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Abstract

Using data from the Current Population Surveys, we investigate the aggregate and distributional consequences of the Covid-19 pandemic and the associated public policy response on labor earnings and unemployment benefits in the United States up until February 2021. We find that year-on-year changes in labor earnings for employed individuals were not atypical during the pandemic months, regardless of their initial position in the earnings distribution. The incidence of job loss, however, was, and continues to be, substantially higher among low earners, leading to a dramatic increase in labor income inequality among the set of individuals who were employed prior to the onset of the pandemic. By providing very high replacement rates for individuals displaced from low-paying jobs, the initial public policy response was successful in reversing the regressive nature of the pandemic's impacts. We estimate, however, that recipiency rates for displaced low earners were relatively low. Moreover, from September onwards, when policy changes led to a decline in benefit levels, earnings changes became much more regressive, even after factoring in benefits.

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1 Introduction

The Covid-19 pandemic has had devastating effects on the American job market. In April 2020, nonfarm payroll fell by 20.5 million jobs compared to March (BLS, 2020). Although there has been some recovery since that time, there were still nearly 9 million fewer jobs in February 2021 compared to February 2020. In response to the pandemic, the U.S. Congress enacted a multi-trillion dollar policy response through the passing of the Coronavirus Aid, Relief, and Economic Security (CARES) Act, as well as several additional packages over the subsequent year.

In this paper we investigate the aggregate and distributional consequences of the pandemic on labor earnings, and the mitigating impact of the associated public policy response. We use data through February 2021 from the Current Population Survey (CPS), the official source for labor market statistics in the U.S. By exploiting the panel structure of the CPS, we are able to track individual-level earnings changes in order to provide a comprehensive analysis of the impacts of the pandemic and the CARES Act policies throughout the earnings distribution. In particular, we are able to distinguish between earnings impacts along the extensive margin (i.e. job loss) and along the intensive margin (i.e. earnings changes among the employed). We are also able to simulate Unemployment Insurance (UI) payments for individuals who have separated from their jobs using information on their pre-displacement earnings. This allows us to estimate heterogeneity in the impact of the public policy response across the pre-displacement earnings distribution. Such an analysis is not possible from cross-sectional data or from data collected by state UI agencies on benefit recipients.

We begin by showing that weekly labor earnings per adult fell by around $90 between February and April 2020, and have only partially recovered over more recent months. Interestingly, using our matched data, we find that, contrary to anecdotal evidence regarding pandemic-related pay increases and pay cuts, year-on-year earnings changes for employed individuals were not atypical during the pandemic period. The decline in labor earnings is entirely driven by the decline in aggregate employment.

Job losses, however, are very unequally distributed throughout the earnings distribution. From April through July, the year-on-year probability of transitioning out of employment was around four times as high for individuals who were in the lowest quintile of the earnings distribution before the onset of the pandemic, compared to those in the top quintile. Since July, the year-on-year probability of exiting employment for top quintile workers has approached pre-pandemic levels, while the bottom quintile workers are still more than 6 percentage points more likely to be out of work compared with previous years. Hence, while the pandemic led to a reduction in average labor earnings growth rates of around 10 percentage points overall among workers who were initially employed, workers initially in the bottom decile of the earnings distribution experienced a contraction of nearly 85 percentage points on average in the early pandemic period (April to July) and nearly 63 percentage points on average during the more recent period (August to February), due to the increased incidence of job loss. This implies that inequality in terms of labor earnings (before factoring in UI payments) increased dramatically during the pandemic months.

We then proceed to analyze the extent to which the labor market public policy response to the pandemic was able to mitigate the overall loss in labor earnings and the associated increase in inequality. We simulate UI benefit receipt at the individual level using pre-displacement weekly earnings and state of residence information from the matched CPS samples. We build off of the state UI benefit database constructed by Ganong et al. (2020), extending the simulator to model benefits provided by the CARES Act, as well as subsequent legislation.

A crucial part of our analysis involves estimating recipiency. To do so, we contrast our CPS-based estimates of eligibility and benefits to aggregate data on UI recipients from the Department of Labor and the Bureau of Economic Analysis. By benchmarking our estimates for eligible claimants to measures of actual claims paid (less estimated fraudulent payments), we estimate that 97% of the individuals that we identify as eligible for standard UI received benefits. However, for the supplementary Pandemic Unemployment Assistance (PUA) program, which was introduced by the CARES Act and was intended to expand eligibility to individuals who are not typically eligible for UI, we estimate that only 55% of those eligible received benefits. These asymmetric recipiency rates have important distributional consequences, given that we estimate that a substantial fraction of low earners would only be eligible for PUA, and hence would be less likely to receive benefits.

We find that, up until July, the public policy response was very successful in reversing the asymmetric impacts of the pandemic. Median weekly earnings for workers who were displaced during the early pandemic period were $496. The CARES Act provision of $600 per week on top of baseline UI benefits, which was in place until July, was therefore strongly progressive, providing very high replacement rates, particularly for low earners. We estimate that during the period between April and July, the growth rate of total earnings (labor earnings plus UI) would have increased by 46 percentage points for bottom quartile workers, if all of the individuals that we deem to be potentially eligible for UI had received benefits. If we apply our estimated recipiency rates, the estimated change is less than half that (though still large), at 19 percentage points. It is also important to emphasize that this average conceals important heterogeneities among low earners, given that it results from the combination of: (i) displaced and UI-eligible workers who were able to claim benefits and experienced large increases in income thanks to the $600 top-up, (ii) non-displaced workers whose earnings remained stable, and (iii) UI-ineligible or non-claiming displaced individuals who experienced a complete reduction in earnings.

Between September and December, when no UI top-ups were provided, earnings changes tilted regressive, with substantial total earnings losses (even after factoring in UI benefits) among workers in the bottom decile of the pre-pandemic earnings distribution, and essentially no change (or if anything slightly positive changes) in total earnings (wages plus UI) among workers in the top decile. In January and February 2021, $300 top-ups were provided. These, however, were far from enough to offset the labor earnings losses experienced by individuals in the bottom of the pre-displacement earnings distribution, particularly after we take into account the low recipiency rate among this group. In fact, we estimate that year-on-year earnings growth rates (including UI) for individuals from the bottom quartile of the pre-pandemic earnings distribution fell by 22 percentage points in January and February 2021.

Overall, we find that around 43% of the benefits paid during the early pandemic period (April-July) went to the bottom-earning one-third of workers (after adjusting for recipiency). During the more recent period (August-February), this share fell to 29%. Thus, despite low-wage workers remaining more likely to have lost wages and employment through February 2021, over recent months they have received a smaller share of benefits.

A rapid literature has developed studying the impact of the Covid-19 pandemic on the labor market. Bartik et al. (2020), Montenovo et al. (2020), Couch et al. (2020), and Cortes & Forsythe (2020a), for example, study the asymmetric impacts of the pandemic across different groups of workers.[1] While these papers focus exclusively on employment outcomes, our contribution in this paper is to focus on earnings. Our data allow us to consider within-individual changes in earnings and to analyze the impact of

[1] A related literature uses data on occupational tasks in order to assess which jobs are more likely to be at risk due to the pandemic (e.g. Béland et al., 2020; Dingel & Neiman, 2020; Mongey et al., 2020).

the pandemic and the associated public policy response on inequality, before and after factoring in unemployment benefits.

Our paper also contributes to the literature that studies the impacts of the public policy response to the pandemic. Baker et al. (2020) examine consumption behavior from the stimulus checks which were a part of the CARES Act, and find that 30% of stimulus payments were spent within the month, with lower-income individuals driving consumption behavior. Cox et al. (2020) use bank account data to show that spending fell for all income groups in March, but had rebounded by April for the lowest income groups – a pattern that is consistent with our finding about the progressivity of the public policy response during the early months of the pandemic (see also Chetty et al., 2020).[2] A number of papers consider whether the generosity of the CARES Act has led to job search disincentives for recipients, and generally conclude that this is not the case. For example, Marinescu et al. (2020) find that applications-per-vacancy increased on Glassdoor.com during the crisis. Looking at cross-state differences in the average UI replacement rate, Dube (2020) finds no evidence that states with a higher replacement rate had lower employment, while in fact Bartik et al. (2020) find a smaller decline in employment and a faster recovery for small businesses.[3]

The two papers most closely related to ours are Cajner et al. (2020) and Ganong et al. (2020). Cajner et al. (2020) use data from ADP (a large U.S. payroll processing company) and, consistent with our results, find that lower-wage workers were disproportionately likely to lose employment during the pandemic. Our analysis based on nationally representative CPS data complements their findings in this regard, while also providing a number of new results about the overall changes in inequality observed during different phases of the pandemic, and how these changes were mitigated by the public policy response through the CARES Act.

Relative to Ganong et al. (2020), we provide a more comprehensive analysis of the impact of the Covid-19 recession and the CARES Act on earnings and on inequality (before and after factoring in UI benefits) by considering *all* workers who were employed prior to the pandemic. Our use of longitudinally matched CPS samples allows us to consider changes not only for individuals who transition to unemployment, but also for those who transition to non-participation, and for those who remain employed.[4]

[2]Brewer & Gardiner (2020) and Carta & De Philippis (2021) provide related results for the UK and Italy, respectively.

[3]See also Altonji et al. (2020) and Finamor & Scott (2021).

[4]As we show in Cortes & Forsythe (2020a), the pandemic induced substantial excess worker flows towards both unemployment and non-participation, with transitions to non-participation representing

We also expand on their UI simulator by explicitly modeling the PUA program, which extended UI eligibility to the self-employed and low-earning individuals.

An additional contribution of our paper relative to existing work is to extend the analysis period through February 2021. This allows us to document the impacts of the pandemic that persist up to one year after its onset, and to consider differences across four phases of pandemic unemployment insurance: the $600 Pandemic Unemployment Compensation period (April-July), the $300 Lost Wages Assistance period (August), the period from September to December with no weekly top-up, and the period from late December onwards with a $300 top-up. Our results provide new insights on the evolution of labor earnings and income inequality under these various UI benefit policy regimes.

2 Data and Methodology

Our analysis uses data from the monthly Current Population Survey (CPS), retrieved from the IPUMS repository (Flood et al., 2020). The CPS has a rotating panel structure. Earnings information is collected at (up to) two points in time for every individual, with the two observations being one year apart. We take advantage of this rotating structure in our analysis and track individuals' employment status and earnings over time. We match individuals across CPS samples following Madrian & Lefgren (1999), by matching monthly files using administrative IDs and confirming matches based on sex, race, and age.[5]

We restrict our analysis to non-institutionalized civilians aged 16 and older. We mainly use data from January 2015 onwards, though we also show some patterns using earlier data. The most recent wave of data used in this paper is for February 2021.[6] The CPS survey is conducted in the week containing the 12th of each month. During the pandemic period, the CPS reported an unusually large number of individuals who were absent from work for unspecified reasons, which the Bureau of Labor Statistics (BLS)

at least one-fifth of the total. A large fraction of these workers who were classified as non-participants in the CPS would have likely been eligible to claim UI benefits, and hence an analysis that focuses solely on workers classified as unemployed (such as in Ganong et al., 2020) might miss an important fraction of UI claimants.

[5] In Cortes & Forsythe (2020a) we show that the evolution of employment during the pandemic months obtained from flow data closely tracks the observed evolution in the cross-sectional stock data.

[6] Since our analysis relies heavily on year-on-year changes, using data from March 2021 onwards is problematic given that the effects of the pandemic start to be noticeable in March 2020.

has indicated are better classified as being on temporary layoff.[7] However, nearly one-quarter of individuals who were absent for "other" reasons in April 2020 report being paid by their employer for their time off. We therefore only re-assign individuals as being on temporary layoff if they appear in the survey as being employed but are absent from work for unspecified reasons, and report that they were not paid by their employer for their time off. This adjustment makes little difference in pre-pandemic periods but decreases the employment rate by nearly 2.5 percentage points in April 2020 (see Cortes & Forsythe, 2020a).

The main measure of labor earnings provided in the CPS (which forms the basis for all officially released statistics on earnings) is usual weekly earnings at the current job, before deductions. This measure is the higher of the following two values: (1) the respondent's answer to the question, "How much do you usually earn per week at this job before deductions?", or (2) for workers paid by the hour, the reported number of hours the respondent usually worked at the job, multiplied by their hourly wage rate. During the pandemic period, many workers' *actual* earnings may have deviated from their *usual* earnings, and particularly so for hourly workers who likely experienced decreases in hours. In order to obtain a measure of earnings that is closer to actual earnings, for hourly workers, we compute their earnings as their hourly wage rate multiplied by their actual hours worked during the reference week at their main job (when both of these variables are non-missing). For workers who are not paid by the hour, since no measure of actual earnings is available, we use their usual earnings as our earnings measure.[8]

We convert earnings in all periods to real June 2020 dollars using the Consumer Price Index (CPI-U) from the Bureau of Labor Statistics. Following Lemieux (2006), we adjust top-coded earnings by a factor of 1.4. We also winsorize the lowest 1% of earnings. We weight individuals using the relevant individual weights for those in the earnings sample (EARNWT in IPUMS).

To understand the impact of the pandemic along the earnings distribution, we classify individuals into ventiles (bins containing 5% of workers). Due to noisiness at the tails, as well as top-coding, we do not sub-divide workers in the bottom or the top decile of the distribution. When analyzing within-individual year-on-year changes across the distribution, we allocate individuals to ventiles based on their position in the earnings distribution in the initial period, but weight them according to their current period

[7] See https://www.bls.gov/cps/employment-situation-covid19-faq-april-2020.pdf

[8] Results obtained when using usual earnings for all workers are qualitatively similar to those presented here, and are available in our earlier working paper version (Cortes & Forsythe, 2020b).

weights.[9]

In order to isolate the impact of the pandemic from seasonal and annual patterns we implement a regression approach. For outcomes aggregated to the monthly level, we run regressions of the following form:

$$Y_t = \gamma_t^m + \alpha_t^y + \beta D_t^C + \epsilon_t \tag{1}$$

where Y_t is the outcome variable of interest in period t (e.g. the change in average earnings between month t and month $t-12$), γ_t^m is a set of calendar month fixed effects, capturing any seasonal patterns in the outcome variable, and α_t^y is a set of year fixed effects.[10] D_t^C is an indicator for the Covid-19 pandemic months – either a vector of dummies for each month from March 2020 through February 2021, or a set of dummies pooling these months, as detailed below. Our coefficient of interest, β, captures deviations in our outcome of interest during the pandemic months, once seasonal effects and annual patterns have been accounted for.

We analyze the impacts of the pandemic along the earnings distribution following a similar regression approach, but using the individual-level data directly and allowing for heterogeneous patterns at each ventile, i.e.:

$$Y_{it} = \gamma_{pt}^m + \alpha_{pt}^y + \beta_p D_t^C + \epsilon_{it} \tag{2}$$

Here, our outcome variable of interest Y_{it} will be a measure of within-individual year-on-year income change (i.e. between month $t-12$ and month t). Our sample will therefore be constituted by individuals who were employed and had non-missing earnings in month $t-12$. p represents the ventile that individual i belongs to (based on his or her position in the earnings distribution in $t-12$). γ_{pt}^m and α_{pt}^y are fully interacted ventile-month and ventile-year fixed effects, which control for any ventile-specific seasonal and annual patterns. Depending on the outcome of interest, we either condition on individuals who are also employed in period t or we include individuals who transition out of employment between $t-12$ and t. In such cases, we measure earnings changes

[9]This is particularly important during the pandemic period due to the increased incidence of non-response. Note that the BLS has stated that "although the collection rates were adversely affected by pandemic-related issues, BLS was still able to obtain estimates that met our standards for accuracy and reliability" (https://www.bls.gov/cps/employment-situation-covid19-faq-april-2020.pdf).

[10]Since all of 2021 is during the pandemic period, we extend the 2020 year dummy to include 2021 as well, since we cannot distinguish "normal" annual variation from the impact of the pandemic in that year.

in percentage terms (rather than log changes), with individuals who are not employed in period t experiencing an earnings change (before transfers) of -100%.[11]

As discussed in detail in Section 4, our analysis of the public policy response to the pandemic builds on the UI simulator of Ganong et al. (2020) as well as using information from the 2019 American Community Survey (ACS), also obtained through IPUMS (Ruggles et al., 2020).

3 Changes in Earnings during the Pandemic

3.1 Impact on Average Earnings

Figure 1 displays the evolution of earnings over time. Panel A shows average real weekly earnings among workers in each cross-section. As has been widely documented, average earnings increased substantially between February and May 2020 (from around $1,070 to $1,150) and remain higher than in the pre-pandemic period. Naturally, this does not translate into higher aggregate labor earnings, given that employment fell dramatically during this time period. As Panel B shows, weekly labor earnings *per adult* fell substantially at the onset of the pandemic, from around $650 in February to around $560 in April, and have not recovered to the levels observed early on in 2020.

The cross-sectional increase in average earnings observed in Panel A of Figure 1 is of course affected by changes in the composition of the workforce due to the large employment contraction at the onset of the pandemic. By exploiting the rotating panel structure of the CPS, we are able to track within-individual changes in earnings in order to determine whether the cross-sectional increase in average earnings is entirely composition driven, or whether it also reflects earnings increases among individuals who remain employed, perhaps because of increases in hazard pay due to the pandemic.[12]

The solid blue line in Panel A of Figure 2 presents raw year-on-year changes in average log real weekly earnings in the cross-section, reflecting the pattern observed in Panel A of Figure 1. The dashed red line, meanwhile, computes average within-individual year-on-year changes in log real earnings for individuals who are employed

[11] Alternatively, we could replace zeros with a small positive value in order to continue working with log earnings. However, given how widespread the job losses have been during the pandemic period, the assumed small positive value is not innocuous and can substantially skew the average earnings changes along the distribution.

