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The $800 Billion Paycheck Protection Program: Where Did the Money Go and Why Did It Go There?

David Autor, David Cho, Leland D. Crane, Mita Goldar, Byron Lutz, Joshua Montes, William B. Peterman, David Ratner, Daniel Villar, and Ahu Yildirmaz

In the early weeks of the COVID-19 pandemic, many small businesses in the United States were in precarious financial condition: revenues had plunged, access to credit was in many cases inadequate or absent, and large-scale layoffs and closures had already occurred (Bartik et al. 2020a, b). The potential consequences of widespread business failure were not confined to business owners. Since approximately 47 percent of US workers were employed by small businesses prior to the pandemic (SBA 2019), these closures held the potential for vast job loss. Over the longer term, widespread firm closures could slow the subsequent economic recovery by destroying intangible firm capital, liquidating high quality worker-firm matches, and forcing the costly reallocation of physical capital.

To aid these distressed businesses, Congress enacted the Paycheck Protection Program (PPP), which provided uncollateralized, low-interest loans of up to $10 million to firms with fewer than 500 employees—loans that were forgivable on the condition that recipient firms maintained employment and wages at close

■ *David Autor is Professor of Economics, Massachusetts Institute of Technology, and also a Research Associate, National Bureau of Economic Research, both in Cambridge, Massachusetts. David Cho is an Economist, Leland Crane is a Senior Economist, Byron Lutz is an Assistant Director, Joshua Montes is a Senior Economist, William Peterman is Chief of the Fiscal Analysis Section, David Ratner is a Principal Economist, and Daniel Villar is an Economist, all at the Board of Governors of the Federal Reserve System, Washington, DC. Mita Goldar is an independent researcher. Ahu Yildermaz is CEO of the Coleridge Initiative, Chevy Chase, Maryland. David Autor is the corresponding author at dautor@mit.edu.*

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to pre-crisis levels in the two to six months following loan receipt. The scale of the aid provided was extraordinary. By the time the program concluded in mid-2021, around $800 billion in loans had been extended. Despite facing initial capacity constraints, the Paycheck Protection Program was notably successful in distributing a vast number of loans in short order: the take-up rate among eligible firms was 94 percent. Crucial to this rapid rollout was the decision to enlist the private sector to oversee the origination of all PPP loans, with the Small Business Administration (SBA) serving as the guarantor.

The Paycheck Protection Program was ultimately comparable in size to the two other major federal transfer programs enacted in response to the pandemic: expenditures on household payments—that is, stimulus checks—were around $800 billion; and expenditures on expanded unemployment benefits totaled roughly $680 billion under the Federal Pandemic Unemployment Compensation program (FPUC), Pandemic Unemployment Assistance program (PUA), and Pandemic Emergency Unemployment Compensation (PEUC) (CRFB 2021). As another standard of comparison, each of these three programs was roughly comparable in size to the *entire* American Recovery and Reinvestment Act of 2009 (ARRA), the principal fiscal stimulus enacted in response to the Great Recession of 2007–2009.

This paper explores who ultimately benefited from those $800 billion in Paycheck Protection Program loans: concretely, where did the money go and why did it go there? We provide an answer in three steps. First, we consider how PPP funds flowed to three proximate sets of actors: workers who otherwise would have been laid off; creditors and suppliers of PPP-receiving businesses (for example, landlords, and utilities) who would otherwise not have received payments; and windfall transfers to PPP-recipient businesses (owners and shareholders) that would have maintained employment and met other financial obligations absent the PPP. Second, we calculate how these recipients were distributed across the household income distribution. Finally, we compare this allocation of funds to the household incidence of the two other major federal pandemic transfer programs: unemployment assistance and direct household payments. Our analysis combines lessons from existing research, including some of our own, and also presents new analysis using anonymized and aggregated payroll data from the private firm ADP, which processes payrolls for over 26 million individual workers in the United States per month.

The Paycheck Protection Program had measurable impacts. It meaningfully blunted pandemic job losses, preserving somewhere between 1.98 and 3.0 million job-years of employment during and after the pandemic at a substantial cost of $169,000 to $258,000 per job-year saved. PPP also reduced the rate of temporary closures among small firms, though it is less clear whether it reduced permanent closures. The majority of PPP loan dollars issued in 2020—66 to 77 percent—did *not* go to paychecks, however, but instead accrued to business owners and shareholders. And because business ownership and share-holding are concentrated among high-income households, the incidence of the program across the household income distribution was highly regressive. We estimate that about

three-quarters of PPP benefits accrued to the top quintile of household income. By comparison, the incidence of federal pandemic unemployment insurance and household stimulus payments was far more equally distributed.

Ironically, the program feature that arguably made the Paycheck Protection Program's meteoric scale-up possible is also the feature that made it potentially the most problematic: the program was essentially untargeted, aside from excluding firms with more than 500 workers (a rule further relaxed for some sectors). Small firms merely needed to attest that they were "substantially affected by COVID-19" to qualify, and almost all did so. Evidence strongly suggests that the program did not ultimately differentiate among firms or geographic areas according to need. This near absence of targeting virtually guaranteed that a large fraction of the first two tranches of $525 billion in PPP loan dollars went to businesses that would have remained viable and retained their employees even absent PPP. Perhaps recognizing this program limitation, Congress explicitly targeted the final tranche ($285 billion) of PPP loans in 2021 toward firms that had experienced revenue losses.

The Paycheck Protection Program's meteoric scale-up, its lack of targeting, and its highly regressive incidence reflect a key tradeoff that policymakers faced in March 2020 when crafting an emergency pandemic business loan program under severe time constraints: a lack of existing administrative infrastructure for overseeing large-scale, targeted federal support to US small businesses. Congress accordingly authorized the Small Business Administration (SBA) to harness the private sector to originate forgivable PPP loans and stipulated only a few coarse limitations on which firms could receive loans. These decisions rapidly opened the PPP floodgates to essentially all firms with fewer than 500 employees. Had policymakers instead insisted on better targeting, this would have likely substantially slowed aid delivery and reduced program efficacy. A key takeaway from the PPP experience is that building administrative capacity now would enable greatly improved targeting of either employment or business liquidity when the next pandemic or other large-scale economic emergency occurs, as it surely will.

The Basics

The Paycheck Protection Program sought to issue forgivable loans to small firms facing financial distress.[1] Businesses were permitted to draw PPP loans worth up to ten weeks of payroll costs—including wage and salary compensation not to exceed $100,000 per worker, as well as paid leave, health insurance costs, other benefit costs, and state and local taxes—with a maximum loan size of $10 million dollars.

[1]The Paycheck Protection Program was one of four large government direct-lending programs introduced during the pandemic; the other three programs were the Main Street Lending Program, Corporate Credit Facilities, and Municipal Liquidity Facility. These programs jointly covered a large swath of the US economy (Decker et al. 2021).

Although the Small Business Administration issued the loan guarantees and would ultimately determine whether loans would be forgiven, PPP loans were processed and delivered through the nation's banking system.

The program received three tranches of funding. The Coronavirus Aid, Relief, and Economic Security Act of 2020 (CARES) established the Paycheck Protection Program and provided $350 billion in appropriations on March 27, 2020. Subsequently, the Paycheck Protection Program and Health Care Enhancement Act,which passed on April 24, 2020, provided an additional $320 billion in appropriations. A third tranche of $285 billion was signed in to law on December 27, 2020, as part of the Consolidated Appropriations Act of 2021. Finally, early on in the pandemic, the Federal Reserve introduced the Paycheck Protection Program Liquidity Facility (PPLF) to bolster the ability of the banking system to provide PPP loans (Anbil et al. 2021).

Loans from the first two tranches were issued in 2020 and available to firms meeting the definition of a small business in the Paycheck Protection Program. In most industries, but not all, this required having fewer than 500 employees. The third tranche provided loans to firms in 2021 that had not previously taken out a PPP loan. It also provided "second draw" loans for firms that had already taken out a PPP loan, had fewer than 300 employees, and had experienced a significant revenue loss in 2020. About 75 percent of the third tranche of funding went to second-draw loans.

While the moniker Paycheck Protection Program suggests that the program was focused solely on employment, the criteria for loan forgiveness reveal another complementary goal: providing firms with liquidity to meet non-compensation obligations to creditors (like suppliers, banks, and landlords). Businesses had to do four things to qualify for PPP loan forgiveness: 1) spend at least 60 percent of the loan amount on payroll expenses; 2) spend (at least) the full loan amount on total qualifying expenses, including payroll, utilities, rent, and mortgage payments; 3) maintain average full-time equivalent employment at its pre-crisis level; and 4) maintain employee wages at no lower than 75 percent of their pre-crisis level. These criteria applied to a "covered period" that started on the date of loan disbursal and ran for 8 to 24 weeks, with the interval at the firm's discretion.

If these criteria were not met, the Small Business Administration offered alternative routes to forgiveness. Businesses could exercise a "safe harbor" option to meet the employment and wage criteria by restoring their full-time equivalent employment and wage rates to their pre-COVID level by the end of 2020 (or by the end of the covered period for loans issued in 2021). A second safe harbor absolved firms of the need to restore full pre-pandemic employment levels if they could document in "good faith" that other pandemic provisions (for example, lockdowns) made it infeasible to return to full business activity. These safe harbor provisions made the employment criteria far less onerous. Moreover, firms that did not meet all criteria could also receive partial loan forgiveness. As of late 2021, 94 percent of PPP loans issued in 2020 had applied for forgiveness and virtually all such applications had been approved by the Small Business Administration (SBA 2021).

