Household Liquidity and Macroeconomic Stabilization: Evidence from Mortgage Forbearance*

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September 2023

Abstract

We estimate the impact of household liquidity provision on macroeconomic stabilization using the 2020 CARES Act mortgage forbearance program. We leverage intermediation frictions in forbearance induced by mortgage servicers to identify the effect of reducing short-term payments with little change in long-term debt obligations on local labor market outcomes. Following statewide business reopenings, a one percentage point increase in the share of mortgages in forbearance leads to a 30 basis point increase in monthly employment growth in nontradable industries. In a model incorporating geographical heterogeneity in intermediation frictions, these responses imply a household-level marginal propensity to consume out of increased liquidity that aligns with existing estimates for direct fiscal transfers. The implied debt-financed fiscal multiplier effects of forbearance are sizable but depend on the repayment terms of deferred payments and the monetary policy stance.

*This paper was formerly titled "Macroeconomic Effects of Mortgage Forbearance: Evidence from the CARES Act." We would like to thank Michael Blank, John Campbell, Gabriel Chodorow-Reich, Marco Di Maggio, Daniel Green, Samuel Hanson, David Laibson, Peter Maxted, Andrei Shleifer, Jeremy Stein, Ludwig Straub, Adi Sunderam, Winnie van Dijk, James Vickery, Paul Willen, and various seminar participants for insightful discussion and comments. Lee acknowledges support from the John Meyer Dissertation Fellowship from Harvard Joint Center for Housing Studies. Maghzian acknowledges support from the National Science Foundation Graduate Research Fellowship and the Stone Program in Wealth Distribution, Inequality, and Social Policy. This research was conducted while Lee was a visiting fellow at the Federal Reserve Bank of Boston. The views expressed in this paper are solely the authors' and do not necessarily reflect those of the Federal Reserve Bank of Boston nor the Federal Reserve System.

1 Introduction

Limited household liquidity can depress aggregate demand during economic downturns. For instance, during the Great Recession, the wave of defaults following the housing crisis had destabilizing effects on both local and aggregate economic activity, which persisted for several years. Since then, policymakers and academics have actively discussed how to best prevent defaults and stimulate consumption among distressed borrowers as a means to promote macroeconomic stability. While the discussion has primarily revolved around understanding the stabilizing properties of various state-dependent mortgage modifications (e.g., Eberly and Krishnamurthy, 2014; Seru and Piskorski, 2018; Campbell et al., 2021), a common underlying theme emphasizes the importance of ensuring household liquidity during times of crises.

In recognition of households' countercyclical liquidity needs, the U.S. federal government enacted a large-scale discretionary debt relief in response to the COVID-19 crisis. As part of the Coronavirus Aid, Relief, and Economic Security (CARES) Act, all federally backed mortgage borrowers with pandemic-related financial hardships became eligible to request forbearance without the need for documentary evidence. Borrowers were permitted to temporarily halt their payments without facing any fees or penalties and could remain in forbearance for a period of up to 18 months. The scale of liquidity provided through forbearance was substantial. As depicted in Figure 1, approximately 5 percent of all conforming mortgages were in forbearance by June 2020, resulting in suspended monthly payments of $900 on average. Upon exiting forbearance, borrowers were typically given the option to defer repayment of their missed payments until the end of their mortgage term as a second-lien loan. Hence, the primary role of the CARES Act forbearance was to reduce short-term payments while preserving long-term debt obligations, making it an ideal setting to analyze the effects of enhancing household liquidity on economic stabilization.[1]

In this paper, we estimate the stabilizing effects of mortgage forbearance implemented under the CARES Act during the pandemic recession. Our empirical analysis examines the labor market recovery of U.S. regions that varied in the amount of liquidity provided through mortgage forbearance. Our findings suggest that mortgage forbearance played a significant role in boosting local demand during the economic recovery. To provide a micro-foundation for this macro-stabilization

[1] See Ganong and Noel (2020) for an insightful discussion on the importance of distinguishing between liquidity effects and wealth effects.

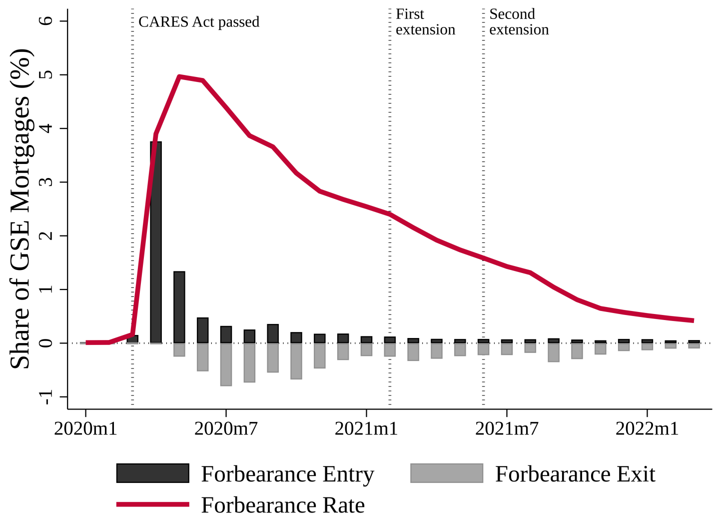


Figure 1: **Mortgage Forbearance Rates in the GSE Mortgage Market.** This figure shows the share of GSE mortgages in forbearance (red curve) along with the entry and exit rates (black and gray bars) at each month. We use vertical dotted lines to mark the date the CARES Act passed and the two subsequent dates when the mortgage forbearance program was extended. Data sources: Fannie Mae and Freddie Mac.

effect, we then develop a stylized heterogeneous-area New Keynesian model that relates local labor market outcomes to household-level consumption responses. Interpreted through the lens of this model, our empirical estimates imply an annual household-level marginal propensity to spend (MPX) of 67 cents and a marginal propensity to consume (MPC) of 43 cents per dollar of liquidity provided through forbearance. The implied cross-sectional multiplier of mortgage forbearance suggests that household liquidity provision through debt forbearance can be a cost-effective fiscal stabilization tool during economic downturns.

Two distinct features of the mortgage forbearance program enable us to identify the impact of liquidity provision on regional employment outcomes. First, despite the broad eligibility criteria, enrollment in mortgage forbearance was not automatic; households in need had to request forbearance. As a result, U.S. regions varied considerably in the uptake of forbearance. However, the voluntary nature of program enrollment introduces a potential issue of reverse causality, as the local forbearance rate is endogenous to the region's economic exposure to the recession.

The second feature of the forbearance program helps us address this endogeneity concern. In contrast to other forms of fiscal policy, the implementation of the program was carried out by mortgage servicers, financial intermediaries in the mortgage market responsible for collecting monthly payments and facilitating transactions with mortgage-backed securities (MBS) investors. We uncover the striking fact that different mortgage servicers exhibit significant variation in their propensity to provide forbearance that cannot be explained by observable loan and borrower characteristics. Using loan-level data for Government-Sponsored Enterprise (GSE) mortgages, we document that servicers can differ by as much as 7 percentage points in forbearance provision to observably similar borrowers. Reassigning a borrower from a servicer at the 25th percentile to one at the 75th percentile of the weighted propensity distribution results in an increase in the probability of take-up that is equivalent to 24 percent of the mean forbearance rate.

Our empirical strategy exploits these intermediation frictions in the *supply* of forbearance to identify the impact of liquidity provision on regional employment outcomes. Specifically, we employ the regional average of the estimated servicer propensity, weighted by local servicer market shares, as an instrument for the regional forbearance outcome. Consistent with our loan-level analysis, we demonstrate that this shift-share measure has substantial explanatory power for the forbearance rates of regions defined by three-digit Zip codes. This instrument is valid under the assumption of conditional exogeneity of servicers' forbearance propensities. That is, conditional on our baseline controls, regions with high and low take-up frictions as indicated by our instrument do not differ in other ways that could affect their economic recovery (Borusyak et al., 2022).[2] We provide supporting evidence for this identifying assumption based on the absence of differential pre-trends in employment outcomes. Additionally, to ensure that the regional variation in servicer propensity is not driven by local economic conditions, we estimate the servicer propensity separately for each state, using only loans outside of that state.

Our empirical specification incorporates a set of baseline controls to account for the varying exposure of each region to the pandemic recession. In addition to average loan characteristics and demographic and socioeconomic factors that reflect regional differences in demand for debt relief, we control for employment growth predicted by local industry shares to account for differences

[2]Two institutional details support the plausibility of this condition. First, despite the program's broad eligibility, servicers exercised some discretion in determining what constituted an application to the program. Instances of public complaints reported to the Consumer Financial Protection Bureau (CFPB) indicate that certain companies wrongfully demanded documentation or were difficult to reach, while others granted forbearance simply upon receiving inquiries about the program. Second, the mortgage servicing market displays significant concentration, with the top 20 firms servicing 66 percent of all conforming mortgages as of February 2020. This wide coverage by large servicers implies that the program implementation may not be tailored to the specific distress levels of individual regions.

in sectoral compositions. Moreover, we include a measure of local labor market slack induced by the initial economic shock to account for any potential path dependence in the labor market recovery. Lastly, we incorporate state fixed effects to account for any state-level differences in policy responses, such as unemployment insurance benefits or lockdown policies.

Even though our instrument helps mitigate the endogeneity issue between forbearance outcomes and regional economic exposure to the crisis, estimating the impact of household liquidity provision at the regional level is complicated by the initial negative supply shocks caused by stay-at-home orders and business closures during the economic lockdowns at the onset of the COVID-19 pandemic. The demand-based stabilization resulting from liquidity provision may have been suppressed, as households may have diverted their spending away from the local economy during these lockdowns. To address this concern, we estimate the employment effects starting from the date when each state relaxed its initial lockdown policy. Since we include state fixed effects in our regressions, our identification strategy relies on cross-sectional differences across areas within each state that all reopened about the same time.

Using our servicer-based instrument, we estimate that a one percentage point increase in the forbearance rate leads to an approximately 30 basis point increase in monthly employment growth in nontradable sectors during the 18 months following statewide business reopenings. The interquartile range in our instrument corresponds to a regional difference in nontradable employment growth equivalent to 7 percent of the mean growth rate (or 16 percent of the standard deviation) during our sample period. In contrast, we find no significant effect for employment in tradable industries and a positive but smaller effect for total employment, as predicted by the theory (Mian and Sufi, 2014). Overall, our main empirical results suggest that (1) frictions in the implementation of mortgage forbearance by financial intermediaries produced economic spillovers, and that (2) effective liquidity provision through forbearance helped stabilize local employment during the recession.

We conduct several tests to evaluate the validity of our empirical design. First, since our instrument relies on the geographic distribution of financial intermediaries, one potential threat is that it may capture the general functioning of local financial institutions involved in intermediating various forms of economic stimulus, not just mortgage forbearance. To address this concern, we show that our instrument does not predict other relief measures intermediated through financial institutions such as the Paycheck Protection Program (PPP), mortgage refinancing, and personal bankruptcy filings. Second, our baseline results are robust to several confounding factors including the COVID-19–infection rate, death rate, population density, and other measures of fiscal stimulus. Lastly, we construct alternative estimates of servicer propensity that condition on mortgages that became past due during the pandemic. We find that this alternative propensity estimate exhibits a strong positive correlation with our main estimate, and our baseline regression results remain robust when using this alternative servicer effect as an instrument.

We next turn to our theoretical analysis to compare our regional estimates with existing evidence on household-level consumption responses. Building on Chodorow-Reich et al. (2021), we develop a regional macroeconomic model that incorporates a housing sector and accounts for geographical heterogeneity in intermediation frictions. We derive a separation result that decomposes the regional estimate on nontradable wage bill into the product of four terms: the local Keynesian multiplier, the labor share of income in nontradable sectors, the expenditure share of nontradable goods, and the household-level MPC for homeowners with mortgage debt. Under a standard calibration of parameters, we find that the implied annual MPX out of a dollar of liquidity provided is 0.67, which is equivalent to the annual MPC of about 0.43 (Laibson et al., 2022). Our estimates are broadly consistent with the range of existing estimates for household-level spending responses (e.g., Parker et al., 2013; Kueng, 2018; Baker et al., 2023).[3]

Finally, we provide a mapping of our estimates into a cross-sectional debt-financed fiscal multiplier to facilitate comparison with existing multiplier estimates for other government policies. Under our preferred assumptions regarding the repayment behavior of deferred mortgage payments and the prevailing interest rate, our results indicate a cross-sectional forbearance multiplier of 2.25. The large returns to forbearance-based fiscal stimulus stem from its cost-effectiveness as a means of temporary liquidity provision, which obligates borrowers to ultimately repay the deferred payments in the future. As a result, the direct outlay needed to implement the policy is small compared with the benefit. This feature stands in stark contrast to other forms of fiscal stimulus that often rely on direct fiscal transfers. Overall, our findings suggest that mortgage forbearance is an effective stabilization tool, particularly when coupled with accommodative monetary policy

[3]The empirical literature typically reports quarterly MPXs in the range of 0.5 to 0.9 and nondurable MPXs in the range of 0.2 to 0.3 (Havranek and Sokolova, 2020). Our implied estimates may be somewhat larger than these quarterly estimates since they represent households' annual spending responses.

that enables low-cost deficit financing.

After reviewing the literature and our contribution below, the paper is structured as follows. Section 2 provides background on the CARES Act mortgage forbearance. Section 3 describes our data sources, and Section 4 details our procedure for estimating the servicer forbearance propensities and constructing the shift-share instrument. Section 5 discusses our research design and presents the empirical results. Section 6 describes our model, followed by a discussion of the implied household-level consumption responses and the debt-financed fiscal multiplier effect in Section 7. Section 8 concludes.

Related literature. An expansive literature examines the economic effects of the COVID-19 crisis and the policy responses implemented during the pandemic (e.g., Chetty et al., 2020; Coibion et al., 2020; Guerrieri et al., 2022; Granja et al., 2022; Pence, 2022). Within this literature, our work is closely related to those focused on forbearance programs. Cherry et al. (2021) provide a comprehensive overview of the CARES Act forbearance across various categories of household debt that include mortgages, student loans, and auto loans. Zhao et al. (2020) analyze income and liquid asset trends for homeowners in relation to their employment and mortgage forbearance statuses, while An et al. (2022) show that mortgage forbearance has contributed to reducing inequality. In comparison to the existing work, we are the first in the literature to analyze the stabilizing effects of mortgage forbearance on regional economic outcomes.