[12] Amazon, for example, increased hourly wages by $2 for workers in a number of roles; see `https://blog.aboutamazon.com/operations/amazon-opening-100000-new-roles?utm_source=social&utm_medium=tw&utm_term=amznnews&utm_content=COVID-19_hiring&linkId=84444004`.

in month t and in month $t-12$. If we consider the patterns typically observed before the pandemic, we see that longitudinal earnings changes tend to be larger than the earnings changes observed in the cross-section. This is because the longitudinal changes are based on a selected sample with stronger labor market attachment. Remarkably, this series remains very stable during the pandemic months. Conditional on being employed, year-on-year earnings changes during the pandemic months were not atypical on average. This implies that the observed increase in mean earnings in the solid blue line is entirely driven by changes in the composition of the workforce.[13]

Panel B of Figure 2 isolates the impact of the pandemic by implementing the regression approach in Equation (1) using data from January 2015 onwards. The blue and red bars use the same variables as in Panel A. The figure plots the estimated coefficients for the monthly pandemic-month dummies, which capture the year-on-year impacts of the pandemic in each month, after controlling for seasonal and annual effects. The estimated coefficients confirm the substantial and significant increase in mean earnings in the cross-section up until August 2020, and the lack of significant changes in earnings growth among individuals employed in month t and month $t-12$, except for some evidence of earnings decreases in the year to September 2020 among workers who were also employed in September 2019.

The green bars in Panel B are based on a specification where the dependent variable is the average within-individual year-on-year percentage change in real earnings, including individuals whose labor earnings fall to zero due to exit from employment.[14] When considering all individuals who were initially employed, including those who exit to non-employment, we observe a dramatic decrease in the average earnings growth rate during the early pandemic months – more than 20 percentage points year-on-year in April, and 17 and 19 percentage points respectively in May and June. This is in line with the substantial decline in earnings per adult documented in Panel B of Figure 1

[13]This result is consistent with the finding of Cajner et al. (2020), who conduct a similar analysis using payroll data from ADP, and is a particularly extreme example of the cyclical composition bias of wages documented by Solon et al. (1994). The literature has been equivocal about whether firms reduce wages during downturns, as is predicted in the Diamond-Mortensen-Pissarides model to facilitate a quick recovery in hiring after downturns. A long literature finds evidence of both cyclical rigidity and flexibility. Most recently, Gertler et al. (2020) find both new hires and continuing workers experience downward nominal wage rigidity, although Jardim et al. (2019) find that many continuing workers do receive nominal wage cuts in administrative data, and the frequency of these cuts increases during recessions.

[14]Note that the dependent variables for the blue and red bars are based on changes in log earnings, rather than percentage changes. Results, however, are nearly identical if we use percentage changes for all specifications.

and, given the lack of major declines in earnings growth rates among those who are employed in the pandemic months (as shown in the red bars), is almost entirely driven by the increased incidence of job loss. Interestingly, statistically significant and quantitatively large declines are also observed in July, September and November, as well as in the first two months of 2021. This is indicative of substantial declines in earnings among individuals who were employed in the pre-pandemic period, which are sustained into 2021, and which still largely operate through the increased incidence of job loss.[15]

3.2 Distributional Impacts

We now turn to the distributional impacts of the pandemic. In Figure 3 we explore the impacts of the pandemic throughout the earnings distribution, focusing on individuals who were employed prior to the pandemic and tracking their outcomes over time. As discussed in Section 2, we isolate the impact of the pandemic throughout the earnings distribution by estimating Equation (2) using individual-level data. The regression incorporates fully interacted ventile-month and ventile-year fixed effects, which allow seasonal and annual patterns to be heterogeneous along the distribution. Our sample includes 294,123 observations covering the period from January 2015 onwards (264,968 observations when conditioning on individuals who remain employed).

Rather than showing the impacts in each individual month, we present results for the impact during the early months of the pandemic (April through July) and during more recent months (August through February).[16] Panel A of Figure 3 shows the impact on labor earnings growth rates using the full sample of individuals who were employed in the baseline period. A clear pattern emerges: during the early months of the pandemic, individuals who initially had lower weekly earnings experienced dramatically larger declines in their labor income growth rates – as high as 85 percentage points for individuals in the bottom decile of the distribution. The impact on year-on-year changes during more recent months is similarly stronger for individuals who were initially in the bottom 20% of the distribution, with the impact on individuals from the

[15]Appendix Figure A.1 shows the estimated impact of the pandemic on the year-on-year job separation rate. The impact is strongest at the onset of the pandemic, but remains elevated in recent months, with little progress since August. As we show in Cortes & Forsythe (2020a), the vast majority of the decline in employment during the pandemic is driven by an increase in the job separation rate; the decline in the job finding rate is comparatively small. Hence, most of the earnings impact of the pandemic would be felt among individuals who were initially employed (which is the sample that we focus on here).

[16]All regressions also control separately for ventile-specific impacts in March 2020 (not shown).

bottom decile remaining substantial, at 63 percentage points.

These changes in earnings may arise because of an extensive margin effect, i.e. a change in the probability of being employed and having *any* labor earnings, and an intensive margin effect, i.e. a change in earnings conditional on remaining employed. Panels B and C separate these two effects. Consistent with our results regarding the impact of the pandemic on average earnings in Figure 2, we find that the impacts of the pandemic along the earnings distribution are driven almost exclusively by the extensive margin effect. Panel B shows that, while the probability of remaining employed declined by less than 5 percentage points for workers in the top decile of the pre-pandemic earnings distribution during the early months of the pandemic, the decline was above 24 percentage points for workers in the bottom decile. During the more recent period, the impact is indistinguishable from zero for workers in the top decile, while it remains large – above 12 percentage points – for those in the bottom decile. These asymmetric effects along the distribution explain the cross-sectional increase in average earnings documented in Figure 1.

Panel C considers the impact of the pandemic on earnings growth rates for workers who remain employed.[17] The results show that the pandemic does not generally have a statistically significant impact on earnings for this group of workers.[18] Appendix Figure A.2 separately analyzes the probability of experiencing a decrease (increase) in individual-level nominal weekly earnings of more than \$10. The results do not provide evidence of widespread systematic reductions in hourly earnings or in paid hours of work among individuals who are still in employment during the pandemic months, regardless of their initial position in the earnings distribution. There is also no evidence of systematic reductions in the rate at which individuals experience earnings increases, nor do earnings increases become more prevalent (in spite of the potential increased

[17]It is worth reiterating that we focus on year-on-year changes due to the structure of our data; hence, individuals who "remain employed" are those who are employed in month t and in month $t-12$ (i.e. when they are in their fourth and eighth month-in-samples); they do not necessarily remain *continuously* employed throughout the entirety of the one-year window over which we compute the earnings change.

[18]The only exceptions are for those between the 50th and the 55th percentile, for whom there is a statistically significant positive impact during the early pandemic period, and for those between the 70th and the 75th percentile, for whom there is a statistically significant negative impact during the more recent period. Point estimates are also negative, at around -0.06, for workers in the bottom 20% of the distribution during the more recent period, with p-values between 0.16 and 0.18.

risk of exposure to disease faced by individuals who are unable to work remotely).[19,20]

Overall, we can conclude that the increase in mean earnings observed in the aggregate data in Figure 1 is entirely composition driven, due to the exit of low earners from employment. If we track individuals who were employed before the pandemic, we see that the pandemic had the effect of dramatically *reducing* labor earnings and *increasing* labor income inequality among these workers. While individuals who were able to maintain their jobs (or who were able to become re-employed after a brief spell of non-employment) did not generally experience any atypical earnings changes, a substantial fraction of individuals transitioned out of employment and hence lost all of their labor income. The prevalence of job loss is particularly acute among those who were initially low earners and were hence unlikely to have access to a large pool of savings. This remains true even if we consider the patterns over more recent months. In what follows we analyze the extent to which these negative impacts were mitigated by the labor market public policy response to the pandemic.

4 The Role of Public Policy

Now that we have estimated the effect of the pandemic on employment and earnings, we turn to the public policy response. The key public policy instrument in the United States to insure against unexpected labor earnings losses is the Unemployment Insurance (UI) system. Each state has its own requirements and benefit levels. Eligibility typically depends on reaching an earnings threshold before displacement; however, many states also require minimum earnings in more than one quarter, as well as other requirements.

In response to the growing economic threat from the Covid-19 pandemic, the Coronavirus Aid, Relief, and Economic Security (CARES) Act was signed into law on March 27th 2020. This extended UI benefits in three ways. First, the CARES Act created

[19] We also find that the entire overall distribution of within-individual year-on-year earnings changes is not very different during the pandemic months compared to the same calendar months in pre-pandemic years, suggesting no evidence of increased dispersion in wage changes among those who remain employed. Results are available from the authors upon request.

[20] Using payroll data from ADP, Cajner et al. (2020) find that, when they focus on the firms that typically adjust wages in March, April, or May in their dataset, there is a 20 percentage point increase in wage freezes and a 12 percentage point increase in wage cuts. These firms, however, represent only around 10% of the businesses in the ADP sample who continuously employed workers during all of 2019 and the first half of 2020. Our results suggest that these patterns are not sufficiently widespread to be detectable in nationally representative data.

a new benefit called Pandemic Unemployment Assistance (PUA), which expands the eligibility universe to individuals who are not typically eligible for UI, including the self-employed, as well as individuals whose earnings or number of weeks worked were too low. Benefits for individuals receiving PUA payments are calculated in the same way as for standard UI recipients, with the exception that the minimum benefit floor is higher, equal to half of the average benefit in the state.[21] Second, the CARES Act created a new program called Pandemic Unemployment Compensation (PUC), which provided a $600 weekly UI top-up for all UI recipients until July 31st 2021. Third, the CARES Act extended the maximum duration of benefits by 13 weeks with the Pandemic Emergency Unemployment Compensation (PEUC). Through subsequent legislation, the Lost Wage Assistance (LWA) Program provided a $300 top-up from August 1st through September 5th 2020, and the late December budget resolution and the March American Rescue Plan (ARP) Act provided another $300 top-up starting December 27th 2020 through September 6th 2021.

Below we discuss how we simulate UI benefits received during the pandemic using our matched CPS samples, and how these payments impacted the overall level and distribution of total earnings (i.e. labor earnings plus benefits) among workers who were employed before the onset of the pandemic.

4.1 Simulating Unemployment Insurance Benefits

The CPS does not collect information on whether an individual is receiving UI benefits. We are, however, able to simulate the benefits that individuals should be eligible to receive using information on their state of residence and their weekly earnings reported in the pre-displacement period. We do this by building on the UI simulator constructed by Ganong et al. (2020).

As above, we focus on individuals observed in month-in-sample 8 who were employed (and had non-missing earnings) in month-in-sample 4 (i.e. one year prior). This ensures that we have a wage observation from which to calculate eligibility and benefits.[22] To be eligible for UI or the CARES Act, an individual generally needs to have been employed

[21] See `https://oui.doleta.gov/dmstree/uipl/uipl2k20/uipl_0320.pdf`.

[22] In Appendix A.1, where we benchmark our estimates on the number of claimants to data on actual claims paid, we also consider individuals who were not employed in month-in-sample 4. If they otherwise meet the eligibility criteria that we define below, we assume that they would qualify to receive the minimum PUA payment (since we do not have information on their pre-displacement earnings).

and involuntarily lost their job. We can identify individuals who are likely to be eligible for UI or the CARES Act by taking advantage of the panel dimension of the CPS as well as using information on unemployment spell lengths and the reason for unemployment.

Pre-pandemic, we identify individuals as potentially eligible for UI if they were employed one year prior, are currently involuntarily unemployed or had a temporary job end, and the duration of unemployment is less than the maximum benefit duration of 26 weeks. We also classify individuals as potentially eligible if they are currently employed but absent from work and unpaid.[23]

This approach will miss individuals who may claim UI but are classified as being out of the labor force by the CPS. Pre-pandemic, this is not of major concern due to UI job search requirements. During the pandemic period, however, there was a substantial increase in flows from employment to non-participation in the CPS (see Cortes & Forsythe, 2020a), and search requirements were relaxed. Thus, we expand our UI eligibility definition beginning in April 2020. In addition to individuals who satisfy our pre-pandemic eligibility criteria, we also deem individuals to be potentially eligible for UI if they are not employed in the current period but were employed at any point in the last three months (i.e. when they were in month-in-sample 5, 6, or 7), regardless of whether they are currently classified as unemployed or out of the labor force in the CPS.[24] In addition, we deem individuals as potentially eligible if they are classified as unemployed and have an unemployment spell that started on or after March 1st 2020, as long as they are not individuals who have never worked (e.g. new entrants). Finally, we also identify individuals as potentially eligible if they are currently classified as out of the labor force, but in a previous month were categorized as unemployed and would have qualified given the above screen.[25]

[23]Not all of the individuals that we deem to be potentially eligible will necessarily receive UI benefits, as this will also also depend on their pre-displacement earnings levels and their self-employment status, as we discuss below.

[24]In Appendix Figure A.3 we show that employment losses during the onset of the pandemic are concentrated among individuals who were employed in the last three months. This supports our focus on these individuals as potential UI recipients.

[25]Hence, starting in April 2020, most individuals who are out of work but were employed one year prior are deemed to be potentially eligible for UI. The exceptions are those whose non-employment spells began prior to the start of the pandemic (i.e. before March 1st 2020) and those for whom we cannot determine the length of their non-employment spell because they appear as non-participants in month-in-samples 5, 6, 7 and 8. Approximately 70% of the individuals that we deem to be ineligible have missing duration information for this latter reason. During the later portion of our sample, it is increasingly likely that these individuals have lost work due to the pandemic and would thus be UI eligible; however we do not find that the share ineligible has increased during our time period. For consistency, we keep the same definition throughout the sample.

We simulate three layers of UI benefits, based on recent public policy. First, we estimate individuals' expected weekly standard UI benefit, building on the UI simulator of Ganong et al. (2020), which is based on UI guidance provided by the Department of Labor.[26] The simulator generates estimated unemployment benefits based on individuals' state of residence and pre-displacement quarterly earnings. Since information on the number of weeks worked per quarter is not available in the monthly CPS, we use information from the 2019 American Community Survey (ACS) to impute weeks worked. Specifically, in the ACS data, we classify individuals into earnings ventiles as we do in the CPS, and compute the fraction in each ventile-state cell that are above the state's weeks worked threshold for eligibility, and the average number of weeks worked conditional on being above the threshold. We calculate this separately for regular employees and self-employed individuals. We then compute expected individual-level unemployment benefits as the product of the probability of being above the weeks worked threshold and the expected weekly standard UI benefit from the simulator conditional on being above the threshold. Note that the inputs for the simulator are the individual's observed weekly earnings and state of residence from the CPS, as well as the average weeks worked for individuals above the threshold in the same percentile bin and state from the ACS. Some individuals will have zero expected standard UI benefits due to low earnings. Individuals who report being self-employed will also have zero expected standard UI benefits.[27]

Second, we simulate the expanded coverage from the PUA provision in the CARES Act. PUA recipients include individuals who were self-employed prior to displacement, and those that do not qualify for standard UI because their earnings are too low or they did not work enough weeks of the prior year to qualify. PUA benefits are based on the same formula as the state's standard benefits; however, earnings minimums and weeks worked requirements are waived. In addition, there is a weekly benefit floor defined for each state, which is calculated as half of the average weekly benefit paid by the state. For individuals that we deem to be potentially eligible for UI but whose expected standard UI benefits would be zero due to earnings being too low, we set PUA benefits equal to the weekly benefit floor in their state. For other individuals who were not self-employed, we compute the expected benefits as above, and add the probability of being below the weeks worked threshold multiplied by the weekly benefit floor in the individual's state. For the self-employed, we compute their predicted PUA payments

[26] See `https://oui.doleta.gov/unemploy/content/sigpros/2020-2029/January2020.pdf`.

[27] We measure self-employment by status in the most recent month worked.

as the maximum between their predicted UI benefits using the UI simulator (based on their individual earnings and state of residence from the CPS, along with imputed weeks worked from the ACS) and the PUA benefit floor in their state of residence.

Third, we add in the various top-up programs. From April through July 2020, we add the $600 PUC benefit to all UI recipients identified as eligible for standard UI or PUA UI benefits; for August 2020 we add the $300 LWA benefit; and for January and February 2021 we add the $300 ARP benefit.

There are several caveats to our approach. First, we do not observe whether individuals meet other requirements for eligibility, such as employment by a covered employer and being discharged rather than quitting. We may incorrectly label some individuals as UI eligible if they retired or otherwise left the labor market.[28] Second, we do not know if the individual actually claimed UI. Bitler et al. (2020) find that during the pandemic, only 42% of unemployed individuals with a high school degree or less were receiving unemployment benefits, compared with 52% of those with a college degree. Although we do not know if this gap is due to eligibility or individual take-up, this suggests that lower-income workers may be less likely to claim even when eligible. Finally, we do not observe whether individuals are undocumented immigrants, who are ineligible to receive UI benefits. Bitler et al. (2020) estimate 4% of workers are undocumented, and these individuals are more likely to be low-wage workers.