One reason that almost all firms were able to meet these criteria is that they were retroactively loosened in June 2020, well after most PPP loans were issued (the discussion above pertains to the revised rules). Adding to the windfall, Congress amended the tax treatment of PPP loans in January 2021 to enable businesses to claim deductions for expenses paid with PPP loans (for example, wages, rent, utilities, etc.) without treating PPP loans as taxable business revenue. This retroactive change, which cost the Treasury an estimated $100 billion in foregone tax revenue, effectively allowed some firms to pay a negative tax rate on PPP income (Harney and Mott 2021). For simplicity, our primary distributional accounting exercise below does not adjust for the additional tax subsidy provided to PPP recipients through this provision, though we briefly estimate its distributional implications—which are highly regressive.

A Timeliness versus Targeting Tradeoff

Fiscal interventions during economic downturns are often judged based on whether they are targeted, timely, and temporary (Elmendorf and Furman 2008). The Paycheck Protection Program was clearly *temporary*. How did it do on the other two T's?

Timeliness

The program deserves high marks for timeliness. When the pandemic began, no existing federal program had the scale to quickly distribute hundreds of billions of dollars to small businesses. The only other possible mechanism seemed to be state unemployment insurance systems (Bernstein and Rothstein 2020), but these systems struggled to handle the flood of initial unemployment insurance claims, and struggled further when tasked with distributing the enhanced unemployment benefits provided by the Coronavirus Aid, Relief, and Economic Security Act of 2020. It seems unlikely that state unemployment insurance systems could have handled an additional novel burden (Hubbard and Strain 2020).

Despite these obstacles, the Paycheck Protection Program succeeded in delivering a staggering sum of money over a two-month period in spring 2020. This can be seen in Table 1. As shown in column 3 of panel A, $505 billion in first draw loans were issued to firms with fewer than 500 employees (column 3) and all but 7 percent of these were issued in 2020 (column 6). A very large share of these loans were issued in April and May (not shown). Finally, the memo lines show that non-employer businesses—for example, the self-employed—received $43 billion in first draw loans and employers with more than 500 employees received a relatively small $18 billion.

One emblem of the Paycheck Protection Program's success is its market penetration, which we define as the employment-weighted share of firms that received PPP loans and will refer to as the takeup rate. We make use of loan-level data from the PPP on the size of each firm that received a PPP loan, along with publicly available employment data from the Census Bureau's Statistics of US Businesses

Table 1
PPP Loans by Employer Size

Employer size (1)	*Employment share* (2)	*Loan $ (billions)* (3)	*Share of $* (4)	*Take-up rate* (5)	*% of $ received in 2020* (6)
A. First draw loans					
1–4	10%	44	9%	81%	84%
5–9	11%	54	11%	98%	93%
10–49	35%	182	36%	99%	96%
50–149	23%	122	24%	97%	98%
150–299	13%	64	13%	91%	98%
300–499	9%	40	8%	87%	97%
1–499	100%	505	100%	94%	93%
Memo:					
Non-employers	–	43	–	–	25%
Employers 500+	–	18	–	–	93%
B. Second draw loans					
1–4	10%	17	9%	30%	–
5–9	11%	25	13%	43%	–
10–49	35%	87	46%	45%	–
50–149	23%	45	24%	34%	–
150–299	13%	14	8%	29%	–
300–499	9%	1	0%	3%	–
1–499	100%	189	100%	34%	–
Memo:					
Non-employers	–	11	–	–	–
Employers 500+	–	0.2	–	–	–

Source: Authors' analysis of Census Bureau Statistics of US Businesses (SUSB) 2018, BLS BED, and SBA PPP data.
Note: Panels A and B reflect data on employer businesses. The main panels exclude loans to the self-employed, sole proprietors, independent contractors, and single-member LLCs with only one reported job because non-employers are excluded from the SUSB data used to calculate the denominator of the takeup rates displayed in column 5. The roughly 4.6 million non-employer loans (constituting about 8 percent of total loan dollars) are reported in the first memo lines of each panel. As PPP loan-level data censor firm size at 500, in the main panels of the table we restrict attention to loans to businesses smaller than 500; loans to businesses reported as having 500 employees in the PPP loan-level data are reported in the second memo line of each panel. Loans to businesses in Guam, Puerto Rico, and the Virgin Islands are excluded. Loans to businesses in the following NAICS industries are excluded as they are out of scope for the SUSB data used in columns 2 and 5: 111, 112, 482, 491, 525110, 525120, 525190, 525920, 541120, 814, and 92.

(SUSB). SUSB data provide total employment for a number of categories of firm size which we use to form the rows of Table 1. For each size category, the takeup rate is the ratio of the total number of employees at PPP-receiving firms from the PPP loan data divided by total employment from SUSB. For example, in the PPP loan data, in the size bin 10–49, there were 1.3 million first-draw loans to firms with a total of 21.4 million employees over 2020 and 2021. In the aggregate, the SUSB data from 2018 (the latest available) report that there were 21.4 million employees in firms with between 10 and 49 workers; accounting for the growth

of employment between 2018 and before the pandemic, aggregate employment between 10 and 49 was 21.7 million. Thus, the takeup rate in this group is 99 percent (21.4 million/21.7 million), as given in column 5. We note that these estimated takeup rates are constrained by significant data limitations in determining the set of firms eligible for a PPP loan, inaccuracies in the reporting of firm size in PPP loan-receipt data, the possibility of fraudulent loans, and other measurement issues. (See the online Appendix, available with this article at the *JEP* website, for further details on the methodology underlying Table 1, as well as additional information on the subsequent analysis in this paper.)

Overall, we estimate that 94 percent of employers with fewer than 500 employees took up a Paycheck Protection Program loan; consistent with this high takeup rate, the distribution of loan dollars is tightly in line with employment shares—compare columns 2 and 4. Indeed, the fact that the second tranche of PPP funding concluded without exhausting all available funds suggests that the program had achieved something close to saturation in its first five months of operation. While near-universal participation in a government program is not altogether surprising since the program in most cases constituted a pure cash transfer, it is nevertheless a substantial administrative accomplishment: merely handing out $500 billion dollars in two months takes many hands. As noted above, this accomplishment would likely have been infeasible had Congress not authorized the Small Business Administration to enlist the private banking sector to issue PPP loans.

The early rollout of the Paycheck Protection Program in April and May 2020 did, however, stumble on two hurdles. First, initial demand for loans significantly exceeded the ability of banks to deliver them. In the face of these capacity constraints, banks appear to have prioritized firms with which they had a preexisting relationship (Amiram and Rabetti 2020; Cororaton and Rosen 2021; Joaquim and Netto 2021; Granja et al. 2020; Li and Strahan, 2020). Larger firms, which tend to have ongoing banking relationships, accessed PPP funds sooner than smaller firms on average. Moreover, as most small business lending is sourced from local banks (Brevoort et al. 2010), the aptitude and willingness of local banks to process loan applications generated significant geographic heterogeneity in the initial distribution of loans (Bartik et al. 2021; Li and Strahan 2020).

The second hurdle was the significant uncertainty and confusion among businesses and banks over the specifics of the program, particularly over whether the loans would be forgiven. For example, in April 2020, the Small Business Administration announced that publicly traded companies were unlikely to satisfy the required good faith certification of need for a loan from the Paycheck Protection Program and stipulated a time window in which firms could return loans. Simultaneously, the Treasury Department announced that loans in excess of $2 million would be subject to review and warned of possible criminal charges for those who failed the review. These issues were resolved over the course of several months. By the second round of funding, confusion about eligibility and forgiveness terms had abated. Meanwhile, initially underperforming banks upped their loan tempo, and non-banks stepped into fill gaps in local loan provision (Granja et al. 2020; Erel

and Liebersohn 2020). By July 2020, virtually all firms that would access a PPP loan in 2020 had done so.

The delay in delivering funds in April and May 2020 had real consequences. Doniger and Kay (2021) and Kurmann et al.(2021) find that loans received even a little earlier had a more pronounced effect on employment than those issued a bit later. Meanwhile, as we show below, the third tranche of loans, which did not go out until 2021, had no discernible effect on employment, perhaps because this tranche was issued when the labor market was already rapidly recovering.

Targeting

The rapid, near-universal takeup of Paycheck Protection Program loans in 2020 is inseparable from the reality that the program was essentially untargeted. That takeup was around 94 percent of *all* small businesses means that loans reached the most and least distressed firms—and all those in between—in nearly equal proportions. This observation helps to explain why there is little geographic correlation between the size of the initial COVID local economic shock, prior to PPP's passage, and subsequent PPP participation (Granja et al. 2020).

Around $200 billion in so-called second draw loans were issued in 2021—see column 3 of Table 1, panel B. Unlike the first two tranches of Paycheck Protection Program funds, these loans were explicitly targeted at firms that had experienced significant revenue losses over the course of the pandemic (and had already received a first PPP loan). We find a much higher correlation between PPP loan volumes and state-level employment declines for loans issued in 2021 than those issued in 2020 (see online Appendix Figure B.1), suggesting that this targeting was more than nominal. Nevertheless these loans do not appear to have boosted employment, as we show below.

