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Employment changes by employer size during the COVID-19 pandemic: a look at the Current Employment Statistics survey microdata

We use the Current Employment Statistics survey microdata for the private sector to calculate employment changes since February 2020 by employer size. We find that, for employers with 1 to 9 employees, the largest component of employment change since February is closings (either temporary or permanent) in all months. For employers with 10 or more employees, the largest component of employment change since February is within employers that have continued to report nonzero employment to the survey, rather than within those reporting zero employment or from imputed closures from nonrespondents to the survey. In percentage terms, the greatest overall employment losses shifted to larger and larger employers each month from March through July. However, the largest employers recovered employment faster than smaller employers from July to September. By September, the largest cumulative employment losses were for employers with 50 to 499 employees, with employment losses of 6.5 percent since February. Meanwhile, by September, employers with 1 to 9 employees had employment losses of 3.3 percent since February.

Note: An updated analysis of this topic is available as a working paper at https://www.bls.gov/osmr/research-papers/2020/ec200140.htm.

Michael Dalton
dalton.michael@bls.gov

Michael Dalton is a research economist in the Office of Employment and Unemployment Statistics, U.S. Bureau of Labor Statistics.

Elizabeth Weber Handwerker
handwerker.elizabeth@bls.gov

Elizabeth Weber Handwerker is a research economist in the Office of Employment and Unemployment Statistics, U.S. Bureau of Labor Statistics.

Mark A. Loewenstein
loewenstein.mark@bls.gov

Mark A. Loewenstein is a senior research economist in the Office of Employment and Unemployment Statistics, U.S. Bureau of Labor Statistics.

The U.S. Bureau of Labor Statistics (BLS) Current Employment Statistics (CES) survey is one of the longest running and most relied-upon sources of current data on the U.S. labor market. The CES survey collects data each month on employment, hours, and earnings, and BLS publishes preliminary estimates at the national level by industry, usually on the first Friday of the following month, with revisions published in the 2 succeeding months. The survey began in 1915 for the manufacturing sector,[1] and many CES data series are available in consistent format from BLS back to 1939.[2] These data are among the Principal Federal Economic Indicators, and they often make headline news when they are released each month.

The CES survey is collected from a large sample of establishments covered by Unemployment Insurance (UI) programs in the United States. Reports from the UI programs are compiled in the BLS Quarterly Census of Employment and Wages (QCEW), which is the sampling frame for the CES and other BLS establishment surveys. The QCEW program also publishes estimates of employment and wages, and the QCEW data are linked to the Business Employment Dynamics (BED) program, which publishes estimates of gross job gains and losses, including by employer size. QCEW data, collected from the full universe of employers covered by UI programs in the United States, are available in much greater detail than the CES data. The QCEW data are available 5 months after the end of the reference quarter, while employer-size estimates from the BED are released about 7 months after that reference date. In ordinary times, employment change by employer size can easily be studied with BED data, and the time lag for these data to become available is only a minor inconvenience that is outweighed by the expanded detail not available with CES estimates. However, these are no ordinary times.

As BLS reported in the April *Employment Situation* news release, job losses associated with the effects of the coronavirus disease 2019 (COVID-19) pandemic on the U.S. economy in the spring of 2020 were the largest in the history of these data.[3] Such enormous and rapid changes in labor markets have led economists to seek available data with as little time lag as possible. The economists of the Harvard University Opportunity Insights team are tracking the employment of low-wage workers by using data from the scheduling and timecard processing company Homebase and financial management application Earnin, and they are tracking the number of small businesses that have closed by using data from small business credit card processor Womply.[4] Another group of economists is tracking labor market outcomes with data from Homebase and Kronos, another workforce management company.[5] In this environment, we believe special tabulations based on the CES microdata are particularly valuable.

There is currently tremendous public interest in how the economic disruptions of the pandemic are affecting businesses differently, depending on their size, especially because prepandemic trends in Economic Census data show increasing market domination by large businesses. In prepandemic work, David Autor, David Dorn, et al. [6] showed increasing product market dominance by the largest and most productive firms in industries within the manufacturing, retail trade, wholesale trade, services, utilities and transportation, and finance sectors from 1982 to 2012; they also found a rising share of U.S. employment in firms employing more than 5,000 employees from 1987 to 2016. Chang-Tai Hsieh and Esteban Rossi-Hansberg[7] showed that these effects are strongest within services, wholesale trade, and retail trade, as national chains in these sectors expanded into more and more local markets. Kevin Rinz[8] showed that the five firms in each industry with the largest number of employees expanded into more and more markets over the 1976–2015 period.

Since the pandemic began, there have been few studies of employment dynamics by employer size. Those we have seen are based on surveys with much smaller sample sizes than those generally used in producing official government statistics. For example, José María Barrero et al.[9] show that many of the 394 businesses that responded to the Survey of Business Uncertainty in April planned to implement staffing increases, and the authors list examples of large companies that have expanded their employment during the pandemic, even as many smaller businesses have shrunk or closed.

Most studies of employers and employment patterns during the pandemic use data only for smaller businesses. Alexander W. Bartik, Marianne Bertrand, Zoe Cullen, et al.,[10] for example, examined a survey of 5,800 small businesses and found that the likelihood of closure was highest for the smallest firms at the beginning of April. Robert W. Fairlie[11] used Current Population Survey data to examine the effects of the pandemic on small business owners and found that the number of working business owners declined by 3.3 million, or 22 percent, between February and April 2020, and that less than half of them had returned to work by May. In another study, Alexander W. Bartik, Marianne Bertrand, Feng Lin, et al.[12] used daily work records data from Homebase and showed how the number of hours worked plummeted in mid-March, before starting a slow recovery in late April, with much of this pattern resulting from firms shutting down. Robert P. Bartlett III and Adair Morse[13] combined several data sources to examine outcomes for businesses with 50 workers or less located in Oakland, California, and found that businesses with 1 to 5 employees fared better than those with 6 to 49 employees or sole proprietorships. However, these studies cannot compare patterns of employment change for small and large employers.