In order to assess the reliability of our estimates, in Appendix A.1 we compare our predictions for the number of UI recipients from the CPS with information on the number of UI claims and the amount of benefits paid based on data from the Department of Labor and the Bureau of Economic Analysis. It is important to emphasize that the pandemic response is ongoing and there is currently no complete data on the total claims or the total dollar outflows of these programs. Nevertheless, we find it reassuring that many of our eligibility-based estimates are similar to those derived from actual UI claims and treasury expenditure data, based on the partial information that is currently available. We do, however, find substantial differences between our estimates for PUA eligibility and the reported number of PUA claims paid by the Department of Labor. This is likely due to eligible individuals not claiming benefits.[29]

We use the gap between our estimate and the information on the number of claims

[28]We do not define eligibility on whether or not the worker reports being retired or disabled, because they could still claim UI even if they do not intend to return to employment.

[29]Forsythe (2021) estimates that only 41% of the unemployed reported receiving benefits during the pandemic period.

paid in order to construct a measure of actual recipiency. We estimate that 3% of those eligible for standard UI do not receive benefits, and 45% of those eligible for PUA do not receive benefits. Below we present results based on our raw estimates (i.e. assuming that everyone that we deem to be eligible for UI receives the benefits that they are entitled to based on our estimates), as well as results adjusted based on these estimated recipiency rates.[30]

4.2 Effect of UI Policies on Average Earnings

We begin by evaluating the effect of UI policies on individual total earnings (labor earnings plus UI payments). Figure 4 shows how standard UI, the PUA, and the PUC/LWA/ARP top-ups affect average within-individual total earnings growth. As we saw in Figure 2, individuals employed before the pandemic experienced a 20 percentage points decrease in their weekly labor earnings growth rate in April, falling to 11 percentage points by July, after which progress stalled. Here we see that standard UI is able to counteract only a portion of these earnings losses, with average total earnings losses shrinking to 15 percentage points in April and 9 percentage points by July, once standard UI benefits are added in. These losses including UI fluctuated over the following months, ending at an 8 percentage point decline by February 2021. By expanding eligibility, PUA was able to shrink the average losses to 7 percentage points in April and 4 percentage points in July. In January and February 2021 these losses remained at about 5 percentage points.

Under the PUC, which provided additional $600 payments on top of standard UI and the PUA expanded eligibility, average total earnings growth rates increased by 30 percentage points in April and 19 percentage points in July, which was the last month the PUC was available. In January and February, the ARP provided total earnings growth rates of 4-5 percentage points. Note, however, that these estimates assume that all eligible individuals claim these benefits. When we adjust by estimated recipiency, we find growth rates of 15 percentage points in April, 9 percentage points in July, and close to zero for January and February 2021. Appendix Figure A.4 shows the level changes in total earnings, in order to visualize how these percentage point changes translate into dollar amounts.

[30] It is important to emphasize that our estimated recipiency rates are based in part on preliminary data on fraudulent payments from the PUA program. Since these numbers are considered to be a lower bound on fraud, our estimated recipiency rate is likely to be an upper bound on recipiency.

4.3 Distributional Effects of UI Policies

Next we want to understand the distributional impacts of these policies. Recall from Figure 3 that the pandemic induced declines in employment disproportionately affected individuals in the bottom half of the pre-pandemic earnings distribution. The progressivity of the UI policies will depend on the extent to which replacement rates vary across the earnings distribution, and the extent to which eligibility and recipiency vary as well.

4.3.1 Replacement Rates

In Figure 5 we compare weekly earnings and benefit amounts along the earnings distribution. In Panel A, we compare the weekly earning levels across deciles for all individuals employed during the pre-pandemic period (blue bars) and those displaced during April to July when the $600 PUC top-up was in place (red bars) and those (still) displaced in January-February 2021, when the $300 ARP top-up was in place (green bars). As a consequence of the fact that job loss was concentrated among low earning workers, here we see that while the previous year's median wage of the potentially displaced set (i.e. across all workers) is $752.47, for the actually displaced the median wage was $495.99 in the early period and $492.55 in the later period.

This provides important context for understanding how the CARES Act payments were structured. The $600 PUC figure was chosen to provide the median full-time earner a 100% replacement rate when combined with standard UI replacement rates of about 40%.[31] However, the policy overshot for two reasons. First, the median weekly pay in the pre-pandemic period was only $752, because many workers do not work full time. This would push the median replacement rate to 120%. Even more importantly, as we saw above, pandemic job loss was concentrated among low-earning individuals, with median weekly earnings of job losers of only $496 in the early pandemic period. After simulating standard UI, PUA, and the $600 PUC payment, we estimate a median replacement rate of 172% among individuals who were eligible for UI during this time period.

The bottom panel of Figure 5 shows how replacement rates varied across the earnings distribution and across different sub-periods. We estimate the replacement rates at the individual level for each of the four time periods, and report the average replacement rate by decile of the previous year's weekly earnings distribution among displaced

[31] See https://www.washingtonpost.com/business/2020/08/06/600-dollar-unemployment-benefit/

workers (where the deciles are calculated separately for each of the four time periods according to the composition of displaced workers in each period). Replacement rates varied dramatically based on the size of the weekly UI top-up payment. During the PUC period (April to July), the $600 weekly payment pushed replacement rates up to 831% for the lowest decile, and were over 100% up to the 80th percentile of the displaced workers' earnings distribution. During the LWA period (August) and the ARP program (January to February), the $300 top-up also led to replacement rates above 400% for the bottom decile, but fell to under 100% by the 60th percentile.

We can also compare replacement rates at the median. While the PUC led to median replacement rates of 172%, for the LWA and the ARP period, median replacement rates were 108% and 110%, respectively. This is much closer to the policy-makers' goal of meeting 100% replacement for the median displaced worker.

These high replacement rates are in sharp contrast to the period from September through December, when no top-up payments were provided. During these four months, replacement rates were well below 100% for all but the bottom decile.[32] Since standard UI and PUA payments are calculated as a fraction of pre-displacement earnings, replacement rates ranged from 40% to 51% for most of the distribution. Thus, while most of the pandemic period was characterized by generous replacement rates, the decline in weekly payments during September to December was swift and severe.

4.3.2 Eligibility and Recipiency

The results above show a high degree of progressivity in replacement rates, particularly during the periods when fixed top-up payments were available. Eligibility for UI, however, varies dramatically across the earnings distribution. In Figure 6 we show that individuals who were in low-earning jobs before the pandemic are much less likely to be employed during the pandemic months, and much more likely to be ineligible for any UI programs, compared to individuals who were in higher-earning jobs. In both the early and later pandemic periods, over one-fifth of pandemic job-losers in the bottom 10% of the earnings distribution would not qualify for their state's standard UI program, but do qualify for the PUA. For higher-earning deciles, estimated PUA eligibility is minuscule. Thus, the expansion of UI eligibility from the CARES Act primarily increased access to UI for low-income workers. However, as discussed above, estimated

[32]For the bottom decile, the minimum benefit level for the PUA program was enough to bring replacement rates above 100%.

recipiency rates for those eligible for PUA are relatively low. Moreover, Figure 6 also shows that a sizable fraction of individuals who were low earners in the prior year and non-employed during the pandemic remained ineligible for coverage.[33] Hence, some of the progressivity embedded in the high replacement rates will be offset by the lower eligibility and recipiency rates among low earners.

4.3.3 Changes along the Distribution

In order to assess the overall impact of UI payments, in Figures 7 and 8 we present estimates of total earnings changes along the distribution analogous to Panel A of Figure 3, now adding different layers of UI payments one by one. As before, this is based on the regression approach in Equation (2), which controls for ventile-specific year and month fixed effects. We break the pandemic into four time periods. In Figure 7 Panel A, we focus on April through July 2020, when the PUC was in place. In Panel B, we focus on August 2020, when the LWA program was in place. In Figure 8 Panel C, we focus on September through December, when there was no additional top-up program in place. And in Figure 8 Panel D we focus on January and February 2021, when the ARP top-up was in place. In Table 1, we present equivalent estimates based on quartiles of the wage distribution, which make it easier to evaluate the effect of each policy on the percent change in wages and benefits flowing to different portions of the ex-ante wage distribution.

For each panel, the figure to the left shows the impacts on earnings growth rates during the pandemic months after factoring in baseline simulated UI benefits, before the CARES Act provisions. Comparing this to the estimates in Panel A of Figure 3, we see that the UI system does a modest job of replacing lost income. From April to July, the bottom third of the income distribution would have their weekly earnings growth rate fall by more than 15 percentage points without UI; with standard UI, this reduction is halved. Nonetheless, we see that these UI benefits are not enough to counteract the increased regressivity in the earnings distribution induced by pandemic job loss. In the later pandemic periods, average earnings losses are smaller and more uniform, but again we see that when we only factor in standard UI, earnings losses are observed for individuals at the bottom of the wage distribution.

We next add the PUA benefits and the various top-up payments, shown in the center

[33] As discussed in Section 4.1, individuals that we deem ineligible are those with unemployment spells that began prior to March 1st 2020, as well as those for whom we cannot calculate the duration of non-employment.

column of Figures 7 and 8. As shown above, the PUA payments primarily increase benefits to individuals at the bottom of the wage distribution, who do not have sufficient earnings or quarters of employment to qualify for their state's UI program. Moreover, the fixed amounts of the different top-up programs translate into larger percentage point increases for low earners. Here we see that from April through July, when the $600 PUC payment was in place, total earnings changes are positive throughout the bottom half of the distribution, and close to zero in the top half. Although most ventiles show small positive total earnings increases, these increases are concentrated in the bottom of the distribution, with the bottom quarter experiencing average weekly total earnings growth rate increases of 20 percentage points or more. Thus, if all of the individuals that we estimate to be eligible for UI during the PUC period had claimed benefits, the UI program would have been sharply progressive.

However, as shown in the graph on the right of Figure 7 Panel A, once we adjust for estimated recipiency by benchmarking to data on actual claims, we find that the progressivity of the CARES Act is curtailed. This is because, as discussed above, low earning individuals are disproportionately only eligible for UI via the PUA program, yet we estimate that only 55% of these individuals actually received benefits. This dramatically reduces the estimated changes in total earnings growth rates for individuals in the bottom decile of the distribution (from 96 to 15 percentage points), and throughout the bottom quarter of the distribution. Adjustment for recipiency has a much smaller effect for the top three-quarters of the pre-pandemic wage distribution. This is because fewer of these individuals lost employment and when they did lose employment they were much more likely to qualify for standard UI, for which recipiency is much higher.

It is important to emphasize that when we look at level changes in total earnings (rather than percentage changes), losses and benefits are much more uniform (see Appendix Figures A.5 and A.6). In other words, the increase for bottom decile workers in Panel A of Figure 7 is disproportionately large due to the fact that earnings levels among these individuals are quite low. It is also important to keep in mind that the positive impact on bottom decile workers results from a combination of (i) displaced and UI-eligible workers who were able to claim benefits and experienced large increases in income thanks to the PUC top-up, (ii) non-displaced workers whose earnings remained largely stable (see Panel C of Figure 3), and (iii) UI-ineligible or non-claiming displaced individuals who experienced a complete reduction in earnings. Thus, there is quite substantial heterogeneity in earnings changes even within this group.

For the period after July 2020, which is shown in Panel B of Figure 7 and Panels

C and D of Figure 8, total earnings growth is much less progressive compared with the April to July period, even after factoring in benefits, and especially after adjusting for recipiency. In the right-hand panels, we see that once we adjust by estimated recipiency, the growth in total earnings fell below zero for the bottom of the wage distribution in all of the sub-periods after July 2020. This is confirmed in Table 1, which shows that total income growth for the bottom wage quartile increased by 19 percentage points during the PUC period, but fell by 8, 19, and 22 percentage points in the subsequent three time periods, respectively.

While we must caution that our recipiency estimates are based on somewhat incomplete data on fraudulent claims from the Department of Labor, these estimates suggest that, although the CARES Act and subsequent policies had the potential to redistribute benefits to low-earning workers and offset the regressivity of the labor earning changes induced by the pandemic, low recipiency rates among the PUA-eligible population led to much less redistribution than we would have seen under 100% recipiency.

4.3.4 Distributional Allocation of Benefits

Figure 9 shows how total benefit payments were distributed across ventiles of the pre-pandemic earnings distribution. In the left figures, we show the distribution if all eligible individuals received benefits, while in the right figures we adjust by estimated recipiency. For the early part of the pandemic, when the PUC was in place, if all eligible had received benefits, the disbursement of payments would have been strongly progressive, with half of the benefits going to the bottom-earning one-third of workers. After adjusting for recipiency, this progressivity is muted, with 43% of benefits going to the bottom one-third. In addition, we estimate a much smaller share of benefits went to the lowest ventile.

Since July, this progressivity has been reduced. If all eligible received benefits, we estimate about 43% of benefits would have gone to the bottom one-third of workers, while after adjusting for recipiency this falls to 29%. Thus, despite low-wage workers remaining more likely to have lost wages and employment through February 2021, since July they have received a smaller share of benefits.

5 Conclusions

The Covid-19 pandemic has had a dramatic impact on the U.S. labor market. By exploiting the rotating nature of the CPS samples, we provide an account of the impact of the pandemic and the associated public policy response on earnings, focusing on a consistent and nationally representative sample of workers who were employed before the onset of the pandemic.

We find that individuals who were employed during the pandemic did not experience atypical earnings changes, regardless of their position in the earnings distribution prior to the pandemic. Low-earning individuals, however, were, by a large margin, disproportionately likely to lose their jobs during the pandemic. These differential job loss probabilities along the earnings distribution have been strongly persistent, and are still strongly observed as of February 2021.

Given the asymmetric impacts of job loss along the earnings distribution, in the absence of the public policy response through the CARES Act, earnings inequality would have experienced a dramatic increase. The PUA and PUC provisions of the CARES Act were able to offset these impacts. The PUA UI eligibility expansion primarily benefited low-income workers, while the \$600 PUC payments led to a larger percentage increase in income for individuals in the bottom third of the wage distribution.

BEA data shows that about \$292 billion was spent on the \$600 PUC payments. This can be compared to the direct support payments that were provided to all families in the CARES Act in the form of Economic Impact Payments (EIP), which amounted to \$1200 per adult and \$500 per child.[34] These payments totalled \$300 billion. Baker et al. (2020) find that these direct payments led to a strong spending response, concentrated among people with low account balances and low earnings, and conclude that targeting stimulus to households with low levels of liquidity will have the largest fiscal multipliers. In particular, they find multipliers of 0.33 for individuals who earn under \$1000 per month, which comprise 20% of our sample of separators and who received replacement rates of over 300%. In contrast, they find the lowest fiscal multipliers for individuals who earn over \$3000 per month, which corresponds to the top 20% of separators, and coincidentally are the only group who face replacement rates below 100%. In addition, they find larger multipliers for households experiencing earnings drops. Thus, by expanding UI beyond full replacement rates for displaced low earners, the targeted aid provided by the CARES Act may have had a stronger fiscal multiplier than the

[34]These payments phased out for individuals earning over \$75,000.

EIP stimulus checks. Moreover, the combination of the EIP stimulus payments and the CARES benefit expansion was likely responsible for the remarkable finding from Han et al. (2020) that poverty rates fell during the early months of the pandemic.[35]

On August 1st, 2020, the $600 PUC benefits expired, beginning a period of substantial policy uncertainty from August through December. Although we show that the $300 payments introduced by later public policy programs were able to keep replacement rates over 100% for the lowest earning half of displaced workers, during the period from September through December, when no public policy top-up was available, the median replacement rate fell below 50%, likely resulting in material hardship for a multitude of UI recipients and potentially contributing to the stalled recovery through the Fall of 2020.

We also estimate that as many as 45% of PUA-eligible individuals did not receive these benefits. Since these individuals are disproportionately drawn from the bottom of the earnings distribution, this implies that the public policy support provided by the CARES Act and subsequent legislation did not end up being as progressive as one might expect. In particular, our estimates that adjust for recipiency imply that, on average, since September 2020, individuals displaced from bottom decile jobs experienced strong declines in their earnings growth rates, even after factoring in benefits including the $300 top-up provided in January and February 2021. It is also important to keep in mind that this negative average masks important heterogeneities, with some displaced bottom decile workers experiencing high replacement rates through the UI system, but also an important fraction of displaced workers being either ineligible or not claiming UI for other reasons and hence experiencing a complete reduction in earnings.

[35]See also Ganong et al. (2021), who analyze the spending response to benefit changes during the pandemic.