Our analysis emphasizes the role of financial intermediaries in the mortgage market (e.g., Cordell et al., 2008; Agarwal et al., 2011; Kim et al., 2018; Kruger, 2018; Jiang et al., 2020; Kermani and Wong, 2021; Fuster et al., 2021; Aiello, 2022). Agarwal et al. (2017) examine the effect of intermediary-specific factors in the implementation of the Home Affordable Modification Program (HAMP) in the aftermath of the Great Recession. Agarwal et al. (2011) and Kruger (2018) document that intermediaries were more inclined to modify their portfolio loans compared with those for which they provide only external servicing. During the COVID-19 crisis, Cherry et al. (2021) document that shadow banks offered forbearance at lower rates compared with traditional depository institutions. While this study focuses on the difference between banks and shadow banks, we document more generally that there is vast heterogeneity in forbearance outcomes across different mortgage servicers even among these two broad categories of financial intermediaries.

Our paper is most closely related to a contemporary work by Kim et al. (2022), who also examine the role of mortgage servicers in forbearance outcomes and find that servicers widely vary in the propensity to enter mortgages into forbearance for observably similar borrowers.[4] While Kim et al. (2022) focus on the microeconomic implications of mortgage forbearance by examining its effect on individual-level outcomes in credit bureau data, such as credit card balances and auto loans, we instead focus on understanding its macro-stabilizing effects by analyzing regional economic outcomes. Our results are consistent with their findings that liquidity from deferred payments served to support both nondurable consumption and precautionary savings.

The positive impact of mortgage forbearance reflects the importance of household balance sheets in the transmission of economic shocks (e.g., Mian and Sufi, 2014; Hurst et al., 2016; Di Maggio et al., 2017; Beraja et al., 2019; Berger et al., 2021) and stabilization policies (e.g., Agarwal et al., 2017; Ganong and Noel, 2019; Auclert et al., 2019; Defusco and Mondragon, 2020). Ganong and Noel (2020) compare principal reductions and maturity extensions in a mortgage modification program and find that borrowers' liquidity needs drive defaults and consumption decisions. Consistent with their results, we find that injecting liquidity into household balance sheets through mortgage forbearance dramatically reduced mortgage defaults and enhanced local demand during the recovery from the pandemic recession. We also contribute to the literature on cross-sectional fiscal multipliers (e.g., Chodorow-Reich, 2019; Nakamura and Steinsson, 2014; Auclert and Mitman, 2018) and provide the first estimate for mortgage forbearance.

Lastly, we connect to the literature on optimal mortgage design (e.g., Eberly and Krishnamurthy, 2014; Piskorski and Tchistyi, 2010; Seru and Piskorski, 2018; Guren et al., 2021). In particular, our work is closely related to Campbell et al. (2021), who examine mortgage design features that enable borrowers to make interest-only payments and extend the maturity of their mortgages during recessions to promote macroeconomic stability. Given the notable similarities between mortgage forbearance under the CARES Act and the state-dependent modification features proposed in that study, our work provides empirical evidence supporting the stabilizing effects of mortgage payment suspension during economic downturns.

[4]While Kim et al. (2022) focus on GNMA mortgages guaranteed by various government agencies, we focus on mortgages securitized by the GSEs. Despite the difference in our specific focus, our findings are similar and complementary to each other.

2 Mortgage Forbearance under the CARES Act

The Coronavirus Aid, Relief, and Economic Security (CARES) Act, enacted into law on March 27, 2020, included a broad mandate allowing households to request forbearance on all federally backed mortgage loans. Mortgages eligible for forbearance include those purchased or securitized by the government-sponsored enterprises (GSEs) (Fannie Mae and Freddie Mac) as well as those guaranteed by Ginnie Mae (GNMA), which are insured by various government agencies including the Federal Housing Administration (FHA) and the U.S. Department of Veterans Affairs (VA).[5] Forbearance under the CARES Act is granted upon the borrower's attestation to financial hardship caused by the pandemic and does not require documentation or formal proof.[6] This practice lies in sharp contrast to standard mortgage modification or disaster relief programs, which generally require extensive proof of hardship or income documentation.

Mortgage borrowers in forbearance are given an option to postpone monthly payments for a fixed duration without incurring additional fees or penalties.[7] To insulate borrowers' credit scores, the CARES Act also requires that intermediaries must not report any missed payments of loans in forbearance to credit reporting agencies. Despite the wide eligibility and generous terms, forbearance enrollment is not automatic: Borrowers must request both the initial forbearance and any extensions from their mortgage servicer.

The original CARES Act specified a six-month forbearance that could be extended up to 12 months, but regulators later allowed for an additional six-month extension.[8] At its inception, there was a lack of clarity on how payments would be structured upon forbearance exit, but the FHA released statements in April 2020 clarifying that deferred payments would not be due in lump sum at the end of the forbearance period. In particular, when mortgage borrowers exit forbearance, they

[5]The private sector also extended forbearance to borrowers of non-agency mortgages that were not eligible for the CARES Act (Cherry et al., 2021).

[6]In particular, Section 4022 of the CARES Act states, "During the covered period, a borrower with a federally backed mortgage loan experiencing a financial hardship due, directly or indirectly, to the COVID-19 emergency may request forbearance on the federally backed mortgage loan, regardless of delinquency status, by (A) submitting a request to the borrower's servicer and (B) affirming that the borrower is experiencing a financial hardship during the COVID-19 emergency."

[7]One notable downside is that borrowers are unable to refinance their mortgage while in forbearance. Once they exit forbearance, they are required to make payments for three months to regain eligibility to refinance.

[8]For GSE loans, borrowers can request up to six months of additional forbearance if their initial forbearance began on February 28, 2021, or earlier. For FHA/VA loans, borrowers can request up to six months of additional forbearance if their initial forbearance began on June 30, 2020, or earlier.

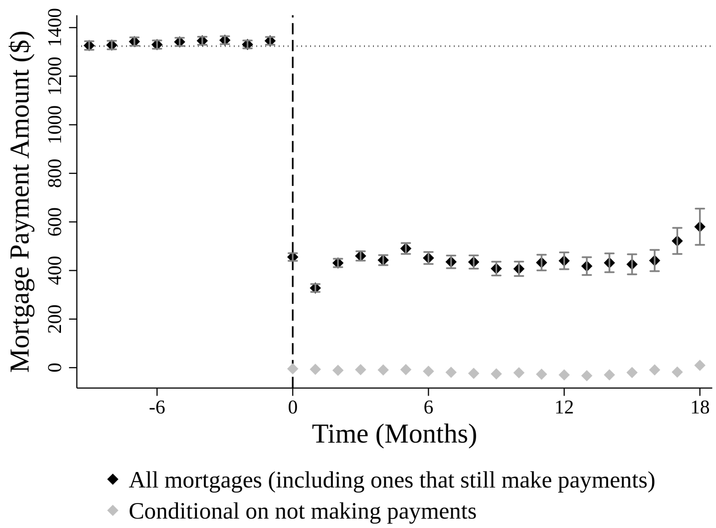


Figure 2: **Evolution of Mortgage Payments in Forbearance.** This figure shows the trend in monthly payments before and after entering forbearance. The estimates are conditional on a sample of GSE mortgage borrowers who were not delinquent before entering forbearance and who remain forborne as of each month after entering forbearance. Data sources: Fannie Mae and Freddie Mac.

are typically granted the option to defer repayment of their missed payments to the end of their mortgage term as a second-lien loan that does not accrue interest, which effectively constitutes a free loan for the missed payments.[9]

2.1 Forbearance Rates and Trends

At the national level, forbearance take-up closely tracked the economic fallout precipitated by the COVID-19 pandemic. Figure 1 shows the monthly fraction of GSE loans in forbearance, which sharply increased after March 2020 following the passage of the CARES Act. The forbearance rate peaked at about 5 percent in May 2020 and gradually declined to 2 percent by June 2021. Following the initial spike, new loans continued to enter forbearance at a steady rate from June 2020 until the end of the program. Forbearance exits were highest in the three to six months following the CARES Act passage and continued at a rate higher than program entry thereafter. The same qualitative pattern holds among GNMA mortgages, albeit with a quantitatively larger magnitude (see Appendix Figure B1).

[9]Due to this feature, the CARES Act mortgage forbearance does involve a small wealth transfer in case borrowers choose this exit option. Nevertheless, the magnitude of this wealth effect is likely negligible.

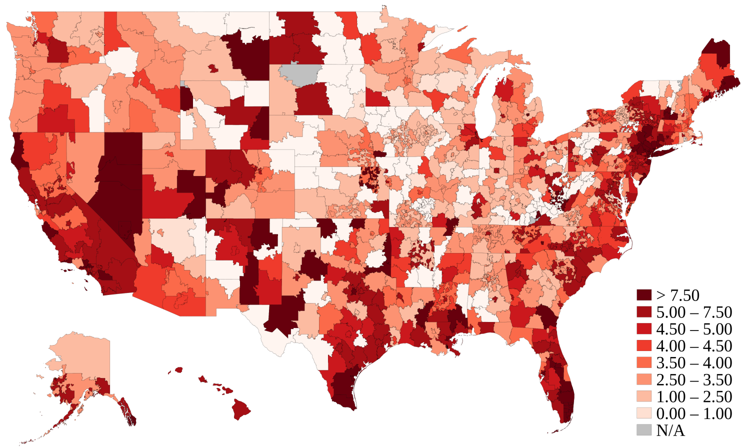


Figure 3: **Distribution of Forbearance Rates across Zip3 Areas.** This figure shows the geographic distribution of forbearance rates across Zip3 areas as of June 2020. The legend shows the color coding of forbearance rates in percentages. Data sources: Fannie Mae and Freddie Mac.

Entering forbearance had a substantial impact on the monthly payments made by mortgage borrowers. Figure 2 shows the trend in monthly payments for forborne borrowers with a GSE-securitized mortgage. Before borrowers enter forbearance, the average monthly payment amount is $1,324. Upon their entering, the monthly payment subsequently falls to $444, resulting in suspended monthly payments of $880 on average. The fact that the average payment is still positive reflects an intriguing pattern that approximately one third of the borrowers continued to make payments while in forbearance. Conditional on remaining in forbearance, the average deferred payment does not vary with the duration of forbearance.

When borrowers exit forbearance, they are typically granted generous repayment options rather than having to pay back their missed payments in lump sum. Appendix Figure A1 shows the composition of forbearance exits among GSE mortgages. Approximately 25 percent of borrowers who exited forbearance did not have any missed payments during the forbearance period, which aligns with the payment pattern of forborne borrowers described above. Among the 67 percent of borrowers who had some missed payments, payment deferral (42 percent)—which let borrowers defer repayment of the missed amounts to the end of their mortgage maturity—was the largest category, followed by loan modifications (10 percent) which altered the terms of the original mortgage to facilitate smooth repayment. Interestingly, 7 percent of exiting borrowers repaid the missed amounts in lump sum even though they were most likely not required to, and 8 percent exited forbearance by selling their house and fully paying back their mortgage.

Lastly, Figure 3 shows the geographic distribution of forbearance rates across three-digit Zip code (Zip3) areas as of June 2020. While approximately 5 percent of GSE mortgages were in forbearance at the national level, the aggregate rate masks significant heterogeneity across regions whose forbearance rates range from near 0 percent to more than 10 percent. Moreover, forbearance outcomes widely vary across areas within each state.[10]

2.2 Intermediation Frictions in Mortgage Forbearance

Despite the broad eligibility and the minimal requirements for the program, not all borrowers took advantage of the program. One indication of frictions in take-up is the fraction of borrowers with mortgages past due who did not enter forbearance. This is because the non-take-up of forbearance while being delinquent is a clear financial mistake for borrowers, as there is no penalty or cost associated with the CARES Act forbearance. Figure A2 shows the share of GSE mortgages past due and the fraction of these delinquent loans that are not in forbearance. About 30 to 40 percent of delinquent borrowers failed to take up forbearance.[11] Panel (b) of Appendix Figure B1 shows the equivalent statistics for GNMA mortgages that exhibit a similar non-take-up rate.

What explains this lack of participation among delinquent borrowers, despite the clear benefits and limited documentation needed for forbearance? One possible reason is that differences in the implementation of the program by servicers prevented some borrowers from taking advantage of the program. Differences in the organizational practices of mortgage servicers resulted in variations in the accommodation of forbearance requests and their communication with households.[12] This delegation of program implementation to mortgage servicers stands in contrast to other forms of debt relief under the CARES Act. For instance, individuals with public student loans were automatically placed in forbearance.

Consumer complaints submitted to the Consumer Financial Protection Bureau (CFPB) corroborate the supposition that there were large differences in the organizational practices of mortgage

[10] Since we control for state fixed effects in our regressions to account for state-level differences in policy responses, we rely on these within-state variations in forbearance outcomes for identification.

[11] Among mortgages that are past due for 60 days or more, about 20 to 30 percent did not take up forbearance.

[12] As discussed by Kim et al. (2022), cash flow risk, regulatory oversight, and organizational structure can affect the incentives of servicers to engage in accommodating forbearance practices. These incentives come into play due to the ambiguity in the CARES Act about the specific practices that intermediaries should take in setting up the forbearance program.

servicers in implementing the forbearance program. Appendix Table A1 categorizes the CFPB complaints and provides an example for each category. Some servicers wrongfully requested documentation of financial hardship or, in some cases, outright denied requests to enroll in or extend mortgage forbearance. In other cases, servicers placed mortgage borrowers in forbearance if they had merely called to obtain more information about the federal program or even automatically entered distressed mortgage borrowers into forbearance without their consent.[13] There is also some indication that servicers miscommunicated how they would treat forbearance exits, which may have impacted households' desire to enter the program, especially at the onset of the crisis.[14] Motivated by the evidence discussed above, in Section 4, we quantify the servicer-induced frictions in take-up by formally estimating different mortgage servicers' propensities to provide forbearance to an observably similar borrower.

3 Data

Our primary analysis is based on loan-level data on mortgage characteristics and performance, combined with region-level data on employment statistics and demographic information. We describe the data used for our analysis below.

GSE Single-Family Loan Performance Data. We focus our analysis on conforming loans that are purchased or securitized by Fannie Mae and Freddie Mac, which constitute approximately 70 percent of the U.S. agency mortgage market (Inside Mortgage Finance, 2023).[15] We measure forbearance from the loan-level data on GSE single-family mortgages. This is a monthly panel dataset that provides a rich set of information on loan characteristics (for example, interest rates, principal balance, payment history), borrower characteristics at origination (for example, credit score, debt-to-income ratio), and property characteristics (for example, property type and location).

