200,000.

[8] Federal Pandemic Unemployment Compensation (FPUC) provided a weekly supplement on top of all UI benefits. FPUC provided a $600 weekly supplement between April and July 2020 and was reauthorized at $300 weekly from January 2021 through the beginning of September 2021. FPUC payments from April 2020 through September 6, 2021, totaled $442.3 billion. Ganong et al. (2020) find that between April and July 2020, 76% of workers eligible for regular unemployment compensation have statutory replacement rates above 100%, meaning that they are eligible for benefits that exceed lost wages.

2008 financial crisis.[9] In a recent study using survey data, Fuster and Zafar (2021) find that people's willingness to pay (for the same house) increases by as much as 15 percent on average when the down payment is reduced from 20 percent to 5 percent.

According to the 2021 American Housing Survey, the median and the 75th percentile household size of home buyers was 2 and 4, respectively. Households of these sizes could be eligible for $6,400 and $11,400 EIPs plus any additional CTCs. The median home purchase price was $266,000 and the typical down payment was around 8%. These figures suggest that the stimulus payments of 2020 and 2021 could significantly relax the credit constraints faced by the marginal home buyers, particularly first time buyers of starter homes. Even for existing homeowners, these payments provide a nontrivial amount of additional liquidity, which could lead to self-reinforcing increases in housing demand and house prices (Stein, 1995). Importantly, the rising housing demand by constrained borrowers could cause house prices at all levels to rise in equilibrium (Ortalo-Magné and Rady, 2006; Määttänen and Terviö, 2014; Landvoigt et al., 2015).

While there are few estimates of the effect of transfer payments on house prices, existing studies generally find a large positive effect of LTV constraint relaxation. For example, Greenwald and Guren (2021) show that increasing LTV limits from 85% to 99% and PTI limits from 36% to 65% can lead to a nearly 20% increase in house prices with unchanged mortgage rates, and around a 40% increase with an additional two-percentage-point reduction in mortgage rates. In Gupta et al. (2023)'s calibration, an increase in FHA loan cap by $75,000 from $380,000 can raise house prices by up to 20%. By comparison, with a 8% typical down payment, a $10,000 stimulus payment would enable constrained households to take on an additional $125,000 loan. Thus, if down payment constrains are as influential as suggested in the literature, it is reasonable to expect a substantial effect of the COVID stimulus payments on house prices.

Another distinctive feature of housing is that it represents a combination of a consumption good and an investment asset. As a result, housing can serve as an important savings vehicle for households (Kaplan and Violante, 2014), and expectation of future prices plays an important role in driving housing demand. Shifts in expectations can

[9]See, among others, Mian and Sufi (2009), Favara and Imbs (2015), Di Maggio and Kermani (2017), Favilukis et al. (2017), Justiniano et al. (2019), Mian and Sufi (2021), Greenwald and Guren (2021), Adelino et al. (2022), and Drechsler et al. (2022). Chodorow-Reich et al. (2022) highlight the role of city-level fundamentals in driving the housing boom-bust-rebound cycle since 2000. Berger et al. (2020) study the effects of the refundable First-Time Homebuyer Credit program of 2009, and find that zip codes with greater exposure to the program experienced greater home sales and house price growth.

also have strong interactions with the income and credit effect. For example, an initial impact of income shocks on housing demand and house prices can be amplified by buyers' adaptive expectations (Glaeser et al., 2008). Glaeser et al. (2012), Adelino et al. (2016), Kaplan et al. (2020), and Albanesi et al. (2022), among others, argue that shifts in expectation were an important driver of the 2000s housing boom.

3 Data and summary statistics

3.1 Measuring stimulus payments of 2020-2021

The unit of observations in the main analyses is the Metropolitan Statistical Area (MSA). Personal income data by MSA are from the BEA's Regional Economics Accounts, which report income data by type (wage, investment income, government transfers, etc.) and geographic location (state, metro, county, etc.). The EIPs are included in both item "Other transfer receipts of individuals from governments", and Addendum item "Refundable tax credits". In addition to the EIPs, the refundable tax credits include the advance child tax credit payments authorized in the American Rescue Plan, as well as various other tax credits that were in effect in 2020 and 2021.[10] While there may have been changes in other tax credits concurrent with the stimulus payments, the magnitude of these changes is negligible relative to the stimulus payments. For example, the American Rescue Plan expanded the health insurance premium tax credit in 2021, but the total increase in spending for this program was approximately $8 billion–merely about 1% of the total EIPs.

Figure A2 plots the average amount of per-capita refundable tax credits (RTCs) across MSAs since 2010. The amount increases gradually in the years leading up to 2020, reaching $483 per person in 2019. It then jumped to $1,332 in 2020 and further to $2,600 in 2021. Comparing to the amount in 2019, the total increase in 2020 and 2021 stands just below $3,000. This increase aligns closely with the total EIPs and CTCs per person, suggesting that the changes in these figures since 2019 serve as a good proxy for the amount of stimulus payments received by residents in an MSA. Consequently, the subsequent analysis measures the total per-capita stimulus payments at the MSA level in

[10] According to the BEA, the other refundable tax credits include the Health Coverage Tax Credit (2003-2021), Health Insurance Premium Assistance Tax Credit (2014-2021), and the Alternative Minimum Tax Credit (2008-2021).

2020 and 2021 by the total increases of per-capita RTCs in the BEA data from 2019,[11]

$$Stimulus\ \ payments = RTCs_{2020} + RTCs_{2021} - 2{\times}RTCs_{2019}. \tag{1}$$

Table 1 reports the summary statistics of stimulus payments as measured in Eq. (1) and other key variables used in the MSA level analyses. The per-capita stimulus payments have an average of $2,965, ranging from $2,024 to $4,188 across MSAs. Figure A3 shows a heatmap of per-capita stimulus payments across MSAs in the sample. Towards the lower end of the spectrum, MSAs such as Boulder, CO, Ithaca, NY, and San Jose, CA have per-capita payments close to $2,000. At the upper end, El Centro, CA, Laredo, TX, and Yuma, AZ received per-capita payments of around $4,000.[12]

As discussed in Section 2, because only households with income below certain thresholds are eligible for the stimulus payments, per-capita payments should be negatively related to an MSA's income level. Panel (a) of Figure 2 presents a scatter plot of per-capita payments against the 2019 per-capita income. It shows a strong negative relation between the two with a correlation of -0.52. In the meantime, the figure also shows that there is substantial variation in the amount of stimulus payments among MSAs with similar per-capita income levels. The R-squared from regressing stimulus payments on 2019 per-capita income is 0.27.

The relatively low explanatory power of per-capita income for the per-capita stimulus payment amount might not be surprising given that the per-capita income could be skewed by the top or bottom earners in an MSA, while the amount of stimulus payments depends on the fraction of population below the income thresholds. I next turn to the taxable income data from the IRS to obtain more granular distribution of income at the MSA level. The IRS data report the number of tax returns by income groups and filing status.

[11] This simple approach to estimate stimulus payments does not account for the potential MSA-specific growth trend in other RTCs. To address this possibility, an alternative approach is to assume that these items have grown at the same rate in 2020 and 2021 as they did before 2020. The main results are robust to this alternative approach. For example, untabulated results show that the point estimates are generally slightly larger if the growth rate of RTCs from 2018 to 2019 is used to infer the amount of refundable tax credits excluding stimulus payments in 2020 and 2021.

[12] All three cities have a large Hispanic population. This is not a mere coincidence. Minorities have lower income on average and are more likely to have received the stimulus payments. Figure A4 shows that per-capita stimulus payments are larger in MSAs with a larger share of Black or Hispanic population. Table A1 shows that regressing the amount of stimulus payments (in thousands) on the share of Black and Hispanic population in 2019 at the MSA level produces point estimates of around 0.6 for both variables. This suggests that, on average, Black and Hispanic individuals received approximately $600 more in stimulus payments compared to White individuals and those from other minority groups.

Panel (b) shows the scatter plot of per-capita payments against the fraction of tax returns with adjusted gross income under $100,000 in 2019.[13] It shows a positive and very tight relation between the two. The correlation is 0.79 and the R-squared from regressing stimulus payments on the fraction of tax returns below $100,000 is 0.62.

3.2 House prices and other housing data

The Fannie Mae Home Price Index (FNM-HPI) from 1985 to 2022 Q3 is used to plot the quarterly house price growth in Figure 1. The index is a national, repeat-transaction home price index measuring the average price change for all single-family properties in the United States, excluding condos. House price data at the MSA level are obtained from Freddie Mac House Price Index (FMHPI). The indices are constructed using a repeat transactions methodology based on loans that have been purchased by Freddie Mac or Fannie Mae, which are conforming loans below the limits as determined by the Federal Housing Finance Agency (FHFA).

Table 1 reports that on average house prices grew by 31% during the two year period from December 2019 to December 2021. There is also large variation in the degree of house price inflation across MSAs. House prices in MSAs such as Midland and Odessa, Texas barely moved, while in MSAs such as Boise City, Idaho and St. George, Utah they appreciated by well over 50% during this period. Figure A5 shows a heatmap of house price growth of all MSAs in the sample. Unlike the housing boom prior to the 2008 financial crisis, which concentrated in coastal areas and other "sand states" such as Nevada and Arizona, the recent boom has spread more evenly across the country, with MSAs in many inland states such as Idaho, Utah, Tennessee witnessing sharp house price appreciation.

Annual housing permit data by MSA in 2020 and 2021 are from the Census Building Permits Survey. Total housing units by county as of 2019 are from the Census Annual Estimates of Housing Units. The county level data are aggregated to the MSA level using the CBSA-county crosswalk file from the Census. Growth in housing units from 2019 to 2021 is proxied by the total housing permits issued in 2020 and 2021, divided by the total number of housing units as of 2019. Median value of owner-occupied housing units data in 2019 are from the Census American Community Survey (ACS) 1-year estimates.

[13] For married couples filing joint returns, the AGI threshold is $150,000 for receiving the full payments. The IRS data do not break down returns at $150,000.

Homeownership data are also from the ACS.

On average, the total number of housing permits in 2020 and 2021 relative to the 2019 housing stock is 2.4%. While this number seems modest, it is substantially larger than the growth rates of housing units in previous years. For example, MSA level housing units on average grew by 1% from 2017 to 2019 and by 0.9% from 2015 to 2017. Housing units growth ranges from around 0 in MSAs such as Danville, IL and Morgantown, WV to over 10% in MSAs such as Austin, TX, Provo-Orem, UT, and The Villages, FL. House prices grew by 53%, 48%, and 32% in these three cities with the highest housing unit growth. Across all MSAs, housing unit growth and price growth are strongly positively correlated with a correlation of 0.49, suggesting a dominant role of increased housing demand in pushing up house prices. In Section 5.3, house price and housing unit growth are combined to create a simple measure of housing demand.

Home listing and inventory data are from Realtor.com. I calculate the percentage change in the number of new listings in 2020 and 2021 from 2019. On average, the number of new listings declines by 7% across MSAs during the two year window. Across MSAs, changes in new listings and house prices exhibit little correlation, with a correlation coefficient of -0.018.

3.3 Other data

Population, total income, and transfer income data at the MSA level are all from the BEA. Total transfer income is reported in "Personal current transfer receipts". Unemployment data at the MSA level are from Bureau of Labor Statistics (BLS)'s Local Area Unemployment Statistics (LAUS) program (the smoothed seasonally adjusted metropolitan area estimates).