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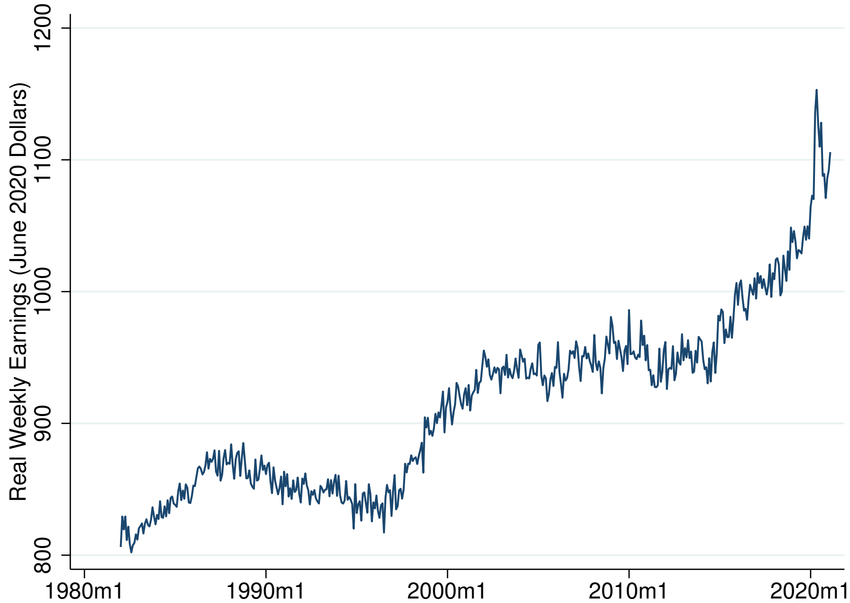
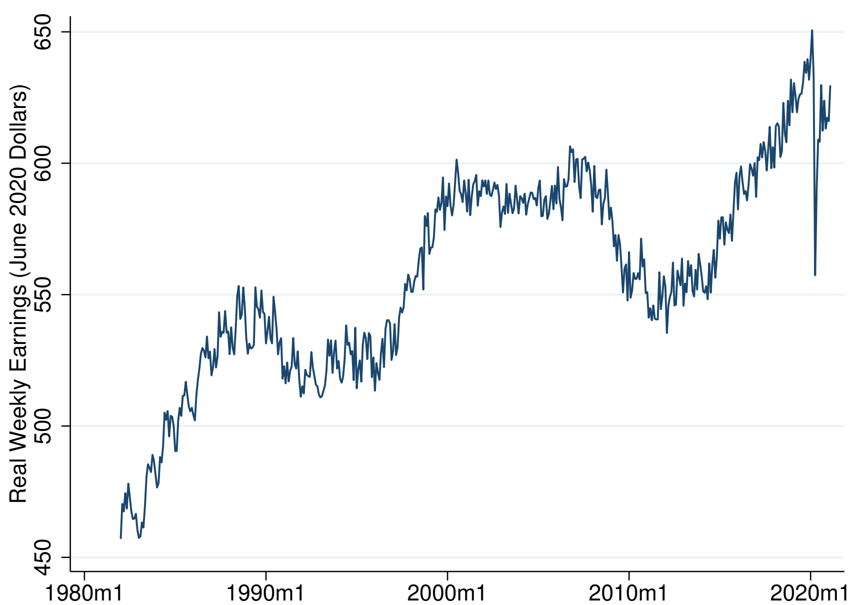
Figure 1: Evolution of Real Weekly Earnings

Panel A: Real Weekly Earnings per Worker



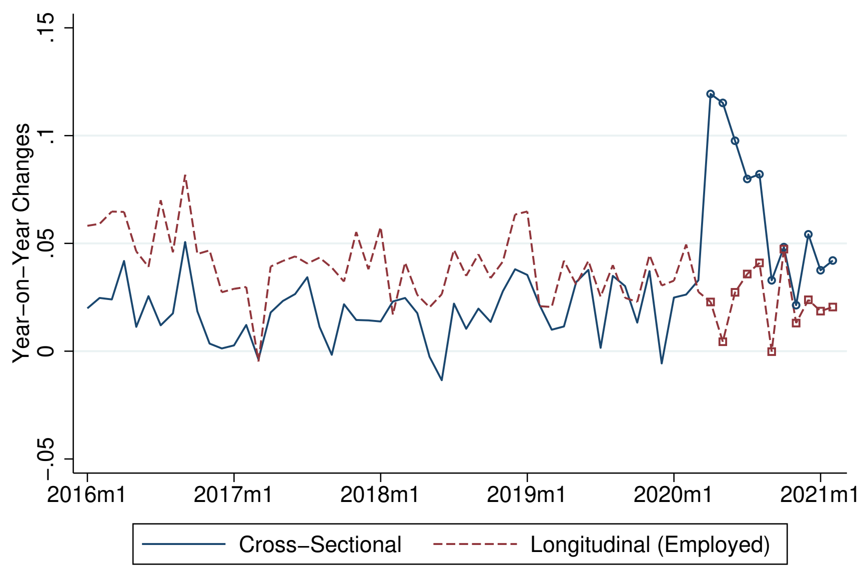
Panel B: Real Weekly Earnings per Adult



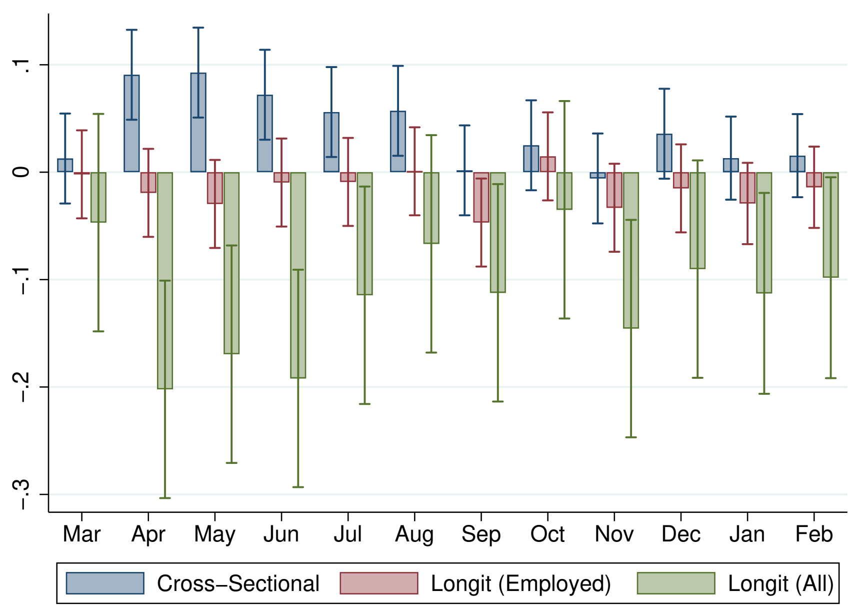
Note: The figure is based on CPS data on earnings in the current job, computed as actual hours worked in the reference week multiplied by the hourly wage rate for workers paid by the hour, and as usual weekly earnings for other workers. Nominal amounts are converted to real June 2020 dollars. Following Lemieux (2006), top-coded earnings are adjusted by a factor of 1.4. The lowest 1% of earnings are winsorized.

Figure 2: Changes in Mean Earnings: Overall vs Within Individuals

Panel A: Year-on-Year Changes in Real Weekly Earnings



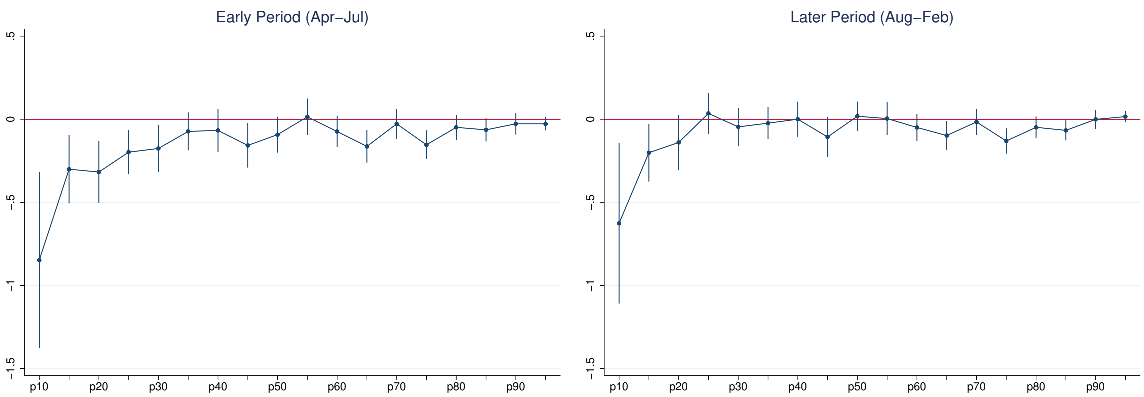
Panel B: Pandemic Impact on Real Weekly Earnings



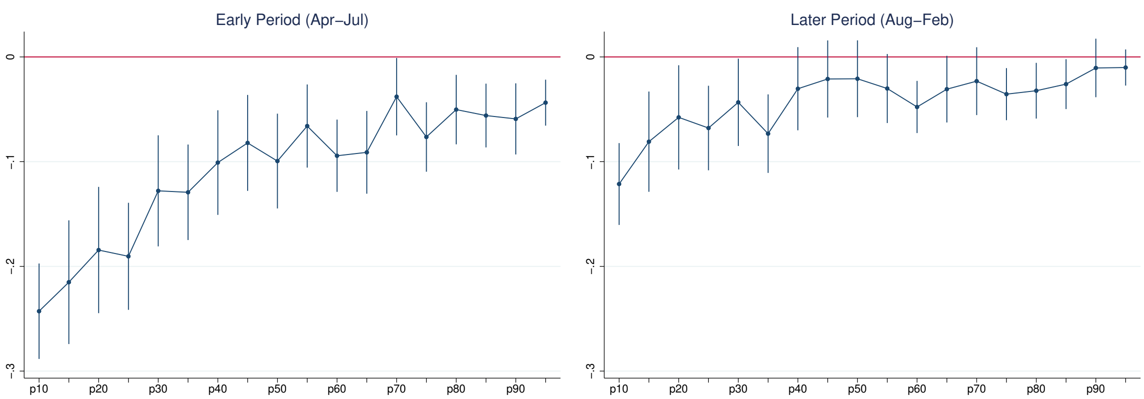
Note: Panel A plots year-on-year changes in average log real weekly earnings in the cross-section of workers in the solid blue line, and average longitudinal (within-individual) changes in log real weekly earnings for workers employed in month t and month $t-12$ in the dashed red line. Panel B plots the estimated coefficients and 95% confidence intervals from Equation (1) using monthly data on year-on-year changes since January 2015 (62 observations). The coefficients capture the effects of the pandemic after controlling for seasonal and year effects. The dependent variables for the "Cross-Sectional" and the "Longit (Employed)" specifications are the series from Panel A. The dependent variable for "Longit (All)" is the average within-individual percentage change in real weekly earnings for all individuals who were employed one year earlier, including those who transition out of employment.

Figure 3: Distributional Impact of the Pandemic

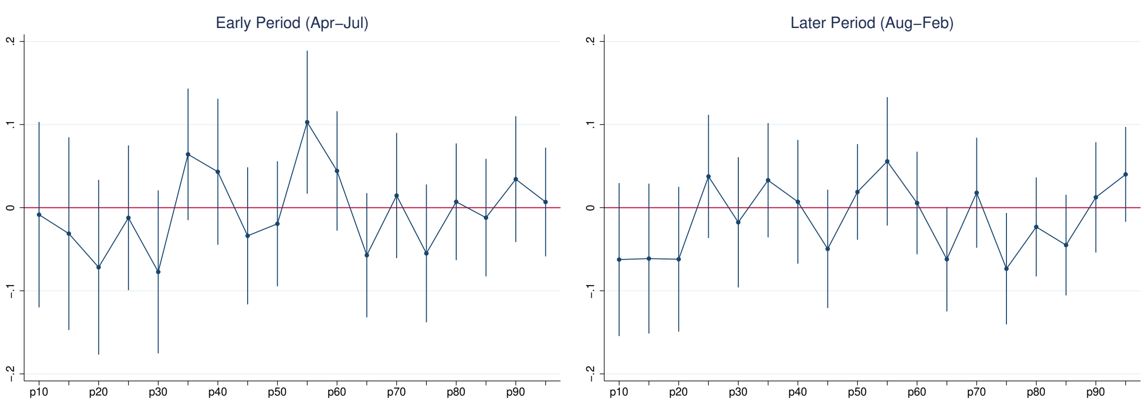
Panel A: Impact of the Pandemic on Labor Earnings Growth Rates (%)



Panel B: Impact on Probability of Remaining Employed (Extensive Margin)

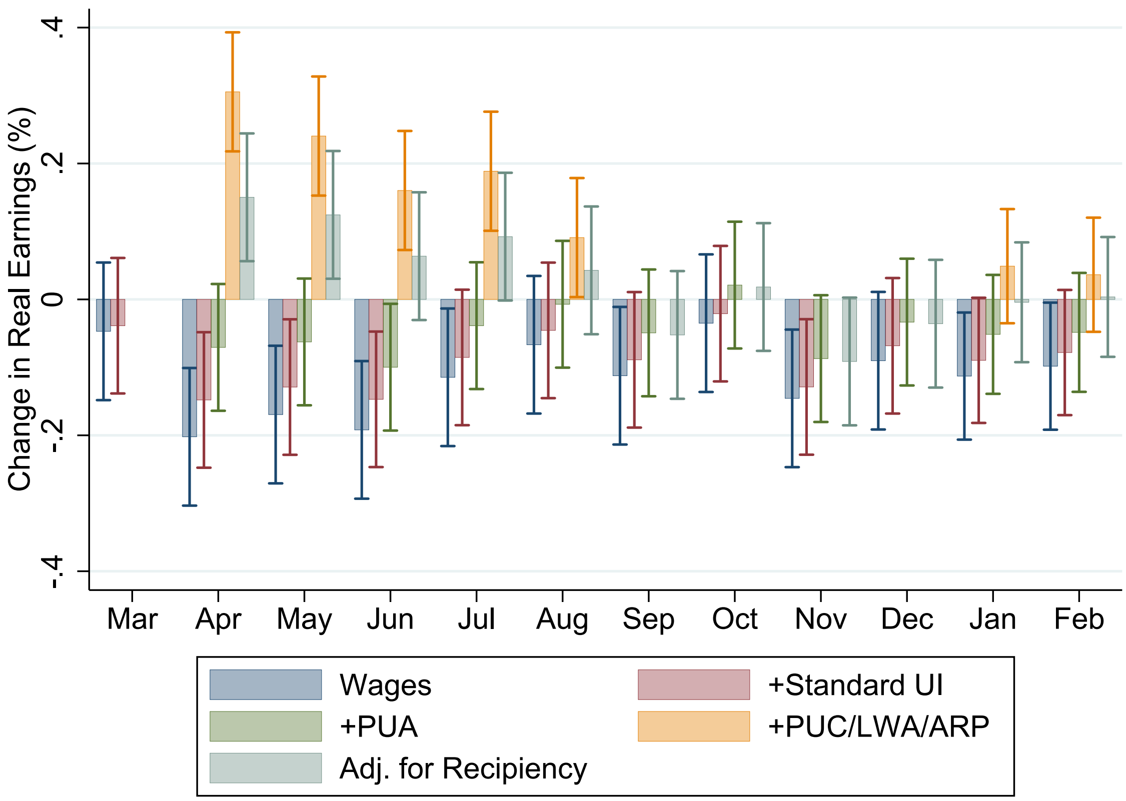


Panel C: Impact on Earnings Conditional on Remaining Employed (Intensive Margin)



Note: The figure plots estimated coefficients and 95% confidence intervals for the impact of the pandemic throughout the earnings distribution, based on the estimation of Equation (2) using data from January 2015 to February 2021. The x-axis represents ventiles of the pre-pandemic earnings distribution (the top and bottom two ventiles are grouped into deciles). The dependent variable in Panel A is the within-individual percentage change in real weekly earnings for all individuals who were employed in their fourth month-in-sample, including those who transition out of employment (294,123 observations). Panel B uses the same sample; the dependent variable is the probability of remaining employed between month-in-sample 4 and month-in-sample 8. The sample in Panel C only includes individuals who are employed in both their fourth and their eighth month-in-sample (264,968 observations). The dependent variable is the within-individual change in log real weekly earnings.

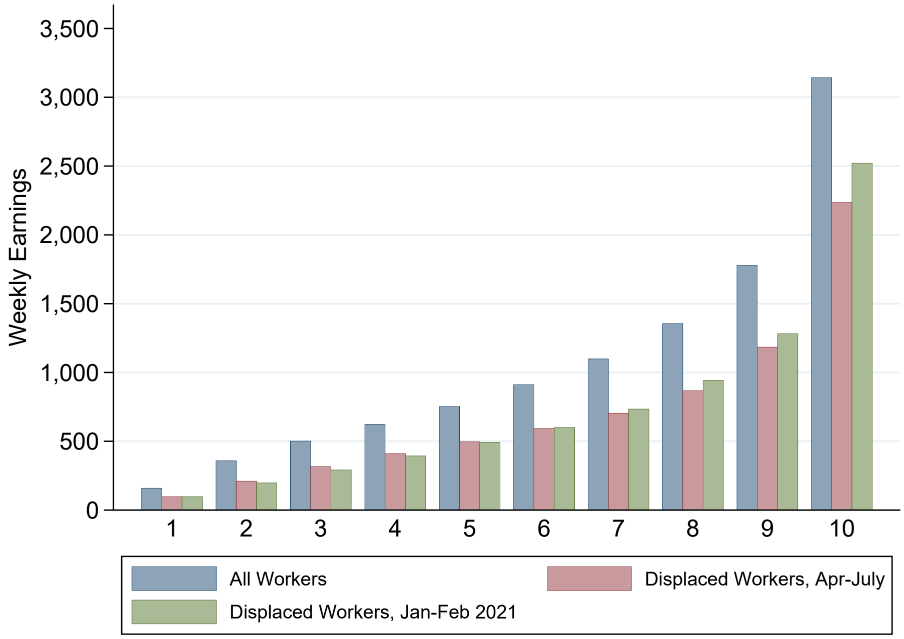
Figure 4: Impact of the Pandemic on Year-Over-Year Percentage Change in Labor Earnings and Simulated Benefits by Program



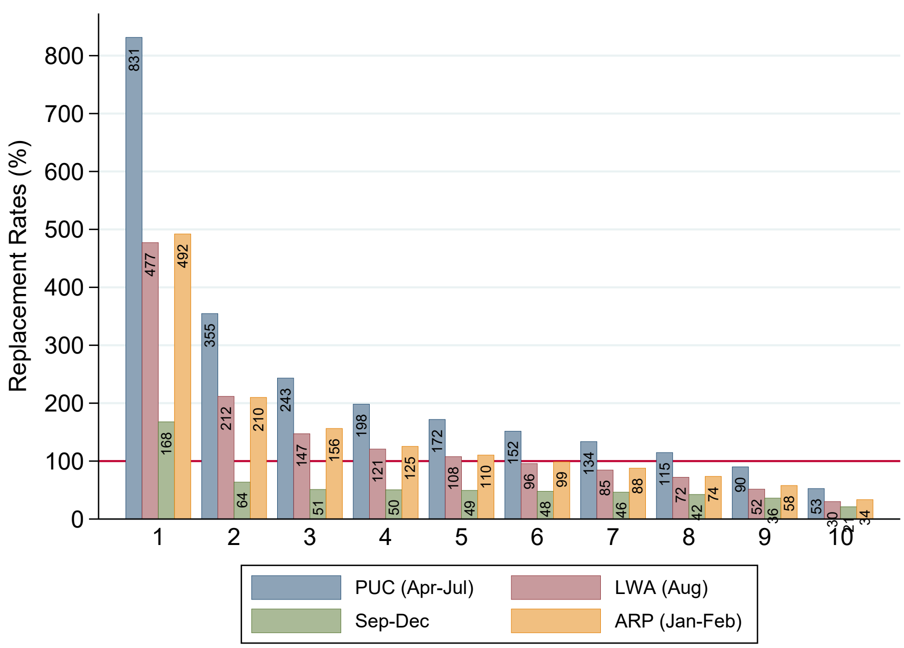
Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), PUC = Pandemic Unemployment Compensation (additional \$600 per week), LWA = Lost Wage Assistance (additional \$300 per week), ARP = American Rescue Plan (additional \$300 per week). This graph plots the estimated coefficients and 95% confidence intervals for the impacts during the pandemic on the average year-over-year percentage change in real weekly earnings (plus benefits) among previously employed individuals based on the estimation of Equation (1). The earnings measures are: (1) actual earned wages (including zeros), (2) wages plus estimated standard UI benefits, (3) the above plus estimated PUA benefits, (4) the above plus weekly top-ups, and (5) wages plus total UI benefits adjusted for estimated recipiency rates.