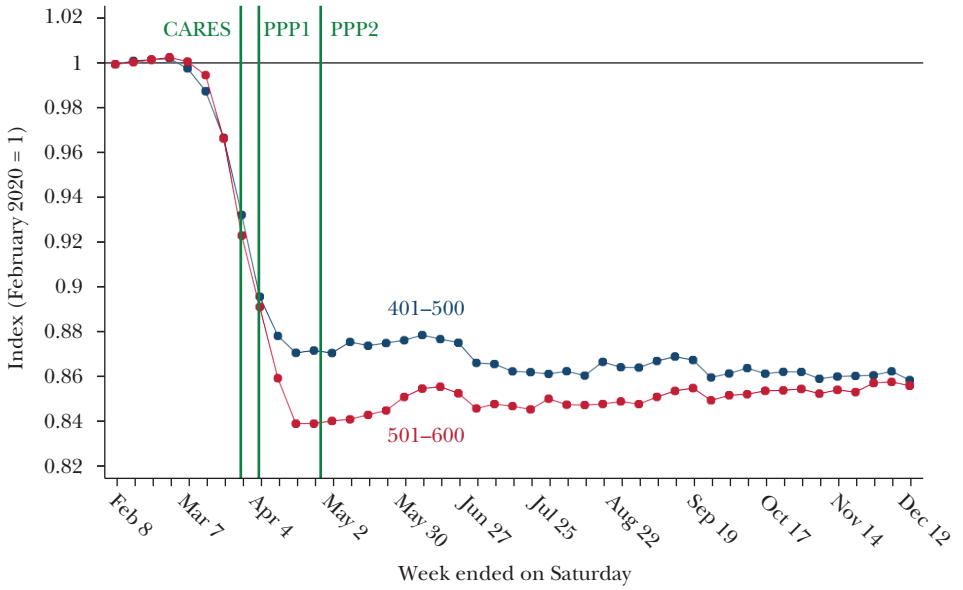
What Did the Paycheck Protection Program Accomplish?

Supporting Employment

A first step in calculating where the Paycheck Protection Program money went is to determine what fraction of funding went to paychecks that would otherwise not have been paid. Because PPP was ultimately taken up by almost all small businesses, we lack an ideal control group for making experimental comparisons. Nevertheless, a burgeoning literature, our own analysis included, indicates that PPP substantially boosted payroll employment.

The simplest and arguably most credible—though not necessarily most complete—method to assess the employment effects of the Paycheck Protection Plan is to compare the trajectory of employment at firms below the 500-employee initial-eligibility threshold to employment at ineligible firms above this threshold during the course of the pandemic. Figure 1—which is similar to our analysis in Autor et al.(2020)—presents this comparison using ADP payroll data. Employment is indexed to each firm's average level of employment in February 2020

Figure 1
Employment by Firm Size for Industries with PPP Eligibility at 500 Workers



Source: Author's calculations using ADP data.
Note: Each series represents average employment for firms with that particular range of workers during 2019 (on average) and in February 2020. Data are weighted by each firm's employment as of February 2020. Sample reflects firms that were present in the ADP data for all 12 months of 2019.

(immediately before the pandemic) for two employment size classes: 401–500 employees (in blue) and 501–600 employees(in red). Employment declines in parallel for these groups of firms at the start of the crisis. Following the launch of PPP, these trends diverge, with employment at firms that are likely eligible for PPP loans (401–500 employees) falling by substantially less than employment at firms that are likely ineligible (501–600). Approximately a month after the start of the PPP, employment had fallen by approximately 4 percent less at likely-eligible firms than at likely-ineligible firms. In the months thereafter, employment levels relative to baseline at likely-eligible and likely-ineligible firms gradually converged, with the difference falling to less than 2 percent by the start of July 2020. It disappeared altogether by September 2020.

Our formal econometric analysis of the employment effects of the Paycheck Protection Program in Autor et al.(2020) exploits this comparison of firms above versus below the size eligibility threshold, while additionally controlling for the differential impact of the pandemic across industries and states. After accounting for the fact that not all eligible firms received a loan, particularly in the initial months of the program, we estimate that taking out a PPP loan boosted firm employment by between 4 and 10 percent in mid-May and by 0 to 6 percent by the

end of the year.[2] Our best evidence is that about 2.97 million jobs per week were preserved by the Paycheck Protection Program in the second quarter of 2020, and 1.75 million jobs per week were preserved in the fourth quarter. Chetty et al. (2020) and Hubbard and Strain (2020) conduct similar analysis exploiting the eligibility size threshold, using non-ADP data sources, and reach broadly similar conclusions. Assuming that the employment effect declines linearly from its peak in May 2020 to zero by June 2021 implies that PPP saved 1.98 million worker years of employment at the very substantial cost of $258,000 per worker-year retained.

These estimates based on eligibility thresholds are subject to an important caveat: because they focus on firms just above and below the 500 employee size-eligibility threshold for Paycheck Protection Program loans, they may not capture the effect of such loans on smaller firms. If smaller firms are more liquidity constrained and hence more likely to shrink or shut down during the pandemic (Chodorow-Reich et al. 2021), the threshold-based estimates will likely underestimate the effects of PPP at these firms and, by implication, understate the full effect of PPP.

To develop causal effect estimates that cover a broader set of treated firms, a number of papers exploit an event-study approach that compares employment at firms receiving a loan early in the program period to employment at firms receiving a loan later. This approach potentially captures the effect of PPP loans on small firms that are well below the eligibility threshold, though it comes at a cost of focusing only on the early months of the program, before most firms had taken loans.[3]

We complement existing event-study estimates using the vast ADP database, which offers substantial precision and a sample frame identical to that used for the size-threshold analysis above. To implement the event-study using the timing of loan takeup, we merge PPP loan-level data from the Small Business Administration to our sample of employers from ADP. This provides the precise date of PPP loan approval for each matched firm within a sizeable sample of firms with fewer than 50 employees.

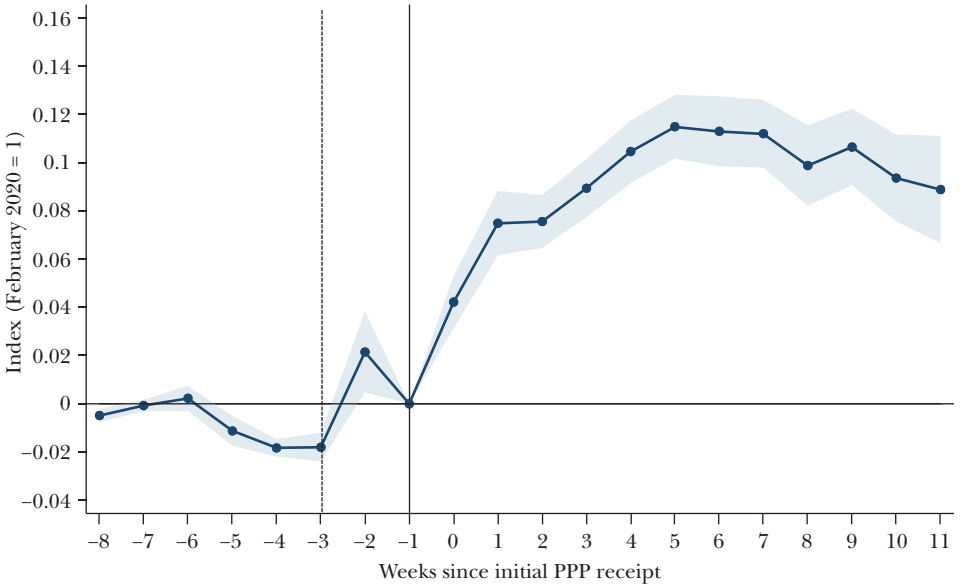
Figure 2 presents our timing-based estimates which trace out the effect of receipt of a Paycheck Protection Program loan on employment at firms with fewer than 50 employees.[4] The employment trend prior to loan approval is roughly

[2] Adjusting for incomplete takeup means rescaling our Intent-to-Treat (ITT) estimates by the takeup rate to obtain Treatment-on-the-Treated estimates (TOT).

[3] Papers using the event-study approach obtain a range of employment effect estimates. The first to employ this approach, Granja et al. (2020), finds aggregate employment effects that are comparable to those found by the eligibility threshold papers. Estimates in Li and Strahan (2020) imply a much smaller boost to employment, however, while those in Bartik et al. (2021), Doniger and Kay (2021), Faulkender et al. (2020), and Kurmann et al. (2021) point toward a larger employment effect.

[4] A rapidly growing literature—for example, Goodman-Bacon (2021), Callaway and Sant'Anna (2020), Sun and Abraham (2020)—highlights the problems that arise in event-study estimates when the magnitude of the treatment effect is correlated with the timing of treatment. We resolve this issue using the approach proposed by Sun and Abraham (2020): we estimate and then average separate treatment effects for each of the first eleven cohorts of borrowers, where cohort refers to week of loan issuance, while using the final seven cohorts as a comparison group. We choose the final seven cohorts to ensure a sufficient sample size. Using only those firms receiving a PPP loan in the final week of the program yields qualitatively similar results.