Table 1 reports the summary statistics of changes in per-capita transfer income excluding stimulus payments (defined as total transfer income minus refundable tax credits) and changes in per-capita non-transfer income (defined as total income minus total transfer income) from 2019 to 2020 and 2021. On average, transfer income excluding stimulus payments increased by around $4,500 per person in 2020 and 2021, to a large extent driven by increases in unemployment insurance during the pandemic. Across MSAs, changes in per-capita transfers excluding stimulus payments have a correlation with changes in unemployment rates from 2019 to 2021 of 0.32. In contrast, the correlation between per-capita

stimulus payments and changes in unemployment rates from 2019 to 2021 is -0.23.[14]

Non-transfer income increased by around $3,000 per person, most of which occurred in 2021. The MSA that had the largest decline in non-transfer income happens to be the oil-rich Midland, Texas, that experienced the lowest house price growth. Its residents saw a decline in income by $56,000 per person from 2019 to 2021.[15] This single data point illustrates the importance of controlling for changes in local income levels unrelated to stimulus payments.

I obtain the population migration data from the IRS, which are based on year-to-year address changes reported on individual income tax returns filed with the IRS. I aggregate the total inflow in the county-to-county migration data to the MSA level using the CBSA-county crosswalk file from the Census. MSAs with the largest total in-migration in 2020 and 2021 as a fraction of total population in 2019 are Coeur d'Alene, ID, Greeley, CO, and Lakeland-Winter Haven, FL with a inflow-to-population ratio of over 12%.

Mortgage data are from the Home Mortgage Disclosure Act (HMDA) dataset. HMDA requires financial institutions to report and publicly disclose loan-level information about mortgages. Every year, tens of millions of loans made by thousands of financial institutions are reported and recorded in the database. The data contain a large number of loan-level variables including loan purpose, loan amount, location of property, and borrower demographic information which includes borrower income in recent years. To measure the number of mortgage-financed housing transactions at the MSA level, I aggregate the number of originated home purchase mortgages to the MSA-year level. On average, the number of home purchase mortgages grew by 28% during 2020-2021 from the 2019 level.

[14] Unemployment rate rose sharply early in the pandemic and recovered quickly during the second half of 2020 and 2021. Changes in per-capita non-stimulus transfers and stimulus payments in 2020 have a correlation with changes in unemployment rate from 2019 to 2020 of 0.49 and -0.2, respectively.

[15] Despite the decline, Midland's per-capita income still ranked No. 1 in the country in 2020 and No. 2 in 2021.

4 Stimulus payments and house prices

4.1 Main results

The baseline model is a cross-sectional regression of house price growth on stimulus payments and control variables at the MSA level:

$$\Delta HP_i = \alpha + \beta Stimulus\ payments_i + \gamma X_i + \epsilon_i, \tag{2}$$

where ΔHP_i is the growth of house price in MSA i from 2019 to 2021. $Stimulus\ payments_i$ is the per-capita stimulus payments (in thousands), defined in Section 3.1. As discussed above, the variation in stimulus payments is a result of the differences in the share of population eligible for the payments across MSAs. Importantly, the eligibility and the amount of per-capita payment is largely based on household income levels before the pandemic. This fact helps alleviate concerns about correlations between stimulus payments and unobserved local economic shocks during the pandemic. However, it is possible that MSAs with different share of eligible populations happen to have experienced differential local shocks, leading to divergent house price growth during the two years. While it is impossible to completely rule out the possibility of omitted variables, I control for an extensive list of variables to ensure that the effect is not confounded by any obvious alternative factors. Standard errors are clustered by the states in which MSAs, or the principal city for multi-state MSAs, are located.

Table 2 reports the results of estimating Eq. (2). Column (1) shows that without any controls, the coefficient of stimulus payments is 0.046 and significant at the 5% level. The estimate suggests that a $1,000 increase in per-capita payments is associated with an increase in house prices by 4.6% during the two-year window. (Given an average household size of 2.5, a $1,000 difference in per-capita payments translates to a $2,500 difference in per-household payments.) It is also useful to consider the effect in terms of the population share eligible for the payments, though it is more complex due to the various eligibility criteria. In the simplest hypothetical scenario, where each household consists of 2.5 adults, either eligible for the full payments ($3,200 per person) or entirely ineligible, the $1,000 difference in per-capita payment would correspond to a 31.25 percentage-point difference in the share of the households eligible for the full $8,000.

I next add changes in local economic conditions and population as control variables.

These include changes in both transfer payments excluding stimulus checks and changes in non-transfer income in 2020 and 2021 from 2019. These other transfer payments include government social benefits and various income maintenance benefits, which experienced mostly modest increases after 2019, except for a few items such as unemployment insurance.[16] To the extent that changes in these other transfers are caused by pandemic-related or other local shocks, including these payments helps control for these shocks. In addition, the change in unemployment rate from 2019 to 2021 is also included to directly control for the severity of the COVID-19 impact on local unemployment in 2020 and the subsequent recovery in 2021. The inclusion of changes in non-transfer income helps control for any differential changes in wages and other sources of income across households of different income levels during the pandemic (e.g., Autor et al., 2023).[17] Finally, the model controls for population size as of 2019 and the net population growth from 2019 to 2021 to account for pandemic-driven population migration. This is potentially important because people were more likely to move to areas with a lower cost of living during the pandemic (e.g., Haslag and Weagley, 2023), which could be associated with higher stimulus payments.

Column (2) shows that changes in other transfer income, changes in non-transfer income, and population growth are all significantly positively related to house price growth, while the change in unemployment rate from 2019 to 2021 is negatively correlated with house price growth. These variables explain a large proportion of the variation in MSA house price growth during this period, with the R-squared rising to 55%, largely driven by population growth. But controlling for these variables does not have a notable effect on the coefficient of stimulus payments, which increases slightly to 0.048 and remains statistically significant.[18] Figure 3 illustrates this positive relationship using a binned

[16]Unemployment insurance increased by a total of around $800 billion in 2020 and 2021, relative to the 2019 level. Other items that had nontrivial increases include social security benefits, medical benefits, and the supplemental nutrition assistance program (SNAP).

[17]Another related factor is variation in savings behavior across the income distribution. For example, an alternative explanation of the result is that low-income households spent less and saved more during the pandemic and used the excess savings for down payments. However, existing studies such as Chetty et al. (2023) find the contrary: high-income households cut spending much more than low-income households during the pandemic, driven by spending reductions in services that require in-person physical interactions.

[18]One might wonder whether the positive association between stimulus payments and house price growth holds for MSAs of different sizes. To test this, I divide MSAs into two groups based on the median population in 2019, which is 248,555, and then repeat the same analysis on these two groups of MSAs. Appendix Table A2 shows that the coefficient of stimulus payment for large and small MSAs is 0.045 and 0.058, respectively, both significant at the 5% level. In the last column, I use the entire sample but weight MSAs by their 2019 population. The coefficient of stimulus payment increases substantially

scatter plot of house price growth from 2019 to 2021 against the residuals obtained from regressing stimulus payments on these control variables.

As noted earlier, because high income families do not qualify for stimulus payments, the amount of per-capita payments is negatively correlated with MSA income levels. Although the estimation controls for many observed economic and demographic changes, one might still be concerned that cities with lower income levels might have experienced more positive unobserved demand shocks, leading to a greater increase in house prices. To partially address this possibility, I next include an area's pre-pandemic per-capita income as an additional control. To see why this simple test helps mitigate concerns about confounding factors, consider two hypothetical cities: City A, where 100% of individuals have an AGI of $75,000, and City B, where 50% of the population has an AGI of $50,000 and the other 50% an AGI of $100,000. Although both cities have the same average AGI, everyone in City A qualifies for the payments, whereas only half of City B's population does. If stimulus payments indeed have a positive effect on housing demand and house prices, we should expect a greater increase in house prices in City A than in City B, an outcome not necessarily predicted by alternative explanations. Column (3) shows that the coefficient of stimulus payments changes little when per-capita income is included, while per-capita income itself is not statistically significant. This result indicates that what matters is not an MSA's average income level, but rather specifically the share of population eligible for the payments.

As one would expect, an MSA's median house price is strongly positively correlated with its income per capita and negatively correlated with the stimulus payments. One possible alternative explanation of the result is that during the pandemic, people moved away from expensive housing markets to more affordable housing markets, causing house prices to rise faster in places with lower housing values and greater stimulus payments. To address this possibility, the next estimation controls for the median MSA house prices as of 2019. Column (4) shows that house price growth from 2019 to 2021 is in fact significantly positively correlated with median housing value in 2019, and controlling for median housing value increases the coefficient of stimulus payments to 0.054.

The estimation so far controls for net population growth, but there may still be a concern that population growth is not enough to account for the effect of pandemic driven migration. This is because population growth reflects net migration, but large population

to 0.089.

inflows could lead to large outflows, leaving the total population relatively unchanged. Such population churn and associated housing demand may still result in significant house price appreciation. I thus next further control for total population inflow during 2020-2021 as a fraction of total population in 2019. Column (5) shows that the coefficient of inflow is indeed positive and statistically significant, and adding this control reduces the payment coefficient to 0.049.[19]

Another possibility is that MSAs with different stimulus payments were already on different house price growth trajectories prior to the pandemic, which could lead to differential house price growth in 2020 and 2021 even in the absence of differential local demand shocks during this period. I next add the lagged two-year house price growth from 2017 to 2019 as an additional control. Column (6) shows that there is indeed a high degree of house price momentum, as the lagged house price growth is highly significant and explains an additional 9% of the variation in MSA house price growth. The coefficient of stimulus payments drops to 0.044 and remains statistically significant.[20]

The next specification controls for an MSA's exposure to the WFH shift. The percentage of jobs that can be performed remotely varies widely across cities and industries (Dingel and Neiman, 2020), and prior research has shown that MSAs with a greater share of population able to work remotely experienced faster house price growth (e.g., Gupta et al., 2022; Mondragon and Wieland, 2022). It should be noted that this finding is unlikely to explain the positive relationship between stimulus payments and house price

[19]One remaining concern is that population growth or migration based on changes of address in tax returns tends to reflect permanent relocation, while some people may have decided to relocate only temporarily during the pandemic. To deal with this concern, I use HMDA data to calculate the change in the fraction of mortgages labeled as secondary residence or investment property from 2019 to 2020 and 2021. Untabulated results show that this change is indeed positively correlated with changes in house prices, but adding this variable as an additional control leads to a slightly larger coefficient of stimulus payments and a larger t-stat.

[20]To further evaluate the possibility of differential housing trends, I conduct a falsification test by regressing house price growth in prior years on stimulus payments and other control variables in 2020 and 2021. Specifically, I use the same variables as in column (3) and their 2020-2021 values but change the dependent variable to house price growth during 2014-2016, 2015-2017, 2016-2018, and 2017-2019, respectively. The coefficient of stimulus payments from each regression and their 90% confidence intervals are plotted in Figure A6. All four coefficients from using house price growth prior to 2020 were close to and not significantly different from 0. The figure also suggests that when controlling for other observables, MSAs with different stimulus payments were not on different house price trends prior to 2020. As an alternative exercise, Appendix Table A4 examines the relationship between house price growth over a two year window and the fraction of households with income below $100,000 at the beginning of the period since 2013. The results show that prior to 2020, there is no significant association between house price growth and the below $100,000 household share. In contrast, house price growth in 2020 and 2021 is significantly higher in areas with a larger fraction of households eligible for the stimulus payments.

growth documented in this paper. This is because individuals with lower income are more likely to work in occupations that cannot be performed at home, resulting in a negative correlation between an MSA's WFH exposure and its stimulus payments.