[13]This practice was alleged in a class action lawsuit against Wells Fargo, which admitted that the company had automatically placed certain types of loans in forbearance (for example, those in active Chapter 13 bankruptcy repayment plans).

[14]In response to the widespread miscommunication of information by mortgage servicers, regulatory agencies launched campaigns targeting households to inform them about debt relief programs (CFPB, 2021).

[15]While the loan-level data for GNMA mortgages are available for public use, they contain only state-level information about the location of the mortgaged property and thus are not suitable for our local labor market analysis. Although we exclude GNMA mortgages from our main analysis, Appendix B describes the key features of the GNMA microdata and discusses forbearance rates and trends in the GNMA mortgage market.

We identify the date when loans entered forbearance based on a flag that indicates the type of assistance plan in which the borrower is enrolled at a given month. We define regions at the level of the three-digit Zip code, which is the most detailed location information available in the GSE data. We restrict our sample to fixed-rate mortgages that are active at any point after January 2020.

We define the lender as the financial institution that initially sold the mortgage to one of the GSEs and the servicer as the institution with servicing rights for that loan.[16] In Section 4, we use this information to estimate the average forbearance propensity of each mortgage servicer (conditional on loan and borrower characteristics) and subsequently construct a shift-share instrument for regional forbearance outcomes by combining the estimated forbearance propensities with the servicers' local market shares computed at the Zip3 level.

Quarterly Census of Employment and Wages. We use monthly employment from the Bureau of Labor Statistics (BLS) Quarterly Census of Wages and Employment (QCEW) to construct our main regional outcome measures.[17] The QCEW is derived from quarterly reports filed by employers whose workers are covered by unemployment insurance laws, which constitute approximately 95 percent of the total private employment in the United States. We start with county-level sectoral employment at the two-digit NAICS industry classification and seasonally adjust the data by taking the change in employment relative to the corresponding month in 2019.[18] We then cross-walk the county-level employment to the Zip3-level using the 2019 population shares.

Following Mian and Sufi (2014), we define nontradable industries as consisting of retail trade (NAICS codes 44 and 45) and accommodation and food services (72), and tradable industries as consisting of manufacturing (31 through 33), agriculture, forestry, fishing, and hunting (11), and mining, quarry, and oil and gas extraction (21).[19] In our main analysis, we use employment in nontradable industries as a proxy for local demand.

[16]The GSE data disclose only the identity of the financial institutions that have at least 1 percent of market share within a given acquisition or reporting quarter. We omit small-share servicers in our loan-level analysis but retain them when calculating the local mortgage market shares.

[17]We primarily focus on employment instead of wages, as the QCEW data only contain quarterly wages.

[18]In our robustness check, we also seasonally adjust the data using a linear model with monthly indicator variables, along with an interaction between the monthly indicators and the period following March 2020. Standard seasonal-adjustment algorithms that rely on moving-average adjustments (for example, Census Bureau X-11) artificially propagate the COVID-19 employment shock to preceding years.

[19]Following Chodorow-Reich et al. (2021), we use a two-digit classification of tradable and nontradable industries to avoid the increased suppression of employment counts at industry-county cells in finer classifications.

American Community Survey. We use the U.S. Census Bureau's American Community Survey (ACS) 2015–2019 estimates archived by the National Historic Geographic Information System (NHGIS) to obtain our measures of regional controls (Manson et al., 2021). In particular, we use the average demographic characteristics (for example, age, race) and socioeconomic characteristics (for example, income, unemployment rate, homeownership rate) at the Zip3 level. To account for differential mortgage ownership across regions, we also compute the fraction with mortgages in each Zip3 area and include it as a baseline control (Di Maggio et al., 2017).

Economic Tracker. The Opportunity Insights Economic Tracker uses anonymized data from private companies to provide economic indicators at both national and regional levels since the beginning of the pandemic (Chetty et al., 2020). The data include real-time information on employment rates, business activities, and mobility. We use the number of COVID-19 cases and mortality provided by the Tracker, which are collected by the New York Times from local public agencies. We also use state-level policy milestones available through the Economic Tracker that provide information on the duration of stay-at-home orders as well as nonessential business closure and reopening dates.

4 Heterogeneity in Forbearance Propensities across Servicers

In this section, we first document that there is substantial heterogeneity in forbearance propensity across different mortgage servicers. We then use this heterogeneity to motivate our instrument for the local forbearance outcome. Our approach makes use of the fact that financial intermediaries provide a source of idiosyncratic variation in the supply or availability of forbearance, conditional on demand-based determinants of the program.[20]

4.1 Loan-level Analysis of Forbearance Outcome

We examine the extent to which a borrower's mortgage servicer predicts forbearance utilization. We consider a linear probability model that relates a mortgage borrower's forbearance outcome to

[20] We draw from related work using intermediary-level variation to study regional and aggregate outcomes (e.g., Greenstone et al., 2020; Amiti and Weinstein, 2018).

borrower characteristics, local economic conditions, and the servicer identity:[21]

$$\mathbb{1}\{\mathrm{F}_{it}\} = \beta X_{it} + \alpha_{z(i)t} + \alpha_{s(i)} + \epsilon_{it}, \tag{1}$$

where $\mathbb{1}\{\mathrm{F}_{it}\}$ is an indicator variable equal to 1 if a loan i is in forbearance during month t, $z(i)$ is the three-digit Zip code of the property, and $s(i)$ is the servicer of the loan. The object of our interest is the servicer's contribution to forbearance take-up, $\alpha_{s(i)}$. To account for differences in the composition of borrowers serviced and their underlying need for mortgage relief, we control for a vector of loan characteristics X_{it} that reflects borrower demand and the Zip3-by-month fixed effects $\alpha_{z(i)t}$ that capture local economic conditions. Loan characteristics include current interest rates, remaining principal balance, credit score at origination, loan-to-value ratio at origination, debt-to-income ratio at origination, and an indicator variable for first-time homeowner. We estimate Equation (1) during the 12-month period following the passage of the CARES Act.

Figure A3 presents the estimated servicer fixed effects for the 58 mortgage servicers that have greater than 1 percent market share in our sample. Panel (a) plots the distribution of the servicer fixed effects, whereas panel (b) depicts the fixed effects for the top and the bottom mortgage servicers. The range of estimated servicer propensities is approximately 7 percent. Given the mean forbearance rate of 3.36 percent in our estimation sample, this difference is sizable and economically meaningful. Moving a borrower from the 25th percentile to the 75th percentile of the weighted servicer propensity distribution leads to an increase in the probability of take-up that is equivalent to 24 percent of the mean forbearance rate.

The servicers' heterogeneity in forbearance propensity is robust to alternative specifications. In particular, following Kim et al. (2022), we restrict our estimation sample to the set of borrowers that were current prior to the onset of the pandemic but missed at least one payment during our sample period, and we estimate a cross-sectional model in which the dependent variable is an indicator for whether a mortgage *ever* entered forbearance during our sample period. We find that this alternative approach also produces a wide dispersion in the estimated servicer effects and that these alternative estimates are strongly positively correlated with our main estimates. The robustness of our findings under this alternative design shows that servicer heterogeneity plays an

[21] In Online Appendix D, we motivate our estimating equation by deriving the relationship of forbearance take-up to servicer and borrower characteristics in a simple household model of forbearance.

important role in driving forbearance outcomes.

4.2 Instrument for Regional Forbearance Outcome

Assessing the stabilizing effect of forbearance is challenging due to the fact that the take-up of forbearance is endogenous to the severity of the economic shock induced by the pandemic as well as other confounding factors that affected the subsequent recovery. To overcome this challenge, we use our estimated servicer propensities to construct a shift-share measure at the regional level that captures disparities in program availability stemming from idiosyncratic differences among servicers. We then employ this measure as an instrument for the regional forbearance rate under the assumption that regions with varying servicer propensities do not exhibit systematic differences in other characteristics that would affect local employment growth, conditional on a set of controls described below (Borusyak et al., 2022).

We first describe the construction of the instrument. Denote S as the set of mortgage servicers. Let $\ell_{z,t,s}$ be the dollar amount of mortgages serviced by servicer s in Zip3 region z at month t, and let $\ell_{z,t} = \sum_{s \in S} \ell_{z,t,s}$ be the total amount of outstanding mortgage debt in region z at month t. The local market share of the servicer s is then $w_{z,t,s} = \ell_{z,t,s} / \ell_{z,t}$. The shift-share measure of servicer effects for region z is defined as:

$$SS_z = \sum_{s \in S} w_{z,t_0-1,s} \alpha_s, \tag{2}$$

where t_0 denotes the beginning of the pandemic recession, and α_s is the servicer fixed effects from the loan-level regression in Equation (1). We use the pre-pandemic market share as of February 2020 to account for the potential endogeneity of servicer market shares during the pandemic.[22] To ensure that the estimated servicer effects do not reflect local economic conditions, we use the state-level, leave-one-out (LOO) estimates of the servicer effects when constructing the shift-share. That is, for each state, we estimate the servicer effects separately by restricting the estimation sample to loans outside of that state.

In Appendix Figure A4, we show the geographic distribution of our shift-share measure across Zip3 areas. Similar to the geographic distribution of the forbearance rates, there is significant geographic dispersion in our shift-share measure both across and within each state.

[22] In practice, the market shares of servicers do not change in a meaningful way over our sample period.

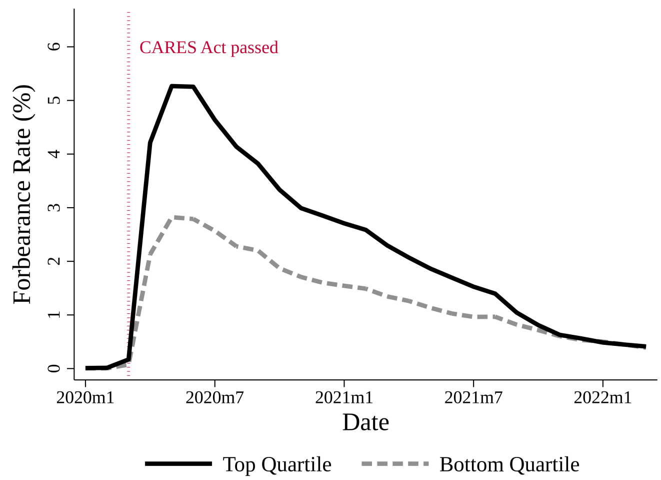


Figure 4: **Forbearance Rates by Shift-share Quartiles.** This figure plots the forbearance rates for Zip3 areas that are at the top (solid black curve) and bottom (dashed gray curve) quartiles of the shift-share distribution. The red vertical line marks the passage of the CARES Act. Data sources: Fannie Mae and Freddie Mac.

Instrument Relevance. Figure 4 plots the mortgage forbearance rates in Zip3 areas that are at the top and bottom quartiles of our shift-share measure. On average, during our sample period, there is approximately one percentage point difference in the forbearance rates between these two groups of regions. Although monthly differences shrink over time, the magnitude of the observed differences, on average, is sizable and economically meaningful.

The differences in forbearance rates across regions, however, could also be a result of the selection of servicers into regions with different characteristics that impact forbearance demand.[23] Appendix Table A2 shows various observable characteristics of regions that are above and below the median of the shift-share instrument. As anticipated, there are some statistically distinguishable differences across the two groups of regions, including average loan characteristics (for example, principal balance) and demographic and socioeconomic characteristics (for example, racial composition, education, average income). To account for these observable differences, we control for average loan characteristics as well as demographic and socioeconomic characteristics as baseline controls in our regressions.

We next assess the conditional relevance of our shift-share instrument on regional forbearance

[23] When estimating servicer effects from our loan-level regression, we can only control for loan characteristics and a limited set of borrower characteristics available in the GSE data, which may not fully capture demand-based determinants of forbearance.

outcomes in a simple panel regression. In column (1) of Appendix Table A3, we first include state-by-month fixed effects to account for any time-varying, state-level differences. A one standard deviation increase in the shift-share measure leads to a 0.47 percentage point increase in the forbearance rate. In column (2), when we additionally control for average loan characteristics and demographic and socioeconomic characteristics at the Zip3 level, this coefficient drops to 0.22 but remains both statistically and economically significant.[24]

Lastly, we present some evidence that our shift-share measure is not predictive of other measures of fiscal stimulus and debt relief during the COVID-19 recession. One potential confounding factor to our shift-share measure is the Paycheck Protection Program (PPP), another large-scale fiscal stimulus under the CARES Act that provided support to small and medium businesses. Since the disbursement of PPP funds was mediated through financial intermediaries (Granja et al., 2022), our shift-share measure exploiting the geographical distribution of financial intermediaries could be predictive of the regional distribution of the PPP funds. In column (3) of Appendix Table A3, we test for this possibility and find that our shift-share measure is not predictive of the regional distribution of the PPP funds. Similarly, in columns (4) and (5), we verify that our shift-share measure is not predictive of the mortgage refinancing rate as well as the bankruptcy filing rate.

5 Empirical Design and Results

We present our baseline empirical design and main results. We discuss the identification conditions required for a causal interpretation of our findings. We also show robustness of our findings along a number of dimensions.

5.1 Empirical Design

We estimate the impact of mortgage forbearance on Zip3-level economic outcomes. To account for the endogeneity of forbearance take-up to local economic conditions, we rely on plausibly exogenous variation in forbearance captured by our shift-share measure of servicer frictions. Our baseline structural equation relates a change in region-level outcome, $Y_{z,t}$, to the average forbear-

[24] Appendix Figure A5 shows the binscatter of the regional forbearance rate and our shift-share instrument, with and without including Zip3 controls.

ance rate during a fixed time period:

$$\overline{\Delta \log Y_{z,t_0 \to T}} = \beta_0 + \beta_1 \overline{\text{Forb}_{z,t_0 \to T}} + \beta_2 X_{z,t_0-1} + \beta_3 \overline{P_{z,t_0 \to T}} + \beta_{\text{state}} + e_z, \tag{3}$$

where $\overline{\cdot_{z,t_0 \to T}}$ denotes the monthly average of a variable in region z from month t_0 to T. Our coefficient of interest is β_1, which captures the impact of forbearance, conditional on pre-pandemic observable characteristics X_{z,t_0-1}, time-varying regional controls $P_{z,t}$, and state fixed effects β_{state}. In our baseline specification, $Y_{z,t}$ is the employment in nontradable sectors.