Figure 2
Event-Study Employment Effects at Firms Sized 1–49



Source: Authors' analysis of SBA and ADP data using Sun and Abraham (2020) "`eventstudyinteract`" STATA implementation.
Notes: Estimates from Sun and Abraham (2020) event-study interaction estimator on the sample of loan-matched ADP firms with between 1-49 employees where firm size is defined using the average size in February 2020. The outcome variable—firm-level employment—is indexed to equal 1 in February 2020. The estimates are weighted by each firm's employment as of February 2020 and include controls for 3-digit industry-by-week and state-by-week fixed effects. Standard errors are clustered at the 3-digit industry. All points to the right of the solid line represent post-treatment periods. Alternatively, accounting for the biweekly pay schedule of most ADP employers, and the back-filling used to establish start dates, all periods to the right of the dashed line can be viewed as post-treatment. See online Appendix Section D.4 for more details.

flat and about equal to zero, but begins rising on loan approval. Five weeks later, employment is roughly 12 percent higher, where it remains through the close of

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We estimate the following specification:

$$y_{it} = \alpha + \sum_{c \in T} \sum_{g=-8}^{11} (\beta_{c,g} * PPP_{g,it}) * D_c + \theta_{jt} + \theta_{st} + \epsilon_{it},$$

where y_{it} is total employment for firm i at week t indexed to equal 1 in February of 2020, θ_{jt} is a vector of NAICS 3-digit industry j–by–week t fixed effects, θ_{st} is a set of state s–by–week t fixed effects, and $PPP_{g,it}$ is a dummy variable equaling one if firm i at time t was approved for a PPP loan g weeks ago; $g = 0$ denotes the week of approval and the week prior to approval ($g = -1$) is the omitted category. D_c is a dummy variable denoting the week of PPP receipt for each cohort in the treatment set T (the first week through the eleventh week of the program). For additional details of how we implement the equation, see the online Appendix.

the outcome window. The relatively flat pre-trend centered around zero, and the sharp upward break after approval, are consistent with the interpretation that we are detecting a causal effect of PPP loans on small firm employment. We emphasize that these results indicate that small firms shrank *relatively* less after receiving a PPP loan as compared to firms not yet receiving a loan—not that their employment rose during the pandemic. The fact that the estimated effect on small firm employment is roughly *twice* as large as what we estimate for larger firms supports the view that smaller firms received a bigger employment boost from PPP.

Combining the results from Autor et al. (2020) for larger firms with the smaller firm results in Figure 2, we estimate that PPP loans originating in 2020 preserved about 3.0 million job-years at an average cost of $169.300 per job-year saved. We use this result below when calculating the share of PPP funds that accrued to paychecks.

While our findings in Figures 1 and 2 capture the employment effects of loans issued in 2020 from the first two tranches of PPP funding, we know of no similar evidence on the consequences of the third major tranche of $278 billion in PPP loans issued in 2021. To complete this picture, we estimate difference-in-difference threshold eligibility results analogous to those in Autor et al.(2020) for the second draw PPP loans which constituted the majority of third tranche loans issued in 2021 (comparing employment at firms above and below the 300 worker eligibility threshold for second draw loans).

Despite seemingly better targeting than the 2020 loans, we find no evidence in Figure 3 that the 2021 second-draw loans boosted employment, perhaps because they were issued too late to be relevant, after the economic recovery was well underway. If this interpretation is correct, it affirms that Congress was wise to prioritize speed over precision in dispatching the initial two tranches of PPP loans.

Preventing Firm Exits

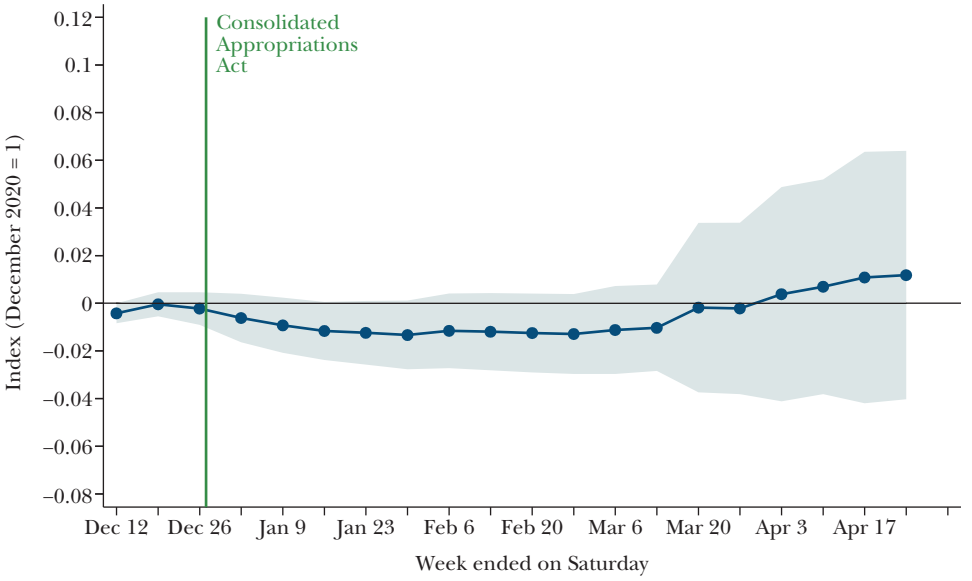
The spike in business closings during the COVID pandemic was historic. The Business Employment Dynamics database collected by the Bureau of Labor Statistics finds that employment at closing firms, which hovered at about 1 million worker per quarter for the last three decades, spiked to 2.1 million workers in the second quarter of 2020. Evidence in Crane et al. (2020) and Kurmann et al. (2021) corroborates these trends using a number of alternative indicators, including data from ADP.

A key justification for the Paycheck Protection Program was to prevent a contagion of business closures that would cause longer-term economic damage (Hubbard and Strain 2020). Business deaths—as distinct from business contractions and temporary closures—may potentially produce lasting economic harm not only by forcing the costly reallocation of physical capital, but also by permanently destroying worker-firm relationships and the associated match-specific capital (Farooq et al. 2020). Indeed, the prevalence of recall hires—as opposed to new hires—when firms rebound from contractions underscores the importance of match-specific capital to both employers and employees (for example, Fujita and Moscarini 2017).

We can observe the importance of firm closures for employment losses during the pandemic in the ADP data. Figure 4 groups firms into size classes based on their

Figure 3

Difference-in-Differences Eligibility Threshold Employment Effect, Second Draw Loans in 2021



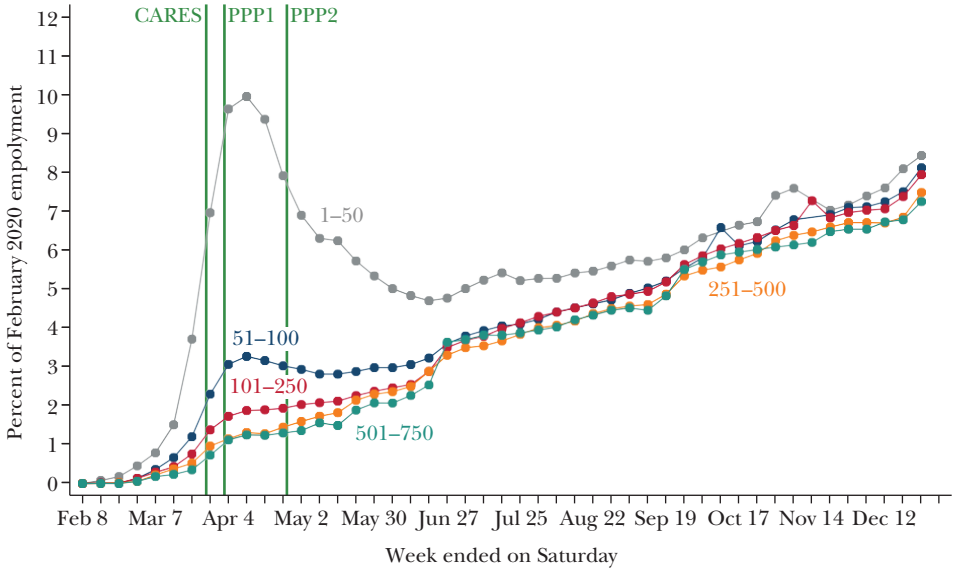
Source: Authors' analysis of ADP data.

Note: Each firm's size is determined using average employment in 2019 and employment in February 2020, the same size measure as used in Autor et al. (2020). Regressions are weighted by firm size as of February 2020 and include controls for state-by-week and industry-by-week effects. Standard errors are clustered at the 3-digit NAICS industry level. Sample comprises firms that were present in the ADP data for all 12 months of 2019. The specification is analogous to the difference-in-difference eligibility threshold specification in Autor et al. (2020); treatment and control groups are based on being within a range of 100 below and above, respectively, the 300 eligibility threshold for second draw loans. See the online Appendix for additional discussion.