Figure 5: Pre-Pandemic Labor Earnings and Replacement Rates

Panel A: Pre-Pandemic Labor Earnings Distribution



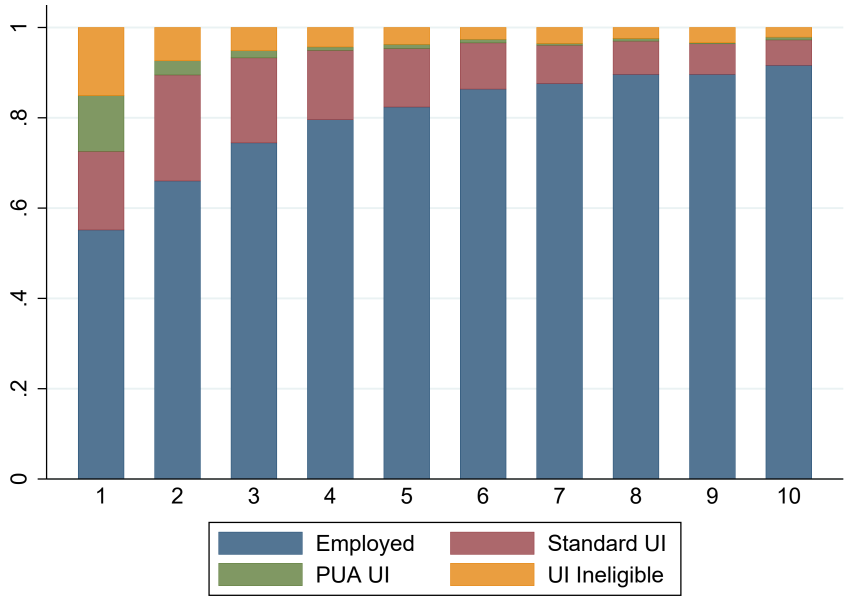
Panel B: Replacement Rates



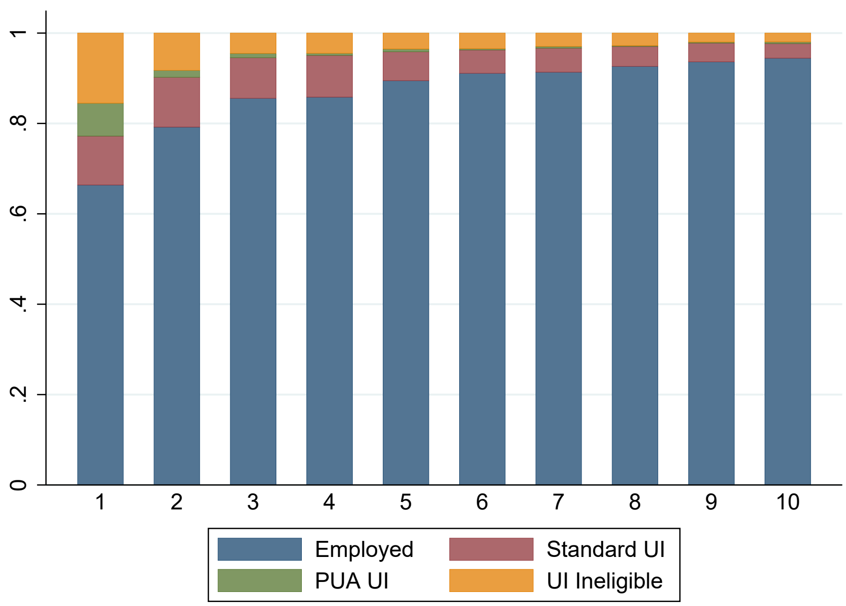
Note: Panel A shows average real weekly earnings in the pre-pandemic period at each decile of the earnings distribution, where the deciles are constructed based on three different samples: all individuals (blue), individuals who were no longer employed in April-July (red), and individuals who were no longer employed in January-February (green). Panel B shows average replacement rates at each decile, where replacement rates are defined as the ratio between the individual's estimated total UI payment (standard UI or PUA plus any weekly top-up) and their prior year weekly earnings. Earnings deciles are based on prior year earnings, and are calculated separately for each of the four time periods using the sample of individuals who lost employment in the corresponding time period. PUC = Pandemic Unemployment Compensation (additional \$600 per week), LWA = Lost Wage Assistance (additional \$300 per week), ARP = American Rescue Plan (additional \$300 per week).

Figure 6: Distribution of Employment and UI Eligibility Status during the Pandemic Period, by Decile of the Pre-Pandemic Earnings Distribution

Panel A: PUC Period (April through July 2020)



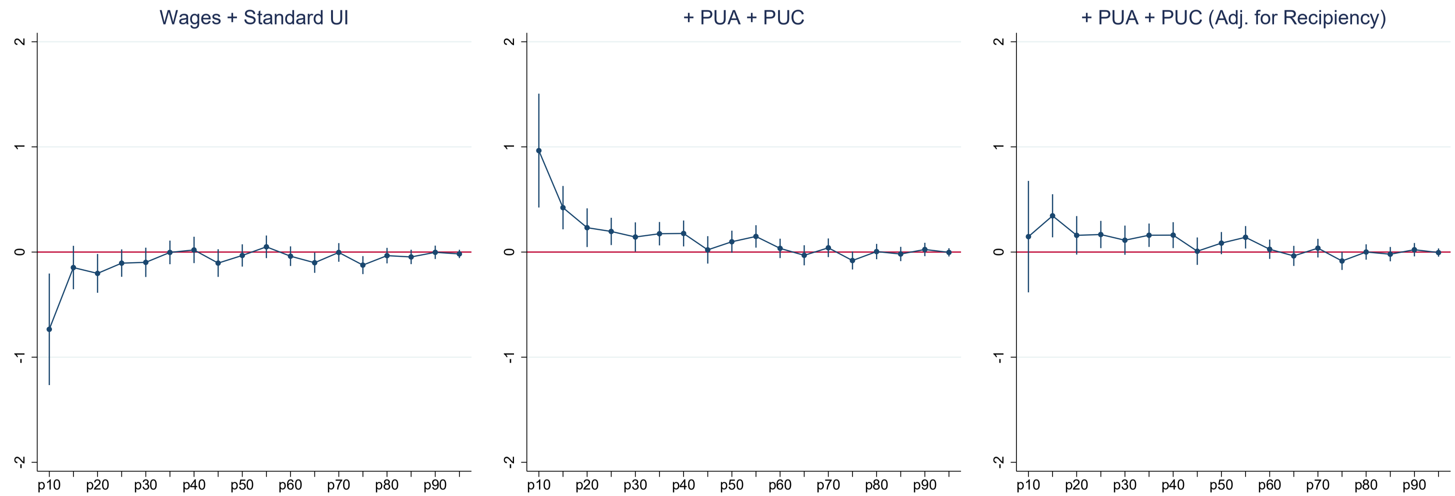
Panel B: Later Period (August through February 2021)



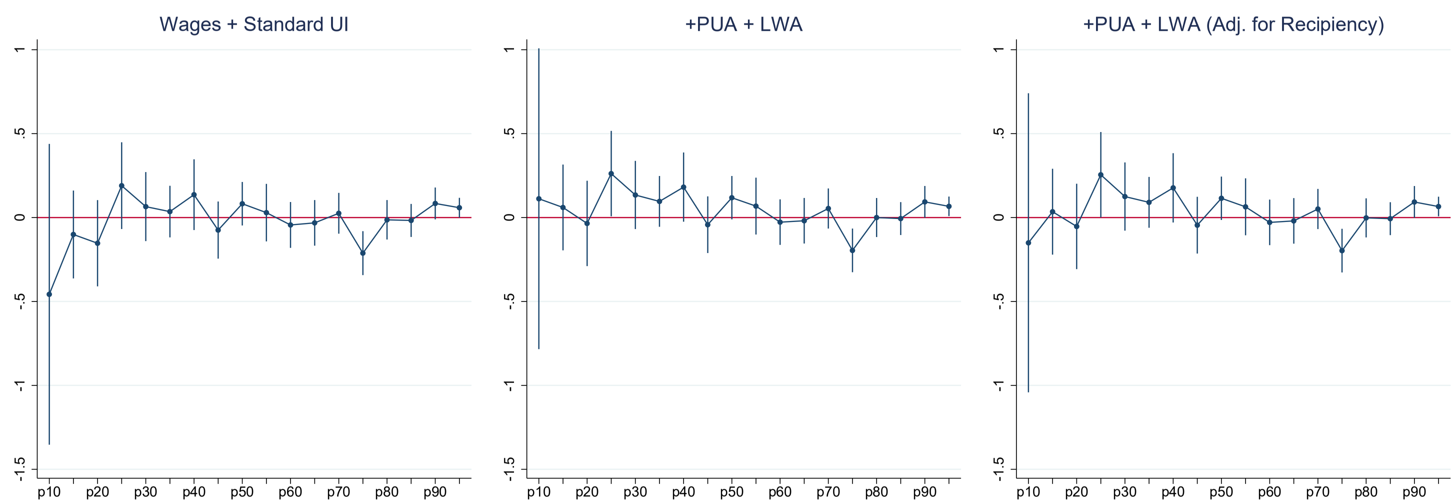
Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), PUC = Pandemic Unemployment Compensation (additional $600 per week). This figure shows the fraction of individuals in each pre-pandemic wage decile that were either: (a) employed during the pandemic months, (b) eligible for standard UI, (c) eligible only for the CARES PUA UI expansion, or (d) ineligible for UI. Individuals' UI eligibility status is predicted based on our approach described in Section 4.1. Note that these are raw shares of individuals, and thus show a larger number of separations than the estimates in Figure 3, which remove typical transition rates.

Figure 7: Distributional Impacts of UI Policies during the Pandemic Period, April through August 2020

Panel A: PUC Period (April through July 2020)



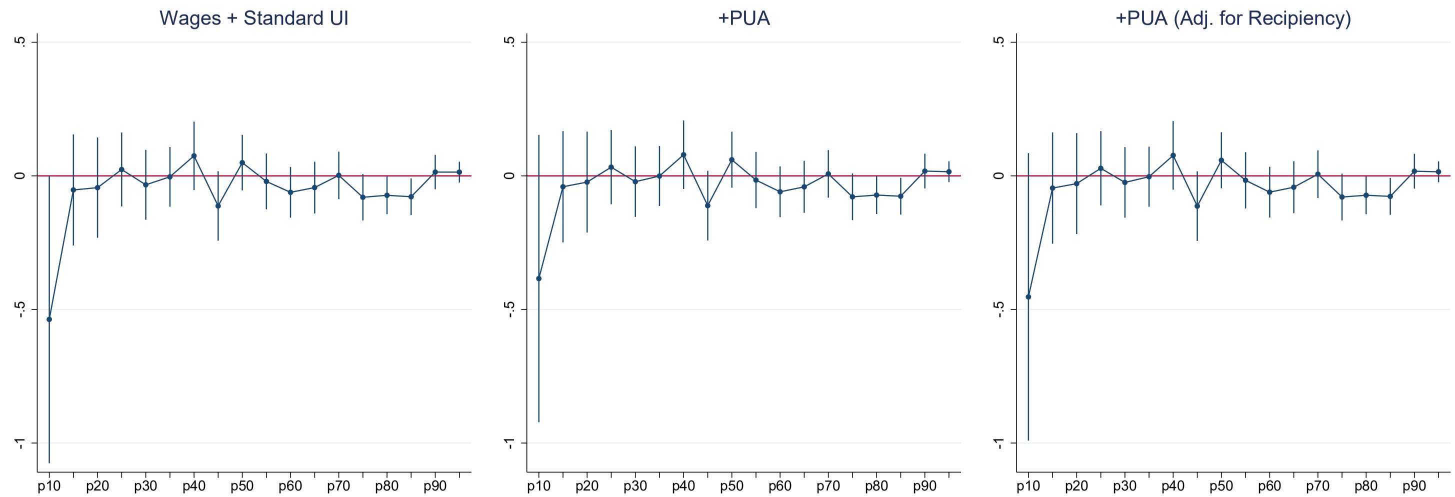
Panel B: LWA Period (August 2020)



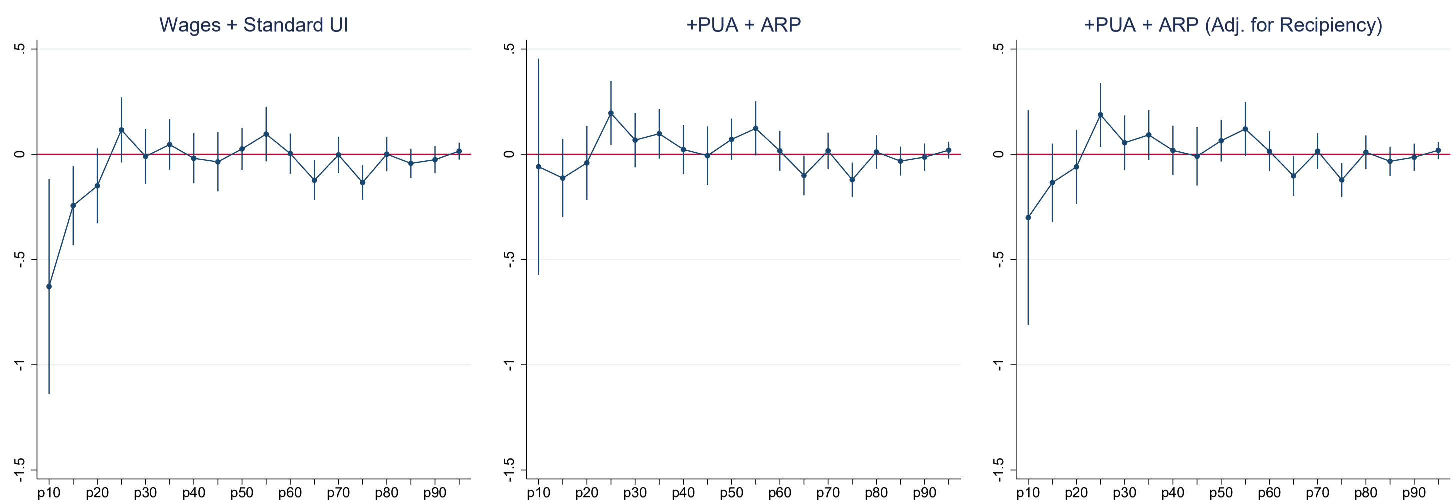
Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), PUC = Pandemic Unemployment Compensation (additional \$600 per week), LWA = Lost Wage Assistance (additional \$300 per week). The figure plots the estimated coefficients and 95% confidence intervals for the changes during the pandemic throughout the earnings distribution, based on the estimation of Equation (2) using data from January 2015 until February 2021. The x-axis represents ventiles of the pre-pandemic earnings distribution (the top and bottom two ventiles are grouped into deciles). The dependent variable is the within-individual percentage change in real weekly earnings plus benefits. Figures in the left column are based on actual earned wages (including zeros) plus estimated standard UI benefits. Figures in the center column are based on the above plus estimated PUA benefits and weekly top-ups (which vary across periods). Figures in the right column are adjusted for estimated recipiency rates.