We estimate Equation (3) with two-stage least squares (2SLS), using our shift-share measure of servicer effects as an instrument for the average forbearance rate in the following specification of the first-stage:

$$\overline{\text{Forb}_{z,t_0 \to T}} = \gamma_0 + \gamma_1 \overline{SS_{z,t_0 \to T}} + \gamma_2 X_{z,t_0-1} + \gamma_3 \overline{P_{z,t_0 \to T}} + \gamma_{\text{state}} + \epsilon_z, \tag{4}$$

where $SS_{z,t}$ is the instrumental variable described in Equation (2). As in the second-stage specification, we control for pre-pandemic regional characteristics X_{z,t_0-1}, time-varying regional controls $P_{z,t}$, and state fixed effects γ_{state}.

Identifying Assumption. The key identifying assumption of our approach is that conditional on our baseline controls, other aggregate factors that are correlated with servicers' forbearance propensities impact areas with high and low exposure to the servicer effects uniformly. The exogeneity of our instrument is motivated by the treatment of servicer propensities as "shocks" from the perspective of regional economies (Borusyak et al., 2022). The sorting of leniant servicers to regions with generally greater forms of fiscal stimulus would be one example of a violation of this condition. Because we estimate forbearance in the cross-section of U.S. regions, we assume asymptotic behavior in the number of regions. We interpret our 2SLS as capturing the local average treatment effect (LATE) under the monotonicity assumption of servicer propensities on local forbearance take-up, which is plausible in our setting.

Our identifying assumption is conditional on a set of baseline controls that are meant to address the fact that locations with higher values of SS_z may differ on observable dimensions that impact their recovery during the pandemic recession. For example, part of the observed differences in outcomes across locations may not only reflect greater mortgage forbearance but also differences in borrower profiles or demographics. To account for these differences, we include a range of pre-pandemic controls such as average loan characteristics (principal balance, interest rate, credit score and LTV/DTI ratios at origination, first-time homebuyer) and demographic and socioeconomic characteristics of the population (age, education, race, income, pre-pandemic unemployment rate, fraction with mortgage). Additionally, we address the fact that Zip3 areas may have differential exposure to the pandemic based on local industry compositions by including the predicted change in local employment based on NAICS3 industry shares (Chodorow-Reich and Wieland, 2020).[25] Lastly, because our state fixed effects account for any statewide differences in economic outcomes, our estimate is derived from variations across within-state Zip3 areas.

Sample Period and Regression Window. One complication in examining the change in regional demand in response to mortgage forbearance activity is that local economies experienced concurrent "supply shocks" from state-ordered economic lockdowns or consumer hesitation in visiting local stores. The first stay-at-home order was issued by California in March 2020, with many states following suit. The beginning of the recession poses a challenge to our empirical design because economic lockdowns can limit the propagation of local demand effects stemming from deferred mortgage payments. To overcome this challenge, our specification examines changes in local employment during an 18-month window following the first reopening month of each state (t_0).[26] Our estimates of regional employment effects can therefore be interpreted as capturing differences in the speed of recovery following the initial lockdown.

Our regression-window adjustment suggests two points that are worth addressing. First, since different regions have different reopening dates, the economic recovery can be affected by the timing of reopening. Our state fixed effects help account for this possibility by comparing within-state Zip3 areas that all reopened in the same month, though local governments may deviate from the state's lockdown guidance. Second, to the extent that different regions were economically impacted by the pandemic differentially (for example, due to more severe lockdowns or limitations

[25] In particular, we construct a shift-share industry employment measure for each region using pre-pandemic industry shares and the national employment growth in each NAICS3 industry.

[26] States varied in their announced reopening date, but the vast majority of permitted businesses reopened between the start of May and the end of July in 2020.

	First-stage		Reduced-form		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share (in SD)	0.389***	0.189***	0.102***	0.055***		
	(0.057)	(0.057)	(0.016)	(0.013)		
Forbearance rate (%)					0.291***	0.294**
					(0.063)	(0.111)
State FE	Y	Y	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y	N	Y
R-squared	0.28	0.46	0.62	0.78	-	-
N	841	841	841	841	841	841
Outcome mean (%)	2.04	2.04	1.13	1.13	1.13	1.13
Outcome SD (%)	1.40	1.40	0.52	0.52	0.52	0.52

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1: **Baseline Results on Nontradable Employment.** This table shows the regression results of our baseline specification for nontradable employment growth. Columns (1)-(2), (3)-(4), and (5)-(6) respectively show the results for first-stage, reduced-form, and 2SLS regressions, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

in remote work based on local industries), some regions may have had more slack in their labor markets, which could have affected the speed of their employment recovery. We account for this possibility by controlling for each region's initial drop in total employment as a proxy measure of local labor market slack in our baseline specification.[27]

5.2 Main Results

Nontradable Employment Growth. Table 1 presents our main results. Column (1) shows the results from the first-stage regression without regional controls. In column (2), we include regional controls, which corresponds to our preferred specification described by Equation (4). Conditional on regional characteristics, a one standard deviation increase in the shift-share instrument leads to a 0.19 percentage point rise in the regional forbearance rate. This increase corresponds to approximately 9.2 percent of the average forbearance rate during our sample period, which is 2.04 percent. The F-statistic of our first-stage is 11.9, which reflects strong relevance of our servicer-based instrument for regional forbearance outcome.

[27] We measure the initial drop in total employment in each region as the log difference between pre-pandemic employment (as of February 2020) and the lowest level of employment observed during the lockdown period.

Columns (3) and (4) present the reduced-form estimates of regressing monthly employment growth on our shift-share instrument without and with regional controls, respectively. In our preferred specification in column (4), a one standard deviation increase in the shift-share measure leads to a 5.5 basis point increase in the average monthly growth of nontradable employment. Accordingly, the implied 2SLS estimate in column (6) suggests that a one percentage point increase in the share of mortgages in forbearance leads to a 29 basis point increase in the monthly nontradable employment growth. Given that the mean and the standard deviation of the nontradable employment growth are 1.13 and 0.52 percent in our sample period, our estimate is sizable and significant both statistically and economically. For example, moving a region from the 25th percentile to the 75th percentile of our shift-share distribution would lead to an increase in nontradable employment growth equivalent to 7.4 percent of the mean growth rate (or 16.1 percent of the standard deviation) during our sample period.

While we focus on nontradable employment as our primary outcome, we show in Appendix Table A4 that the results are almost identical when we instead use nontradable payroll as the outcome variable. Appendix Table A5 displays the results weighted by Zip3 population, which are also similar to the baseline results. Lastly, Appendix Table A6 displays the OLS estimates for comparability. The OLS estimates are considerably smaller or close to zero in magnitude, which likely reflects the endogeneity of forbearance outcomes to local economic conditions that can lead to reverse causality. This finding highlights the importance of separating supply-side frictions, conditional on demand-based factors, for identifying the economic impact of forbearance, as discussed in Sections 4 and 5.1.

5.3 Robustness

We interpret our baseline specification as providing evidence of the local demand effects associated with the greater liquidity provided by mortgage forbearance. We now examine alternative specifications and additional outcome variables that corroborate this interpretation of our baseline estimates. We also assess the robustness of our main results to including a variety of potential confounding factors.

	Non-Tradable		Tradable		Total	
	(1)	(2)	(3)	(4)	(5)	(6)
Forbearance rate (%)	0.291***	0.294**	0.017	-0.129	0.136***	0.105*
	(0.063)	(0.111)	(0.049)	(0.114)	(0.035)	(0.049)
State FE	Y	Y	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y	N	Y
N	841	841	835	835	841	841
Outcome mean (%)	1.13	1.13	0.38	0.38	0.62	0.62
Outcome SD (%)	0.52	0.52	0.48	0.48	0.28	0.28

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$}

Table 2: **Tradable and Total Employment.** This table shows the 2SLS estimates for different employment sectors. Columns (1) and (2), (3) and (4), and (5) and (6), respectively, show the results for nontradable, tradable, and total employment, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

Pre-Pandemic Placebo Effects. To test whether our estimates are driven by differences in the secular growth rates in different regions, we estimate Equation (3) using the 12-month, pre-pandemic employment growth as the outcome variable. Appendix Table A7 displays the results. We find that our shift-share measure does not predict forbearance outcome in the period preceding the CARES Act, as shown by the precisely estimated null effects in the first stage reported in columns (1) and (2).[28] More importantly, the shift-share measure does not predict employment growth during the pre-pandemic period, as evidenced by the small and insignificant reduced-form estimates reported in columns (3) and (4). The lack of pre-trends in employment growth is also confirmed in Figure 5, which plots the local-projection estimates of our shift-share instrument on employment growth (discussed further below). Hence, differences in the trajectory of Zip3 areas before the pandemic do not explain our results on employment growth during the recovery period.

Tradable Employment and Total Employment. While we have so far focused on nontradable employment growth as a proxy for local demand effects, we follow Mian and Sufi (2014) in assessing whether our instrumented measure of forbearance predicts regional employment in tradable sectors and total employment, which are less influenced by local aggregate demand. Columns (3) and (4) of Table 2 present the 2SLS estimates of mortgage forbearance on monthly employment

[28]This result is mechanical in large part, as typically only a small number of distressed borrowers are under forbearance.

growth in the tradable sectors. The coefficient estimates are not statistically distinguishable from zero, confirming that mortgage forbearance had little impact on tradable employment. Columns (5) and (6) report the results using total employment growth as the outcome variable. A one percentage point increase in the forbearance rate leads to an 11 basis point increase in the monthly growth in total employment, which is smaller in magnitude compared with the increase for nontradable sectors. Overall, these results support the interpretation that the increased liquidity provided through mortgage forbearance had an impact on regional employment through local aggregate demand effects.

Robustness to Confounding Factors. To explore the sensitivity of our empirical design, Table 3 presents the 2SLS estimates from alternative specifications that include additional covariates. Column (1) reproduces the result from our baseline specification in column (6) of Table 1. Column (2) includes the COVID-19–infection and mortality rates to account for labor supply effects associated with greater exposure to the pandemic. In column (3), we consider systematic differences between rural and urban areas (for example, COVID-19 exposure, viability of social-distancing measures, and the distribution of mortgage servicers) by controlling for population density.[29] Including these additional controls does not materially change our estimate.

Next, we assess the robustness of our results to controlling for other measures of economic stimulus during the pandemic that can impact local employment recovery.[30] In columns (4) and (5), we control for the share of refinanced mortgages and the per capita PPP amount, respectively. In column (6), we control for the personal bankruptcy filing rate in 2020 and also for the equivalent rate in 2019 to account for the fact that some financial intermediaries automatically enrolled their distressed mortgage borrowers into forbearance (for example, those associated with an active Chapter 13 bankruptcy repayment plan). Including these additional controls does not significantly change our estimate, which is consistent with our previous analysis in Section 4.2 that our shift-share measure does not predict other economic stimulus measures.

Lastly, column (7) includes all additional controls from columns (2)-(6) and shows that the

[29] Alternatively, controlling for the RUCA (Rural-Urban Commuting Area) classifications of the U.S. Department of Agriculture Economic Research Service yields similar results.

[30] State-level differences in fiscal stimulus, such as unemployment insurance (UI) generosity or broadened Supplemental Nutrition Assistance Program (SNAP) eligibility, are already absorbed by state fixed effects in our baseline specification.

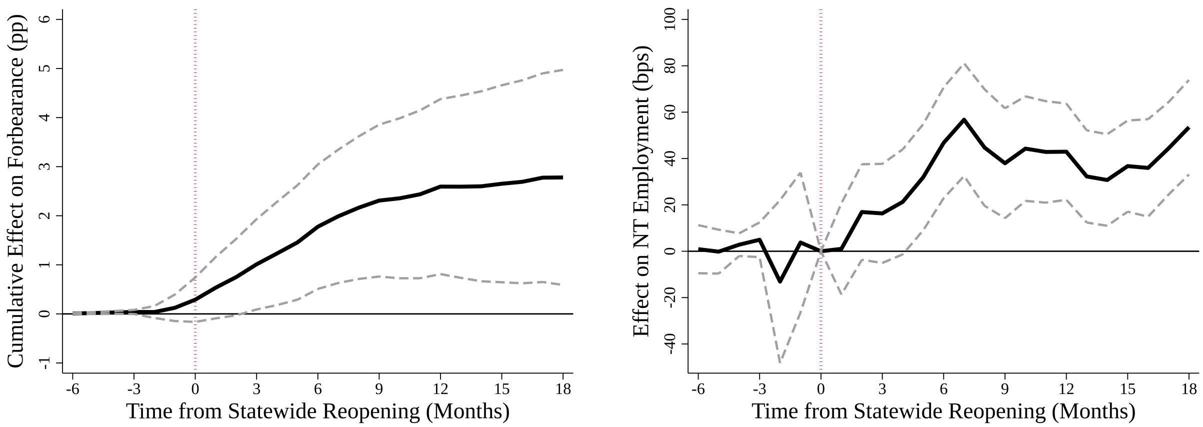
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Forbearance rate (%)	0.294**	0.304*	0.289*	0.295**	0.289**	0.283**	0.287*
	(0.111)	(0.125)	(0.113)	(0.112)	(0.102)	(0.108)	(0.112)
COVID rate (%)		-0.027					-0.034
		(0.072)					(0.069)
Death rate (%)		-11.55					-10.83
		(12.03)					(11.80)
Population density			0.016				0.017
			(0.026)				(0.026)
Refinancing rate (%)				0.026			0.031
				(0.056)			(0.058)
PPP amount (per capita)					-0.001		-0.000
					(0.002)		(0.002)
2019 Bankruptcy filings (%)						1.23*	1.24*
						(0.60)	(0.61)
2020 Bankruptcy filings (%)						-1.31	-1.34
						(0.69)	(0.70)
State FE	Y	Y	Y	Y	Y	Y	Y
Zip3 controls	Y	Y	Y	Y	Y	Y	Y
N	841	841	841	841	841	841	841

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: **Robustness to Confounding Factors.** This table shows the robustness of 2SLS estimates to potential confounding factors. Column (1) repeats our baseline estimate. Columns (2) through (6) additionally control for COVID-19 exposure, population density, mortgage refinancing rate, PPP amount, and bankruptcy filing rate, respectively. Column (7) includes all controls. The shift-share variable is expressed in SD units. The outcome variable is expressed in percentages. Data sources: GSEs, QCEW, ACS, Economic Tracker, Small Business Administration (SBA), and U.S. Courts.

resulting estimate is similar to our baseline estimate. Overall, our empirical design is robust to controlling for potential confounding factors considered above.