February 2020 (pre-pandemic) employment and reports the share of their original employment that is lost due to firm shutdowns in each week between February and December 2020. Shutdowns are heavily concentrated among small firms: fully 10 percent of employment at firms that had 1–50 employees in February 2020 was lost due to shutdowns by early April 2020. For firms with more than 50 workers, these losses were only one-tenth to one-third as large. (We note that the general upward slope of the series in this figure is expected since some fraction of firms inevitably closes each year.[5])

[5]We define a firm as shutdown if it has no paid employment in a given week. Although we cannot definitively determine whether firms that appear to be shutdown in the ADP data have shuttered business or rather stopped utilizing ADP's payroll services, we expect that the *spike* in apparent shutdowns during the pandemic primarily reflects firms dropping to zero employment rather than discontinuing ADP's services.

Figure 4
Share of February 2020 Employment at a Firm with Zero Employment



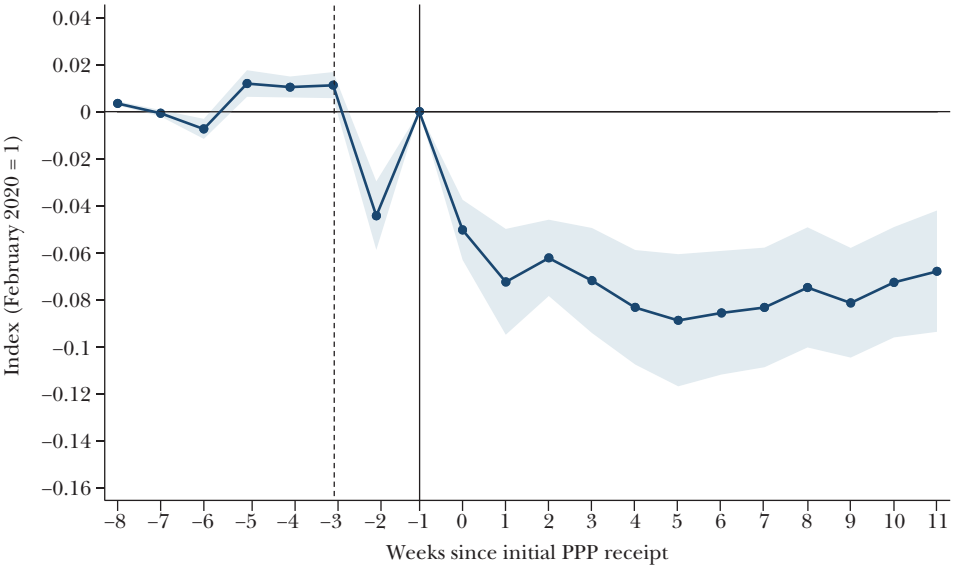
Source: Authors' analysis of ADP data.
Note: Each series represents the size-weighted share of firms with zero employment in a given week, using February 2020 employment as the weight. Sample reflects firms that were present in the ADP data for all 12 months of 2019, and excludes firms in NAICS 72.

Figure 4 also offers tantalizing evidence that the Paycheck Protection Program may have inhibited firm closures or spurred reopenings. Among firms sized 1–50 and 51–100, firm shutdowns peaked shortly after PPP loans began flowing and rapidly reversed course thereafter. By June 2020, the fraction of employment at small firms lost due to closure was only half as large as in April—meaning that many had reopened.

Following recent work by Dalton (2021), we test whether the receipt of a Paycheck Protection Program loan affects the probability that firms with fewer than 50 employees remain open (or reopen after closure). Using event study estimates akin to those above for small-firm employment, we find in Figure 5 that PPP loans reduced employment losses due to small-firm closures by about 8 percentage points five weeks after loan receipt. Since our earlier results in Figure 2 found a peak PPP effect on small-firm employment of 12 percentage points at week five, we infer that about two-thirds of the employment-preserving effect of PPP loans on very small firm employment was due to PPP keeping the lights on at establishments that would have otherwise shuttered—at least temporarily.[6]

[6]One anomaly in our results in Figure 5 is that the estimated employment effects of PPP receipt at small firms appear to start a week too early relative to loan receipt. A possible explanation is that a large

Figure 5
Employment Change Due to Firm Closure, Firms Sized 1–49



Source: Authors' analysis of SBA and ADP data using Sun and Abraham (2020) "`eventstudyinteract`" STATA implementation.
Notes: Estimates from Sun and Abraham (2020) event-study estimator on the sample of loan-matched ADP firms with between 1–49 employees where firm size is defined using the average size in February 2020. The analysis is implemented by setting y_{it} in the equation in footnote 4 equal to one if firm i has zero employment in week t and zero if it has positive employment. The specification includes controls for 3-digit industry-by-week and state-by-week fixed effects. Standard errors are clustered at the 3-digit industry. The coefficient vector displayed in the figure can be interpreted as the percentage point effect of the PPP on employment due to firm closure as the specification is weighted by pre-pandemic firm employment. All points to the right of the solid line represent post-treatment periods. Alternatively, accounting for the biweekly pay schedule of most ADP employers, and the back-filling used to establish start dates, all periods to the right of the dashed line can be viewed as post-treatment. See online appendix Section D.4 for more details.

Ultimately, permanent business closure proved less pervasive than many had anticipated at the pandemic's onset. The Paycheck Protection Program may be part of the reason. Because our methodology permits examining firm closures only over the short run, we cannot assess whether PPP averted permanent firm exits or mainly temporary closures. Using a related methodology, Dalton (2021) finds that the

fraction of ADP paycheck recipients are paid biweekly, and this payment scheme blurs the observable timing of any discrete event over the prior 13 days. Concretely, imagine that a firm's two-week pay period begins July 17 and ends July 31. After receiving a PPP loan, that firm reopens its doors on July 30th. In our estimation, this firm will show an employment jump on July 17, even though all of its hires occurred 13 days later, when the loan was issued.

PPP effect on small-firm closures waned somewhat over the ensuing seven months, indicating that some of the PPP effect on closure was temporary, not permanent, in nature. For larger firms around the 500 employee eligibility threshold, we find no consistent evidence that the PPP influenced shutdowns, either over the short- or longer-term (for details, see online Appendix figure E.1). Despite bolstering jobs during the pandemic, PPP may not have had a pronounced effect on preserving intangible business capital. More work is needed to definitively assess the effect of the PPP on permanent business closure.[7]

Reducing Commercial Delinquency

Alongside preserving jobs and keeping firms open during the pandemic, the Paycheck Protection Program may have indirectly benefited creditors of small businesses—landlords, banks, holders of mortgage-backed securities, and suppliers—by keeping payments flowing. There is limited evidence on the effect of PPP on loan recipients' ability to pay creditors, but the evidence that exists suggests the impact was positive. Exploiting differences in the tendency of small versus large commercial properties to have PPP-eligible tenants, Agarwal et al. (2021) find that PPP significantly blunted the rise in commercial mortgage delinquency rates during the pandemic, particularly in the retail sector. Using survey data and a variant of the event-study strategy discussed above, Granja et al. (2020) also find that PPP decreased delinquency on mortgages and other payments.

Where Did the Money Go?

The estimates above provide a key input for answering our motivating question—that is, where did the money go? Using the employment effects estimated above, along with many other data sources, we estimate the incidence of the $510 billion in Paycheck Protection Program loans issued in 2020 across the household income distribution. We further compare this incidence to other pandemic economic assistance programs. Additional information on these calculations can be found in section F of the online Appendix.

Proximate Recipients: Workers versus Non-workers

Paycheck Protection Program funds were paid to businesses. In turn, businesses used these funds to pay three proximate groups of beneficiaries: workers who otherwise would have been laid off; creditors and suppliers who otherwise would not have been paid; and owners and shareholders of PPP-receiving firms as residual claimants in cases where businesses would have met some or all of their payroll and other financial obligations absent PPP (also known as "windfall profits"). The distribution

[7] Other recent work provides mixed evidence on these outcomes. Granja et al. (2020) find little evidence of a PPP effect on firm shutdown. Bartik et al. (2021) and Kurmann et al. (2021), though, find that PPP mitigated business shutdowns.

of PPP funds among these groups—workers versus non-workers, in particular—matters for our accounting exercise because different groups represent different parts of the household income distribution.

We focus first on payments to workers. As documented above, Paycheck Protection Program loans issued in 2020 modestly raised employment at recipient firms. To convert these employment effects into payroll expenditures, we use the main estimates reported above from Autor et al. (2020), who find that PPP boosted employment by about 6 percent in mid-May 2020, with effects tapering off gradually thereafter. These numbers imply that PPP preserved about 2.97 million jobs per week in the second quarter of 2020 and about 1.75 million jobs per week by the fourth quarter of 2020. Assuming a linear trend decline in this program effect, PPP would have had zero employment effects by June 2021. Converting these weekly job numbers into job-years (that is, one worker for one year), implies that PPP preserved about 1.98 million job-years of employment at a cost of $258,000 per job-year saved (that is, $510 billion/1.98 million). We assume that actual employee compensation for each saved job averaged $58,200 since the average weekly wage from the Current Population Survey in February 2020 is $786 (truncating at an annual wage of $100,000 above which the PPP did not provide additional support per worker) and, on average, total compensation is 42 percent larger than wages according to BLS Employer Costs for Employee Compensation data ($786 × 52 × 1.42). The 1.98 million job-years saved then imply that $115 billion in PPP loans ($58,200 × 1.98 million) accrued to employee paychecks.