To our knowledge, the only data (other than those from the CES survey) that are well suited for comparisons of employment change in recent months by employer size are those from the private firm Automatic Data Processing, Inc. (ADP). ADP, a human resources management software and services company that serves as the payroll processor for about 20 percent of employees in the United States, compiles these data from their own records. A group of economists (most of whom are affiliated with the Federal Reserve) has worked for several years to produce a weekly ADP employment series benchmarked to the QCEW, although this weekly employment series is not publicly available except in research papers.[14] This past spring, Tomaz Cajner et al.[15] used these data to show that more small businesses than large businesses paid no employees in April, but the gap in overall employment patterns by employer size narrowed by the end of May, as these small businesses reopened. By the end of May, the average employment decline in small businesses was smaller than that for large businesses.

One focus of economic research during spring 2020 has been to use changes in employment and business survival by business size to study the impact of the Paycheck Protection Program (PPP), the unprecedented federal program enacted in March 2020. This program allocated $669 billion in forgivable loans, largely to businesses with 500 or fewer employees. Raj Chetty et al.[16] and the Opportunity Insights Team used data from Earnin, a financial management application, matched with employer names and locations in the ReferenceUSA data, to measure weekly changes in employment rates by business size and industry from February to June. They found little difference in employment changes by employer size, although their size groups do not correspond neatly to the 500-employee size cutoff of the PPP. David Autor, David Cho, et al.[17] used the ADP data to do more precise comparisons of employment, hours, and total wages paid weekly by firm size from February to June. They found small differences in the changes in employment, total hours, and total wages paid for firms just above and below the 500-employee threshold, and these differences appear during the weeks that the PPP funds were distributed. However, none of these studies address differences in employment patterns by employment size more generally.

In contrast to the datasets described above, the CES survey offers a large, representative sample of employers. In this article, we present recent changes in CES employment for the private sector by employer size.[18] The remainder of the article is organized as follows: the next section discusses several methodological issues in producing these estimates, the section that follows presents these estimates, and the final section provides some concluding remarks.

Methodology

Employment estimates from the CES survey are published monthly and have three components.[19] The first and largest component is the average rate of employment change experienced by responding establishments that report positive employment in the previous and the current month. The second component is an imputation for the employment change of nonrespondents based on the rate of employment change for respondents reporting positive employment. The third component is a prediction from the net birth–death model. These methods address the following two facts: (1) establishments are less likely to report data the month they go out of business, and (2) there is about a 7-month lag between the time a new establishment opens for business and the time it appears in the sample frame. Typically, establishment births and deaths nearly cancel each other out. Instead of attempting to estimate births and deaths separately, the net birth–death model predicts net change in employment from establishment births and deaths on the basis of historical seasonal patterns. The two components are added together to produce a monthly estimate of overall employment change.

The sudden and enormous impact of the COVID-19 pandemic beginning this past spring required revisiting some of the assumptions underlying the birth–death model used in producing the official CES estimates. As noted previously, before the pandemic, establishment reports of zero employment were not explicitly included in the estimates; instead, they were handled implicitly through the net birth–death model. Beginning in April, if the number of reports of zero employment was greater than what normally would be expected, they were explicitly included in the employment-change estimates. Excess returns of employment from zero—which became more prominent beginning in May—were also explicitly included in these employment-change estimates. In addition,

growth rates for the portion of the sample reporting positive employment were included in the net birth–death model to capture the cyclical component of business openings and closing.[20]

This article takes a somewhat different approach to addressing the estimation issues raised by the pandemic. We focus on establishments that responded to the February survey and disregard births since then, on the assumption that openings have been negligible during this period of uncertainty and record-high unemployment.[21] Similar to the published CES estimates, the major component in our estimates of employment change is the average sample growth rate of February establishments that continued to report positive employment in subsequent months. Unlike with the published CES estimates, our approach explicitly includes all reports of zero employment in our estimates of employment change. In addition, we explicitly impute the employment of nonrespondents, by using employment change for respondents in the same month and the proportion of CES nonrespondents who permanently closed in previous years of QCEW data.[22] Because we disregard openings and estimate the fraction of nonrespondents that have zero employment, we do not use the net birth–death model at all. This method prevents us from including the public sector in these estimates, because reporting units in the public sector can differ substantially between the CES survey and the QCEW. One additional difference between our estimates and the official CES estimates is that we include all establishments that responded in February and are still in the CES sample in later months, while the official CES estimates are based only on establishments responding in consecutive months.

We categorize employer size by total employment across all establishments that use the same Internal Revenue Service employer identification number (EIN) when they file reports with state UI programs, assigning size groups from annual average employment for fourth quarter 2019 in QCEW data, with no reclassification of size groups as employer sizes change over time.[23] Readers should be cautioned that the EINs reported to the UI system are nonrandom pieces of information about firms; there are many instances in our data in which a large firm acquires an establishment, but the payroll department of that establishment does not switch to the new firm's EIN in reporting employment to its state UI program.

As noted previously, our methods explicitly distinguish between nonrespondents and respondents with zero employment. Because a substantial number of establishments that do not respond in time for the first or second preliminary estimates do respond in time to be included in final estimates, we use CES estimates based on final data wherever possible. Thus, as of October 2020, the most recent final data were those for July 2020, with second-preliminary data available for August 2020 and first-preliminary data available for September 2020.

Continuing employers

Let $emp_{i,M,S,J}$ denote the employment of establishment *i* in month *M*, size class *S*, and industry *J,* and let $emp_{i,Feb,S,J}$ denote the employment of the same establishment in February 2020. The change in employment between month *M* and February for all establishments that respond in month *M*, report positive employment in month *M*, are in size class *S*, and are in industry *J* is given by

(1)

$$\Delta \mathrm{EMP}_{R,M,C,S,J} = \sum_{i \in R,C} (\mathrm{emp}_{i,M,S,J} - \mathrm{emp}_{i,\mathrm{Feb},S,J}),$$