Dynamic Effects of Forbearance. While our baseline specification focuses on the average change in outcome during a fixed, 18-month window, we consider a possibility that the effect of mortgage forbearance is time-varying over our sample period. For example, since mortgage forbearance primarily serves as a short-term liquidity injection to households, mortgage forbearance may have a stronger impact on short-horizon outcomes. To investigate these dynamic effects, we run a local projection analysis by regressing our shift-share instrument on the cumulative change in the regional forbearance rate and the nontradable employment at each month, conditional on our base-



(a) Cumulative Forbearance Differential

(b) nontradable Employment Growth

Figure 5: **Local Projection: First-Stage and Reduced-Form.** This figure plots the local-projection estimates of our shift-share instrument (black curve) along with their 95 percent confidence intervals (dashed gray curve). Panel (a) shows the cumulative effect on forbearance. Panel (b) shows the effect on nontradable employment. The shift-share measure is expressed in SD units. Data sources: GSEs, QCEW, and ACS.

line controls described above.

In Figure 5, panel (a) displays the local-projection estimates of our shift-share instrument on the cumulative forbearance rate along with their 95 percent confidence intervals. A one standard deviation increase in our shift-share measure leads to a sharp accumulation of forbearance differential of roughly 2 percentage points in the first 12 months followed by a steady but slower increase in the following period. This pattern is consistent with our previous analysis in Figure 4 that forbearance rates across regions in the shift-share quartiles exhibited a greater divergence during the initial year.

Panel (b) plots local-projection estimates for nontradable employment growth. The pre-reopening estimates confirm the absence of differential trends, which complements our earlier analysis of the pre-pandemic placebo effects. After statewide reopenings, a one standard deviation increase in our shift-share measure results in a significant surge in nontradable employment of approximately 50 basis points within the first six months. Notably, this rapid initial recovery is followed by a partial reversion of effects in the subsequent six months, which is then followed by a rebound. Although the exact reason for this pattern remains unclear, one hypothesis suggests that the swift initial recovery might have triggered a more severe outbreak of the second wave of COVID-19 in late 2020, prompting stronger policy responses from local government authorities, which, in turn, could have affected the labor market recovery.[31]

Alternative Servicer Effects. We explore the sensitivity of our results to using the servicer forbearance propensities estimated from an alternative specification described in Section 4.1. Specifically, following Kim et al. (2022), we restrict our estimation sample to loans that missed at least one payment during the pandemic and estimate a cross-sectional model that has an indicator variable for entering forbearance at any point during our sample period as the outcome variable. Since delinquent borrowers would undoubtedly benefit from forbearance, this alternative specification more explicitly controls for forbearance demand. We then construct a shift-share measure based on these alternative servicer effects and re-estimate our baseline specification.

Appendix Table A8 shows that the results are broadly similar to our baseline results. For example, the preferred specification in column (6) suggests that a one percentage point increase in the forbearance rate leads to a 32 basis point increase in monthly nontradable employment growth, which is comparable to our baseline estimate of a 29 basis point increase.

6 Theoretical Model

Our empirical analysis suggests that mortgage forbearance played an important role in fostering local employment during the recovery phase of the pandemic recession. In this section, we develop a stylized heterogeneous-area New Keynesian model that relates local labor market outcomes to household-level consumption responses. In Section 7, we interpret our results through the lens of this stylized model and directly map our empirical estimates to the household-level MPC. Our setup relies heavily on the framework used by Chodorow-Reich et al. (2021) but differs in ways specific to our setting. In particular, we enrich the household block by introducing homeownership and mortgage ownership statuses and incorporate geographical heterogeneity in intermediation frictions to align the model with our empirical setting. We describe the key features of the model in the main text and present additional details in Online Appendix E.

[31] In response to the second wave of COVID-19, many state governments implemented a second lockdown that included statewide business closures (Chetty et al., 2020).

6.1 Model Environment

We consider a continuum of areas (a) where firms produce nontradable (N) or tradable (T) goods using capital (K) and labor (L) as factors of production. Time is discrete and denoted by $t \in \{0, 1, \ldots\}$. We model $t = 0$ as the "short-run," whereby labor is initially immobile and the economy is subject to a negative aggregate shock. We allow for capital to be mobile in all periods. We assume that monetary policy stabilizes aggregate demand by targeting the average nominal wage. However, wage stickiness, combined with cross-sectional heterogeneity across areas, implies that local labor market outcomes are determined by local demand in the short run. We model $t \geq 1$ as the "long-run," whereby labor is fully mobile across areas. Under average nominal wage targeting, production and employment in each area are determined solely by productivity in the long run.

Each area is populated by infinitely lived households that consume one unit of housing every period. There are three types of households denoted by superscript $i \in \{r, c, m\}$ with their respective share given by θ^i. The type-r households are "renters" who live hand-to-mouth and spend their income every period after paying a constant rent D. The type-c households are unconstrained "capitalists" who hold a uniform portfolio of capital distributed across all areas. They own a house without mortgage debt and make endogenous consumption-saving decisions. The type-m households are "mortgagors" who own a house with infinite-maturity mortgage debt M on which they make a constant payment $r^m M$ every period. Among mortgage owners, a fraction μ lives hand-to-mouth, similar to renters, and spends their income net of mortgage payments every period. The remaining fraction $1 - \mu$ is unconstrained, similar to capitalists, and makes endogenous consumption-saving decisions. The liquidity constraint for the hand-to-mouth mortgage owners is the key source of the consumption effects generated from mortgage forbearance, as we detail below. Lastly, we assume that renters supply labor endogenously, whereas capitalists and mortgagors provide labor exogenously.[32]

Mortgage Forbearance Policy. Since our main objective is to examine how regional differences in mortgage forbearance translate into differences in local employment, we introduce a stylized version of the mortgage forbearance program in our model. Specifically, we model mortgage

[32] As in Chodorow-Reich et al. (2021), these assumptions help us isolate the wealth effects on consumption from those on labor supply while generating empirically sensible Keynesian multiplier effects and changes in labor.

forbearance as the option for mortgage owners to skip their mortgage payment in period 0 in exchange for increasing their mortgage debt from M to M' for all subsequent periods. We analyze the setting where M' is set such that the present discounted value of the increase in future payments is equal to the value of the missed payment in period 0.[33] Hence, mortgage forbearance provides liquidity to constrained homeowners without affecting their overall debt obligations.

Geographic Heterogeneity in Intermediation Frictions. To align the model with our empirical setting, forbearance in each area is intermediated by a local mortgage servicer that is subject to some level of operational frictions. Consequently, only a fraction $\Psi_a \in [0,1]$ of mortgage owners in area a actually get to participate in the program. The variation in the availability of the forbearance program serves as the source of geographical heterogeneity in our model. We assume that areas are identical otherwise.[34]

6.2 Households

At each period t, households of type i residing in area a allocate their consumption $C^i_{a,t}$ between nontradable and tradable goods to maximize the consumption aggregator,

$$C^i_{a,t} = (C^{i,N}_{a,t}/\eta)^\eta (C^{i,T}_{a,t}/(1-\eta))^{1-\eta}, \tag{5}$$

where η is the share of nontradables in consumption. Since the household problem depends on the type of agents considered, we discuss each type in turn.

Renters. Since renters live hand-to-mouth, they do not hold any form of assets and therefore spend all of their net-of-rent labor income each period. To introduce local aggregate demand effects, we assume renters supply labor endogenously subject to partially sticky wages and disutility of labor. The aggregate labor of renters is specialized across a continuum of types $\nu \in [0,1]$, where a worker of type ν supplies $L^r_{a,t}(\nu)$ with an elasticity of substitution ϵ_w between different types of labor. A fraction $1-\lambda_w$ of labor types supply labor according to the nominal wage $\overline{W}$ targeted by

[33] More formally, we assume M' is set such that $r^m M = \sum_{n=1}^{\infty} \frac{r^m(M'-M)}{\Pi_{k=1}^n R^f_{t+k}}$.

[34] In particular, as a simplifying assumption, we do not model regional differences in forbearance demand and instead focus on the supply-side frictions, which are the source of identifying variation in our empirical analyses.

the monetary policy. The remaining fraction λ_w set wages to maximize:

$$\frac{W_{a,t}(\nu)L^r_{a,t}(\nu)-D}{P_{a,t}}-\chi\frac{(L^r_{a,t}(\nu))^{1+\phi^r}}{1+\phi^r}, \tag{6}$$

where ϕ^r is the inverse Frisch elasticity of labor supply. Importantly, linear disutility of labor excludes wealth effects arising from labor supply (Greenwood et al., 1988).

Mortgagors. Representative mortgage owners can be subdivided into those who are constrained ($i = mc$) and those who are unconstrained ($i = mu$). Mortgagors of each type supply a fixed amount of labor $\overline{L}$ and choose consumption to maximize:

$$\Sigma_{t=0}^{\infty}(1-\rho)^t \log C^i_{a,t} \tag{7}$$

subject to

$$P_{a,t}C^i_{a,t}+r^m M(1-\Psi_a)+\frac{A^i_{a,t+1}}{R^f_t}=W_{a,t}\overline{L}+A^i_{a,t}, \qquad t=0, \tag{8}$$

$$P_{a,t}C^i_{a,t}+r^m\left(M(1-\Psi_a)+\Psi_a M'\right)+\frac{A^i_{a,t+1}}{R^f_t}=W_{a,t}\overline{L}+A^i_{a,t}, \qquad t\geq 1, \tag{9}$$

$$A^i_{a,t}=0, \qquad i=mc, \forall t, \tag{10}$$

where $1-\rho$ is the discount factor common to all households, $A^i_{a,t}$ is the household's asset holdings, $W_{a,t}$ is the wage, and $P_{a,t}$ is the local price index of the consumption aggregator.

Mortgage owners who are hand-to-mouth ($i = mc$) are constrained to have zero liquid assets, and thus their consumption expenditure each period is equal to their labor income net of mortgage payments. Consequently, the MPC for this household type is always equal to 1. When the negative aggregate shock occurs in period 0, mortgage forbearance provides liquidity to these households by permitting them to defer their current payment in exchange for higher payment amounts in all future periods. However, due to intermediation frictions, only a fraction Ψ_a is able to take advantage of this policy.

Unconstrained mortgage owners ($i = mu$), on the other hand, are not liquidity-constrained and their consumption is determined by the level of their permanent income,

$$P_{a,t}C^{mu}_{a,t} = \rho\left(\sum_{n\geq 0}^{\infty}\frac{W_{a,t+n}\overline{L} - r^m M}{R^f_t \dots R^f_{t+n-1}} + A^{mu}_{a,t}\right). \tag{11}$$

The MPC of these households is equal to ρ. Since forbearance preserves overall debt obligations and does not change the lifetime wealth of these households, unconstrained mortgage owners do not benefit from forbearance and hence are indifferent to the policy. For simplicity, we assume that these households do not participate in the program.

Aggregating the two types of mortgage owners, the representative mortgage owner's consumption is given by

$$C^m_{a,t} = \mu C^{mc}_{a,t} + (1-\mu)C^{mu}_{a,t}, \tag{12}$$

where μ denotes the share of constrained mortgagors. The MPC of the representative mortgagor is equal to $\mu + (1-\mu)\rho$.

Capitalists. Capitalists behave similarly to unconstrained mortgage owners, except that they do not make mortgage payments and earn capital income in each period. Accordingly, their MPC out of income is equal to ρ.

6.3 Production and Equilibrium

Nontradable goods are produced using a Cobb-Douglas technology with labor $L^N_{a,t}$ and capital $K^N_{a,t}$,

$$Y^N_{a,t} = \left(K^N_{a,t}/\alpha^N\right)^{\alpha^N}\left(L^N_{a,t}/(1-\alpha^N)\right)^{1-\alpha^N}, \tag{13}$$

where α^N denotes the capital share in the nontradable sector. The tradable good is produced with tradable inputs from each area that similarly combine labor $L^T_{a,t}$ and capital $K^T_{a,t}$ using a Cobb-Douglas technology,

$$Y^T_t = \left(\int_a (Y^T_{a,t})^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}}, \tag{14}$$

$$Y^T_{a,t} = \left(K^T_{a,t}/\alpha^T\right)^{\alpha^T}\left(L^T_{a,t}/(1-\alpha^T)\right)^{1-\alpha^T}, \tag{15}$$

where ϵ is the elasticity of substitution between tradable inputs produced in each area, and α^T denotes the capital share in the tradable sector.

Monetary policy sets the risk-free rate R_t^f such that the average nominal wage is equal to the target level at every time period:

$$\int_a W_{a,t} da = \overline{W}, \tag{16}$$

where $\overline{W}$ is exogenously determined. In the absence of cross-sectional heterogeneity, monetary policy would stabilize the labor supply in each area at its frictionless level (that is, the level that would obtain without nominal rigidities). However, heterogeneity due to regional asymmetries in intermediation frictions can induce local aggregate demand effects when labor is immobile in the short run, because the policy would only stabilize the *average* labor supply across areas. We assume that risk-free assets are in zero net supply.

Given the distribution of the intermediation frictions $\{\Psi_a\}_a$, an equilibrium of the economy is characterized by a set of prices for input factors, consumption goods, the capital asset, and the interest rate such that (1) firms choose output according to their production technologies; (2) consumption, labor, and assets are determined by the maximization problem of households; (3) monetary policy targets the nominal wage $\overline{W}$; and (4) the markets for goods, input factors, and the risk-free asset all clear. Online Appendix E provides a more complete characterization of the equilibrium.

6.4 Linearization around a Common-Friction Benchmark

We first consider a common-friction benchmark where all areas are subject to the same level of frictions in mortgage forbearance take-up, $\overline{\Psi}$. Due to the assumption on nominal wage targeting and the perfect symmetry across regions in this case, the short-run wage is equal to the preset-level, $W_0 = \overline{W}$. Labor supply is the same as that of the frictionless benchmark, which we calibrate to be equal to the level exogenously supplied by mortgage owners, $L_0 = \overline{L}$.

Next, to investigate the implications of heterogeneous frictions across areas, we log-linearize the equations that characterize the equilibrium around this common-friction benchmark (see Online Appendix E for derivations). Denoting the log-deviation of a variable Y for each area as Δy (e.g.,

$\Delta\psi_a \equiv \Psi_a - \overline{\Psi}$), we can derive the following conditions:

$$\Delta\left(w_{a,0} + l^N_{a,0}\right) = \mathscr{M}(1-\alpha^N)\eta\mu\frac{\Delta\left(\psi_a\right)\theta^m r^m M}{\overline{W}L^N_0} + (\mathscr{M}-1)\,\frac{1-\alpha^T}{1-\alpha^N}\frac{1-\eta}{\eta}\Delta\left(w_{a,0} + l^T_{a,0}\right), \tag{17}$$

$$\Delta\left(w_{a,0} + l^T_{a,0}\right) = -(\epsilon-1)(1-\alpha^T)\Delta w_{a,0}. \tag{18}$$

Equation (17) decomposes the change in nontradable wage bill (as a result of local deviation in intermediation frictions) into components that reflect the direct and indirect effects of increased forbearance take-up. The first term is the direct effect, where $\mathscr{M}$ is the local Keynesian multiplier effect, $1-\alpha^N$ is the labor share of nontradable sectors, η is the spending share of nontradables, and μ captures the MPC out of liquidity provided through forbearance.[35] Intuitively, the direct effect of forbearance is a function of the total amount of liquidity provided through forbearance, which depends on the level of intermediation frictions ($\Delta\left(\psi_a\right)$) and the amount of mortgage payments ($\theta^m r^m M$).