Column (7) reports the results where the Dingel and Neiman (2020) measure of WFH exposure is used. The exposure has a negative but statistically insignificant relation with house price growth from 2019 to 2021.[21] The coefficient of stimulus payments drops to 0.038, but remains statistically significant at the 5% level. In column (8), I follow Mondragon and Wieland (2022) and measure WFH exposure based on the share of workers in an MSA who report working from home in the 2019 ACS. The coefficient of remote work share is significantly positive, suggesting that house price grew faster in areas where a larger share of the population works remotely, consistent with the findings in Mondragon and Wieland (2022). The coefficient of stimulus payment increases to 0.058.[22]

The last model specification includes state fixed effects to compare stimulus payments and house price growth across MSAs within the same state. This specification discards substantial variation in house price growth and stimulus payments across states, as untabulated results show that state fixed effects alone can explain 60% of the variation in house price growth across MSAs during the two-year period. Nonetheless, this specification helps address concerns about unobserved shocks to a region that correlate with both stimulus payments and house price growth. Column (9) shows that the coefficient of stimulus payments declines to 0.044 when only variation within states is used for identification.

Overall, the results show that house prices grew faster during 2020-2021 in areas where residents received a larger amount of stimulus payments on average. This finding is consistent with the discussion in Section 2.2 that stimulus payments could significantly relax the borrowing constraints for potential home buyers. Evidence from quantitative models also suggests that the magnitude of the estimated effect is plausible. For example, Berger et al. (2023) find a large effect of fiscal stimulus programs on housing demand using a quantitative life-cycle model. Particularly relevant for this paper, their calibration shows that a $1,000-per-household transfer payment leads to an over 30% increase in housing

[21] Gupta et al. (2022) find that the Dingel and Neiman (2020) WFH exposure is positively related to house price growth from 2019 to 2020 among the 30 largest MSAs. If I limit the estimation to the 30 largest MSAs, the WFH variable is indeed positive and statistically significant.

[22] Untabulated results show that if the change in remote work share from 2019 to 2021 is also added as a control, it is not statistically significant, while the coefficient of stimulus payments remains virtually the same.

transactions and investment over a three-year window. They find that a key driver of this large response is the alleviation of down payment constraints faced by marginal home buyers.

Extrapolating the cross-sectional estimates suggests that the stimulus payments could potentially explain a substantial portion of the observed house price appreciation. For example, multiplying the point estimates from Table 2 by the per-capita EIPs and CTC payments of $2,750 yields an estimated overall impact of stimulus payments on house prices ranging from 10% to 16%, which represents approximately one-third to one-half of the average house price increases across MSAs.

4.2 Timing of the effect

The analyses in the previous section focus on the growth in house prices during the entire two-year period of 2020 and 2021. To shed light on the timing of house price adjustments, I next examine the evolution of house prices at the monthly frequency over the two-year period. Specifically, I calculate the growth rate of house prices for each month in 2020 and 2021 from December 2019 and regress the growth rate on the per-capita stimulus payments in 2020-2021 and the same control variables used in column (2) of Table 2.

Figure 4 plots the coefficient estimates of stimulus payments and the 90% confidence intervals for each month within the two-year period. The gray bars in the figure represent the timing of the three rounds of EIPs, with the height of the bars indicating the magnitude of total payments for each round, including the nearly $100 billion CTC distributed in 2021. The figure shows that there is little divergence in house price growth across MSAs with differing levels of stimulus payments in 2020. House prices in high-payments MSAs begin to grow more rapidly in early 2021 and the coefficient becomes statistically significant in the later half of the year. The coefficient continues to increase throughout the remainder of the year, reaching 0.048 by December 2021.

4.3 Stimulus payments excluding the CTC

Because of the advance payments of the CTC in 2021, the per-capita stimulus payment calculated in Eq. (1) is positively correlated with the share of young children across MSAs. A potential issue is that families with young children may have experienced a greater increase in housing demand for reasons unrelated to the stimulus payments, leading to an

upward bias in estimating the effect of stimulus payments on house prices.

To address this concern, I create a measure of EIPs by excluding the advance payments of the CTC from the stimulus payment measure in 2021. This is done by estimating the amount of advance payments based on the share of the population eligible for these advance CTC payments, using Census age data, and then subtracting the estimated amount from the total refundable tax credits reported in the BEA data in 2021.[23]

Table A3 replicates the analyses in Table 2 using this adjusted measure of stimulus payments. The point estimates are slightly larger across all model specifications, suggesting a stronger association between per-capita EIPs and house price growth.

4.4 Persistence of the effect

This paper focuses on housing market activity during the 2020–2021 period when stimulus payments were made. Naturally, one might wonder how house prices evolved beyond 2021. If some households' housing demand responded to the stimulus payments with a delay, we could see continued effects beyond 2021. However, if the large transitory income shocks brought future demand forward by relaxing financial constraints, we might expect to see a reversal in the effect.

Figure 5 extends the analysis in Section 4.2 through July 2024. It shows that house prices in high-payment MSAs continued to appreciate relative to low-payment MSAs for several months into 2022, before plateauing for the rest of 2022 and 2023. One possible explanation for the persistence of this effect is that the initial boom may have shifted investors' expectations about the future trajectory of house prices, sustaining demand in high-payment areas (Chi et al., 2023). Starting in 2024, a clear reversal in the effect emerges. By July, the coefficient falls below its level from late 2021, and large standard errors render it statistically indistinguishable from zero. While it is still too early to determine whether this reversal will continue, the downward trend aligns with the notion that large transitory income shocks can significantly impact housing demand and prices, but that these effects may not be permanent.

[23]The amount of advance payment was $1,800 for children under 6 and $1,500 for children aged 6 to 17.

5 Stimulus payments and other housing outcomes

In this section, I explore the relationship between stimulus payments and other key housing market outcomes, including homeownership rates, housing supply, and transaction volumes. Additionally, I implement a regression kink design to estimate the effect of stimulus payments on homeownership rates. These analyses provide further evidence that stimulus payments contributed to the recent housing market boom by raising housing demand.

5.1 Homeownership

During the pandemic, there was a notable uptick in the overall homeownership rate, with minority households experiencing a more pronounced increase.[24] This section studies whether the stimulus payments contributed to the observed increase in homeownership rate. If the payments were sufficient to alleviate the financial constraints of marginal home buyers and induce them to enter homeownership, there should be an increase in homeownership rates among payment recipients. On the other hand, if the rising housing demand is concentrated in existing homeowners seeking to upgrade their properties, there may not be any significant changes in homeownership rates.

I first examine the change in homeownership rates across MSAs from 2019 to 2021 as a function of stimulus payments. Homeownership rate is measured by the ratio of owner occupied housing units over total occupied housing units. To account for any MSA-specific trends in homeownership, the change in homeownership rate from 2017 to 2019 is added as an additional control. MSAs are weighted by the 2019 population in the estimation.

Panel A of Table 3 reports the findings from using the 1-year and 5-year ACS estimates.[25] The two coefficients are similar in magnitude, with the coefficient from the 1-year estimate marginally insignificant (p-value=0.113) and the coefficient from the 5-year estimates significant at the 1% level. The estimate of 0.004 indicates that for every

[24] As depicted in Figure A7, the aggregate homeownership rate rose by 1.2 percentage points for White households from 2019 to 2021, while it climbed by 2 and 2.5 percentage points for Black and Hispanic households, respectively. The increase in minority homeownership during the pandemic has received considerable attention. See, for example, Bhattarai and Fowers (2022) and Choi and Zinn (2022).

[25] The difference between the 2017–2021 and 2015–2019 5-year estimates reflects the "long-run" differences between 2015–2016 and 2020–2021. To capture the changes in homeownership before 2020, the estimation in column (2) also controls for the change in homeownership from 2015 to 2017, in addition to the change from 2017 to 2019.

$1000 increase in per-capita stimulus payments, the homeownership rate increases by 0.4 percentage points.

I next turn to homeownership data at the household level using the Integrated Public Use Microdata Sample (IPUMS) (Ruggles et al., 2023) of the ACS over the period of 2019 to 2021. Since the data do not contain information on the amount of stimulus payments received by households, I examine the homeownership rate of households of different income levels. Specifically, following Adelino et al. (2018), each year I sort households into quintiles based on reported family income levels and compare homeownership rates of households in each quintile before and after 2020.[26]

I regress homeownership status on the income quintile dummies and their interactions with a 2020-2021 indicator variable, while controlling for the age of household head and the size of households. Column (1) of Panel B shows that households in the bottom three quintiles experienced an increase in homeownership rates after 2020 relative to households in the top quintile. In column (2), the interactions between household size and household head age and the post-2020 dummy variable are added to allow these factors to have a differential impact on homeownership during the pandemic. Lower-income households exhibit a larger differential increase in homeownership. Compared to the top income quintile, the homeownership rates of households in the bottom three quintiles increase by 1.9, 1.4, and 0.8 percentage points, respectively. This more pronounced effect among low-income families aligns with the fact that the fixed payments provide a relatively greater boost to the income and savings of these families. In the last column, county by year fixed effects are included to compare households located in the same county. The point estimates become slightly larger and the fourth quintile now also exhibits a relative increase in homeownership rate by 0.3 percentage points, significant at the 10% level.

5.2 Regression kink test based on income limits

One potentially effective approach to assessing the impact of the stimulus payments is to use the income thresholds that determine payment eligibility. For instance, mar-

[26]The upper income limits for the bottom four quintiles in 2019 are $27,000, $50,900, $80,000, and $130,300, respectively. Thus nearly all households in the bottom three quintiles are eligible for the full stimulus payments. According to the IRS data, the majority of tax returns with income between $75,000 and $100,000 or over $100,000 are filed jointly by married couples. Thus the majority of households in the fourth quintile would also be eligible for the payments. Only a small fraction of households in the top quintile with married couples and income below $150,000 would be eligible for the full payments.

ried couples filing jointly qualify for the full payments if their income is below $150,000, with the payment amount gradually decreasing as income surpasses this threshold. This setup enables an examination of whether there is any noticeable change, or 'kink,' in the homeownership-income relationship around this threshold. A decline in the slope for incomes above the limit would suggest that stimulus payments have positively influenced homeownership.

However, implementing this test using the ACS micro data presents several challenges. First, the income reported in the ACS differs from the AGI used to determine stimulus payment eligibility. A significant discrepancy arises from household contributions to retirement savings. According to the recent IRS data, around 57% of taxpayers with an AGI between $100,000 to $200,000 reported retirement contributions on their W-2 forms in 2018. Among those who contribute, the average contribution was slightly over $7,000. Additionally, around one third of the taxpayers report statutory adjustments such as IRAs and health savings account deductions on their 1040 forms, with an average of around $4,000 reported. These figures imply that many households with reported income above $150,000 might still be eligible for the full payment, which could make it difficult to detect a change in the relationship around the threshold. Another limitation is the ACS's lack of historical income data. For example, a family with a 2021 AGI of $160,000 could have been eligible for full payments if their 2019 income was below $150,000.