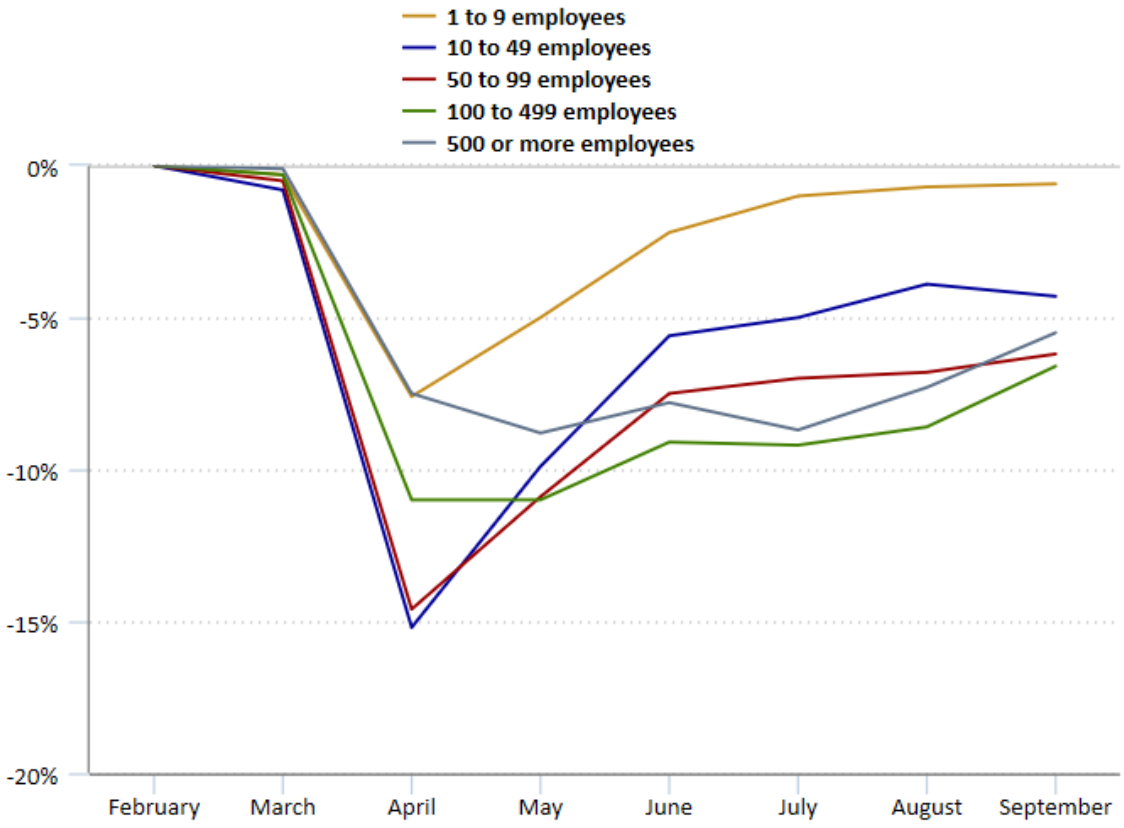
where *R* is the set of responding establishments and *C* is the set of continuing establishments with positive employment in month *M*. Then the percent change in employment for these continuing establishments is given by

(2)

$$\%\,\Delta \mathrm{EMP}_{R,M,C,S,J} = \frac{\sum_{i \in R,C}(\mathrm{emp}_{i,M,S,J} - \mathrm{emp}_{i,\mathrm{Feb},S,J})}{\sum_{i \in R,C} \mathrm{emp}_{i,\mathrm{Feb},S,J}}.$$

Figure 1 shows the percent change in employment in each month from March to September 2020, for each employer size category, relative to February 2020 employment for these establishments. We calculated these estimates by using equation (1) and weighted employment in February for each establishment in size class *S* across all industries.[24] Establishments in all size groups had employment below February levels from March to September. In percentage terms, the greatest employment losses were shifting to larger and larger employers for each subsequent month through July, but then the very largest employers had the fastest employment recovery between July and August, and in preliminary figures for September, it appears that employers with 100 or more employees had the fastest employment recovery from August to September. The employment trough was in April for all size groups except 500 or more employees, which had lower employment in May, June, and July than in April.

Figure 1. Percent change in employment in each month from March to September 2020, relative to February 2020 employment, by employer size



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics, Current Employment Statistics survey.

Employers reporting zero employment

The change in employment between month *M* and February for establishments that report zero employment in month *M*, in size class *S*, and industry *J* is given by

(3)

$$\Delta \mathrm{EMP}_{R,C',S,J} = -\sum_{i \in R,C'} \mathrm{emp}_{i,\mathrm{Feb},S,J},$$

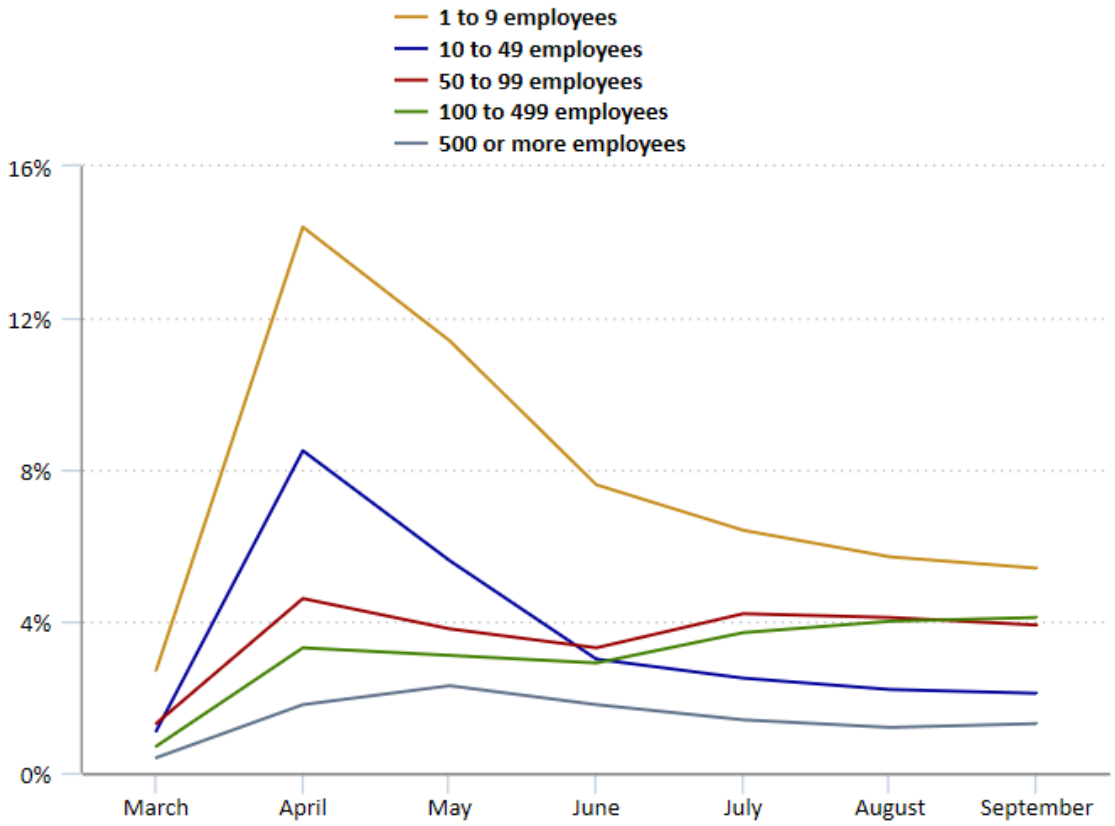
where *C′* is the set of establishments reporting positive employment in February and zero employment in month *M*. The reduction in employment at closing establishments in month *M* relative to the average employment of respondents in February is given by