The second term highlights the indirect effects of forbearance through adjustments to tradable wage bills, which result from the common price of labor across the two sectors. However, based on the muted response of tradable employment to forbearance in our empirical analyses, we infer that most of the observed effects stem from the direct liquidity effects of forbearance. Hence, following Chodorow-Reich et al. (2021), we set $\Delta\left(w_{a,0} + l^T_{a,0}\right) = 0$ by assuming a unit elasticity of substitution between tradable inputs ($\epsilon = 1$) in Equation (18).

Model Summary and Separation Result. Rearranging Equations (17) and (18) and focusing on the special case with $\epsilon = 1$, we derive a modified version of the separation result presented in Chodorow-Reich et al. (2021) that is tailored to our specific setting:

$$\underbrace{\Delta\left(w_{a,0} + l^N_{a,0}\right)\overline{W}L^N_0}_{\text{Nontradable payroll increase}} = \mathscr{M}(1-\alpha^N)\eta\mu \times \underbrace{\Delta\left(\psi_a\right)\theta^m r^m M}_{\text{Liquidity from forbearance}}. \tag{19}$$

[35]While μ is formally defined as the share of constrained mortgage owners, we interpret this term as the portion of the representative mortgagor's MPC that can be attributed to the constrained mortgage owners in our model. As discussed in Section 6.2, the total MPC of the representative mortgagor is $\mu + (1-\mu)\rho$, where the first and second terms represent the components attributed to constrained and unconstrained types, respectively.

This expression shows that the dollar amount of the increase in nontradable payroll (due to liquidity provision through forbearance) can be decomposed into the product of four terms: the local Keynesian multiplier ($\mathscr{M}$), the labor share of income ($1 - \alpha^N$), the spending share of nontradables (η), and the household-level MPC for mortgage owners in forbearance (μ). In Section 7, we use this decomposition to recover the household-level MPC implied by our empirical estimates under standard calibrations of other parameters.

7 Discussion

In this section, we combine our empirical estimates from Section 5 with the theoretical results from Section 6 to compute the implied household-level MPC as well as the cross-sectional multiplier effects of mortgage forbearance. We compare our results to existing estimates in the literature for alternative forms of liquidity provision and discuss the policy implications of our findings.

7.1 Implied Household-Level MPC

We use the separation result presented in Equation (19) to translate our empirical estimate on labor market outcomes into household-level consumption responses. To align the units with our empirical estimate, we consider a one percentage point increase in the share of mortgages in forbearance (that is, $\Delta\psi_a = 1\%$). Because our empirical analysis covers a period of 18 months, we interpret the length of period 0 in our model as one year and, accordingly, the parameter μ as the *annual* MPC out of a dollar of liquidity provided through forbearance.

We begin by converting our empirical estimate into monetary values. We first calculate the amount of liquidity provided from a one percentage point increase in the forbearance rate as:

$$\Delta(\text{Liquidity from forbearance}) = \widehat{A} \times N^{1\%}, \tag{20}$$

where $\widehat{A}$ is the average amount of suspended mortgage payment among forborne borrowers (shown in Figure 2). We use the estimate adjusted for the fact that approximately one-third of borrowers continued to make payments while in forbearance. We then multiply the average suspended payment by $N^{1\%}$, a quantity equivalent to 1 percent of the total mortgage market.[36] Next, we compute the increase in nontradable wage bill resulting from the liquidity provided through forbearance as:

$$\Delta(\text{Nontradable payroll}) = \hat{\beta}_1^{2SLS} \times W_0^N L_0^N, \tag{21}$$

where $\widehat{\beta}_1^{2SLS}$ is our preferred estimate on nontradable payroll (reported in column (6) of Appendix Table A4),[37] and $W_0^N L_0^N$ is the total wage bill of nontradable sectors from QCEW at the beginning of our sample period. Appendix Table A9 summarizes the calibration of parameters and statistics.

Substituting Equations (20) and (21) into Equation (19) and rearranging, we obtain

$$\mathscr{M}(1-\alpha^N)\eta\mu = \frac{\Delta(\text{Nontradable payroll})}{\Delta(\text{Liquidity from forbearance})} = 0.35. \tag{22}$$

To recover μ, we externally calibrate three additional parameters. We set the local Keynesian multiplier to a commonly used value in the literature, $\mathscr{M} = 1.8$, and also assign a standard value to the labor share of income, $(1-\alpha^N) = 2/3$. We compute the ratio of the total wage bill in nontradable and tradable sectors from QCEW to approximate the relative consumption shares, and set $\eta = 0.44$. Substituting these terms yields

$$\widehat{\mu}^{MPX} = 0.67. \tag{23}$$

It is important to note that our empirical estimate on the local labor market reflects households' spending responses for all expenditures, which encompass both durable and non-durable consumption. However, because our model assumes a notional consumption flow that does not differentiate between these two types, we follow the approach of Laibson et al. (2022) to map the MPX estimate in Equation (23), which is derived from our empirical results, into a notional MPC estimate that is

[36] Since our empirical analysis covers only the GSE mortgage market, we adjust the number of GSE mortgages by a factor of 2.15 to account for the presence of a roughly equivalent number of GNMA mortgages in forbearance. See Appendix C for details.

[37] Alternatively, following Chodorow-Reich (2019), we can convert our baseline estimate on nontradable employment (reported in Table 1) into a wage bill using the average wage, which yields nearly identical results.

the object of interest in our model:[38]

$$\hat{\mu}^{\text{MPC}} = 0.43. \tag{24}$$

Hence, our estimate suggests that a dollar of liquidity provided through mortgage forbearance increases a household's annual expenditure by 67 cents and its consumption by 43 cents.

Comparison with Existing Estimates. The magnitudes of the implied household-level MPX and MPC are in line with existing estimates from the literature. For example, estimates of the MPX for total expenditure typically range from 0.5-0.9, whereas estimates for nondurable expenditure range from 0.15-0.25 (e.g., Johnson et al., 2006; Agarwal and Qian, 2014; Kueng, 2018). The notional MPC, in theory, lies between the MPX for nondurables and the total MPX (Laibson et al., 2022). It is worth noting that empirical estimates typically measure *quarterly* spending responses, whereas our implied MPX and MPC estimates are more likely to reflect *annual* spending responses. Hence, our implied estimates may be somewhat larger than the quarterly estimates reported in the literature.

7.2 Multiplier Effects of Mortgage Forbearance

We next approximate the implied multiplier effects of mortgage forbearance by comparing the costs and benefits associated with the CARES Act forbearance program. We provide a back-of-the-envelope calculation that translates our main empirical estimate into a multiplier effect. Our multiplier estimate is likely to be conservative since we only focus on nontradable sectors and do not consider any spillover effects on other industries. Furthermore, we only consider the effect of forbearance on local employment and do not include other potential general-equilibrium channels of stabilization, such as boosting house prices (e.g., Anenberg and Scharlemann, 2021) and preventing defaults and foreclosures (e.g., Campbell et al., 2011; Gupta, 2019).

[38] Laibson et al. (2022) provide a simple mapping of notional MPCs into MPXs:

$$MPX = \left(1 + \frac{s}{\delta} \times \frac{1}{\tau}\right) MPC,$$

with durable share s, real interest rate r, durable depreciation rate δ, and time horizon τ. The main difference between the two measures arises from spending on durable goods, which involves upfront expenditures that are gradually converted into notional consumption over time.

We approximate the cross-sectional fiscal multiplier by comparing the dollar value of our employment effect and the cost of providing mortgage forbearance as follows:

$$\mathcal{M}_{CX} \approx \frac{\Delta(\text{Nontradable labor bill})}{\Delta(\text{Government spending})}. \tag{25}$$

Since the numerator can be obtained using the same calculation shown in Equation (21), we focus on analyzing the denominator, which represents the fiscal costs associated with providing the liquidity of the amount specified in Equation (20).[39]

We make several assumptions to approximate the fiscal expense to the federal government. First, since the fiscal cost of the program depends on the repayment terms of deferred mortgage payments, we assume a simplified repayment structure in which all mortgage borrowers exiting forbearance are allowed to defer their missed payments to the end of their mortgage maturity as an interest-free, second-lien loan. While a few different types of repayment plans were adopted in practice, payment deferral has been the most popular option for a majority of borrowers exiting forbearance in our data (see Appendix Figure A1).

Second, we assume that the federal government finances the expense by issuing a long-term bond in the amount equal to the deferred mortgage payments in Equation (20). We further assume that the long-term bond has a maturity of 11.8 years, which is the average effective remaining maturity of all forborne loans in the data, at an interest rate of 1.46 percent, which was the 30-year Treasury rate at the onset of the CARES Act in March 2020.[40,41]

Under these assumptions, the fiscal cost of the program primarily consists of the waived interest payments on these interest-free loans since the principal balance of the loan amount is repaid by

[39] We assume that the direct costs associated with the CARES Act forbearance program are borne entirely by the federal government. Implementation of the forbearance policy may have also resulted in costs by servicers who may have had to adapt organizational practices to comply with the CARES Act. We implicitly assume that these costs are negligible compared with the direct fiscal costs when assessing the cross-sectional fiscal multiplier.

[40] We compute the effective remaining maturity of a mortgage using the benchmark prepayment model developed by the Public Securities Association (PSA). In our baseline, we use the PSA-100 model, which is a very conservative choice that assumes no volatility in the interest rate. If we instead assume a moderate level of volatility in the interest rate (for example, PSA-200 model), the effective maturity becomes shorter at seven years and the cross-sectional multiplier estimate becomes even larger at 3.68 (see Row 1 of Appendix Table A10).

[41] Since the interest-free loan from payment deferral after forbearance can induce a behavioral response that dampens borrowers' prepayment behavior, we conduct a sensitivity check applying a stricter assumption on the conditional prepayment rates (for example, PSA-75 model) in computing the effective maturity of a mortgage (see row [3] of Appendix Table A10). Although the effective maturity becomes longer at 13.9 years, the cross-sectional multiplier estimate remains sizable at 1.95.

the borrowers at the end of their mortgage maturity. Our back-of-the-envelope calculation suggests a cross-sectional multiplier estimate of

$$\hat{\mathcal{M}}_{CX} = 2.25.$$

Appendix C describes our calculation in greater detail, and Appendix Table A10 presents the sensitivity of our estimate to various assumptions.

Our cross-sectional multiplier estimate is sizable and in line with estimates in the literature, which typically range from 1 to 2.5 (Chodorow-Reich, 2019). This implies that mortgage forbearance is a highly effective fiscal measure for stabilizing aggregate demand during times of economic distress. The efficacy of mortgage forbearance can be primarily attributed to its low cost. To see why, consider an alternative repayment structure that immediately forgives borrowers of their missed payments during forbearance. Under this scenario, the fiscal cost for the program is equal to the total amount of deferred mortgage payments, which implies a multiplier estimate of 0.35 as shown in Equation (22). This suggests that the efficacy of mortgage forbearance arises from its low cost as a measure of temporary liquidity injection, which lies in contrast to direct fiscal transfers that typically involve larger costs. Lastly, while our multiplier estimate is sensitive to the interest rate assumption, it tends to be higher at lower interest rates (see Appendix Table A10). For example, if the interest rate is 2 percent instead of 1.46 percent, our multiplier estimate would become somewhat smaller at 1.70. This finding suggests that mortgage forbearance can be especially effective in the low-interest-rate environment or when interacted with an expansionary monetary policy during economic downturns.

8 Conclusion

In this paper, we estimate the macroeconomic effects of a large-scale mortgage forbearance program introduced by the CARES Act. While the CARES Act made debt forbearance almost universally eligible for all federally-backed mortgages, forbearance outcomes vary considerably across different mortgage servicers for observably similar mortgage borrowers. We use heterogeneity in regional exposure to this servicer effect to construct a shift-share measure that has significant explanatory power for the regional forbearance rate and use it as an instrument to estimate the effect of mortgage forbearance on local economic outcomes.

Our findings suggest that mortgage forbearance boosts local demand during economic recovery from a recession and thus can be a highly cost-effective fiscal measure of economic stabilization. While policy discussions have emerged regarding the inclusion of state-dependent modification features in mortgage contracts to promote macroeconomic stability during economic downturns (e.g., Eberly and Krishnamurthy, 2014; Guren et al., 2021; Campbell et al., 2021), this paper provides empirical evidence substantiating the stabilizing effects of such features by demonstrating the significant impact of the large-scale mortgage forbearance program on local labor market recovery.

We conclude by discussing directions for future research. First, it is important to empirically analyze household-level consumption responses out of mortgage forbearance. Since our results on local labor markets hinge on the consumption effects of households, credible evidence on households' spending responses can micro-found the macro-stabilization effects and confirm the channel through which mortgage forbearance augments local demand during economic downturns. Second, while this paper focuses on the consumption effects of mortgage forbearance, it would be interesting to analyze other potential general-equilibrium consequences of forbearance in the housing market, such as prevented foreclosures, spillovers to house prices, and new mortgage originations (e.g., Campbell et al., 2011; Gupta, 2019; Anenberg and Scharlemann, 2021).