Figure 8: Distributional Impacts of UI Policies during the Pandemic Period, September 2020 through February 2021

Panel C: No Top-Up (September through December 2020)

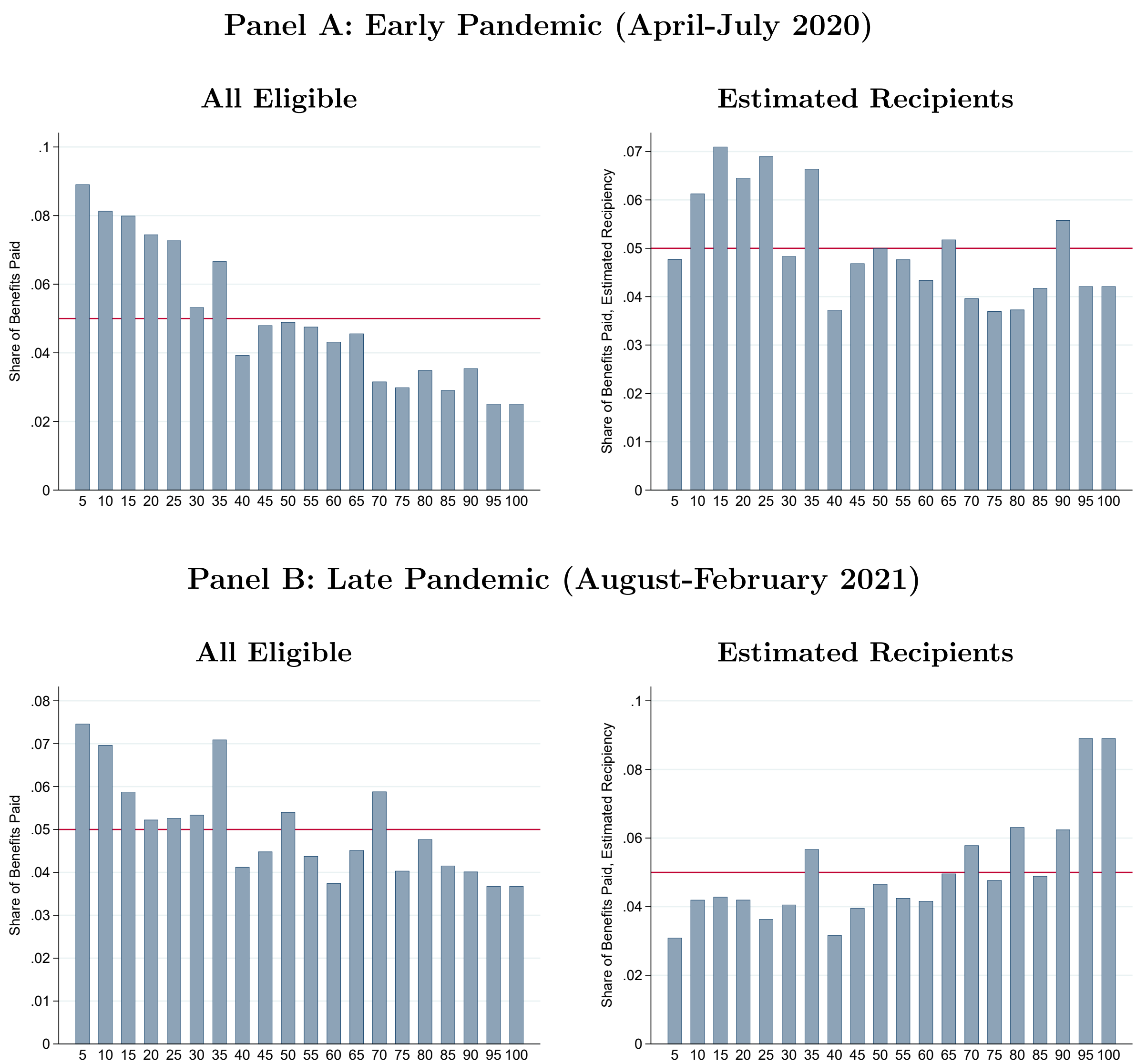


Panel D: ARP Period (January through February 2021)



Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), ARP = American Rescue Plan (additional $300 per week). The figure plots the estimated coefficients and 95% confidence intervals for the changes during the pandemic throughout the earnings distribution, based on the estimation of Equation (2) using data from January 2015 until February 2021. The x-axis represents ventiles of the pre-pandemic earnings distribution (the top and bottom two ventiles are grouped into deciles). The dependent variable is the within-individual percentage change in real weekly earnings plus benefits. Figures in the left column are based on actual earned wages (including zeros) plus estimated standard UI benefits. Figures in the center column are based on the above plus estimated PUA benefits and weekly top-ups (which vary across periods). Figures in the right column are adjusted for estimated recipiency rates.

Figure 9: Share of Total UI Benefits by Wage Ventile



Note: This graph plots the share of total benefits across standard UI and the CARES Act going to each ventile of the pre-pandemic wage distribution. The left figures assume all eligible recipients received payments. The right figures are adjusted for estimated recipiency. Due to top-coding, we cannot separately identify the 95th and 100th percentiles, so divide the top 10 percent evenly between the two ventiles.

Table 1: Impact of the Pandemic and the Associated Policy Response on Earnings Growth Rates (Before and After Benefits)

	Dependent Variable: Average Year-over-Year Growth Rate (% Change) in ...				
	Wages	Wages + UI	Wages + UI + PUA	Wage + UI + PUA + Top-up	Adjusted for Recipiency
	(1)	(2)	(3)	(4)	(5)
Panel A: FPUC Period (April to July 2020)					
Bottom 25%	-0.399***	-0.290***	-0.234***	0.460***	0.193***
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
25-50%	-0.134**	-0.0569	-0.0520	0.134**	0.0730
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
50-75%	-0.0696	-0.0288	-0.0269	0.0484	0.0186
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
75-100%	-0.0399	-0.0259	-0.0253	-0.00307	-0.0165
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
Panel B: LWA Period (August 2020)					
Bottom 25%	-0.273***	-0.217***	-0.191***	0.00320	-0.0812
	(0.0586)	(0.0568)	(0.0565)	(0.0606)	(0.0532)
25-50%	0.0140	0.0517	0.0545	0.106	0.0582
	(0.0586)	(0.0568)	(0.0565)	(0.0606)	(0.0532)
50-75%	-0.0156	0.00710	0.00852	0.0328	0.00113
	(0.0586)	(0.0568)	(0.0565)	(0.0606)	(0.0532)
75-100%	0.0108	0.0185	0.0184	0.0280	0.0125
	(0.0586)	(0.0568)	(0.0565)	(0.0606)	(0.0532)
Panel C: No Top-Up (September to December 2020)					
Bottom 25%	-0.219***	-0.169***	-0.137***	-0.129**	-0.185***
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
25-50%	-0.0547	-0.0146	-0.0111	-0.00964	-0.0486
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
50-75%	-0.0374	-0.0188	-0.0176	-0.0141	-0.0322
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
75-100%	-0.0197	-0.0123	-0.0123	-0.0104	-0.0234
	(0.0414)	(0.0402)	(0.0399)	(0.0428)	(0.0376)
Panel D: ARP Period (January to February 2021)					
Bottom 25%	-0.323***	-0.274***	-0.245***	-0.0591	-0.220***
	(0.0428)	(0.0415)	(0.0412)	(0.0442)	(0.0389)
25-50%	-0.0219	0.0146	0.0172	0.0667	0.0238
	(0.0428)	(0.0415)	(0.0412)	(0.0442)	(0.0389)
50-75%	-0.0354	-0.0148	-0.0138	0.00895	0.00456
	(0.0428)	(0.0415)	(0.0412)	(0.0442)	(0.0389)
75-100%	-0.0164	-0.0103	-0.00993	-0.00229	0.00670
	(0.0428)	(0.0415)	(0.0412)	(0.0442)	(0.0389)
N	244	244	244	244	244
R^2	0.979	0.981	0.981	0.982	0.988

Note: The table shows the estimated change in average earnings growth rates (before and after benefits) for individuals from each quartile of the pre-pandemic earnings distribution during each sub-period. Coefficients are obtained from a regression based on Equation (2), estimated on data collapsed at the quartile by year-month level. The dependent variable is the total change in wages and UI benefits in the quartile, divided by the one-year-prior total wages earned in the quartile.

A Appendix

A.1 Benchmarking UI Estimates

In this section we benchmark our predictions for the number of UI recipients from the CPS to other data sources on the number of UI claims and benefits paid.

In the main body of the paper we focus on individuals who were employed one year prior and thus have a previous wage observation, allowing us to analyze the impact of labor market public policy on earnings inequality in this sample. For the purposes of the benchmarking exercise in this section, however, we also simulate eligibility for individuals who were not employed one year prior. In this case, since we do not have previous earnings to use to construct estimated benefits, we assume individuals are ineligible for state UI benefits and instead receive the state minimum PUA benefits. See Section 4.1 for more details.

We begin by comparing the characteristics of predicted UI claimants from the CPS data during the pandemic period to the characteristics of actual UI recipients provided by states to the Department of Labor (DOL). The DOL data is derived from ETA 203 reports submitted monthly by states, and covers the period from April 2020 through February 2021 for beneficiaries of standard state UI programs (similar data for the PUA program is not available from the DOL). It is important to note that the DOL data is aggregated from state reports of varying quality. Some data, such as gender and age, appear to be high quality with few missing values. Industry is generally derived from the business registry data, but nonetheless, 14% of claimants are missing industry information. Occupation is generally self-reported by claimants and is likely subject to substantial mis-reporting, in addition to the 19% missing data. Race and ethnicity also both suffer from substantial missing data, with 24% for race and 12% for ethnicity.

In spite of these limitations, Appendix Table A.1 compares the characteristics of predicted claimants of standard state UI programs that we obtain from the CPS with the DOL data. The table also shows the characteristics of predicted PUA claimants from the CPS. The table shows that the share of women and Hispanics are similar between the DOL data and our CPS predictions. The CPS data, however, predicts a smaller share of black claimants than in the DOL data (15% vs 24%). There are also some differences in the age distribution, with a higher share of workers 55 and up in the CPS data compared with actual recipients (29% versus 24%). This suggests that we may be erroneously classifying some retirees as potential UI claimants.

The industry distribution is quite similar between the two data sources, with two main differences: The DOL data reports substantially higher shares of recipients from the Professional and Business Services industries (14% versus 10%); however the vast majority of this is due to staffing agencies and other intermediaries. This is not surprising, since CPS respondents who work for intermediaries often report the industry they work in. Second, the DOL data reports a lower share of claimants in Education and Health Services (15% versus 20%).

In addition, we can compare individuals across occupations, with the caveat that the DOL data is self-reported by claimants so may be less accurate. Here we see the distributions are broadly similar with a few differences. For most of the occupations that show differences (such as transportation, production, food service), the associated industry distribution is much more similar between the DOL and CPS data. Two occupations stand out: computer/math occupations (6% for DOL vs. 1% for CPS), and education (2% for DOL vs. 7% for CPS). For the latter, this is consistent with the gap we also see in the industry distribution. This may suggest that we are erroneously classifying teachers on summer break as unemployed.

Overall, while the comparison between the DOL and the CPS data is subject to caveats, and while we cannot know with complete certainty whether a particular individual claims UI, we are reassured by the fact that the characteristics of our predicted claimants is broadly similar to that of actual UI recipients as reported by the DOL.

Next, we compare the total estimated number of claimants and payments. There have been a variety of issues with states reporting data on UI recipients, leading to large over-counts in the number of claims. Thus, we instead use data on actual weeks of claims paid and the total amount paid through the three main programs: the standard UI, the PUA program, and the PEUC program.[1] Since eligibility for standard UI and PEUC depends on weeks of claims which are difficult to estimate in the CPS, we combine numbers from both programs. PUA claims figures remain incomplete, with 6 to 7 states not reporting any PUA claims each month.[2]

We begin by comparing the number of estimated UI claimants in the CPS with actual UI claims paid from March 2020 through January 2021 in Panel A of Table A.2.[3] On the CPS side, we focus on two groups: our main sample of individuals who were employed

[1]These numbers are reported monthly by each state UI system on forms ETA5159 and ETA902p.

[2]Five states have never reported any PUA claims on form ETA902p (Alabama, New Hampshire, South Carolina, Vermont, and Wyoming).

[3]We restrict our analysis to January 2021 in order to have more complete data from the DOL and BEA.

prior to the pandemic (in 2019 or early 2020) and an additional group who were not employed in that time period but may also be eligible for unemployment insurance. We calculate that there were 265 million person-months of individuals who were employed prior to the pandemic but were no longer employed during the pandemic period, among which 135 million (51%) were eligible for standard unemployment insurance, 39 million were eligible for PUA (15%), and the remaining 91 million (34%) were ineligible for either program. For individuals who were non-employed when observed in the CPS prior to the pandemic, we estimate 72 million person-months (7% of the non-employed) were eligible for PUA.[4] Thus, we estimate that individuals who were not employed one year prior comprise about 29% of all person-months of standard UI or PUA eligibility.

We can then compare these CPS-based estimates to the number of claims reported by states to the DOL. The totals based on our estimates of standard UI and PEUC turn out to be very close to the official figures. In particular, 131 million person-months of claims of standard UI (or PEUC) were reported to the DOL between March 2020 and January 2021. This is 4 million less than our estimate from the CPS of 135 million, or an error of 3%. However, we do see larger differences in the number of PUA claims we estimate are eligible and the number of total claims. We estimate 111 million person-months of individuals eligible for PUA, while the DOL reports 82 million person-months of paid claims. Further, the Office of the Inspector General of the DOL has estimated at least 10% of all UI payments were likely fraudulent, with the fraud concentrated in the PUA program.[5] Although the true fraud numbers remain to be determined, 10% of overall fraudulent claims would translate to 21 million fewer person-months of claims. If these were concentrated in the PUA program, this would mean that approximately 45% of the individuals that we estimate to be eligible PUA claimants did not receive benefits. Although there is uncertainty in these estimates, they are consistent with other research that shows that many eligible UI claimants did not claim or receive benefits (Forsythe, 2021). When estimating actual recipiency, we therefore assume 3% of state UI eligible and 45% of PUA eligible do not receive benefits, based on this analysis.

One benefit of our CPS-based measure is that it estimates eligibility at the point of unemployment. In the spring and summer of 2020, there was considerable delay in

[4] As discussed above, without a wage observation pre-pandemic, we cannot estimate standard UI benefits, and thus assume these individuals receive PUA. This is not unreasonable given these individuals' truncated work history.

[5] https://www.oig.dol.gov/public/semiannuals/84.pdf

individual claims and benefit receipt, leading weekly claims reports to reflect a mix of contemporaneous and lagged payments. In Figure A.7, we show the monthly evolution of estimated claims from the CPS compared with actual payments from the DOL. While estimated claims peaked in April in the CPS, DOL payments did not peak until June and remained elevated throughout the fall, compared with the CPS estimates.

Panel B of Table A.2 focuses on payment amounts rather than claimant numbers. The left side of the table tallies the total dollars in benefits we predict have been received by claimants.[6] On the right side of the table, we use estimates constructed by the Bureau of Economic Analysis (BEA) on the total dollar value of various unemployment insurance programs.[7] The BEA data is constructed using data from DOL and Treasury. We use these BEA estimates because they include spending on the PUC program, which is unavailable from the DOL reports.

When we compare spending on standard UI, we estimate 193 billion in spending from March through January, while the BEA estimates 195 billion. In contrast, when we examine PUA estimates, we estimate 75.3 billion spent on PUA from the CPS, compared with 100.4 from the BEA. Summing these two types of UI payments, we estimate a total of 268.3 billion in spending, which is a bit smaller than the BEA data (295).

There are several reasons why our estimates differ. First, some individuals who we predict to be eligible for state UI may instead receive PUA, if for instance they were not employed by a covered employer, or they are an independent contractor that failed to identify as self-employed to the CPS. On the PUA side, we may be under-estimating spending if some of the individuals for whom we do not have previous earnings information qualify for larger payments than the minimum. In addition, there have been issues with fraud and mistaken payments, which could lead the DOL and BEA data to be inflated compared to our CPS estimate which is based on predicted eligibility. Overall, however, the fact that our estimates for standard state UI and PEUC do not differ dramatically from the figures obtained from BEA give us confidence that our imputation procedure is fairly accurate.

Nonetheless, it is important to emphasize that there is considerable uncertainty in our estimates of PUA claims and payments. We estimate a larger number of claims than

[6] We aggregate predicted weekly benefits in the CPS to the monthly level by assuming that an individual who we deem to be eligible for UI during the CPS reference week would claim unemployment benefits during all weeks in that month.