Acknowledging these data limitations, the subsequent analysis implements a regression kink design to examine the relationship between household income and homeownership status reported in the ACS data. I restrict the sample to single-family households with either one married couple or without any couple or children under 19. The respective income thresholds for these two groups of households are $150,000 and $75,000. The ACS income data for the past twelve months is adjusted to reflect the calendar year income using the adjustment factor provided in IPUMS, and income figures from 2021 are converted to 2019 equivalents using the CPI variable in IPUMS.

The model estimated is

$$Own_i = \alpha + \beta_1(Income_i/c_i) + \beta_2(Income_i/c_i) \times \mathbf{1}\{Income_i \geq c_i\} + \gamma X_i + \epsilon_i, \quad (3)$$

where income is normalized by the income limit discussed above, Own is an indicator variable for owning the housing unit, $\mathbf{1}\{Income_i \geq c_i\}$ is an indicator equal to 1 if income

is above the limit and 0 otherwise, and X is a vector of control variables that include family size, age group, and an indicator variable for couples in the household.

Panel A of Table 4 reports the results using the 2021 ACS sample across various bandwidths. In column (1) where households with income within 10% of the threshold are used, the coefficient is -0.124 but is not statistically significant. In column (2), where a 12.5% bandwidth is used, the coefficient becomes significantly more negative and statistically significant at the 1% level. The next two columns show that, as the bandwidth expands to 15% and 17.5% of the thresholds, the coefficients remain negative and significant at either the 5% or 1% level.[27] Figure 6 provides visual confirmation of the kink in the relationship for the 17.5% bandwidth. These results are consistent with a causal effect of stimulus payments on homeownership. The estimates indicate that compared to households comprising married couples with no kids and an income of \$150,000 (eligible for \$6,400 payments), those with an income of \$160,000 (eligible for \$1,600 payments) exhibit a relative decrease in homeownership by 0.8 to 1.9 percentage points.

As a placebo test, I repeat the same analysis using the 2019 ACS data. Panel B reports that none of the coefficients in the four estimations is statistically different from zero. Appendix Figure A8 shows that the relationship between household income and homeownership is similar below and above the income limits in 2019. Furthermore, untabulated results show that when alternative hypothetical income thresholds of \$30,000 above or below the actual limits are used, none of the coefficients across the four different bandwidths is statistically negative with the 2021 ACS sample. These results lend further credibility to the regression kink design.

5.3 Housing supply

This section examines whether there is any differential changes in housing supply across MSAs with different stimulus payments. It also explores whether the impact of stimulus payments on house prices and housing units varies with local housing supply elasticity.

First, I use the number of new privately-owned housing units authorized by building permits as a proxy for housing starts and changes in housing stock. I regress the total number of housing permits issued in an MSA in 2020 and 2021 divided by the number of

[27] The optimal bandwidth selected using the procedure from Calonico et al. (2014) is 0.118 around the threshold. Using this bandwidth yields a coefficient estimate of -0.246, significant at the 1% level.

housing units in 2019 on per-capita stimulus payments and control variables. Column (1) of Table 5 reports that the coefficient of stimulus payment is -0.005 and significant at the 5% level, suggesting that areas receiving higher payments experienced slower housing unit growth. As shown in column (2), however, adding unit growth as a control variable in the house price regression has little impact on the stimulus payment estimate, while the unit growth coefficient itself is negative but not statistically significant.

Under certain assumptions, one can create a measure of shift in housing demand using changes in house prices and housing units. Specifically, assuming a log-linear demand for housing and a unit elasticity of housing demand, the local shift in housing demand can be measured simply by the sum of house price growth and housing unit growth (Charles et al., 2018). Column (3) shows that stimulus payments have a significantly positive effect on the sum of house price and unit growth, with a magnitude similar to those on house price growth reported in Table 2.

A natural question to ask is whether the house price and quantity response depends on housing supply elasticity. While the housing supply elasticity should be more relevant in the longer run, it could affect short-run house price responses through expectations (Glaeser et al., 2008; Mian and Sufi, 2009). To explore this, I use the land unavailability measure developed by Lutz and Sand (2022), which extends the popular Saiz (2010) measure of housing supply elasticity and create an interaction between stimulus payments and (demeaned) land unavailability.[28] Column (4) shows that the interaction between stimulus payments and land unavailability is indeed significantly positive, suggesting that stimulus payments have a more pronounced effect on house price growth in areas with limited land availability. The estimate implies that a one-standard deviation increase in land unavailability increases the impact of $1,000 stimulus payments on house price growth by 3.2 percentage points. In contrast, when examining housing unit growth, column (5) shows that the interaction term is not statistically significant, suggesting that the response of housing unit growth to stimulus payments does not vary with land availability. This result may be attributed to a lag in the adjustment of housing supply to demand shifts.

Lastly, I examine the change in the number of new home listings to measure shifts in the supply of existing homes. Specifically, I calculate the growth of new home listings in 2020 and 2021 from 2019 and examine the growth of listings across MSAs with differential

[28] I also allow the effects of the control variables (those having a significant relation with housing demand shift) to vary with housing supply elasticity by including their interactions with land unavailability.

payments. Column (6) shows that the coefficient of stimulus payment is positive and statistically significant, indicating that high payment MSAs had relatively larger increases in the number of new listings. Column (7) further shows that controlling for the changes in listings raises the coefficient of stimulus payments to 0.051 in the house price estimation. Overall, the findings in this section provide further evidence that the stimulus payments are associated with a right-ward shift in the housing demand schedule.

5.4 Housing transactions and mortgage terms

The final section of the paper employs the HMDA data to examine the volume of housing transactions and the dynamics of mortgage terms. I use the number of home purchase mortgages originated at the MSA level as a proxy for home purchase activities. The increase in mortgage originations from 2019 to 2020 and 2021 is regressed on stimulus payments and control variables. Column (1) of Panel A of Table 6 reports that the coefficient of stimulus payments is 0.11 and is significant at the 1% level, indicating that a $1,000 extra payment per person is associated with a 11% increase in mortgage-financed home purchases over the two-year span. The heightened housing transaction volume may be attributed to first-time home buyers entering into homeownership, as previously documented, and to existing homeowners benefiting from eased down payment constraints due to rising house prices, as highlighted by Stein (1995).

I next examine mortgage terms in the HMDA data, focusing on several key indicators: the loan-to-value ratio, loan-to-income ratio, denial rate, and mortgage rate spread. Denial rate is defined as the fraction of home purchase loan applications that are not approved. The rate spread reported in the HMDA data is the difference between a loan's annual percentage rate and the average prime offer rate for a comparable type mortgage. For each variable, I calculate the changes within MSAs by comparing the average of 2020 and 2021 values to the baseline in 2019.

Columns (2) and (3) show that stimulus payments are not associated with significant changes in either loan to value ratio or loan to income ratio. However, column (4) shows that areas with greater stimulus payments experience a significant increase in mortgage denial rate. These results suggest that the increase in home purchases in high payment areas is not driven by an expansion in the supply of mortgage credit. The last column shows that high payment areas experience a significant decline in rate spread; however, the

magnitude of the effect is modest: an additional one-thousand dollar per-capita payment is associated with a decline in rate spread by about 6 basis points.

Since stimulus payments are not counted as income in mortgage applications, borrowers who used these funds to boost their down payments may secure larger loans relative to their income, potentially raising their LTI ratio. However, this effect might not manifest at the MSA level because housing transaction volume tends to move together across income groups, including home purchases by current homeowners who typically have lower LTI ratios on their new mortgages. I thus next delve into transaction level data and examine the dynamics of LTI ratios across different income levels. For each year from 2018 to 2021, I sort home buyers into five groups based on the level of income reported in HMDA and calculate the average LTI ratio for each quintile and year.[29] Figure 7 shows that the LTI ratio increases for all quintiles from 2019 to 2021, with the most significant rises occurring among lower-income groups. This contrasts with the finding by Adelino et al. (2016) that the LTI levels did not evolve differentially for borrowers across different income brackets during the housing boom prior to the Great Recession.

Panel B presents the analysis of LTI ratios in 2019 and 2021 based on income levels. Column (1) shows that relative to borrowers in the top income quintile, borrowers in the bottom two quintiles saw a 26 percentage points increase in their LTI ratio from 2019 to 2021. In column (2), the estimation allows the change in LTI ratios to vary by borrower age group and the number of applicants. Column (3) further controls for county by year effects and shows more pronounced differential changes in LTI ratios across income levels when comparing transactions within the same county. The greater increase in LTI ratio among lower-income borrowers, who were more likely to receive the payments and for whom the payment amounts were more significant relative to their income and savings, is consistent with the view that stimulus payments helped ease the down payment constraints of these borrowers.

6 Conclusion

This paper examines the impact of the historic fiscal stimulus payments during the Covid pandemic on the housing market. The amount of the three rounds of payments was

[29]The upper income limits for the bottom four quintiles in 2019 are $52,000, $73,000, $100,000, and $150,000, respectively.

significant relative to the average household savings and the typical down payment made by home buyers. I find that cities with a larger share of the population eligible for the payments experience a faster appreciation of house prices, an increase in homeownership rates, and a surge in housing transactions. These effects cannot be explained by other observed economic or demographic shocks during the pandemic. Using household level data and a research design leveraging the phased reduction in payment amounts above certain income limits provides further evidence of a positive effect of these payments on housing demand.

To my knowledge, this paper provides the first empirical evidence that stimulus checks have a significant impact on household housing demand and housing market dynamics. Prior studies of consumer spending out of stimulus payments do not consider housing purchases. This paper's results suggest that excluding housing may lead to a significant underestimation of the impact of fiscal stimulus payments, particularly for payments of large sizes. Housing expenditure and investment associated with increased housing demand could be an important channel through which the transfer payments stimulate the economy. Rising house prices could lead to further spending through a housing wealth effect. The findings also support the view that the fiscal stimulus and relief efforts helped contribute to the housing boom during the pandemic and the heightened level of inflation not seen since the early 1980s.