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APPENDIX

A Additional Figures and Tables

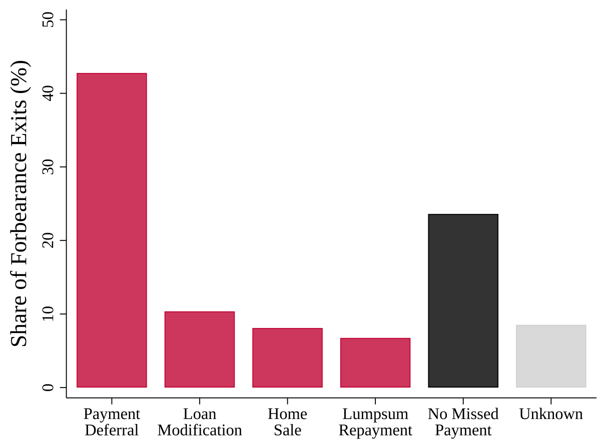
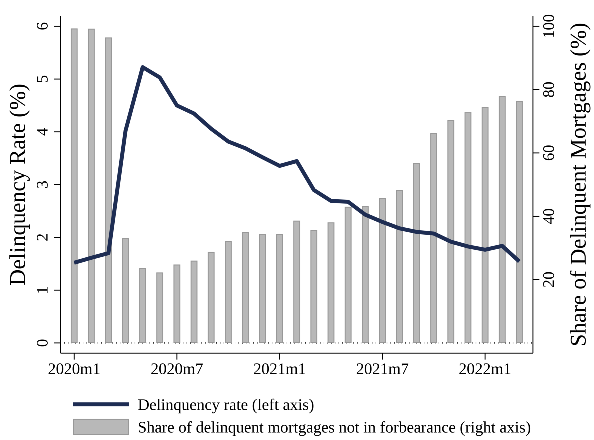
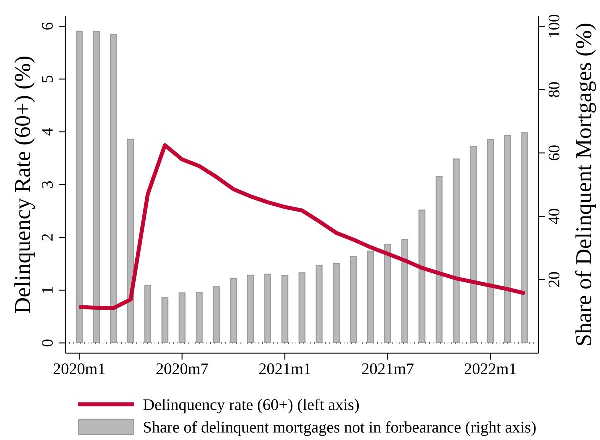


Figure A1: **Composition of Forbearance Exits.** This figure shows the share of exit categories among GSE mortgages. The sample includes all forborne mortgages that exit forbearance at some point during the April 2020–March 2022 period. Data sources: Fannie Mae and Freddie Mac.

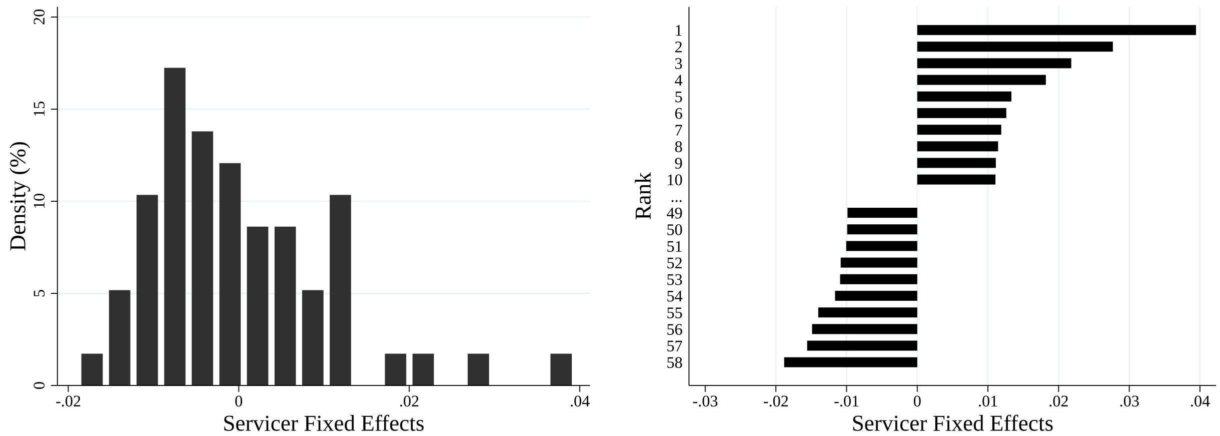


(a) 30+ Days Past Due



(b) 60+ Days Past Due

Figure A2: **Delinquent GSE Mortgages Not in Forbearance.** The left-hand panel shows the share of delinquent mortgages that are past due by 30 days or more (navy curve) alongside the fraction of such mortgages that are not in forbearance (gray bars). The right-hand panel shows the equivalent information for delinquent mortgages that are past due by 60 days or more. Data sources: Fannie Mae and Freddie Mac.



(a) Distribution of Servicer Fixed Effects

(b) Top and Bottom Servicer Fixed Effects

Figure A3: **Servicer Forbearance Propensity.** This figure shows the variation in the estimated forbearance propensities for mortgage servicers. The left-hand panel shows the distribution of the servicer fixed effects. The right-hand panel shows the forest plot of mortgage servicers with the top and bottom forbearance propensities. Data sources: Fannie Mae and Freddie Mac.

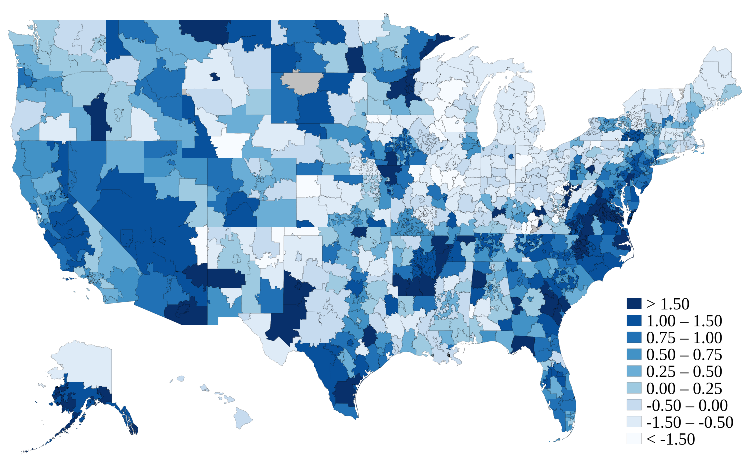
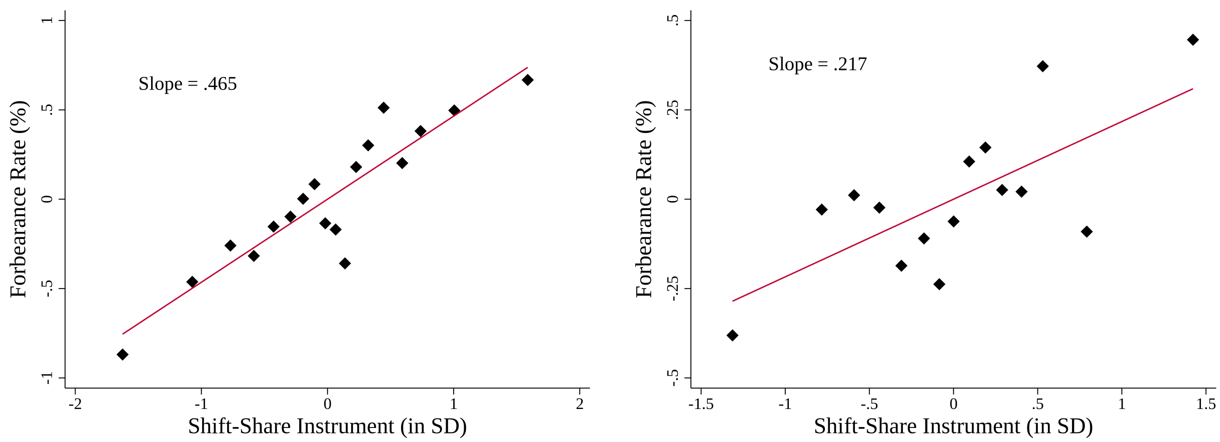


Figure A4: **Distribution of Shift-Share Measure across Zip3 Areas in June 2020.** This figure shows the geographic distribution of the shift-share measure that captures the average forbearance propensity of mortgage servicers in each Zip3 area. The legend is expressed in terms of SD units. Data sources: Fannie Mae and Freddie Mac.



(a) State Fixed Effects

(b) State Fixed Effects + Zip3 Controls

Figure A5: **Instrument Relevance.** This figure shows the binscatter of regional forbearance rates and our shift-share instrument. The left-hand panel plots the variables residualized with respect to state fixed effects. The right-hand panel plots the variables residualized with respect to state fixed effects and Zip3-level controls. Data sources: GSEs and ACS.

Category	Subcategory	Consumer Complaint Narrative
Difficulty with enrollment	Unable to reach servicer	"I am looking for loan forbearance under the covid-19 assistance from XXX. I have spent over 36 hours on hold only to be cut off. I try to fill out the form on their website and it does not recognize my loan number. I can not find a means to email them."
	Denial of request	"I have been seriously affected by COVID, my husband passed away and the bank refuses to assist me with any of the government backed programs, like mortgage forbearance .... I have called several times, went to the branch and all I get is the round around excuses."
	Request of documentation	"I requested forbearance .... I have been affirming that I am experiencing financial hardship during the COVID-19 ... Unfortunately XXX informed me that I have to submit various documents to prove that I am having a financial crisis."
Difficulty with extension	Unable to reach servicer	"XXX is making it difficult to extend the required mortgage forbearance. When I attempted to select "extend forbearance" it said I was not eligible. I am concerned that XXX is not following the intent of the relief package, and making it unreasonably difficult to get the extension."
	Request of documentation	"I was in the mortgage forbearance program .... requested an additional 180 day extension ... denied the extension by my loan servicer who is requesting additional financial information .... I would simply like to be granted the additional 180 days as outlined in the Cares Act ...."
	Denial of request	"I am having problems working with my mortgage company, XXX. At the beginning of the pandemic, I did receive my COVID forbearance for 3 months but after that period they haven't allowed me to continue with forbearance even though I have been contacting them continuously."
Inaccurate information	Exit options	"Tried calling XXX to see if they can help during the COVID-19 pandemic and they are only offering forbearance but you have to pay it back after the three months in full. How can somebody pay back three months all at once if you're having troubles already ..."
	Credit health and exit options	"With the Current COVID economic collapse, I called my mortgage holder, XXX, they informed me they can place my loan in forbearance, however, it will ruin my credit and all payments will be due in 90 days, in full, no partial payments or my loan will be foreclosed on."
Unconsented enrollment	Enrollment upon inquiry	"I reached out to XXX to inquire about borrowers assistance for covid 19 related changes. They automatically enrolled me into a forbearance program and cancelled my bi-weekly automatic payments. ... I never agreed to or signed a forbearance agreement."
	Automatic enrollment	"XXX is a trash company who put my mortgage in forbearance when no one asked. I've been paying my mortgage on time and in full every month and when I try to refinance my mortgage away from that horrible company, the new company gets a message that my loan is currently in forbearance."
Difficulty with unenrollment	Delay in processing	"I was on forbearance with XXX due to COVID. I requested to discontinue forbearance and began paying mortgage payments. After numerous, weekly phone calls and hours of time on hold, I have been promised ... It is now almost 6 months and is not complete."
	Automatic extension	"I have a mortgage with XXX and went in to forbearance when covid hit. ... We were ready to come out after the three months that was agreed upon but they extended it without permission for another three months. I called and asked how to cancel the forbearance and the story changes every time I called."

Table A1: **CFPB Consumer Complaints.** This table categorizes examples of consumer complaints to the Consumer Financial Protection Bureau related to mortgage forbearance.

	Without State FE		With State FE	
	Difference	*p*-value	Difference	*p*-value
	(1)	(2)	(3)	(4)
Average Loan Characteristics				
Principal Balance (in $K)	33.239	0.00	15.153	0.00
Interest Rate	0.017	0.19	-0.001	0.91
Credit Score at Origination	1.893	0.00	0.589	0.28
LTV Ratio at Origination	-1.239	0.00	-0.509	0.06
DTI Ratio at Origination	0.953	0.00	0.366	0.00
First Time Homebuyers	0.001	0.83	0.004	0.34
Demographic and Socioeconomic Characteristics				
Age: 30-39	0.007	0.00	0.004	0.00
Age: 40-49	0.004	0.00	0.003	0.00
Age: 50-59	-0.002	0.00	0.000	0.81
Age: 60-69	-0.006	0.00	-0.003	0.08
Age: 70+	-0.007	0.00	-0.006	0.00
Education: 12 Years	-0.038	0.00	-0.023	0.00
Education: 13-15 Years	-0.012	0.00	-0.007	0.00
Education: 16 Years	0.027	0.00	0.020	0.00
Education: 17+ Years	0.020	0.00	0.013	0.00
White	-0.073	0.00	-0.024	0.00
Black	0.042	0.00	0.016	0.00
Asian	0.014	0.00	0.005	0.06
Hispanic	0.051	0.00	0.015	0.00
Population (in logs)	0.487	0.00	0.296	0.00
Population Density (in logs)	0.665	0.00	0.466	0.00
Average Income (in $K)	3.543	0.00	2.540	0.00
Unemployment Rate, 2015-2019	0.001	0.18	0.000	0.59
Homeownership Rate	-0.026	0.00	-0.007	0.22
Fraction with Mortgage	0.039	0.00	0.026	0.00
Pandemic Controls				
COVID Rate (%)	0.001	0.95	-0.009	0.51
Death Rate (%)	0.000	0.72	0.000	0.69
PPP Amount (in $K per-capita)	0.167	0.20	0.195	0.00
Refinancing Rate (%)	2.364	0.00	0.788	0.07
Bankruptcy Filing Rate (%)	-0.005	0.52	0.006	0.18

Table A2: **Covariate Balance.** This table displays the covariate balance between Zip3 areas that are above and below the median of our shift-share instrument. Column (1) shows the average difference between the two groups of regions. Column (3) shows the difference controlling for state fixed effects. Columns (2) and (4) present the *p*-values obtained from a test of the null hypothesis that the difference is zero. Data sources: GSEs, ACS, Economic Tracker, SBA, and U.S. Courts.

	(1) Forbearance rate (%)	(2) Forbearance rate (%)	(3) PPP amount (per capita)	(4) Refinancing rate (%)	(5) Bankruptcy filing rate (%)
Shift-Share (in SD)	0.465***	0.217**	-2.480	-0.016	0.004
	(0.085)	(0.073)	(2.191)	(0.015)	(0.003)
State x Time FE	Y	Y	Y	Y	Y
Zip3 controls	N	Y	Y	Y	Y
R-squared	0.402	0.505	0.844	0.251	0.768
N	15138	15138	8920	15138	15138

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3: **Predictability of Forbearance and Other Economic Stimulus Measures.** This table shows the results of a panel regression of forbearance rates and other economic stimulus measures on our shift-share instrument, controlling for state-by-time fixed effects, average loan characteristics, and demographic and socioeconomic characteristics. The shift-share variable is expressed in SD units. Standard errors are two-way clustered by month and Zip3. Data sources: GSEs, ACS, SBA, and U.S. Courts.