[7] https://www.bea.gov/sites/default/files/2020-11/effects-of-selected-federal-pandemic-response-programs-on-personal-income-october-2020.pdf

the DOL reports, while we estimate a smaller dollar amount of claims paid than the BEA reports. We believe the claims numbers to be more accurate, since our estimates for dollars paid are based on using one week of labor earnings to estimate the 5 quarters of earnings that are input into the UI benefit calculations. However, if our dollar estimates are more accurate, this would indicate that all eligible PUA claims were paid, which would be very similar to the results that we report that are unadjusted for recipiency.[8]

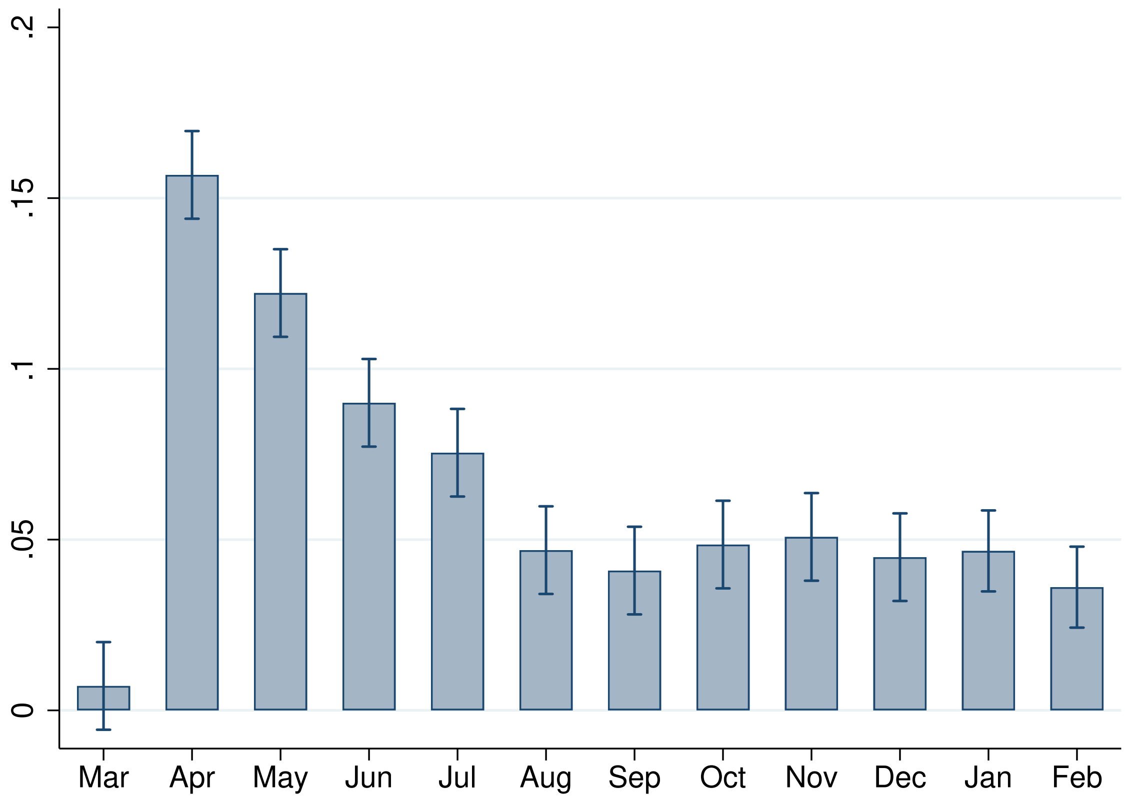
Finally, we compare our estimates for dollars spent on the three rounds of weekly top-ups: the \$600 per week PUC, the \$300 per week LWA and the \$300 per week ARP. Our estimates for the LWA and ARP are remarkably similar to the BEA estimates, with gaps of less than 10% each. However, we estimate a larger gap with the PUC, overshooting the BEA estimates by about 85 billion dollars. This is a substantial difference, especially given that the BEA overall reports more spending on UI and PUA payments than we estimate from the CPS. This is in part due to the gap between our estimated eligibility for PUA and actual non-fraudulent claims paid. Overall, we find it reassuring that our eligibility-based estimates are broadly similar to those derived from actual UI claims and treasury expenditures, though it will take some time until the true numbers for claims and benefits are determined.

As a final exercise, we can compare the total payments made through the different UI programs to the total volume of labor earnings losses experienced during the pandemic months. Panel C of Table A.2 shows that the total year-on-year change in aggregate labor earnings between March and January amounted to \$222 billion.[9] This raw change, however, is an under-estimate of the impact of the pandemic if one considers the fact that aggregate labor earnings would have normally been expected to increase during this time period, due to normal rates of population, employment, and wage growth. If we once again implement the approach of estimating Equation (1), now using aggregate labor earnings as the dependent variable, we can obtain estimates of the impact of the pandemic in each month. Aggregating these monthly impacts, we estimate total pandemic-induced labor earnings losses to be \$514 billion. Comparing this number to the total UI benefit payments we estimate were paid, total estimated benefits exceeded wages lost by \$197 billion. If instead we use the BEA estimates of total payments, then total payments exceed total pandemic-induced labor earnings losses by \$137 billion.

[8]Since we estimate that all but 3% of basic UI claims are received, the recipiency adjustment makes little difference for this group.

[9]This amount is obtained by multiplying year-on-year changes in aggregate weekly earnings by the number of weeks per month, and adding up the total obtained for the pandemic months (March through January).

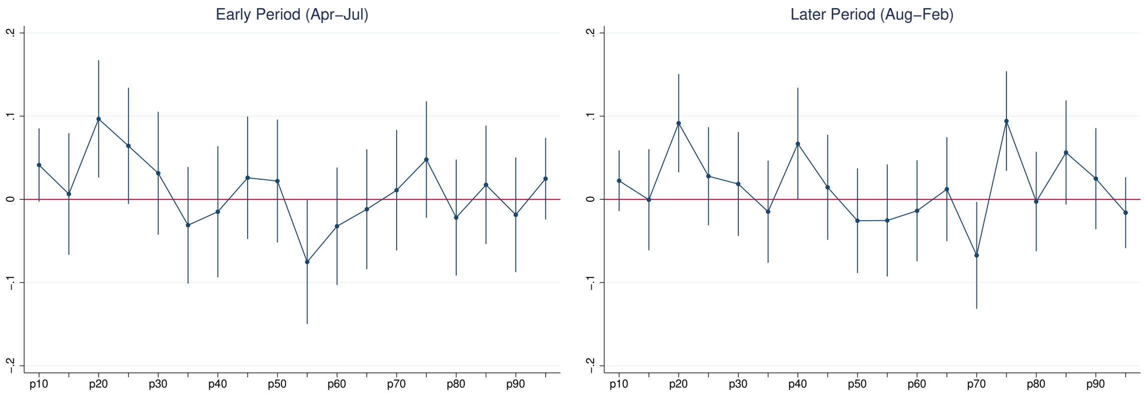
Figure A.1: Estimated Impact of the Pandemic on the Year-on-Year Job Separation Rate



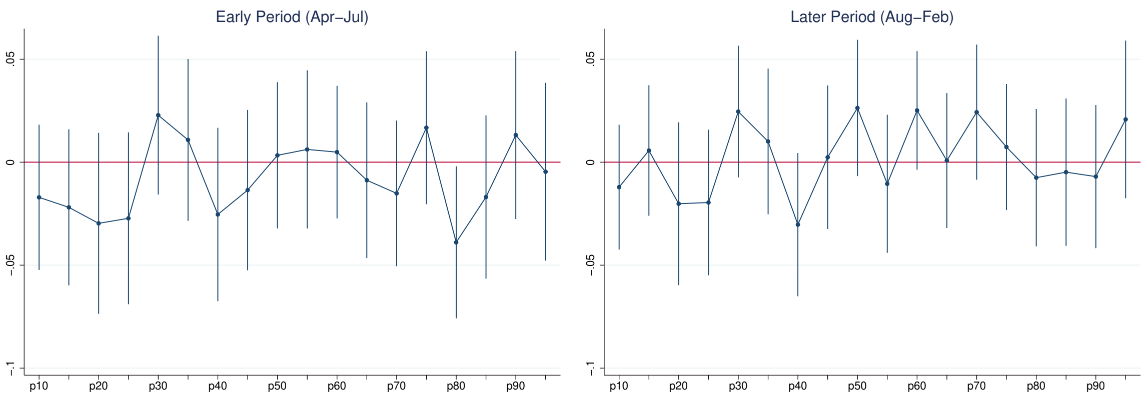
Note: The figure plots the estimated coefficients and 95% confidence intervals obtained from the estimation of Equation (1) using the year-on-year job separation rate as the dependent variable.

Figure A.2: Pandemic Impact on Nominal Weekly Earnings Changes

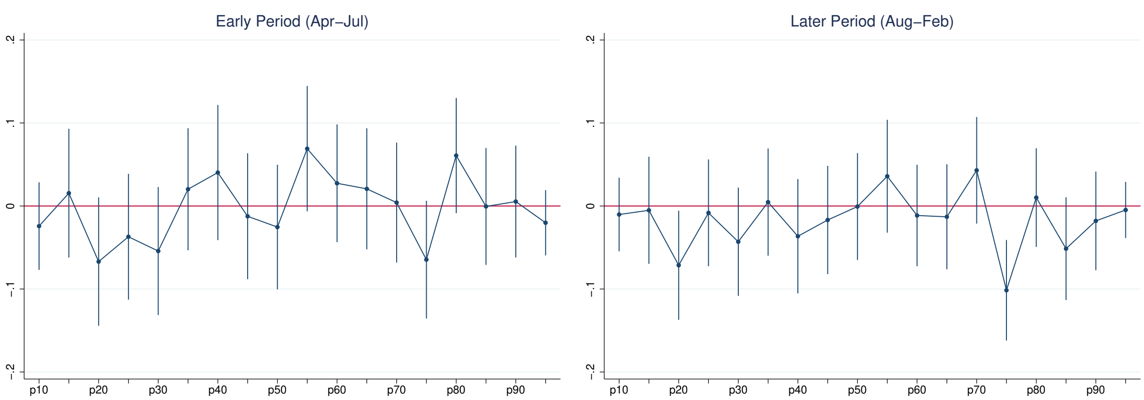
Panel A: Earnings Cut



Panel B: No Change

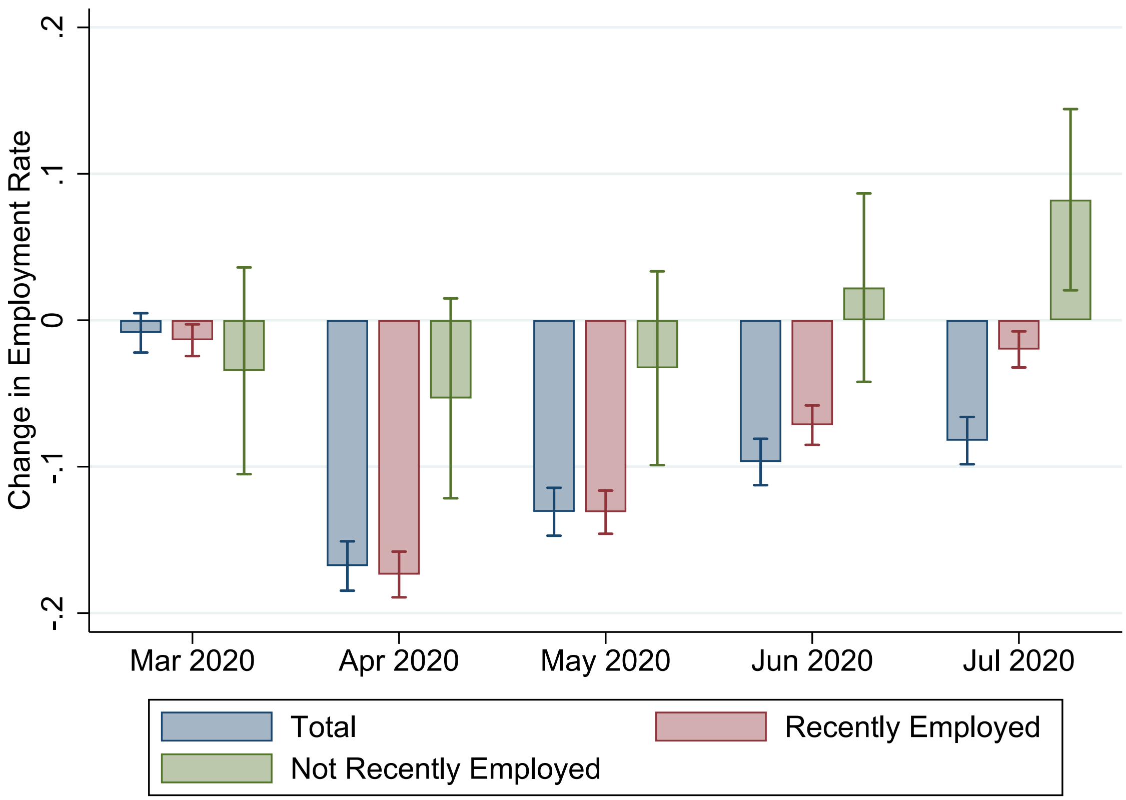


Panel C: Earnings Increase



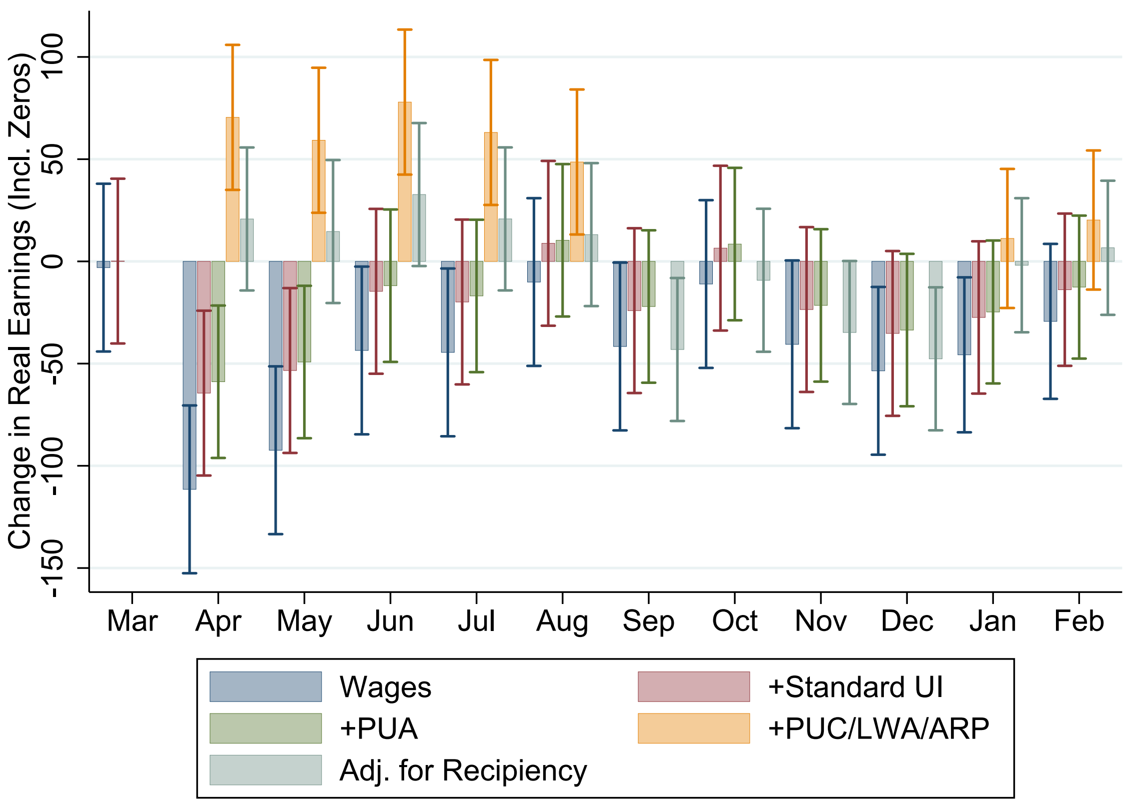
Note: The figure plots the estimated coefficients and 95% confidence intervals from Equation (2) using individual-level data on year-on-year changes in nominal earnings from January 2015 until February 2021. The x-axis represents ventiles of the pre-pandemic earnings distribution (the top and bottom two ventiles are grouped into deciles). The panels provide estimates of the impact of the pandemic on the probability of experiencing an earnings cut, an earnings increase, or no change in earnings, respectively. Earnings cuts and increases are based on changes of at least $10 in weekly earnings. The sample includes individuals who are employed in both month-in-sample 4 and month-in-sample 8 (264,968 observations).

Figure A.3: Change in Employment Rate by Employment History



Note: The figure plots the estimated impact of the pandemic (along with 95% confidence intervals) on the employment rate for different groups of workers. Recently employed are individuals who were employed at some point in the last three months, while not recently employed are the balance.