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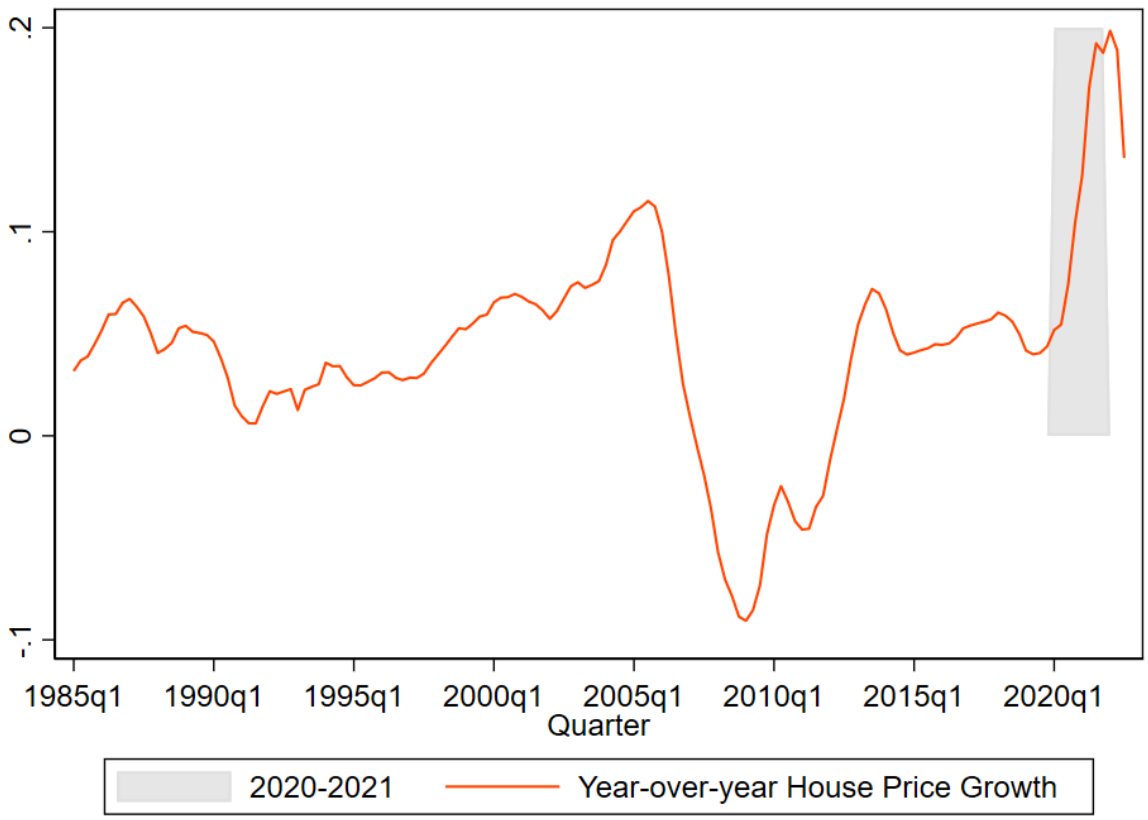
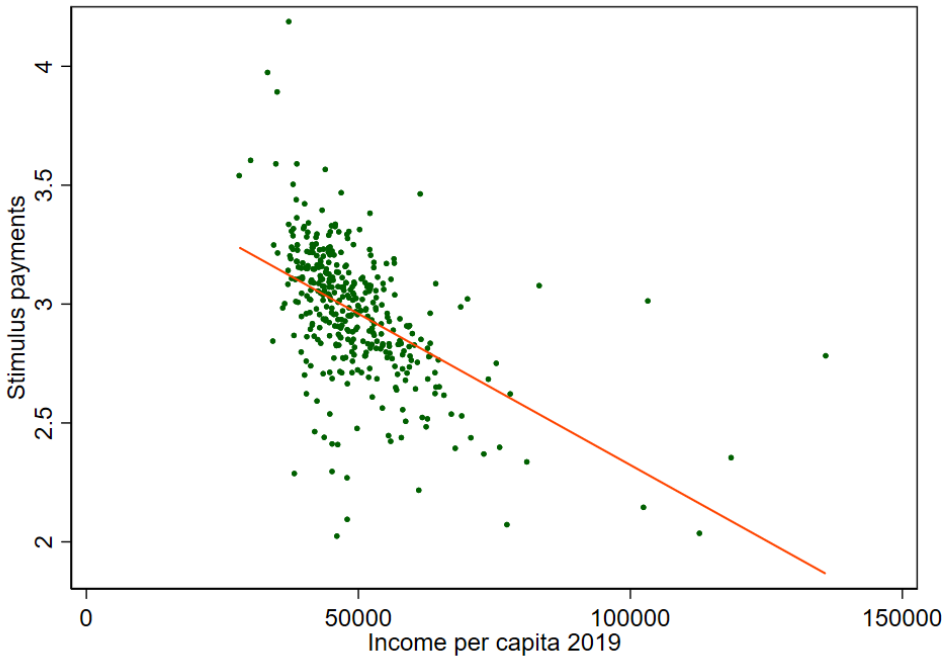
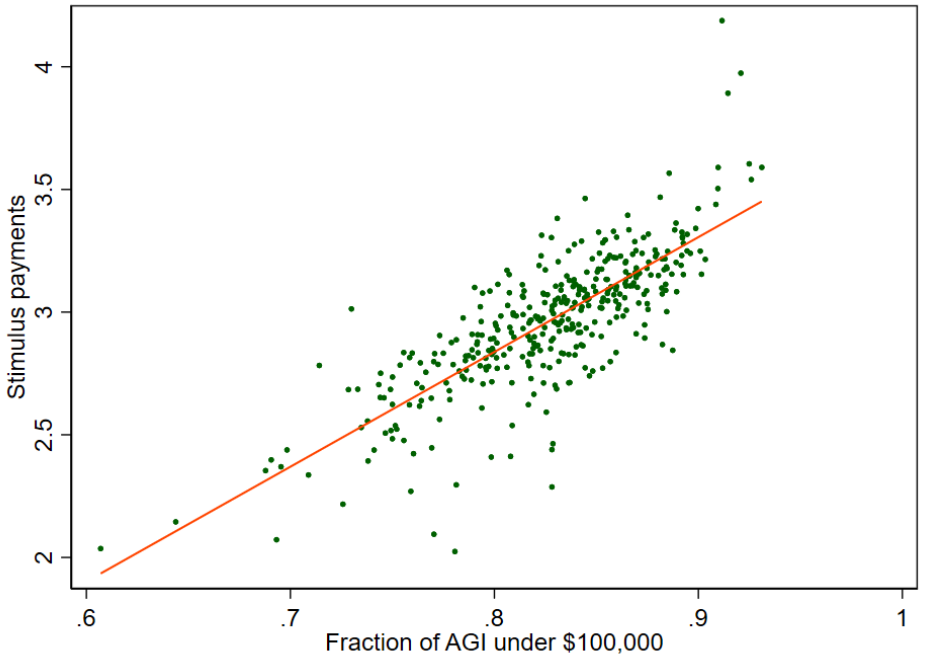


Figure 1: National house price growth 1985-2022. This figure plots the quarterly year-over-year growth in house prices from 1985 to the third quarter of 2022. The house price index data are from Fannie Mae.



(a)



(b)

Figure 2: Stimulus payments and income levels across MSAs. Panel (a) plots the per-capita stimulus payments of 2020 and 2021 against per-capita income in 2019. Panel (b) plots the per-capita stimulus payments of 2020 and 2021 against the fraction of tax returns with adjusted gross income below $100,000.

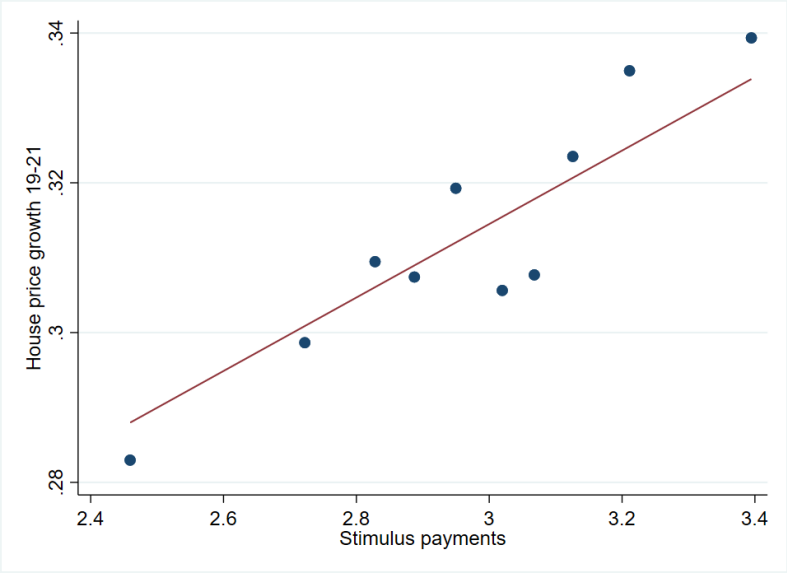


Figure 3: House price growth and stimulus payments. This figure shows the binned scatter plot of house price growth from 2019 to 2021 against the residuals from regressing stimulus payments on the control variables included in column (2) of Table 2: changes in other transfers, changes in non-transfer income, changes in unemployment rate, population growth from 2019 to 2021, and log population in 2019.

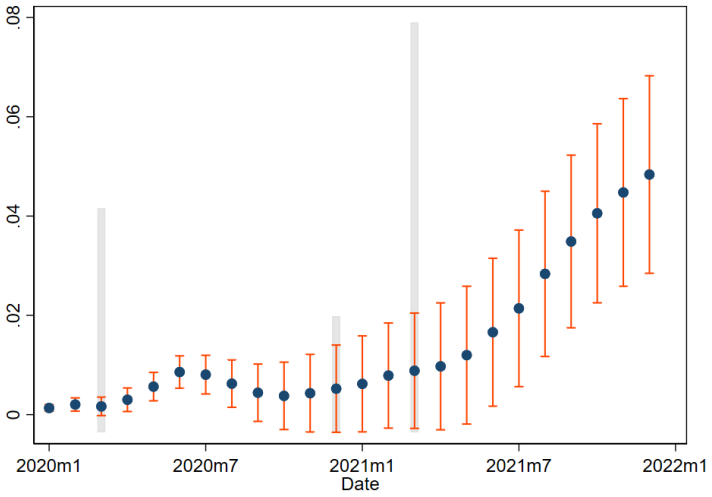


Figure 4: Monthly house prices and stimulus payments of 2020 and 2021. House price growth from December 2019 to each of the subsequent month in 2020 and 2021 is regressed on the 2020–2021 stimulus payments and control variables in column (2) of Table 2. The figure plots the coefficient of *stimulus payments* and the 90% confidence interval from each of the 24 regressions. The gray bars indicate the months when the three round of EIPs started to be disbursed. The height of the bar indicates the size of each payment.

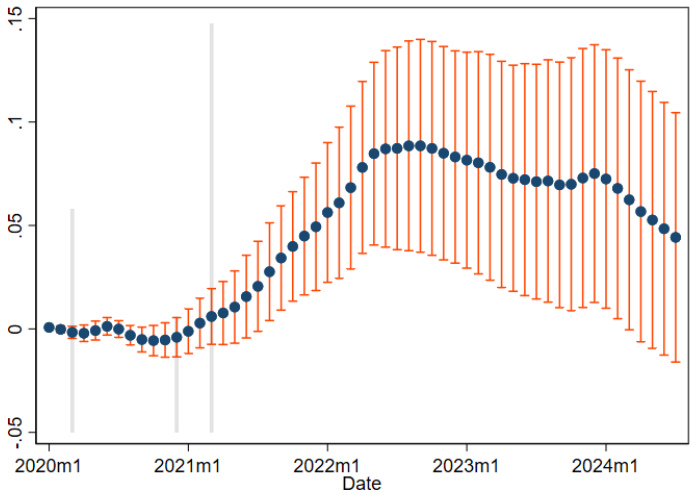


Figure 5: Evolution of house prices through 2024. House price growth from December 2019 to each of the subsequent month through July 2024 is regressed on the 2020–2021 stimulus payments and all the control variables in Table 2. The figure plots the coefficient of *stimulus payments* and the 90% confidence interval from each of the regressions.