(4)

$$\%\Delta \mathrm{EMP}_{R,M,C',S,J} = \frac{-\sum_{i \in R,C'} \mathrm{emp}_{i,\mathrm{Feb},S,J}}{\sum_{i \in R} \mathrm{emp}_{i,\mathrm{Feb},S,J}}.$$

Figure 2 shows the percentage of establishments that reported zero employment in each month from March to September 2020, relative to the number of establishments that existed in February 2020, by employer size. In every month, the employer size category with the largest fraction of employers having no employment is the smallest size category: employers with 1 to 9 employees.

Figure 2. Percentage of establishments reporting zero employment in each month from March 2020 to September 2020, by employer size

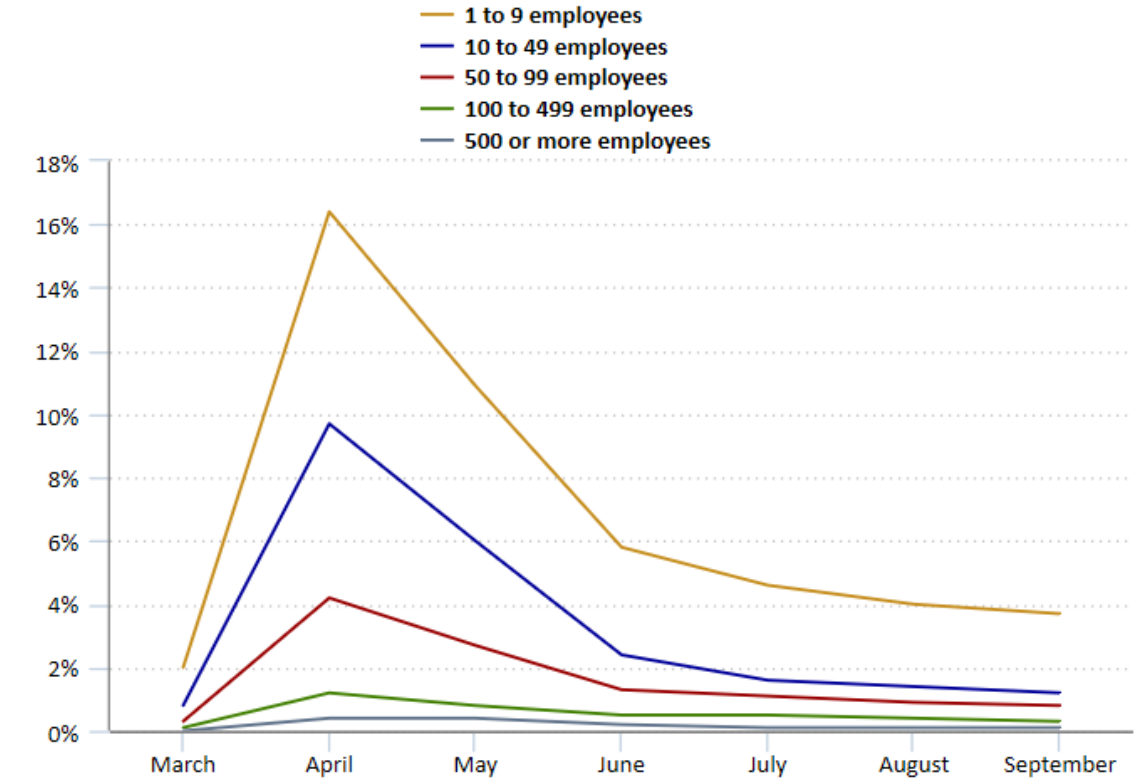


Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics, Current Employment Statistics survey.

Patterns of establishment closure over time have been different for employers of different sizes. Among employers with 49 or fewer employees, the percentage of establishments that were closed was greatest in April and has been declining since then. Among employers with 500 or more employees, the percentage of establishments that were closed was highest in May. The percentage of establishments with zero employment increased from June through September among employers with 50 to 499 employees.

Figure 3 shows the percentage of employment lost since February 2020 in the establishments reporting zero employment in each month from March to September 2020. The patterns are very similar to those shown in figure 2. However, except for the smallest two size categories in April, the percentage of employers reporting zero employment is always greater than the percentage of employment lost as a result of employers reporting zero employment. This suggests that, within each category, smaller employers are more likely to have zero employment.

Figure 3. Percentage of employment lost since February 2020 in establishments reporting zero employment in each month from March 2020 to September 2020, by employer size



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics, Current Employment Statistics survey.

Employers that did not respond to the CES survey

Finally, we estimate the change in employment for establishments that responded to the CES survey in February but did not respond in month *M*. Similar to the birth–death model used in standard CES estimates, our approach assumes nonrespondents with positive employment in month *M* experienced the same changes in employment as similarly sized responding establishments in the same industry.[25] Additionally, using prior years' data from the QCEW to estimate the probability that a nonresponding establishment in the CES survey is closed, we include this probability of an establishment being closed in the imputed employment for each nonresponding establishment in month *M*.