	First-stage		Reduced-form		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share (in SD)	0.389***	0.189***	0.114***	0.056**		
	(0.057)	(0.057)	(0.022)	(0.020)		
Forbearance rate (%)					0.331***	0.298*
					(0.080)	(0.136)
State FE	Y	Y	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y	N	Y
R-squared	0.28	0.46	0.54	0.69	-	-
N	841	841	841	841	841	841
Outcome mean (%)	2.04	2.04	1.63	1.63	1.63	1.63
Outcome SD (%)	1.40	1.40	0.66	0.66	0.66	0.66

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4: **Results on Nontradable Payroll.** This table shows the regression results of our baseline specification for nontradable payrolls. Columns (1) and (2), (3) and (4), and (5) and (6) respectively show the results for first-stage, reduced-form, and 2SLS regressions, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

	First-stage		Reduced-form		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share (in SD)	0.370***	0.157**	0.099***	0.047**		
	(0.066)	(0.059)	(0.019)	(0.018)		
Forbearance rate (%)					0.366***	0.293+
					(0.106)	(0.150)
State FE	Y	Y	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y	N	Y
R-squared	0.38	0.66	0.67	0.80	-	-
N	841	841	841	841	841	841
Outcome mean (%)	2.04	2.04	1.13	1.13	1.13	1.13
Outcome SD (%)	1.4	1.4	0.52	0.52	0.52	0.52

Standard errors in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A5: **Weighted Results on Nontradable Employment.** This table shows the regression results of our baseline specification for nontradable employment growth, weighted by Zip3 populations in 2019. Columns (1) and (2), (3) and (4), and (5) and (6) respectively show the results for first-stage, reduced-form, and 2SLS regressions, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

	OLS		OLS	
	(1)	(2)	(3)	(4)
Forbearance rate (%)	0.034***	0.008	0.051***	0.017
	(0.010)	(0.009)	(0.010)	(0.011)
State FE	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y
Weighted	N	N	Y	Y
R-squared	0.60	0.73	0.67	0.80
N	841	841	841	841
Outcome mean (%)	1.13	1.13	1.13	1.13
Outcome SD (%)	0.52	0.52	0.52	0.52

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6: **OLS Results on Nontradable Employment.** This table shows the regression results of our baseline specification for nontradable employment growth, estimated using OLS. Columns (1) and (2), (3) and (4), and (5) and (6) respectively show the results for first-stage, reduced-form, and 2SLS regressions, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

	First-stage		Reduced-form	
	(1)	(2)	(3)	(4)
Shift-share (in SD)	-0.000	0.001	-0.005	-0.008
	(0.003)	(0.003)	(0.006)	(0.006)
State FE	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y
N	841	841	841	841

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A7: **Pre-Pandemic Placebo Effects.** This table shows the regression results for pre-pandemic placebo effects. Columns (1) and (2) and (3) and (4) respectively show the results for first-stage and reduced-form regressions, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

	First-stage		Reduced-form		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share (in SD)	0.384***	0.127*	0.083***	0.040**		
	(0.058)	(0.060)	(0.016)	(0.014)		
Forbearance rate (%)					0.243***	0.316^{+}
					(0.061)	(0.179)
State FE	Y	Y	Y	Y	Y	Y
Zip3 controls	N	Y	N	Y	N	Y
R-squared	0.28	0.45	0.61	0.78	-	-
N	841	841	841	841	841	841
Outcome mean (%)	2.04	2.04	1.13	1.13	1.13	1.13
Outcome SD (%)	1.40	1.40	0.52	0.52	0.52	0.52

Standard errors in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A8: **Alternative Servicer Effect Estimates.** This table shows the regression results based on alternative servicer effect estimates. Columns (1) and (2), (3) and (4), and (5) and (6) respectively show the results of first-stage, reduced-form, and 2SLS regressions, with and without including Zip3-level controls. The shift-share variable is expressed in SD units. All outcome variables are expressed in percentages. Data sources: GSEs, QCEW, and ACS.

	Description	Value	Target / Source
Theoretical Model Parameters			
$\mathscr{M}$	Local Keynesian Multiplier	1.8	Chodorow-Reich (2019)
$1-\alpha^N$	Non-Tradable Labor Share	2/3	Chodorow-Reich et al. (2021)
η	Non-Tradable Expenditure Share	0.44	QCEW
$r^m M$ (or $\widehat{A}$)	Mortgage Payment Amount	\$900	Figure 2
Labor and Mortgage Market Statistics			
$N^{1\%}$	1% of Mortgage Market	0.52M	
$N^{\text{GSE},1\%}$	1% of GSE Market	0.24M	FRED
F^{GNMA}	Adjustment Factor for GNMA Mortgages	2.15	GSE / GNMA data
$W_0^N L_0^N$	Monthly Non-Tradable Wage Bill	\$55.6B	QCEW
MPC-MPX Mapping			
s	Durable Share	0.125	Laibson et al. (2022)
δ	Durable Depreciation Rate	0.22	Laibson et al. (2022)
r	Real Interest Rate	0	Laibson et al. (2022)

Table A9: **Calibration of Parameters.** This table presents the calibration of parameters that we use in Section 7 to compute the implied household-level consumption responses and the cross-sectional multiplier effects of forbearance.

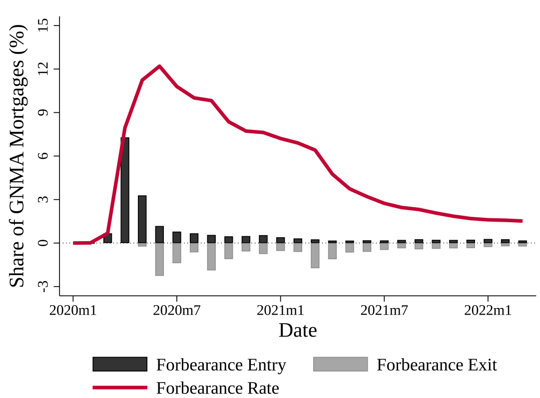
			Interest Rate, i				
		T	1%	1.46%	2%	3%	4%
1	Effective Maturity w/ PSA-200	7.0	5.27	3.68	2.74	1.90	1.48
2	Effective Maturity w/ PSA-100 (Baseline)	11.8	3.19	**2.25**	1.70	1.20	0.95
3	Effective Maturity w/ PSA-75	13.9	2.75	1.95	1.48	1.06	0.85
4	Full Mortgage Maturity	23.8	1.68	1.21	0.94	0.70	0.58

Table A10: **Sensitivity of Forbearance Multiplier.** This table shows the sensitivity of our cross-sectional multiplier estimate of mortgage forbearance to underlying assumptions. i is the nominal interest rate at which the federal government issues a long-term bond to finance the mortgage forbearance expense. T is the maturity of the long-term bond. Effective maturity of a mortgage is computed using the benchmark prepayment model developed by the Public Securities Association (PSA) as described in Appendix C. Data sources: GSEs, FRED, and J.P. Morgan Markets.

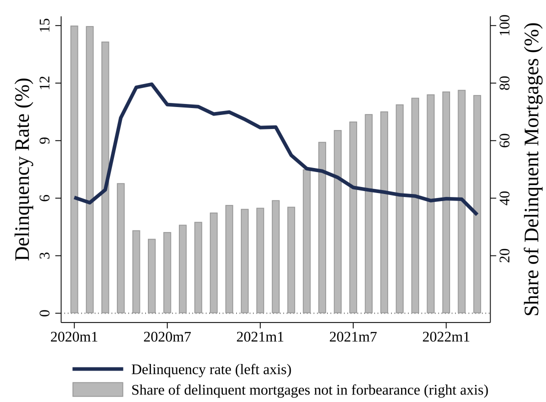
B Comparison to GNMA Mortgage Market

Ginnie Mae Disclosure Data on MBS Portfolio Loans. To supplement our analyses, we use Ginnie Mae credit performance data on single-family mortgages. This is a loan-level monthly panel data set that provides detailed information on loan and borrower characteristics. Since May 2020, Ginnie Mae has also published monthly supplemental data that contain loan-level forbearance status. In contrast to the GSE data, however, the GNMA data disclose only state-level information on property location. Since our local labor market analysis requires more granular geographic information, the GNMA sample is excluded from our main analysis.

Forbearance Rates and Trends. In panel (a) of Figure B1, the forbearance rate sharply increased after March 2020, peaked at about 12 percent in June 2020, and gradually declined to 4 percent by June 2021. This pattern is qualitatively similar but quantitatively larger compared with the pattern observed for GSE mortgages. The larger fraction of GNMA mortgages in forbearance is consistent with the evidence that low-income households were more exposed to the recession. The higher forbearance rate also implies that despite the lower market share of GNMA mortgages, their contribution to the aggregate forbearance rate is comparable to GSE mortgages. In panel (b), the non-take-up rate among delinquent mortgages is similar to the pattern for GSE mortgages.



(a) Mortgage Forbearance Rates



(b) Delinquent Mortgages not in Forbearance

Figure B1: **Forbearance Rates and Non-Take-Up in the GNMA Mortgage Market.** The left-hand panel shows the share of GNMA mortgages in forbearance along with the entry and exit rates at each month. The right-hand panel shows the share of mortgages past due and the fraction of these delinquent mortgages that are not in forbearance. Data source: Ginnie Mae.

C Multiplier Effect Calculation Details

We approximate the cross-sectional fiscal multiplier effects by comparing the dollar value of our employment effects and the fiscal costs associated with providing mortgage forbearance as shown in Equation (25):

$$\mathcal{M}_{CX} \approx \frac{\Delta(\text{Nontradable payroll})}{\Delta(\text{Government spending})}.$$

In this section, we provide a more detailed discussion of how we approximate the denominator, which represents the fiscal costs associated with providing the liquidity of the amount calculated in Equation (20).

As noted in Section 7.2, we make a few assumptions. First, we assume that all mortgage borrowers exiting forbearance choose to defer repayment of their missed payments to the end of their mortgage maturity as an interest-free, second-lien, loan. In this case, the fiscal cost of the program can be understood as the waived interest payments on these interest-free loans. Furthermore, since we assume that the federal government finances this expense by issuing a long-term government bond, the denominator of the above expression can be written as:

$$\Delta(\text{Government spending}) = \Delta(\text{Liquidity from forbearance}) \cdot [1 - (\frac{1}{1+i})^T], \tag{26}$$

where Δ(Liquidity from forbearance) is the dollar amount of liquidity provided through mortgage forbearance, i is the interest rate on a long-term bond used to finance the fiscal expense, and T is the average effective years remaining in mortgage maturity for all forborne loans. We discuss each of these terms in turn.

Liquidity from Mortgage Forbearance. We calculate the amount of liquidity provided through mortgage forbearance using Equation (20):

$$\Delta(\text{Liquidity from forbearance}) = \widehat{A} \times N^{1\%},$$

where $\widehat{A}$ is the average amount of suspended mortgage payment among forborne borrowers. As shown in Figure 2, approximately one third of the borrowers continued to make payments while in forbearance. Hence, we use $\widehat{A} = \$880$ to capture the actual amount of liquidity resulting from forbearance.

We then multiply this estimate by $N^{1\%}$, a quantity equivalent to 1 percent of the total mortgage market. Since our empirical analysis only covers the GSE segment of the agency mortgage market, we adjust the number of GSE mortgages by a multiplicative factor to account for the presence of a roughly equivalent number of GNMA mortgages in forbearance. Because the relative servicing shares of the GSE and GNMA mortgages in the agency mortgage market are 0.7 and 0.3 (Inside Mortgage Finance, 2023) and the average forbearance rates in these two segments of the market are 2.1 percent and 5.5 percent respectively in our sample period, we set the adjustment factor as 2.15 ($= \frac{0.7\times 2.1\% + 0.3\times 5.5\%}{0.7\times 2.1\%}$). We multiply the number of mortgages equivalent to 1 percent of the GSE mortgage market, obtained from the Federal Reserve Economic Data (FRED), by this adjustment factor.

Interest Rate (i). In our baseline, we set the interest rate to $i = 1.46\%$, the 30-year Treasury rate at the onset of the CARES Act in March 2020.

Effect Maturity (T). We compute the effective maturity of a mortgage using the benchmark prepayment model developed by the Public Securities Association (PSA). The PSA-100 model assumes that the conditional prepayment rate (CPR) is 0.2 percent in month 1, gradually increases to 6 percent in month 30 (in increments of 0.2 percent), and stays at 6 percent for the rest of the period. The PSA model scales linearly so that PSA of 200, for instance, would assume that CPRs increase from 0.4 percent to 12 percent.

In our baseline, we use the standard PSA-100 model and obtain the average effective remaining maturity of all forborne loans of $T = 11.8$ years. This assumption is a conservative choice since the PSA-100 model assumes no volatility in the interest rate and, accordingly, no prepayment due to the interest rate change. In our analysis of PSAs using the JP Morgan Markets data, the PSA maturity is near 100 only when there is a large positive gap between a mortgage's coupon rate and the prevailing market interest rate.[42] However, the PSA maturity of a mortgage can be much higher in general.[43]

[42]For instance, in September 2022, when the 30-year fixed rate mortgage rate was high at 6.11 percent, the PSA maturity of a 4.5 percent GSE mortgage was 140.05, which is still above our baseline of 100. The average coupon rate of all forborne mortgages in our data is 4.37 percent.

[43]In March 2020, for example, when the market rate was 3.45 percent, the PSA maturity of a 4.5 percent mortgage

Summary. Substituting the terms described above, we approximate the denominator as:

$$\Delta(\text{Government spending}) \approx (\$4.68 \times 10^8) \cdot [1 - (\frac{1}{1.0146})^{11.8}] = \$7.38 \times 10^7.$$

Finally, combining the numerator and the denominator, we obtain our multiplier estimate:

$$\mathscr{M}_{CX} \approx \frac{\Delta(\text{Nontradable labor bill})}{\Delta(\text{Government spending})} = \frac{\$1.66 \times 10^8}{\$7.38 \times 10^7} = 2.25.$$

Appendix Table A9 presents our calibration of parameters. Appendix Table A10 displays the sensitivity of our estimate to assumptions about the interest rate and the effective maturity.

was 770.95, which corresponds to CRPs that range from 1.5 percent to 46.3 percent.