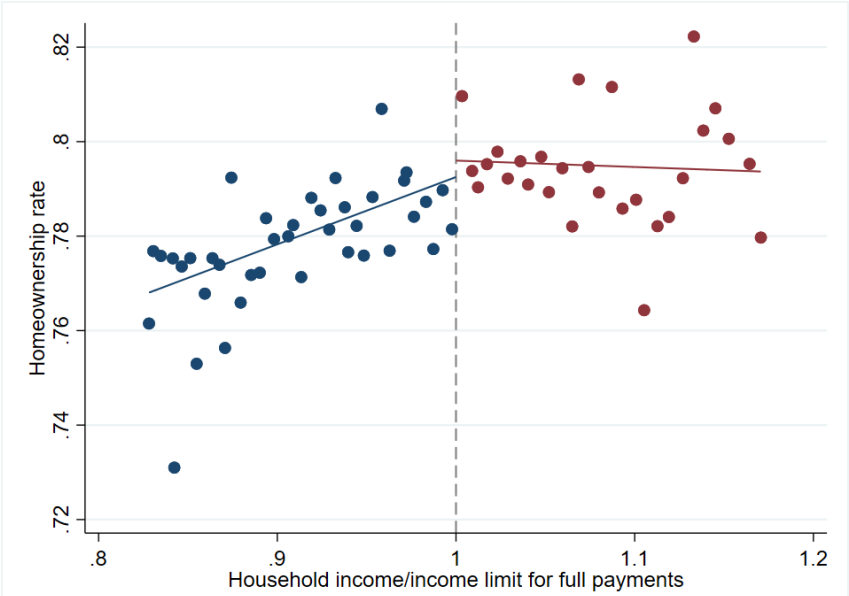


Figure 6: Household income and homeownership status in 2021. This figure presents a binned scatter plot of homeownership status and household income relative to the income limits for full stimulus payments. These income limits are $150,000 for families with a married couple and $75,000 for families without any couple or children under 19. Homeownership has been residualized from family size, age group, and married-couple indicators.

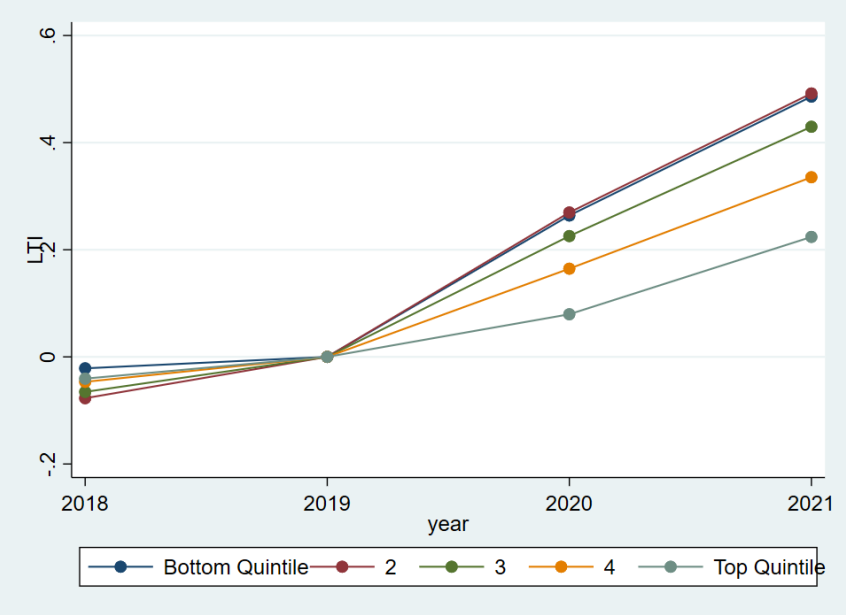


Figure 7: Loan to income ratio by income quintile. This figure plots the average loan to income ratio from 2018 and 2021 relative to 2019 for each income quintile.

Table 1: Summary Statistics

ΔHP is the house price growth rate from 2019 to 2021. *Stimulus payments* is the total per-capita economic impact payments of 2020 and 2021 and the child tax credit payments of 2021 (in thousands). Δ*Other transfer* is the total increase in other transfers per capita from 2019 to 2020 and 2021 (in thousands). Δ*Non transfer* is the total increase in per-capita non-transfer income from 2019 to 2020 and 2021 (in thousands). ΔPop is the growth rate of total population from 2019 to 2021. $\Delta Unemp\ rate$ is the change in unemployment rate from 2019 to 2021. $Ln(Pop_{2019})$ is the log population in 2019. IPC_{2019} is the per-capita income in 2019 (in thousands). $Median\ Hvalue_{2019}$ is the median value of owner occupied housing units in 2019 (in thousands). $Pop\,inflow$ is the inflow of population from outside of the MSA in 2020 and 2021 divided by population in 2019. $Under100_{2019}$ is the fraction of tax returns with adjusted gross income below \$100,000 in 2019. WFH is the fraction of jobs that can be performed entirely from home, as estimated by Dingel and Neiman (2020). $Remote\,share_{2019}$ is the share of workers that work at home in 2019 according to the ACS data. $\Delta Homeownership$ is the change in homeownership rate from 2019 to 2021. $\Delta Units$ is the growth rate of housing units. $\Delta Listing$ is the growth of total number of new listings in 2020 and 2021 from 2019. $\Delta Mortgages$ is the growth rate of originated home-purchase mortgages from 2019 to 2020 and 2021.

	Mean	SD	Min	p50	Max	No. of obs
ΔHP	0.313	0.090	0.021	0.303	0.609	382
Stimulus payments	2.965	0.281	2.024	2.986	4.188	382
$\Delta Other\ transfer$	4.315	1.433	1.248	4.121	9.925	382
$\Delta Non\ transfer$	3.015	4.073	-56.119	3.007	25.297	382
ΔPop	0.008	0.018	-0.051	0.005	0.090	382
$\Delta Unemp\ rate$	0.527	0.977	-4.900	0.400	3.900	382
$Ln(Pop_{2019})$	12.698	1.086	10.931	12.423	16.772	382
IPC_{2019}	49.524	11.455	28.091	47.135	135.900	382
$Median\ Hvalue_{2019}$	204.916	112.254	79.900	171.100	968.800	382
$Pop\,inflow$	0.049	0.024	0.014	0.045	0.124	382
$Under100_{2019}$	0.827	0.047	0.607	0.833	0.931	382
WFH	0.325	0.055	0.193	0.314	0.519	382
$Remote\ share_{2019}$	0.051	0.020	0.010	0.048	0.130	382
$\Delta Homeownership$	0.011	0.025	-0.106	0.011	0.087	382
$\Delta Units$	0.024	0.019	0.000	0.019	0.112	382
$\Delta Listing$	-0.070	0.089	-0.365	-0.069	0.539	382
$\Delta Mortgages$	0.278	0.168	-0.297	0.262	0.945	382

Table 2: Stimulus payments and house price growth in 2020 and 2021

The dependent variable is the growth in house prices from 2019 to 2021. *Stimulus payments* is the total per-capita economic impact payments of 2020 and 2021 and the child tax credit payments of 2021. Other variables are defined in Table 1. Standard errors are clustered by state.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stimulus payments	0.046**	0.048**	0.048**	0.054**	0.049**	0.044**	0.038**	0.058***	0.044**
	(0.022)	(0.021)	(0.023)	(0.023)	(0.020)	(0.019)	(0.018)	(0.021)	(0.019)
$\Delta Other\ transfer$		0.013***	0.013***	0.010**	0.008*	0.008**	0.008**	0.008**	0.007
		(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.007)
$\Delta Non\ transfer$		0.005***	0.005***	0.004***	0.004***	0.004***	0.004***	0.004***	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\Delta Unemp\ rate$		-0.006	-0.006	-0.007	-0.009	-0.009	-0.009	-0.008	-0.004
		(0.007)	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)	(0.006)	(0.008)
ΔPop		3.728***	3.727***	3.611***	2.592***	2.066***	2.034***	1.885***	1.684***
		(0.231)	(0.238)	(0.235)	(0.333)	(0.308)	(0.310)	(0.304)	(0.294)
$Ln(Pop_{2019})$		-0.001	-0.001	-0.001	0.006	0.004	0.006	0.004	0.000
		(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
IPC_{2019}			-0.000	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Median\ Hvalue_{2019}$				0.000**	0.000	0.000	0.000	0.000	-0.000
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Pop inflow					1.040***	0.734***	0.745***	0.645***	0.337
					(0.267)	(0.242)	(0.240)	(0.231)	(0.205)
ΔHP_{17-19}						0.714***	0.712***	0.686***	0.381***
						(0.123)	(0.124)	(0.124)	(0.142)
WFH exposure							-0.083		
							(0.062)		
$Remote\ share_{2019}$								0.617***	0.745***
								(0.212)	(0.193)
State FE	No	No	No	No	No	No	No	No	Yes
R-squared	0.021	0.547	0.547	0.553	0.585	0.671	0.673	0.682	0.810
N	382	382	382	382	382	382	382	382	377

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Stimulus payments and homeownership

In Panel A, the dependent variable is the change in the homeownership rate from 2019 to 2021 at the MSA level. *Stimulus payments* is the total per-capita economic impact payments of 2020 and 2021 and the child tax credit payments of 2021. Control variables include changes in other transfers per capita, changes in per-capita non-transfer income, the growth rate of total population from 2019 to 2021, changes in unemployment rate, the log population in 2019, and changes in homeownership rate from 2017 to 2019. In column (2), the estimation further controls for changes in homeownership rate from 2015 to 2017. In Panel B, the dependent variable is an indicator variable for owning the housing unit. *Quintile* $1-4$ are indicators for family income quintiles in each year. *Post* is an indicator variable for year 2020 and 2021. Control variables include the age of the household head and the size of the household. The sample period is from 2019 to 2021. Observations are weighted by household weights included in the ACS data. Standard errors are clustered by the state in which the household is located.

Panel A: MSA stimulus payments and homeownership

	ACS 1-year	ACS 5-year
	(1)	(2)
Stimulus payments	0.005	0.004***
	(0.003)	(0.001)
Controls	Yes	Yes
R-squared	0.185	0.355
N	380	379

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Household income and homeownership

	(1)	(2)	(3)
Quintile 1×*post*	0.012***	0.019***	0.023***
	(0.002)	(0.002)	(0.002)
Quintile 2×*post*	0.010***	0.014***	0.016***
	(0.002)	(0.002)	(0.002)
Quintile 3×*post*	0.004**	0.008***	0.009***
	(0.002)	(0.002)	(0.002)
Quintile 4×*post*	0.001	0.002	0.003*
	(0.002)	(0.002)	(0.002)
Quintile dummies	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Controls*post	No	Yes	Yes
Year FE	Yes	Yes	No
County*year FE	No	No	Yes
R-squared	0.225	0.225	0.268
N	3512968	3512968	3512968

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Income and homeownership around stimulus payment income thresholds

The dependent variable is an indicator equal to 1 if the housing unit is owned, and 0 if rented. *Above* is an indicator if the family income is above the eligibility limit, and 0 otherwise. *Income* is the reported family income divided by the income limit for full payments. For households without married couples or children under 19, the limit is $75,000. For households with married couples, the limit is $150,000. The twelve-month income is converted to the calendar year income using the adjustment factor in IPUMS and the income in 2021 is further converted to 2019 dollars using the CPI variable in IPUMS. The column headers indicate the income bandwidth used in each estimation. Control variables include household head age group and family size group indicators. Standard errors are clustered by state.