To estimate the proportion of nonrespondents with zero employment, we use QCEW data from 2007 to 2018 to model the probabilities that responding and nonresponding establishments subsequently shut down permanently. For each month *M*, employer size class *S*, and industry *J*, we calculate the proportion of CES nonrespondents that last had positive employment in the QCEW in the same calendar year, $\alpha^{R'}_{M,S,J}$. Similarly, we denote the proportion of CES month *M* respondents in size class *S* and industry *J* that last had positive employment in the QCEW in the same calendar year as $\alpha^{R}_{M,S,J}$. Let $c_{M,S,J} = \frac{\alpha^{R'}_{M,S,J}}{\alpha^{R}_{M,S,J}}$ denote the ratio of these two proportions, and let $b_{M,S,J}$ denote the fraction of responding establishments in size class *S* and industry *J* that reported zero employment to the CES

survey in month *M* in 2020, as shown in figure 2. We assume the fraction of nonrespondents with zero employment is equal to the product of $b_{M,S,J}$ and $c_{M,S,J}$.[26] For example, if nonrespondents and respondents in size class *S* and industry *J* closed with the same frequency in the 2007–18 period, we assume the fraction of nonrespondents in month *M* that had zero employment is exactly the same as the proportion of respondents that reported zero employment. If the nonrespondents in size class *S* and industry *J* in the 2007–18 period closed with a 20-percent higher probability than similar respondents, then our specification implies that the fraction of nonrespondents in month *M* that had zero employment is 20 percent higher than the proportion of respondents that reported zero employment in month *M*.

Given these assumptions, our estimate of the percentage change in employment from February 2020 to month *M* for nonresponding establishments in size class *S* and industry *J* is given by

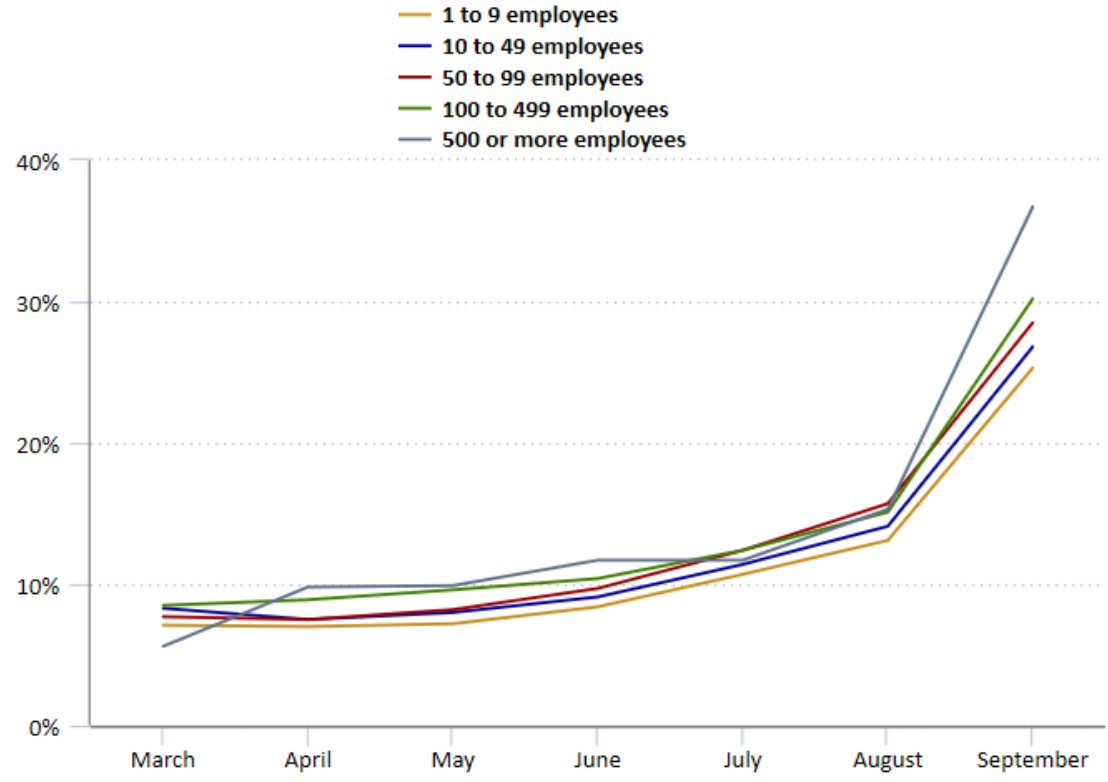
(5)

$$\%\Delta \mathrm{EMP}_{R',M,S,J} = \%\Delta \mathrm{EMP}_{R,M,S,J} - \left(b_{M,S,J} * c_{M,S,J}\right) - \%\Delta \mathrm{EMP}_{R,M,S,J} * b_{M,S,J} * c_{M,S,J}$$

We estimate the percent change in the employment of nonrespondents as the percent change in the employment of respondents with positive employment minus the estimated probability that a respondent reports zero employment.

Figure 4 shows the percentage of sampled establishments that did not respond to the CES survey over the March–September 2020 period, conditional on responding in February 2020, by employer size categories. For March to July, these are the percentages as of the point when BLS compiled figures for the final estimate (10 to 11 weeks after the survey reference week), but for August the second preliminary estimates are based on data collected only 6 to 7 weeks after the survey reference week, and for September the preliminary estimates are based on data collected only 2 weeks after the reference week. These percentages show some increases over time, even before the preliminary data for August and September. A possible explanation is that as time goes on, establishments that are permanently shutting down are dropping out of the survey.

Figure 4. Percentage of sampled establishments that did not respond to the CES survey over the March 2020–September 2020 period, conditional on having responded in February 2020, by employer size



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics, Current Employment Statistics (CES) survey.