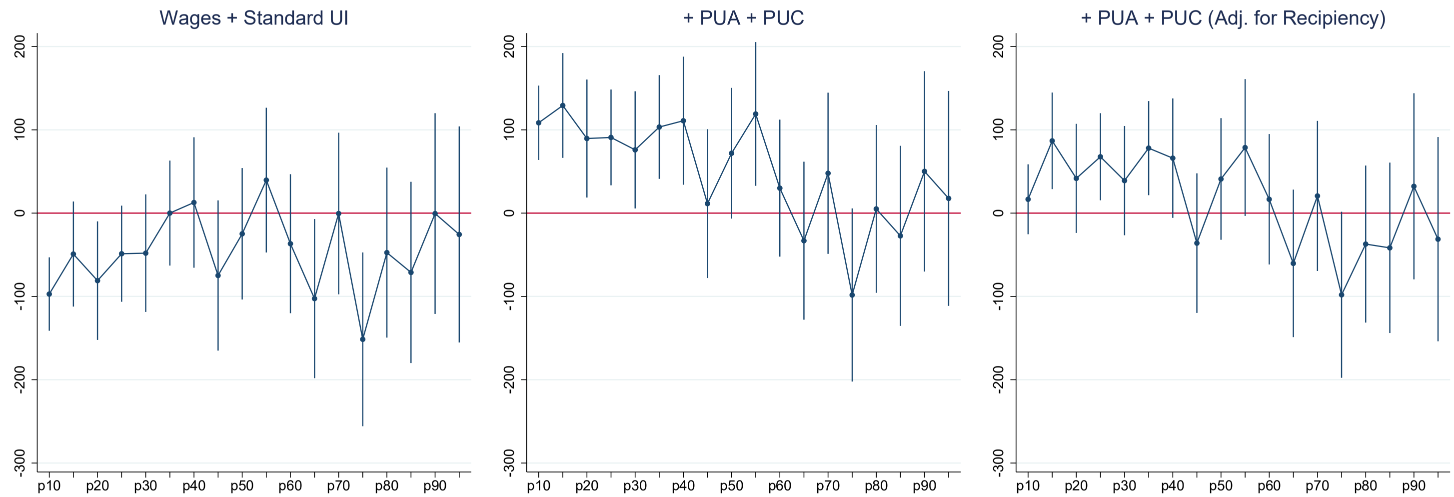
Figure A.4: Impact of the Pandemic on Year-Over-Year Dollar Change in Labor Earnings and Simulated Benefits by Program



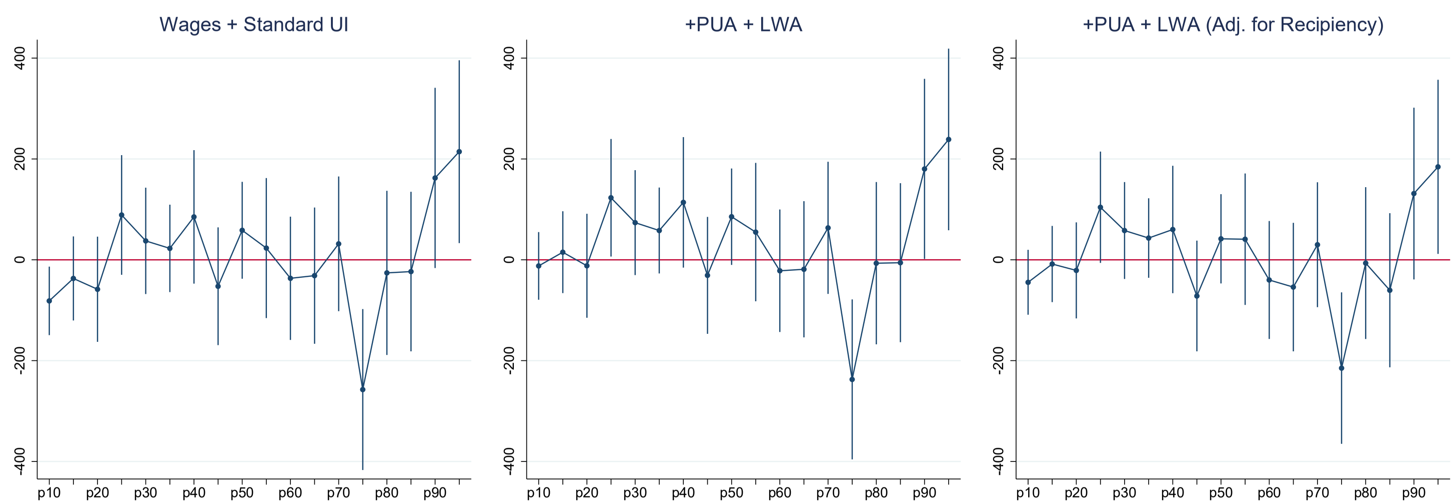
Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), PUC = Pandemic Unemployment Compensation (additional \$600 per week), LWA = Lost Wage Assistance (additional \$300 per week), ARP = American Rescue Plan (additional \$300 per week). This graph plots the estimated coefficients and 95% confidence intervals for the impacts during the pandemic on the average year-over-year dollar change in real weekly earnings (plus benefits) among previously employed individuals based on the estimation of Equation (1). The earnings measures are: (1) actual earned wages (including zeros), (2) wages plus estimated standard UI benefits, (3) the above plus estimated PUA benefits, (4) the above plus weekly top-ups, and (5) wages plus total UI benefits adjusted for estimated recipiency rates.

Figure A.5: Impact on Year-Over-Year Dollar Change in Labor Earnings and Simulated Benefits, April through August 2020

Panel A: PUC Period (April through July 2020)



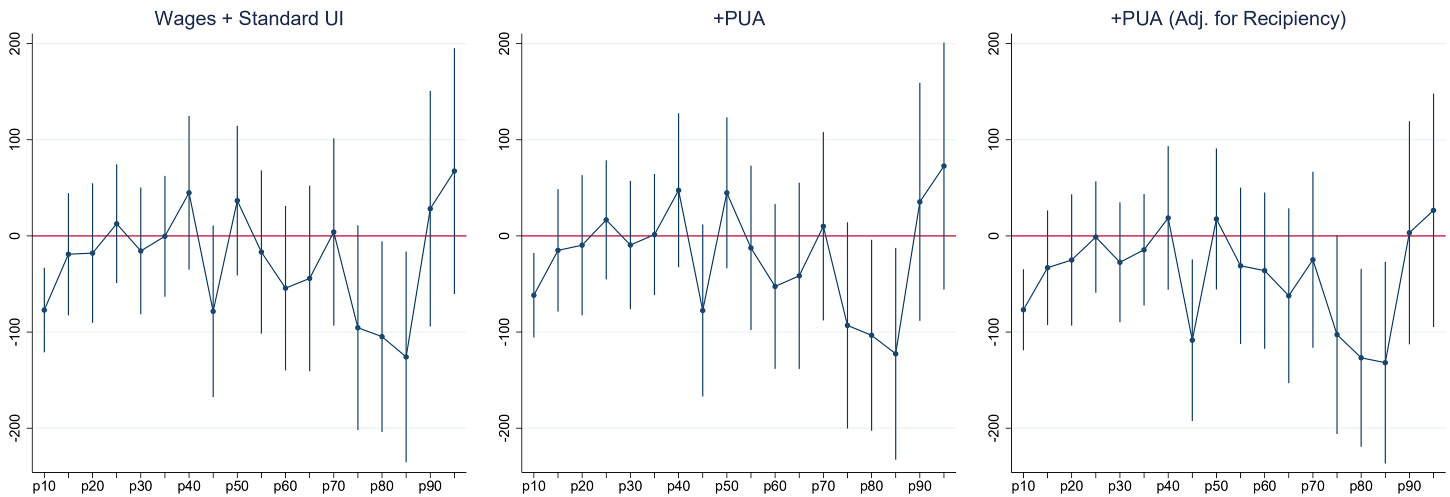
Panel B: LWA Period (August 2020)



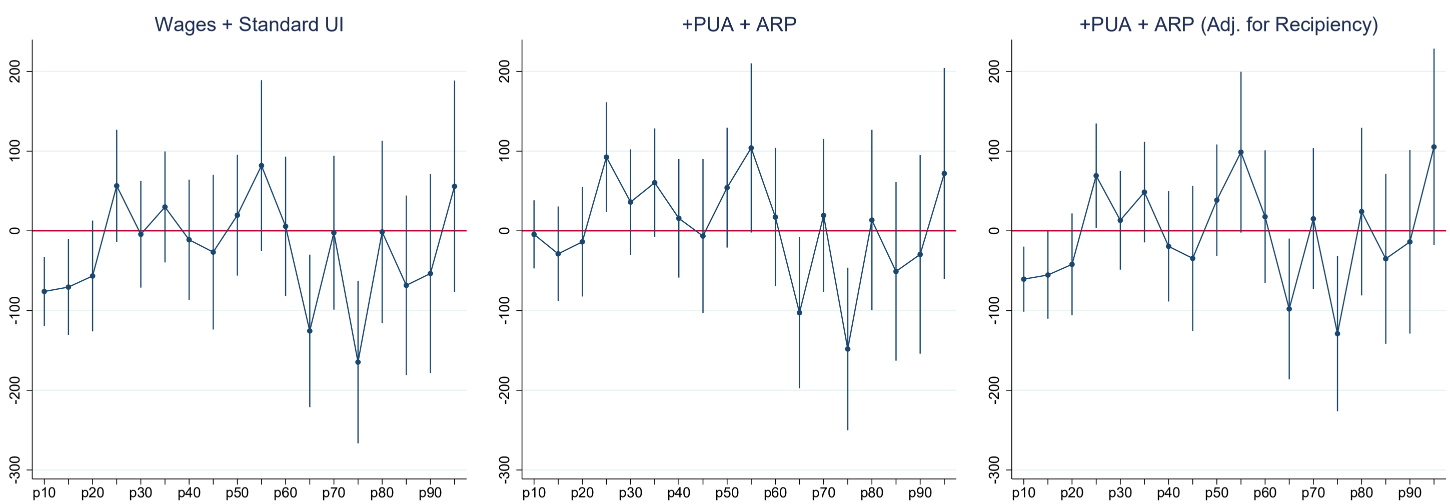
Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), PUC = Pandemic Unemployment Compensation (additional \$600 per week), LWA = Lost Wage Assistance (additional \$300 per week). The figure plots the estimated coefficients and 95% confidence intervals for the changes during the pandemic throughout the earnings distribution, based on the estimation of Equation (2) using data from January 2015 until February 2021. The x-axis represents ventiles of the pre-pandemic earnings distribution (the top and bottom two ventiles are grouped into deciles). The dependent variable is the within-individual change in real weekly earnings plus benefits (dollar amount). Figures in the left column are based on actual earned wages (including zeros) plus estimated standard UI benefits. Figures in the center column are based on the above plus estimated PUA benefits and weekly top-ups (which vary across periods). Figures in the right column are adjusted for estimated recipiency rates.

Figure A.6: Impact on Year-Over-Year Dollar Change in Labor Earnings and Simulated Benefits, September 2020 through February 2021

Panel C: No Top-Up (September through December 2020)

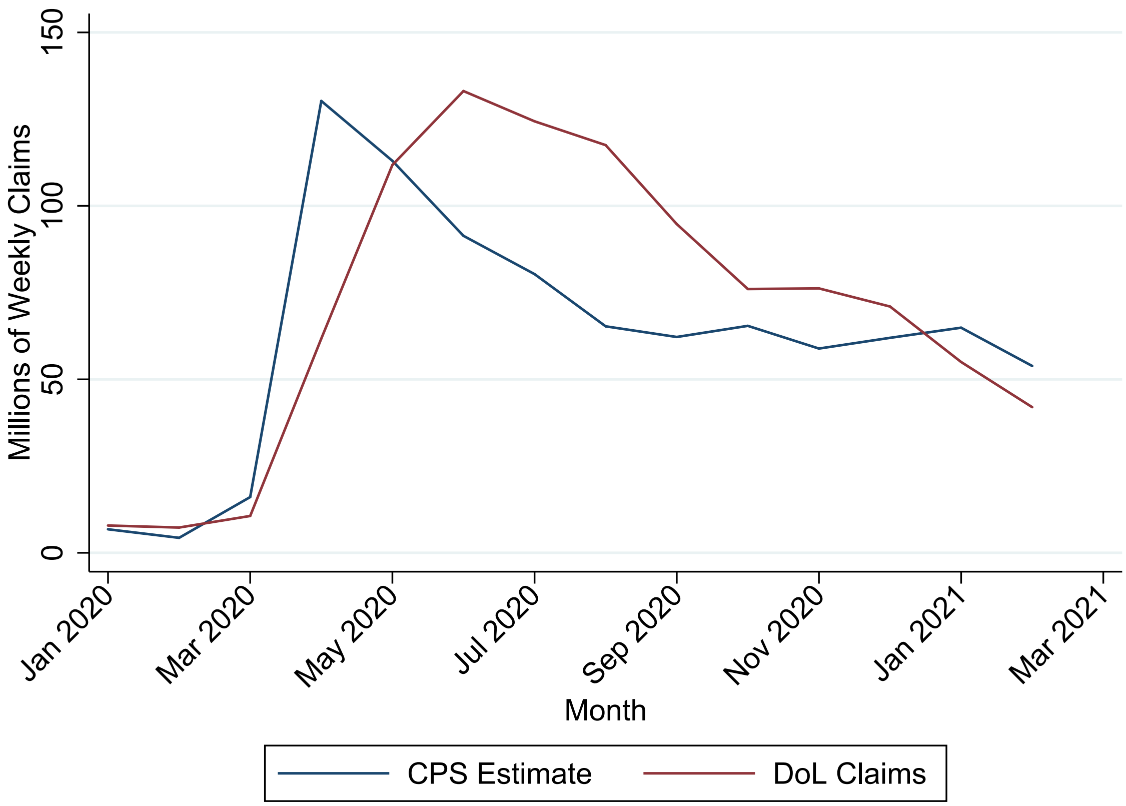


Panel D: ARP Period (January through February 2021)



Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), ARP = American Rescue Plan (additional $300 per week). The figure plots the estimated coefficients and 95% confidence intervals for the changes during the pandemic throughout the earnings distribution, based on the estimation of Equation (2) using data from January 2015 until February 2021. The x-axis represents ventiles of the pre-pandemic earnings distribution (the top and bottom two ventiles are grouped into deciles). The dependent variable is the within-individual change in real weekly earnings plus benefits (dollar amount). Figures in the left column are based on actual earned wages (including zeros) plus estimated standard UI benefits. Figures in the center column are based on the above plus estimated PUA benefits and weekly top-ups (which vary across periods). Figures in the right column are adjusted for estimated recipiency rates.

Figure A.7: Monthly Predicted Claims versus DOL Reported Claims



Note: This graph plots the predicted weeks of UI claims from the CPS compared with the acutal number of claims reported by the DOL. The CPS claims are adjusted for estimated recipiency. Both figures include data from standard UI as well as pandemic expansion programs.

Table A.1: Characteristics of UI Recipients versus CPS Predicted Recipients

	Actual UI Recipients (DOL)	CPS Predicted UI Recipients	CPS Predicted PUA Recipients
Female	52%	51%	51%
Hispanic	21%	23%	15%
Black	24%	15%	11%
White	66%	73%	78%
Other	11%	12%	11%
Under 25	16%	16%	14%
25-35	16%	21%	12%
35-55	38%	34%	35%
55+	24%	29%	40%
Industry:			
Agriculture, forestry, fishing, and hunting	1%	1%	1%
Mining	1%	1%	0%
Construction	6%	7%	12%
Manufacturing	10%	9%	4%
Trade	15%	14%	10%
Transportation and utilities	5%	7%	6%
Information	3%	2%	2%
Financial activities	3%	3%	3%
Professional and business services	14%	10%	13%
Educational and health services	15%	20%	17%
Leisure and hospitality	21%	20%	17%
Other services	5%	5%	13%
Public administration	1%	2%	1%
Occupation:			
Management	7%	6%	12%
Business/Finance	2%	3%	2%
Computer/Math	6%	1%	1%
Engineering	1%	1%	1%
Science	0%	0%	1%
Social Services	1%	1%	0%
Legal	0%	1%	0%
Education	2%	7%	5%
Arts/Entertainment	2%	2%	9%
Health	2%	3%	2%
Heath Support	3%	4%	3%
Protective	1%	1%	1%
Food/Serving	17%	12%	9%
Maintenance	3%	5%	5%
Personal Care	4%	5%	12%
Sales	16%	10%	10%
Office Support	8%	10%	6%
Farm	1%	1%	0%
Construction	5%	6%	7%
Installation	3%	2%	3%
Production	11%	6%	3%
Transportation	6%	11%	8%

Note: This table compares the demographic and industry characteristics among predicted UI claimants from the CPS and actual characteristics of standard state UI recipients reported to the DOL on ETA form 203. The DOL does not collect demographic data for the PUA program. The data span April 2020 through February 2021. The DOL data has substantial missing data: 1% for gender, 1% for age, 24% for race, 12% for ethnicity, 14% for industry, and 19% for occupation. Percentages refer to the share of the non-missing data, but should be interpreted with caution.

Table A.2: CPS Job Losses and Predicted Claims vs. Department of Labor and Bureau of Economic Analysis Unemployment Insurance Claims Data

Panel A: Job Losses and UI Claims During Pandemic Months

	CPS job separations (person-months, millions)				DOL UI claims (person-months, millions)		
	State UI + PEUC	PUA	Total	Ineligible	State UI+ PEUC	PUA	Total
Employed	135.16	39.31	174.48	90.66			
Non-Employed		72.04	72.04	933.15			
Total	135.16	111.35	246.52	1023.81	131.09	82.14	213.23

Panel B: Unemployment Insurance Payments During Pandemic Months

	CPS, predicted dollars paid (billions)						BEA estimate of UI dollars paid (billions)					
	State UI + PEUC	PUA	PUC	LWA	ARP	Total	State UI + PEUC	PUA	PUC	LWA	ARP	Total
Employed	193.33	22.5	247.0	20.1	17.8	500.6	194.6	100.4	291.7	35.7	28.6	650.9
Non-Employed		52.9	129.9	14.2	13.8	210.8						
Total	193.3	75.3	376.8	34.4	31.5	711.4						

Panel C: Labor Income Changes During Pandemic Months

	CPS (billions of dollars)
Total	-221.99
Pandemic-Induced	-513.67

Note: PUA = Pandemic Unemployment Assistance (eligibility expansion), PUC = Pandemic Unemployment Compensation (additional $600 per week), LWA = Lost Wage Assistance (additional $300 per week), ARP = American Rescue Plan (additional $300 per week), PEUC = Pandemic Emergency Unemployment Compensation (benefit duration extension). In the left-hand columns of Panel A, we report the total number of person-month job separations in the CPS over the pandemic period (March 2020 through January 2021), broken down by whether they were employed one year prior, and by their predicted eligibility status for the different UI programs based on our approach described in Section 4.1. The right-hand columns present data from the Department of Labor (DOL) on claims paid by program. The DOL figures are based on monthly reports by each state UI system on forms ETA5159 and ETA902p. The PUA data remains incomplete, as not all states have reported this data in all months. Panel B presents corresponding dollar amounts of benefits as estimated in the CPS and as produced by the Bureau of Economic Analysis (BEA). Panel C computes the total change in labor income from March through January based on CPS data. Pandemic-induced estimates are obtained by estimating Equation (1). See Appendix A.1 for more details.