Panel A: 2021				
	[0.9,1.1]	[0.875,1.125]	[0.85,1.15]	[0.825,1.175]
Income×*Above*	−0.124	−0.289***	−0.140**	−0.162***
	(0.101)	(0.079)	(0.059)	(0.040)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*
R-squared	0.179	0.178	0.175	0.176
N	91316	112388	134013	160898
Panel B: 2019				
	[0.9,1.1]	[0.875,1.125]	[0.85,1.15]	[0.825,1.175]
Income×*Above*	0.011	−0.037	−0.055	−0.007
	(0.142)	(0.089)	(0.069)	(0.058)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*
R-squared	0.178	0.177	0.174	0.172
N	91680	116579	136651	159067

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Stimulus payments, housing unit growth, and housing demand

The dependent variable is housing unit growth, house price growth, the sum of housing unit growth and house price growth, house price growth, housing unit growth, new home listing growth, and house price growth from 2019 to 2021, respectively. *Stimulus payments* is the total per-capita economic impact payments of 2020 and 2021 and the child tax credit payments of 2021. *Land unavail* is the (demeaned) percentage of land unavailable for housing construction from Lutz and Sand (2022). Control variables include changes in other transfer income, changes in non-transfer income, changes in unemployment rate, population growth from 2019 to 2021, and the log population in 2019.

	ΔUnit	ΔPrice	ΔDemand	ΔPrice	ΔUnit	ΔListing	ΔPrice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Stimulus payments	-0.005**	0.046**	0.044**	0.062***	-0.003	0.036*	0.051**
	(0.002)	(0.021)	(0.021)	(0.016)	(0.002)	(0.021)	(0.022)
Land unavailability				-0.004	-0.000		
				(0.003)	(0.000)		
Payments×Land unavailability				0.002**	0.000		
				(0.001)	(0.000)		
$\Delta Unit$		-0.398					
		(0.402)					
$\Delta Listing$							-0.065
							(0.044)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.684	0.550	0.635	0.600	0.705	0.083	0.551
N	382	382	382	376	376	382	382

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Stimulus payments and home purchase mortgages

In Panel A, the dependent variable is the growth of home purchase mortgages, changes in loan-to-value ratio, changes in loan-to-income ratio, changes in mortgage denial rate, and changes in mortgage rate spread, respectively. *Stimulus payments* is the total per-capita economic impact payments of 2020 and 2021 and the child tax credit payments of 2021. Control variables include changes in other transfer income, non-transfer income, unemployment rate, population growth from 2019 to 2021, and the log population in 2019. In Panel B, the dependent variable is the ratio of mortgage amount to borrower income. *Quintile* $1-4$ are indicators for borrower income quintiles in each year. The sample includes the universe of HMDA home-purchase mortgages in 2019 and 2021. *Post* is an indicator variable for year 2021. Control variables include borrower age group and the number of applicants. Standard errors are clustered by the state in which the property is located.

Panel A: Stimulus payments and mortgages at the MSA level

	Mortgage growth	ΔLTV	ΔLTI	ΔDenial rate	ΔRate spread
Stimulus payments	0.110***	0.058	-0.022	0.006***	-0.059***
	(0.032)	(0.146)	(0.024)	(0.001)	(0.014)
Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.094	0.170	0.029	0.094	0.164
N	382	382	382	382	382

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Borrower income and LTI

	(1)	(2)	(3)
Quintile 1×*post*	0.265***	0.251***	0.416***
	(0.028)	(0.027)	(0.028)
Quintile 2×*post*	0.272***	0.258***	0.354***
	(0.021)	(0.021)	(0.021)
Quintile 3×*post*	0.209***	0.198***	0.256***
	(0.012)	(0.011)	(0.020)
Quintile 4×*post*	0.112***	0.104***	0.128***
	(0.007)	(0.006)	(0.012)
Quintile dummies	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Controls*post	No	Yes	Yes
Year FE	Yes	Yes	No
County*year FE	No	No	Yes
R-squared	0.165	0.165	0.350
N	9501567	9501567	9501548

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Online Appendices

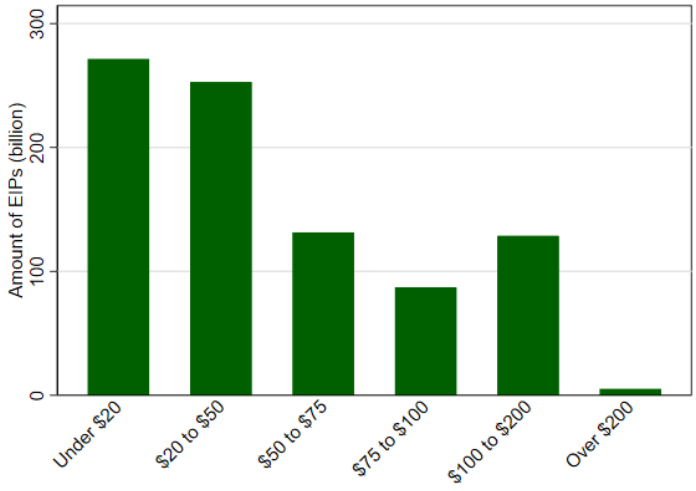


Figure A1: Amount of total EIPs and advance CTC payments by income group. This figure plots the total EIPs and advance CTC payments received by individuals with adjusted gross income below $20,000 (including those with zero or negative AGI and those who did not file a tax return in 2019 or 2020), between $20,000 and $50,000, $50,000 and $75,000, $75,000 and $100,000, $100,000 and $200,000, and over $200,000. Data source: IRS SOI Tax Stats - Coronavirus Aid, Relief, and Economic Security Act Statistics and Advance Child Tax Credit Payments in 2021.

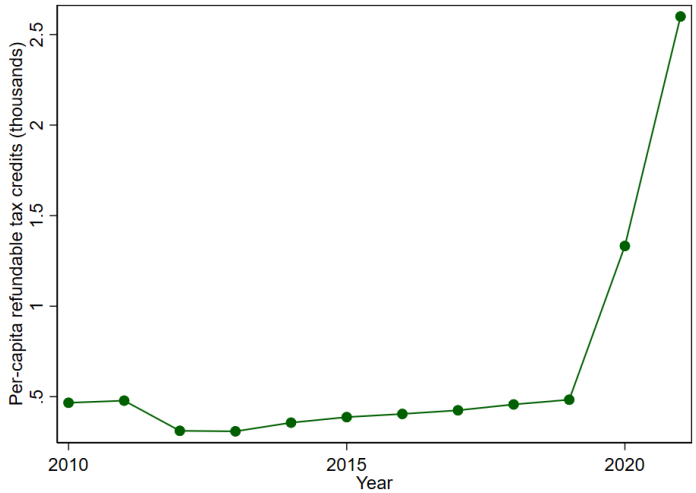


Figure A2: Per-capita refundable tax credits, 2010-2021. This figure plots the average per-capita refundable tax credits (in thousands) across MSAs in the sample from 2010 to 2021. Economic impact payments of 2020 and 2021 and the child tax credit payments of 2021 are included in this item in BEA's transfer income data by MSA.

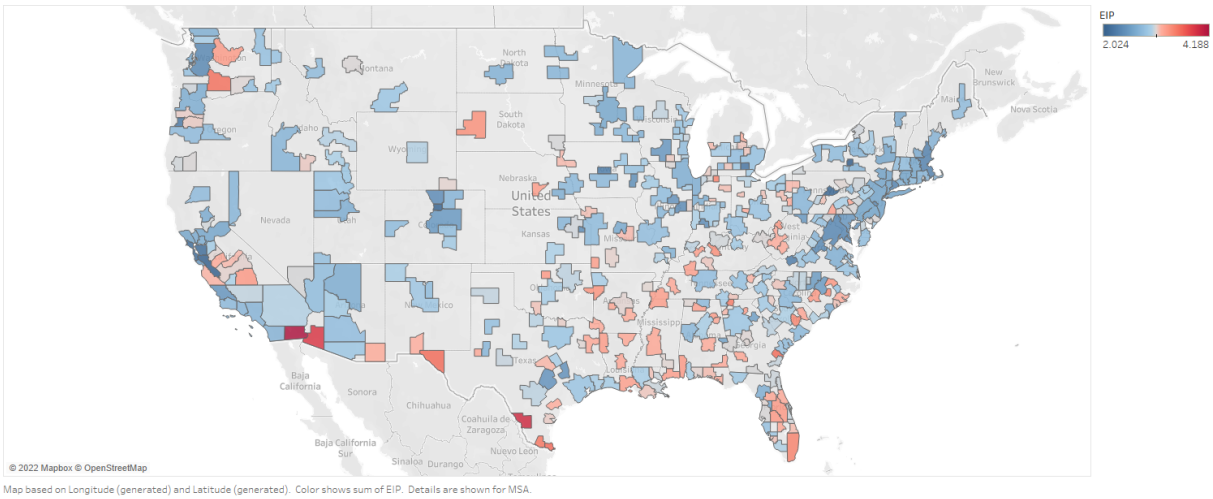


Figure A3: Per-capita stimulus payments 2020-2021. This heatmap shows the per-capita stimulus payments (in thousands dollars) across the 382 MSAs in the sample. Stimulus payments are inferred from BEA's transfer income data by MSA, as described in Section 3.1.

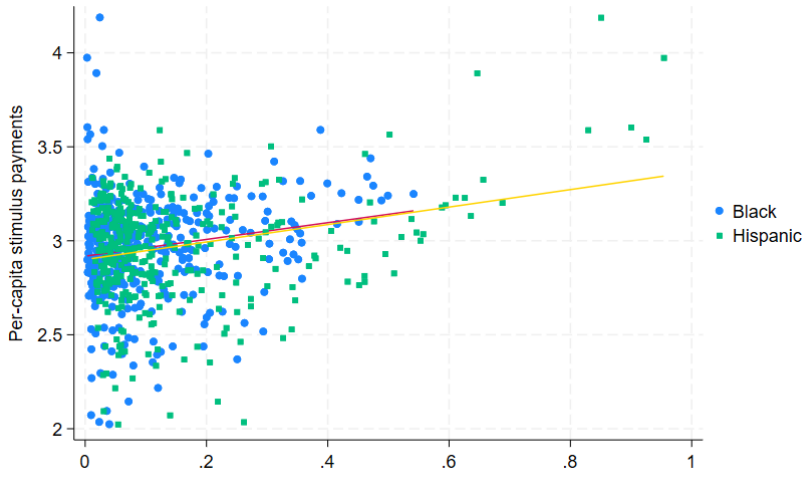


Figure A4: Stimulus payments and race and ethnicity. The figure plots the amount of per-capita stimulus payments in 2020-2021 against the fraction of MSA population that is Black and Hispanic, respectively.