We also produce an alternative estimate of the amount of Paycheck Protection Program loans accruing to compensation based on our 3.0 million job-years saved estimate which combines the results from Autor et al. (2020) and the larger effects for smaller firms in Figure 2. Continuing to assume that compensation at retained jobs averaged $58,200 implies that $175 billion in PPP compensation went to paychecks. It is likely that this $175 billion estimate is an upper bound on the share of PPP funds flowing to worker compensation. Some event-study estimates for the *entire* size distribution of PPP-eligible firms, including small firms, find an overall peak PPP employment effect of approximately 6 to 8 percent (for example, see online Appendix Figure D.1 and Dalton 2021). These estimates are more in line with our smaller $115 billion estimate. Additionally, our assumption of a smooth trend decline in PPP's impacts through June 2021 is generous.[8] Moreover, we are not accounting for loans issued in 2021 where our evidence suggests the PPP failed to boost employment; doing so would further lower the estimated share of PPP loans that flowed to workers relative to non-workers and hence substantially raise the estimated cost per job-year preserved.

These bounds of $115 billion to $175 billion in Paycheck Protection Program funds accruing directly to paychecks imply that between 23 percent and 34 percent

[8] In Autor et al. (2020), we detect no statistically significant impact of PPP on employment after July 2020. Because the point estimates remain non-zero through December 2020, we extrapolate the entire series out until it is numerically zero in June 2021.

of the first two tranches of PPP dollars totaling $510 billion supported jobs that would otherwise have been lost. By implication, the remaining $335 to $395 billion (66 to 77 percent) accrued to owners of business and corporate stakeholders, including creditors and suppliers, and others.

The Household Distributional Incidence

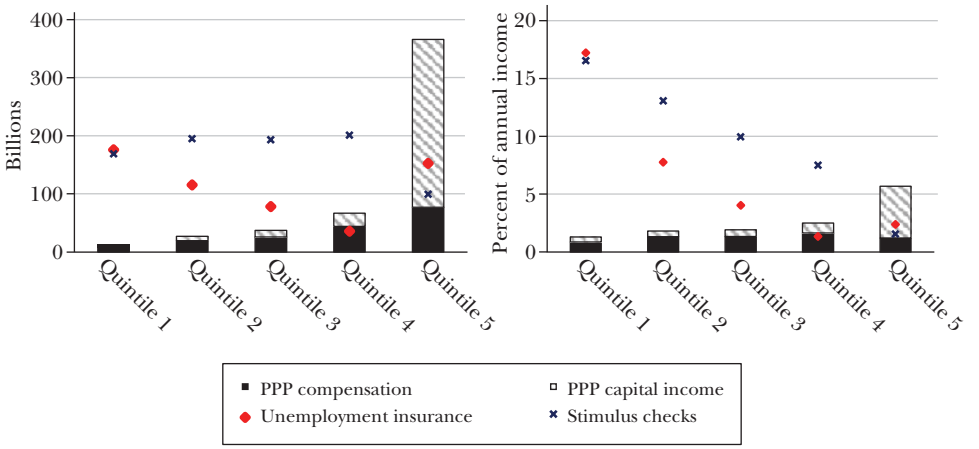
To trace the flow of Paycheck Protection Program payments from their proximate recipients to their household incidence requires information on the income distributions of both worker and non-worker (that is, owner) beneficiaries. Starting with the worker beneficiaries, we estimated above that, at the high end, $175 billion in PPP money flowed to workers whose jobs were saved. We assume that the distributional incidence of those funds followed the distribution of job loss in 2020 by household income quintile. To estimate this distribution, we first measure employment declines across the weekly wage distribution using the Current Population Survey Outgoing Rotation Group (CPSORG) files. Pandemic job losses were largest for low-paid workers: total employment fell by 17.8 percent from March 2020 through the end of 2020 among the lowest-paid (first) quintile of workers; by 10.6 percent in the second quintile; by 6.0 and 2.2 percent in the third and fourth quintiles, respectively; and by a substantial 8.7 percent among the highest quintile of earners. We convert these job loss percentages into average weekly wage losses by multiplying each by the February 2020 pre-COVID average weekly wage within quintile. From there, it is straightforward to calculate the share of compensation lost by weekly wage quintile, which we impute to the household income distribution using March CPS data on the joint distribution of weekly wages and household income.[9]

We make an analogous (but simpler) imputation for the household incidence of the $335 billion in Paycheck Protection Program fund payments that flowed to non-worker beneficiaries, such as creditors and suppliers who otherwise would not have been paid and owners and shareholders of PPP-receiving firms. Specifically, we use the Congressional Budget Office's (2020a) most recent estimates on the distribution of capital incomes by type to distribute the funds across households. We do not attempt to account for the flow of PPP funds from proximate and subsequent recipients—for example, a PPP-receiving firm's supplier pays its workers or a worker at a PPP-receiving firm pays her landlord. Thus, our exercise is in the spirit of the static distributional incidence analyses performed for tax policies by the Joint Committee on Taxation.

Unlike Paycheck Protection Program payments, which went to businesses, transfer payments made by the two other major federal pandemic emergency assistance programs—pandemic unemployment insurance payments and household

[9] Specifically, we calculate $S_q \equiv T \times \frac{U_q \times W_q}{\sum_{q=1}^{5} U_q \times W_q}$, where T is total PPP dollars that support employment, U_q is quintile q's share of job losses during the pandemic, and W_q is quintile q's wage in February 2020 prior to the pandemic. We then map from the *weekly wage* distribution to the *household income* distribution using March CPS supplement data on the probability that a worker in a given weekly wage quintile is in each household income quintile.

Figure 6
Distribution of Paycheck Protection Program, Unemployment Insurance, and Stimulus Check Payments



Source: Authors' analysis of CBO, Census Bureau, BEA, BLS ECEC, and Current Population Survey microdata, and estimates from Autor et al. (2020), Bhutta et al. (2020), and Boesch et al. (2021).
Note: See online Appendix for details of calculations. Calculations are based on our upper-end (most generous) estimate of the wage compensation supported by PPP. Online Appendix Figure F.1 reports the same calculations using our lower-end estimate of the wage compensation supported by PPP.

stimulus payments—went directly to households and workers. The size of these payments rivaled those of PPP, as noted above. To facilitate comparison with PPP, we calculate the distributional incidence of these as well.

For household payments, we use incidence data from Bhutta et al. (2020), who analyzed the effect of stimulus payments on household finances using the Survey of Consumer Finances. For unemployment insurance, we calculate approximate shares of benefits paid during the pandemic—including regular state programs and the pandemic enhancements to unemployment insurance—using, as a starting point, our estimates of average wages lost during the pandemic, and applying the methodology above for apportioning the PPP funds to paychecks. We combine these data on wages lost by quintile with simple estimates of the unemployment insurance replacement rate by quintile, which we estimate using same CPS ORG data. This calculation accounts for both pandemic supplements to weekly unemployment insurance benefits and the portion of Pandemic Unemployment Assistance payments that went to the self-employed, as estimated by Boesch et al. (2021).

Panel A of Figure 6 reports the distribution of Paycheck Protection Program, unemployment insurance, and household payments in billions of dollars across household quintiles. As the figure makes clear, the distribution of PPP loans overwhelmingly accrued to high-income households. Of the $510 billion in PPP loans provided in 2020, we estimate that only $13.2 billion ultimately flowed to households in the bottom fifth of the income distribution, and that $130.8 billion flowed to the second through fourth quintiles. The remaining $365.9 billion (72 percent)

flowed to the top fifth of household income. This skew reflects two features of PPP. First, high-wage earners are found in high-income households. Though the PPP offered loans to support only up to $100,000 in annual earnings, even with this truncation, the top fifth of households accounts for about 35 percent of wage and salary earnings. Second, the distribution of capital ownership is even more right-skewed than the distribution of wage earnings—with the top fifth of households commanding 86.2 percent of capital income—meaning that subsidies to businesses are ultimately subsidies to high-income households.

If we additionally account for the $100 billion in tax credits that Congress granted to PPP-receiving businesses in January 2021 by making PPP payments nontaxable, we conclude that an additional $85 billion flowed to the top quintile of households, raising that quintile's total PPP distribution further from $365.9 to $450.9 billion.[10]

In comparison, both household stimulus payments and pandemic unemployment insurance payments were far less regressive than in the Paycheck Protection Program. The incidence of household stimulus checks in dollar terms was close to uniform across the lower four income quintiles. Moreover, due to the income caps that Congress set on household payments, the incidence of these payments was much smaller for the highest quintile of households.

Meanwhile, the incidence of unemployment insurance during the pandemic was weighted towards both the upper and lower tails of the household income distribution. We estimate that 31.5 percent ($175.6 billion) and 20.7 percent ($115.4 billion) in pandemic unemployment insurance payments went to the bottom fifth and second-to-bottom fifth of households, respectively (red diamonds in panel A of Figure 6). Surprisingly, the top fifth of households received a bit more than one-quarter of unemployment insurance benefits. This occurred both because the highest income quintile of wage and salary workers sustained substantial employment losses during the pandemic (as documented above), and because the Pandemic Unemployment Assistance (PUA) program allowed self-employed business owners—who tend to have high incomes—to collect unemployment insurance benefits. Estimates from Boesch et al. (2021) suggest that self-employed business owners received about 40 percent of Pandemic Unemployment Assistance insurance benefits.