Overall employment results

We now examine the contributions of these three separate components to the overall change in employment since February 2020. Note that the estimated change in employment of nonrespondents in size class *S* and industry *J* in month *M* is given by

(6)

$$\widehat{\Delta \mathrm{EMP}}_{R',M,S,J} = \left(\frac{N_{M,R',S,J}}{N_{M,S,J}}\right) * N_{M,S,J} * \overline{\mathrm{emp}}_{\mathrm{Feb},R',S,J} * \left(\%\Delta \mathrm{EMP}_{R,M,C,S,J} - b_{M,S,J} * c_{M,S,J}\right),$$

where $N_{M,R',S,J}$ is the number of nonrespondents in month *M*, size class *S,* and industry *J;* $N_{M,S,J}$ is the number of sampled respondents in month *M*, size class *S* and industry *J*; $\frac{N_{M,R',S,J}}{N_{M,S,J}}$ is the nonresponse rate for month *M*, size class *S*, and industry *J*; and $\overline{\mathrm{emp}}_{\mathrm{Feb},R',S,J}$ is the average establishment employment in February for the set of nonrespondents *R′* in month *M*, size class *S,* and industry *J*. Total February employment is the product of the

number of eligible respondents in month, *M*, size class *S*, and industry *J*, and the average February employment, denoted by

(7)

$$N_{M,S,J} * \overline{\text{emp}}_{\text{Feb},S,J}.$$

Dividing (1) by (7) yields the percent change in overall employment of establishments in size class *S* and industry *J* that is due to the change in employment at continuing establishments. Dividing (3) by (7) yields the percent change in overall employment resulting from the change in employment at closing establishments. Dividing (6) by (7) yields the percent change in overall employment of establishments in size class *S* and industry *J* that is due to the decline in employment for nonrespondents. For August and September, in order to correct for a higher nonresponse rate resulting from using preliminary data, we assign the nonresponse rate for July to August and September's numbers. So,

$$\frac{N_{\text{August},R',S,J}}{N_{\text{August},S,J}} * \frac{\overline{\text{emp}}_{\text{Feb},R',S,J} * (\%\Delta\text{EMP}_{R,\text{August},C,S,J} - b_{\text{August},S,J} * c_{\text{August},S,J})}{\overline{\text{emp}}_{\text{Feb},S,J}}$$

becomes

$$\frac{N_{\text{July},R',S,J}}{N_{\text{July},S,J}} * \frac{\overline{\text{emp}}_{\text{Feb},R',S,J} * (\%\Delta\text{EMP}_{R,\text{August},C,S,J} - b_{\text{August},S,J} * c_{\text{August},S,J})}{\overline{\text{emp}}_{\text{Feb},S,J}},$$

and

$$\frac{N_{\text{September},R',S,J}}{N_{\text{September},S,J}} * \frac{\overline{\text{emp}}_{\text{Feb},R',S,J} * (\%\Delta\text{EMP}_{R,\text{September},C,S,J} - b_{\text{September},S,J} * c_{\text{September},S,J})}{\overline{\text{emp}}_{\text{Feb},S,J}}$$

becomes

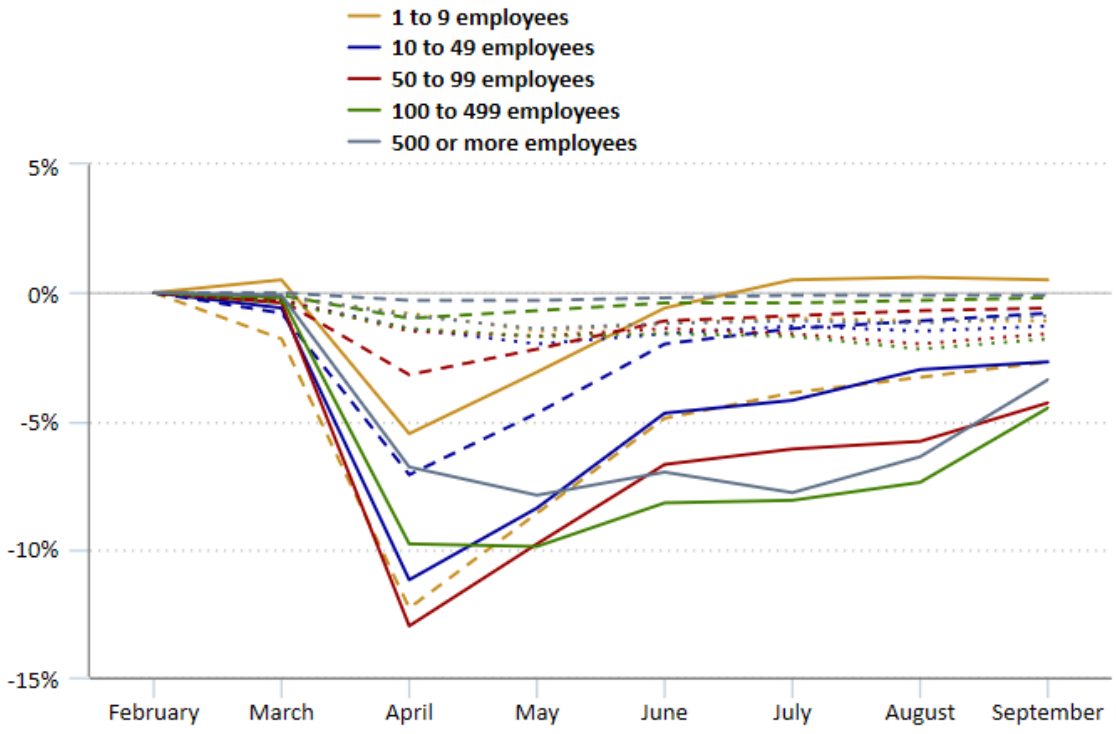
$$\frac{N_{\text{July},R',S,J}}{N_{\text{July},S,J}} * \frac{\overline{\text{emp}}_{\text{Feb},R',S,J} * (\%\Delta\text{EMP}_{R,\text{September},C,S,J} - b_{\text{September},S,J} * c_{\text{September},S,J})}{\overline{\text{emp}}_{\text{Feb},S,J}},$$

where $\frac{N_{\text{July},R',S,J}}{N_{\text{July},S,J}}$ is the nonresponse rate for July for size class *S* and industry *J*.

Each of the three components of change is for a specific industry group. To obtain percent changes for the economy as a whole, we sum the components across all industries.[27] The results are depicted in figure 5. The dotted line for nonresponding establishments in this figure represents their excess employment reduction beyond that accounted for by the employment losses at responding establishments because of their imputed excess closures (as represented by the fact that $c_{M,S,J} > 1$). The employment losses in nonresponding establishments that are imputed not to have closed match the solid line shown for continuing establishments. We see in figure 5 that the massive employment changes of the last few months were driven by employment losses in continuing establishments in every employer size category except for the very smallest. For employers with 1 to 9 employees, job losses (and gains) were driven by employer closures and reopenings.