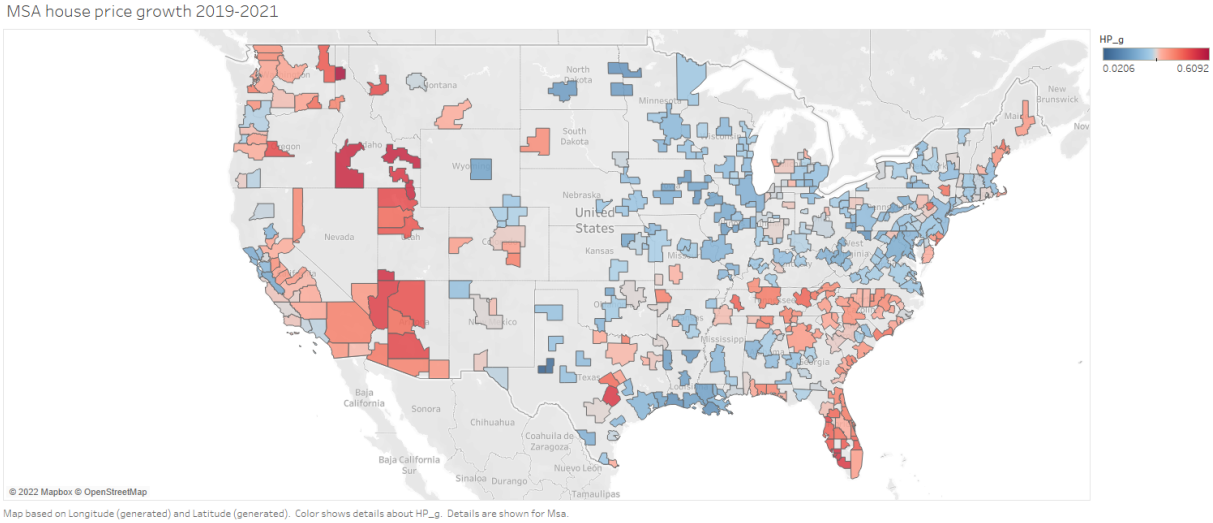


Figure A5: MSA house price growth 2019-2021. This heatmap shows the growth of house prices from 2019 to 2021 across the 382 MSAs in the sample. MSA-level house price data are from Freddie Mac.

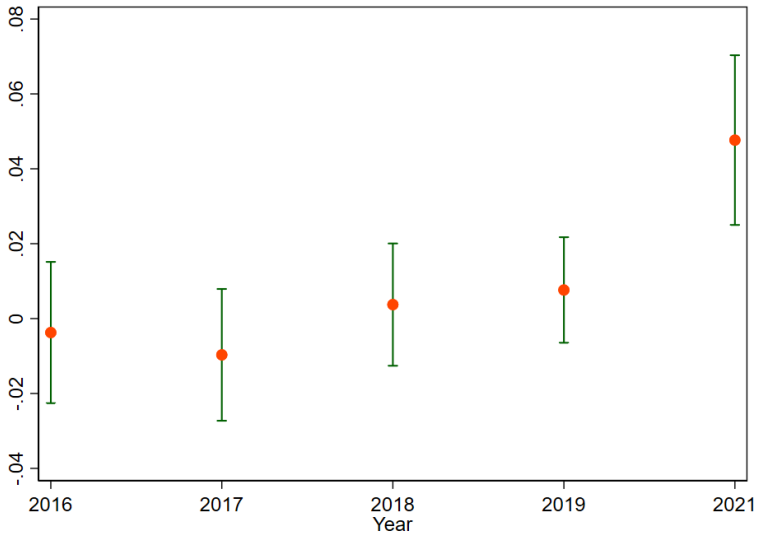


Figure A6: House price growth over a two-year period from 2016 to 2021 and stimulus payments of 2020 and 2021. House price growth during each of the five two-year periods from 2016 to 2021 (2014–2016, 2015–2017, 2016–2018, 2017–2019, 2019–2021) is regressed on the 2020–2021 stimulus payments and control variables in column (3) of Table 2. The figure plots the coefficients of *stimulus payments* and the 90% confidence intervals.

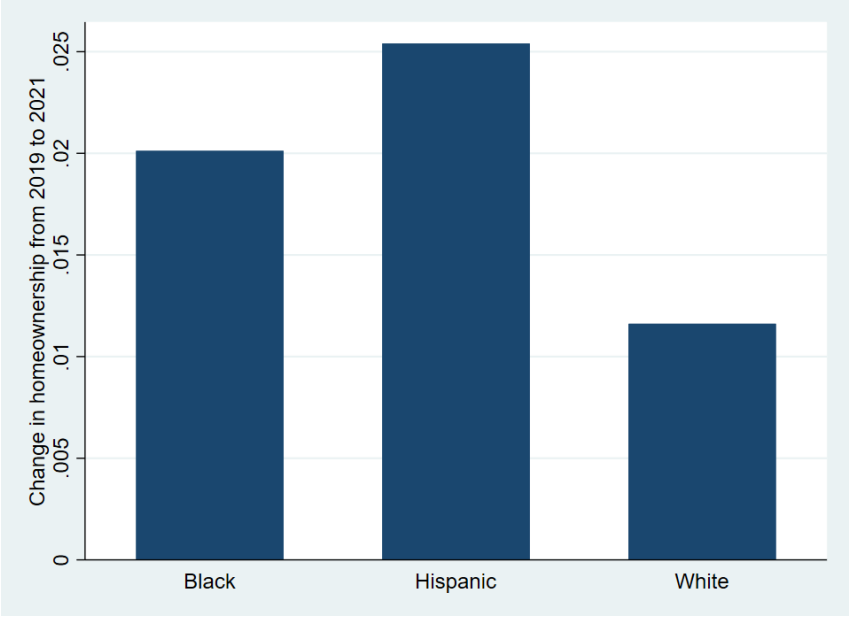


Figure A7: Changes in homeownership rate by race and ethnicity 2019-2021. Homeownership is measured as the fraction of occupied housing units that are owner-occupied. Housing units data by race and ethnicity are obtained from the one-year American Community Survey.

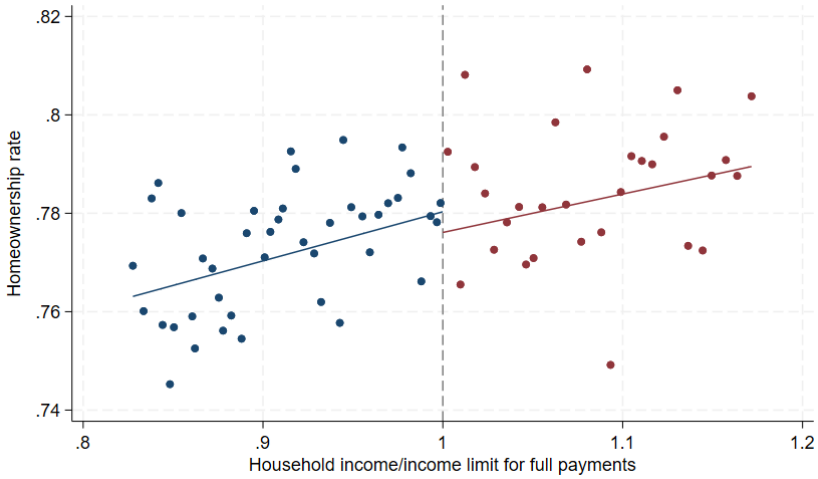


Figure A8: Household income and homeownership status in 2019. This figure presents a binned scatter plot of homeownership status and household income relative to the income limits for full stimulus payments. These income limits are $150,000 for families with a married couple and $75,000 for families without any couple or children under 19. Homeownership has been residualized from family size, age group, and married-couple indicators.

Table A1: Stimulus payments and race composition at the MSA level

The dependent variable is per-capita stimulus payments in 2020 and 2021. *Black ratio* and *Hispanic ratio* is the fraction of population in an MSA that are Black and Hispanic, respectively.

	(1)
$Black\ ratio_{2019}$	0.655^{***}
	(0.129)
$Hispanic\ ratio_{2019}$	0.572^{***}
	(0.087)
R-squared	0.130
N	382

$^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table A2: Stimulus payments and house price growth by MSA population

The dependent variable is the growth in house price from 2019 to 2021. *Stimulus payments* is the total per-capita economic impact payments of 2020 and 2021 and the child tax credit payments of 2021. Control variables include the total increase in per-capita transfers excluding stimulus payments and in per-capita non-transfer income from 2019 to 2020 and 2021, the growth rate of total population from 2019 to 2021, changes in unemployment rate from 2019 to 2021, and log population in 2019. Standard errors are clustered by state.

	Large MSAs	Small MSAs	Pop-weight
	(1)	(2)	(3)
Stimulus payments	0.045^{**}	0.058^{**}	0.089^{***}
	(0.018)	(0.026)	(0.030)
Controls	Yes	Yes	Yes
R-squared	0.601	0.524	0.637
N	191	191	382

$^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table A3: Economic impact payments and house price growth in 2020 and 2021

The dependent variable is the growth in house prices from 2019 to 2021. $EIPs$ is the total per-capita economic impact payments of 2020 and 2021. Other variables are defined in Table 1. Standard errors are clustered by state.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$EIPs$	0.060**	0.061**	0.063**	0.072***	0.065***	0.062***	0.059***	0.075***	0.061***
	(0.028)	(0.023)	(0.024)	(0.024)	(0.020)	(0.021)	(0.020)	(0.021)	(0.021)
$\Delta Other\ transfer$		0.012**	0.012**	0.009*	0.007	0.007*	0.007*	0.007*	0.004
		(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.007)
$\Delta Non\ transfer$		0.005***	0.005***	0.004***	0.004***	0.004***	0.004***	0.004***	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\Delta Unemp\ rate$		-0.005	-0.005	-0.006	-0.008	-0.008	-0.008	-0.007	-0.003
		(0.007)	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)	(0.006)	(0.007)
ΔPop		3.699***	3.702***	3.570***	2.582***	2.052***	2.040***	1.869***	1.667***
		(0.233)	(0.237)	(0.229)	(0.336)	(0.306)	(0.309)	(0.300)	(0.293)
$Ln(Pop_{2019})$		-0.000	-0.000	-0.000	0.006	0.005	0.005	0.004	0.001
		(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
IPC_{2019}			0.000	-0.000	-0.001	-0.000	-0.000	-0.000	0.000
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Median\ Hvalue_{2019}$				0.000***	0.000	0.000	0.000	0.000	-0.000
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Pop\ inflow$					1.013***	0.703***	0.709***	0.612***	0.324
					(0.263)	(0.228)	(0.229)	(0.221)	(0.201)
ΔHP_{17-19}						0.717***	0.717***	0.691***	0.380***
						(0.123)	(0.124)	(0.123)	(0.138)
$WFH\ exposure$							-0.032		
							(0.060)		
$Remote\ share_{2019}$								0.621***	0.757***
								(0.191)	(0.187)
State FE									
R-squared	0.030	0.554	0.554	0.562	0.592	0.679	0.679	0.690	0.813
N	382	382	382	382	382	382	382	382	377

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Fraction of income below $100,000 and house price growth

The dependent variable is the change in house prices over a two-year window, as labeled in the table header. $Under100\ ratio_{t-2}$ is the fraction of tax returns in an MSA with a reported AGI below $100,000, at the beginning of the two-year period. Control variables include total increase in per-capita transfers excluding refundable tax credits, increase in per-capita non-transfer income, changes in unemployment rate, population growth during the same two-year window, log population and per-capita income at the beginning of the two-year period.

	13-15	15-17	17-19	19-21
$Under100\ ratio_{t-2}$	0.032	0.131	0.069	0.821***
	(0.146)	(0.151)	(0.076)	(0.193)
Countrols	Yes	Yes	Yes	Yes
R-squared	0.591	0.538	0.358	0.582
N	382	382	382	382

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$