Panel B of Figure 6 recasts these distributional incidence figures into household annual income replacement rates rather than dollar transfers. Both stimulus checks and unemployment insurance payments replaced about 17 percent of the incomes of the lowest quintile of households, with much lower shares at higher quintiles. Thus, although the combination of these three programs is highly regressive

[10] We make this calculation by attributing the $100 billion in forgone tax revenues to the share of business income that goes to the top fifth of households, which is approximately 85 percent. An alternative calculation yields a comparable conclusion: the Congressional Budget Office estimates that the average marginal tax rate on capital income is 18.6 percent; noting that PPP distributed $510 billion in 2020 and that the top fifth of households commands about 85 percent of capital income, we obtain a tax benefit for the top fifth of $81 billion.

in dollar terms, it is roughly progressive in replacement rate terms due to the highly skewed distribution of US household incomes.

Macroeconomic Benefits

An additional benefit of these transfers programs is that they provided stimulus during a time of rapid economic contraction. The short-term macroeconomic boost of a program during a recessionary period is conventionally linked to the marginal propensity to consume (MPC) of those who receive benefits from the program. Cashin et al. (2018) provide estimates of the MPC for different types of fiscal shocks based on characteristics such as: the type of policy change (say, tax versus transfer payment); who is receiving the benefit (say, low-income households versus corporations); and whether the flow of benefits is temporary or permanent. These MPC estimates are informed by a publicly available macroeconomic model, FRB/US, used by the Federal Reserve Board staff (described in Brayton et al. 2014), and by the relevant empirical literature.

Using these marginal propensity to consume estimates, we offer a back-of-the-envelope comparison of the degree of stimulus provided by the three main programs mentioned above: the Payment Protection Program, stimulus payments, and pandemic-enhanced unemployment insurance. This calculation relies on the following assumptions:

1. Since unemployment insurance payments are generally made to households that are highly liquidity-constrained, the marginal propensity to consume out of unemployment insurance payments is one (Cashin et al. 2018).
2. Because stimulus payments are made to a broad mixture of households across the income distribution, we use the estimate from Cashin et al. (2018) for the MPC of general, temporary transfers to households of 0.5.
3. The part of the Paycheck Protection Program that flows through to wages is similar to unemployment insurance, and thus has a plausible marginal propensity to consume of one.
4. For the part of PPP that flows to non-workers, we use the estimates in Cashin et al. (2018) for the MPC of temporary corporate tax cuts of 0.2; this relatively low marginal propensity to consume is consistent with these funds flowing disproportionately to the upper quintile of the income distribution.

Weighting these last two components together, we obtain an overall marginal propensity to consume out of PPP loans of about 0.5, which is comparable to stimulus checks (where we have an imputed MPC of 0.5) and much lower than unemployment insurance payments (where we have imputed an MPC of one).[11]

[11] We noted in the previous section that a substantial share of Pandemic Unemployment Assistance recipients were likely high income self-employed business owners who might be expected to have a lower marginal propensity to consume than the one we assume here for unemployment insurance recipients.

This illustrative calculation thus suggests the PPP loans and stimulus checks were roughly equally effective at boosting spending, and both were much less effective on this margin than pandemic unemployment insurance.

These estimates have the virtue of transparency. They also have shortcomings. The pandemic environment surely generated non-normal household and business behavior. Extraordinarily high replacement rates delivered by enhanced unemployment benefits may have diminished the marginal propensity to consume of recipients. The substantial share of payroll income received by the top quintile from the Paycheck Protection Program also suggests that treating this income as similar to unemployment insurance probably overstates the MPC. Finally, these estimates quantify only the transfer's initial boost to aggregate demand; they do not capture aggregate supply effects, such as that arising from preventing firm bankruptcies, or subsequent general equilibrium effects. Fortunately, the Congressional Budget Office (2020b) has also estimated the boost to GDP per dollar for these same pandemic programs, carefully accounting for the pandemic environment and the specifics of each program. CBO also strives to capture the full, general equilibrium effect of each program, including its potential impact on business closure. CBO concludes that the enhanced unemployment and stimulus checks were far more effective at boosting GDP than was PPP. Specifically, the CBO estimates a per dollar boost to GDP of 0.36 for the PPP and 0.60 and 0.67 for stimulus checks and enhanced unemployment insurance benefits, respectively. Taking account of the highly distributionally-skewed incidence of PPP payments, we concur that PPP was likely the least effective of the three programs in boosting the macroeconomy.

Lessons Learned from the Paycheck Protection Program Experience

The US small business sector appeared at risk of collapse at the outset of the pandemic. To avert this collapse, Congress enacted the Paycheck Protection Program, which successfully distributed vast amounts of aid to the near-universe of eligible small businesses in the space of a few months. Our best evidence to date indicates that the PPP's economic impacts were less than hoped: it preserved only a moderate number of jobs at a high cost per job-year retained and transferred resources overwhelmingly to the highest quintile of households.

These outcomes should not, however, be viewed first and foremost as programmatic failures. The PPP's regressive distributional incidence and its limited efficacy as economic stimulus stem from the program's absence of targeting. This absence, in turn, reflected necessity. Given the time constraints and, more profoundly, the

Nonetheless, even if we assumed an MPC of *zero* for self-employed PUA recipients, the overall MPC out of unemployment insurance would be about 0.7 (since non-PUA benefits were about 70 percent of total unemployment insurance), which is still higher than our estimates of the MPC out of PPP and stimulus checks.

lack of existing administrative infrastructure for overseeing targeted federal support to the entire population of US small businesses at the onset of the pandemic, we strongly suspect that Congress could not have better targeted the Paycheck Protection Program without substantially slowing its delivery. We thus concur with Bartik et al. (2021) that policymakers made a defensible trade-off between speed and targeting in the PPP's design.

However, if the Paycheck Protection Program was a logical answer to a highly constrained question, a forward-looking lesson from the PPP experience is that the United States should invest now to relax those constraints. We have emphasized that the PPP had dual goals: preserving jobs and providing liquidity. These goals could be better served with the administrative capacity to address these issues directly and separately, thus enabling better targeting and a more progressive incidence. The primary job retention goal of the Paycheck Protection Program could in the future be better achieved through an expanded program to encourage "work-sharing," which refers to a policy in which employers, when faced with an economic downturn, are encouraged to reduce hours worked more broadly across the workforce rather than laying off a narrower group outright. In effect, the government program ends up paying partial unemployment to many, rather than full unemployment to some.

Currently, 26 US states have a work-sharing program through their unemployment insurance systems, but these were not well-subscribed where available during the COVID recession. A number of proposals over the last decade that advocate for expanded work-sharing suggest that to reach broader coverage, such programs should be simplified and automated (Abraham and Houseman 2014; Strain 2020; Dube 2021). A work-sharing program can target firms of all sizes that are cutting hours or employment, not just small firms. Additionally, with sufficient administrative capacity developed in normal times, the progressivity of the program could be altered as policymakers deem appropriate.

A separate liquidity provision program could then be targeted primarily at small firms, which are more likely to be liquidity-constrained. Moreover, with better information systems operational, liquidity could be provided in proportion to firms' decline in revenues as well as firms' actual fixed obligations.

Distinct from the United States, many other high-income countries responded to the pandemic with a mixture of job retention incentives, including 1) work-sharing programs that allowed either partial or complete furloughs; 2) newly introduced wage subsidy programs, similar in many ways to the Paycheck Protection Program, that provided businesses with direct support for at least some fraction of their wage bill (OECD 2021). Both work-sharing and wage subsidy programs were targeted. Wage subsidy programs were explicitly targeted to firms that had experienced declines in revenue: for example, Canada's Employer Wage Subsidy was available to firms that experienced a year-over-year revenue drop of 30 percent (reduced to 10 percent later). In some countries, firms were entitled to wage subsidies on a sliding scale in proportion to their declines in revenues. By contrast, work-sharing programs were not *explicitly* targeted to distressed firms. But the requirement that firms reduce workers' hours to obtain assistance generally makes firm participation

unattractive absent a negative shock (for additional discussion in this symposium, see the paper by Giupponi, Landais, and Lapeyre). Of course, the details of these programs, such as the length of benefits and the extent to which non-payroll expenses are covered, as well as their efficacy, varies across countries.

A key lesson from these cross-national comparisons is that targeted business support systems were feasible and rapidly scalable in other high-income countries because administrative systems for monitoring worker hours and topping up paychecks were already in place prior to the pandemic. Lacking such systems, the United States chose to administer emergency aid using a fire hose rather than a fire extinguisher, with the predictable consequence that virtually the entire small business sector was doused with money. This approach may have been necessary, but it was desirable only because the United States lacked viable alternatives. By building administrative capacity in the years ahead, the United States could more deftly target, calibrate, and deploy its emergency business response systems when most needed. This investment will pay off in the near term in improvements of existing programs, such as work sharing—and will pay off again when the next crisis arises.