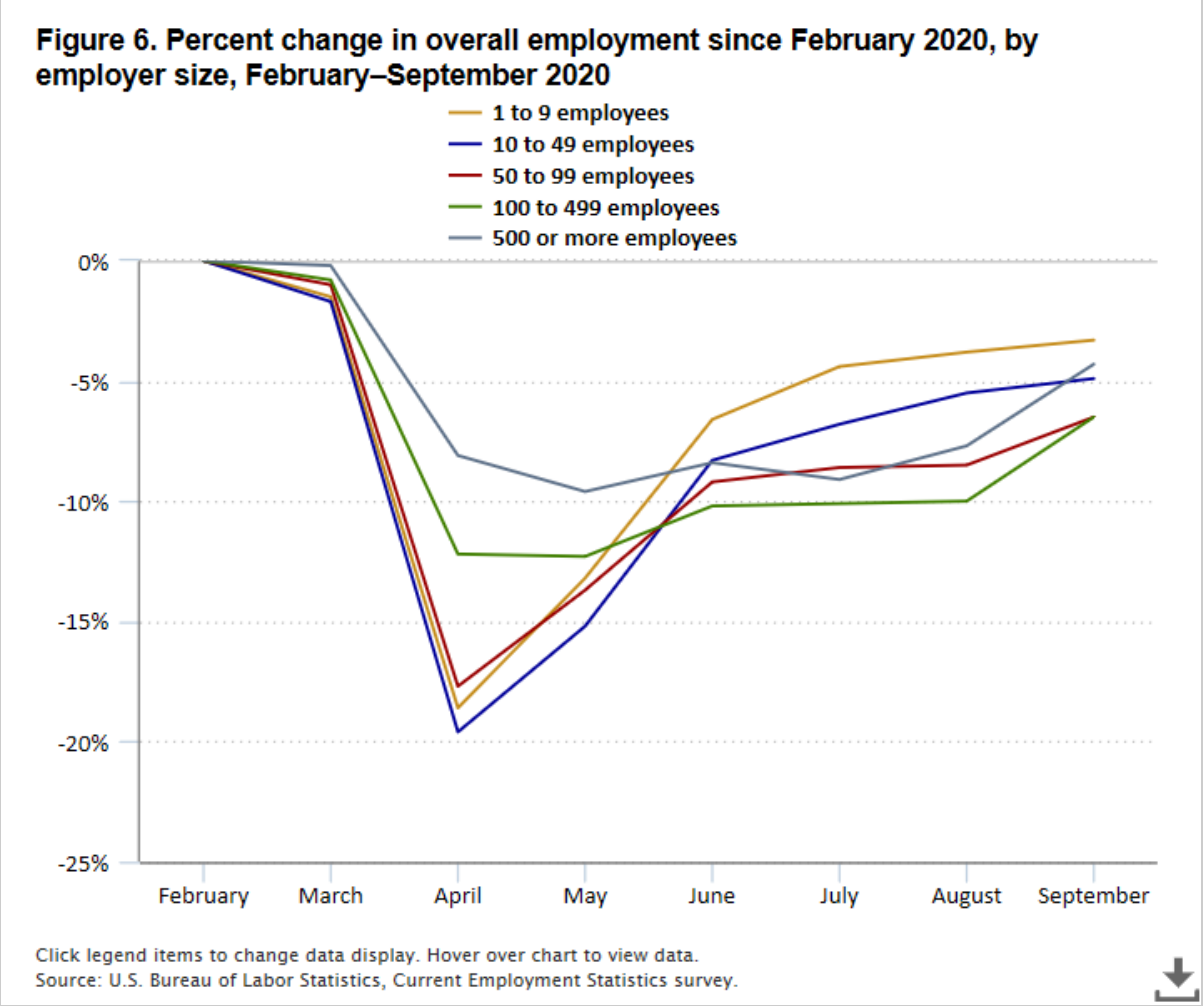
Figure 5. Percent change in employment for continuing, closed, and nonresponding establishments, by employer size, February–September 2020

Continuing = solid lines; closed = dashed lines; nonresponding = dotted lines.



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics, Current Employment Statistics survey.

Overall employment changes are the sum of the changes in the three components. Figure 6 shows overall employment changes since February by employer size. The largest declines in employment were in April for employers with fewer than 100 employees. Overall employment recovery in the first few months since then was much faster in smaller employers. Between April and June, employment levels largely recovered for employers with fewer than 100 employees, they recovered less for larger employers, and employment losses converged across employer sizes. Between June and August, employment levels continued to recover for employers with fewer than 50 employees, but there was less recovery for larger employers. However, from August to September, employment levels recovered fastest among employers with more than 100 employees. Since July, employers with at least 500 employees have had the biggest improvement. As of September, employers with fewer than 10 employees in February had the smallest losses in employment, followed by employers with more than 500 employees in February, and employers with 50-499 employees in February had the largest losses in employment.



Conclusion

In this article, we have discussed the rationale of producing estimates of recent employment changes by employer size using a large representative survey sample, we have explained our method of producing these estimates, and we have shown the results. Our methods for producing these special estimates rely on disregarding the net-birth–death modeling of the official CES publications and instead examining only the set of private-sector establishments that responded to the CES survey in February 2020. These procedures will only be appropriate as long as employer births remain negligible and this group of establishments does not rotate out of the CES sample.

We find that the massive employment changes of the past few months were driven by employment losses in continuing establishments in every employer size category except for the very smallest employers. For employers with 1 to 9 employees, job losses (and gains) were driven by employer closures and reopenings. The largest employment impacts of the pandemic were for employers of 1 to 99 employees in April 2020, but as the pandemic-induced economic crisis continued into the summer, its employment impacts shifted to larger employers. By June and July, the largest impacts were for employers of 100 to 499 employees. Employment recovery of employers with 500 or more employees appeared to be slower than for that of smaller employers through July; but employers

with 500 or more employees had the fastest employment growth from July to August, and preliminary employment figures for September suggest that this was also true from August to September.