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References

Abraham, Katherine G., and Susan N. Houseman. 2014. "Proposal 12: Work Sharing to Reduce Unemployment." *Policies to Address Poverty in America*, edited by Melissa S. Kearney and Benjamin H. Harris, 1–10. Washington, DC: The Brookings Institution.

Agarwal, Sumit, Brent W. Ambrose, Luis A. Lopez, and Xue Xiao. 2021. "Did the Paycheck Protection Program Help Small Businesses? Evidence from Commercial Mortgage-backed Securities." https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3674960.

Amiram, Dan, and Daniel Rabetti. 2020. "The Relevance of Relationship Lending in Times of Crisis."

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3701587.

Anbil, Sriya, Mark Carlson, and Mary-Frances Styczynski. 2021. "The Effect of the PPPLF on PPP Lending by Commercial Banks." FEDS Working Paper 2021-030.

Autor, David, David Cho, Leland Crane, Mita Goldar, Byron Lutz, Joshua Montes, William B. Peterman, David Ratner, Daniel Villar, and Ahu Yildirmaz. 2020. "An Evaluation of the Paycheck Protection Program Using Administrative Payroll Microdata." https://economics.mit.edu/files/20094.

Bartik, Alexander W., Marianne Bertrand, Feng Lin, Jesse Rothstein, and Matthew Unrath. 2020a. "Measuring the Labor Market at the Onset of the COVID-19 Crisis." *Brookings Papers on Economic Activity*.

Bartik, Alexander W., Marianne Bertrand, Zoe Cullen, Edward L. Glaeser, Michael Luca, and Christopher Stanton. 2020b. "The Impact of COVID-19 on Small Business Outcomes and Expectations." *Proceedings of the National Academy of Sciences* 117 (30): 17656–17666.

Bartik, Alexander W., Zoe B. Cullen, Edward L. Glaeser, Michael Luca, Christopher T. Stanton, and Adi Sunderam. 2021. "The Targeting and Impact of Paycheck Protection Program Loans to Small Businesses." NBER Working Paper 27623.

Bernstein, Jared, and Jesse Rothstein. 2020. "A Fast, Simple Way to Get Support to Workers without Paid Leave." *Washington Post*, March 10. https://www.washingtonpost.com/outlook/2020/03/10/fast-simple-way-get-support-workers-without-paid-leave/.

Bhutta, Neil, Jacqueline Blair, Lisa Dettling, and Kevin Moore. 2020. "COVID-19, The CARES act, and Families' Financial Security." *National Tax Journal* 73 (3): 645–72.

Boesch, Tyler, Katherine Lim, and Ryan Nunn. 2021. "What Did and Didn't Work in Unemployment Insurance during the Pandemic." *Federal Reserve Bank of Minneapolis*.

Brayton, Flint, Thomas Laubach, and David Reifschneider. 2014. "The FRB/US Model: A Tool for Macroeconomic Policy Analysis." https://www.federalreserve.gov/econresdata/notes/feds-notes/2014/a-tool-for-macroeconomic-policy-analysis.html.

Brevoort, Kenneth P., John A. Holmes, and John D. Wolken. 2010. "Distance Still Matters: The Information Revolution in Small Business Lending and the Persistent Role of Location, 1993–2003." FEDS Working Paper 2010-08.

Callaway, Brantly, and Pedro H.C. Sant'Anna. 2020. "Difference-in-Differences with Multiple Time Periods." *Journal of Econometrics* 225 (2): 200–30.

Cashin, David, Jamie Lenney, Byron Lutz, and William Peterman. 2018. "Fiscal Policy and Aggregate Demand in the USA before, during, and following the Great Recession." *International Tax and Public Finance* 25: 1519–58.

Congressional Budget Office. 2020a. *The Distribution of Household Income, 2017*. Congressional Budget Office.

Congressional Budget Office. 2020b. "The Effects of Pandemic-Related Legislation on Output." Congressional Budget Office.

Chetty, Raj, John N. Friedman, Nathaniel Hendren, Michael Stepner, and The Opportunity Insights Team. 2020. "How Did COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data." NBER Working Paper 2743.

Chodorow-Reich, Gabriel, Olivier Darmouni, Stephan Luck, and Matthew Plosser. 2021. "Bank Liquidity Provision across the Firm Size Distribution." *Journal of Financial Economics*.

Cororaton, Anna, and Samuel Rosen. 2021. "Public Firm Borrowers of the US Paycheck Protection Program." *Review of Corporate Finance Studies* 10 (4): 641–93.

Crane, Leland D., Ryan A. Decker, Aaron B. Flaaen, Adrian Hamins-Puertolas, and Christopher J. Kurz. 2020. "Business Exit During the COVID-19 Pandemic: Non-Traditional Measures in Historical Context." Finance and Economics Discussion Series 2020-089.

Center for Economic Policy Research. 2021. "CPS ORG Uniform Extracts, Version 2.5." Washington, DC.

CRFB. 2021. "Covid Money Tracker." https://www.covidmoneytracker.org/.

Dalton, Michael. 2021. "Putting the Paycheck Protection Program into Perspective: An Analysis Using Administrative and Survey Data." Bureau of Labor Statistics Working Paper 542.

Decker, Ryan A., Robert J. Kurtzman, Byron F. Lutz, and Christopher J. Nekarda. 2021. "Across the Universe: Policy Support for Employment and Revenue in the Pandemic Recession." *AEA Papers and Proceedings* 111 (May): 267–71.

Doniger, Cynthia L., and Benjamin Kay. 2021. "Ten Days Late and Billions of Dollars Short: The Employment Effects of Delays in Paycheck Protection Program Financing." https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3747223.

Dube, Arindrajit. 2021. "A Plan to Reform the Unemployment Insurance System in the United States." Hamilton Project Policy Proposal 2021-03.

Elmendorf, Douglas W., and Jason Furman. 2008. "If, When, How: A Primer on Fiscal Stimulus." Hamilton Project Strategy Paper January 2008.

Erel, Isil, and Jack Liebersohn. 2020. "Does FinTech Substitute for Banks? Evidence from the Paycheck Protection Program." NBER Working Paper 27659.

Farooq, Ammar, Adriana D. Kugler, and Umberto Muratori. 2020. "Do Unemployment Insurance Benefits Improve Match Quality? Evidence from Recent U.S. Recessions." NBER Working Paper 27574.

Faulkender, Michael, Robert Jackman, and Stephen I. Miran. 2020. "The Job-Preservation Effects of Paycheck Protection Program Loans." US Treasury, Office of Economic Policy Working Paper 2020-01.

lood, Sarah, Miriam King, Renae Rodgers, Steven J. Ruggles, Robert Warren, and Michael Westberry. 2021. "Integrated Public Use Microdata Series, Current Population Survey: Version 9.0, Annual Social and Economic Supplement 2020." Minneapolis, MN: IPUMS.

Fujita, Shigeru, and Giuseppe Moscarini. 2017. "Recall and Unemployment." *American Economic Review* 107 (12): 3875–3916.

Goodman-Bacon, Andrew. 2021."Difference-in-Differences with Variation in Treatment Timing." *Journal of Econometrics* 225 (2): 254–77.

Granja, Jōao, Christos Makridis, Constantine Yannelis, and Eric Zwick. 2020. "Did the Paycheck Protection Program Hit the Target?" NBER Working Paper 27095.

Harney, John, and Gregory Mott. 2021. "IRS Blesses Tax Breaks on Forgiven PPP Loans after Law Change." *Bloomberg Tax*, January 6. https://news.bloombergtax.com/daily-tax-report/irs-blesses-tax-breaks-on-forgiven-ppp-loans-after-law-change.

Hubbard, Glenn, and Michael R. Strain. 2020. "Has the Paycheck Protection Program Succeeded?" *Brookings Papers on Economic Activity*.

Joaquim, Gustavo, and Felipe Netto. 2021. "Bank Incentives and the Impact of the Paycheck Protection Program." Unpublished.

Kurmann, Andre, Etienne Lale, and Lien Ta. 2021. "The Impact of COVID-19 on Small Business Dynamics and Employment: Real-Time Estimates with Homebase Data." Unpublished.

Li, Lei, and Philip Strahan. 2020. "Who Supplies PPP Loans (And Does it Matter)? Banks, Relationships and the COVID Crisis." NBER Working Paper 28286.

OECD. 2021. *OECD Employment Outlook 2021*. https://www.oecd.org/employment-outlook/#Read-the-report.

Small Business Administration (SBA). 2019. "2019 Small Business Profile." Technical Report, Office of Advocacy 2019. https://cdn.advocacy.sba.gov/wp-content/uploads/2019/04/23142719/2019-Small-Business-Profiles-US.pdf.

Small Business Administration (SBA). 2021. "Forgiveness Platform Lender Submission Metrics, November 28, 2021. https://www.sba.gov/document/report-ppp-forgiveness-platform-lender-submission-metrics-reports?utm_medium=email&utm_source=govdelivery (accessed November 30, 2021).

Strain, Michael. 2020. "Let's Provide Unemployment Benefits Without the Layoffs." *Bloomberg Opinion*, May 7.

Sun, Liyang, and Sarah Abraham. 2020. "Estimating Dynamic Treatment Effects in Event Studies with Heterogeneous Treatment Effects." *Journal of Econometrics* 225 (22): 175–99.