These overall patterns of employment losses since February—whereby losses varied much less by employer size in September than in April and, by July, were greater for employers with 50 or more employees than for employers with 1 to 49 employees—may surprise some readers. However, the patterns are similar to those shown for February through May in figure 3 of Cajner et al., which are based on ADP data.[28] These researchers also report that, for smaller employers, employment fell more in late March and April and recovered faster in May, leading to convergence in cumulative employment patterns for employers of different sizes by the end of May.

We have no overall explanation for the patterns we find, but we note that employment changes from July to September may coincide with the end of Paycheck Protection Program (PPP) support for many employers. This program, which began approving loans on April 3 and provided forgivable loans to cover 2.5 months of payroll costs, was intended primarily for businesses with fewer than 500 employees.[29] The forgiveness of loans dispersed before June 5 was tied to employee retention for an 8-week period beginning on the disbursement date.[30] Published data from the program show that 85 percent of the 4.3 million disbursed loans were approved by May 15, and two and a half months after May 15 is the end of July. To the extent that PPP funds helped smaller businesses retain or rehire their employees—or that the requirements for PPP loan forgiveness gave smaller businesses an incentive not to lay off employees until 8 weeks after receiving these funds—the timing of the PPP program may explain why improvements in employment were slowing for smaller employers relative to the largest employers from mid-July to mid-September. Recent research by Steven J. Davis and John C. Haltiwanger show that improvements in the liquidity available to young and, to a lesser extent, small firms directly affect employment decisions.[31] Since the PPP offered a large single injection of liquidity for smaller firms, it is likely that it had at least a temporary effect on employment, which would be attenuated once the liquidity injection runs out and that may explain the slowdown in improvement for smaller firms relative to larger firms as of September 2020. This remains an open empirical question for future research.

SUGGESTED CITATION

Michael Dalton, Elizabeth Weber Handwerker, and Mark A. Loewenstein, "Employment changes by employer size during the COVID-19 pandemic: a look at the Current Employment Statistics survey microdata," *Monthly Labor Review,* U.S. Bureau of Labor Statistics, October 2020, https://doi.org/10.21916/mlr.2020.23

NOTES

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18 This is not the first effort to use the CES data to estimate changes in employment by employer size. In 2012, the U.S. Bureau of Labor Statistics (BLS) released experimental estimates from the CES survey by firm size for April 1990 through March 2011. (For details of this estimation program, see Nicholas Fett and Brenda Loya. "Current Employment Statistics by size class using base-size definitions," Statistical Survey Paper, October 2015, https://www.bls.gov/osmr/research-papers/2015/st150130.htm.) However, user comments and internal analysis showed that these estimates required further work in benchmarking employment totals to the Quarterly Census of Employment and Wages (QCEW) and accounting for new employer births. As efforts to release QCEW data more and more quickly succeeded, there was less reason for BLS to devote additional resources to the improvement of CES estimates by employer size, and the experimental estimates were removed from the BLS webpages in early 2020. (For more information, see "Current Employment Statistics—CES (national): experimental size class employment, hours, and earnings series from the Current Employment Statistics survey," https://www.bls.gov/ces/notices/2017/size-class-discontinuation.htm.) However, the

scale of employment changes in recent months has given us new reason to produce more timely estimates of changes in employment by employer size. Furthermore, benchmarking is not an issue for our short-run analysis and there have likely been few new employer births during the pandemic.

19 For a more detailed and complete description of the CES estimation methodology in general and the net birth-death model in particular, see Kirk Mueller, "Impact of business births and deaths in the payroll survey," *Monthly Labor Review*, May 2006, https://www.bls.gov/opub/mlr/2006/05/art4full.pdf.

20 A more detailed description of the adjustments in the CES estimation methodology resulting from the COVID-19 pandemic can be found in "Current Employment Statistics—CES (national): changes to the net birth-death model due to the COVID-19 pandemic," https://www.bls.gov/web/empsit/cesbd.htm.

21 For more information on BLS unemployment estimates, see "Labor force statistics from the Current Population Survey: help finding the unemployment rate over time," https://www.bls.gov/cps/prev_yrs.htm. During the Great Recession (2007–09), firm openings fell by 27 percent from their high during the 2005–10 period. The current economic contraction is more severe than that of the Great Recession, and it is reasonable to expect that openings have declined by a greater amount. Consistent with this, new business applications of likely employers, as tabulated by the Census Bureau's Business Formation Statistics series, fell sharply from March 2020 through the first week of June. However, these applications increased beginning in June. We are not sure what to make of this, but note that to the extent that this increase reflects potential births of new establishments, there is still often a lag between the application and the actual opening. For more information on the Business Formation Statistics, see https://www.census.gov/econ/bfs/index.html.

22 As noted above, the CES also imputes the employment of nonrespondents using the average employment change for respondents in the same month. However, the CES also imputes this employment change to establishments that report zero employment and subsequently corrects for this with the net birth–death model.

23 The establishment is our unit of analysis because the CES survey receives reports from establishments rather than from entire UI accounts. However, we classify these establishments by the size of their EINs in the QECW in order to obtain estimates by employer size. The Business Employment Dynamics data refer to estimates of employment by EIN size as "firm size estimates," but our previous work that attempted to link true firm-reported data to the QCEW show many examples in which firms use multiple EINs in reporting to the QCEW. Thus, we refer to our estimates by using the more general term "employers" rather than "firms." See "Linking firms with establishments," *Monthly Labor Review*, June 2013, https://www.bls.gov/opub/mlr/2013/06/art2full.pdf.

24 Weighted employment takes the sample weight multiplied by the reported employment.

25 This assumption is probably conservative in the present context because establishments with greater disruptions in employment may well be less likely to respond to the CES survey.

26 Of course, this is an approximation since shutting down permanently is not the same as having no employment in a given month, but $c_{M,S,J}$ should capture the fact that establishments with no employment are more likely to be nonrespondents than establishments that are operating.

27 More precisely, we estimate the employment change components separately for each size and industry group, and then weight them by the share of employment in each group. The industry groups we use are agriculture, mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information, financial and insurance, real estate, professional services, management services, educational services, healthcare services, leisure and hospitality, and other services.

28 See Cajner, Crane, Decker, Hamins-Puertolas, et al., "Using payroll processor microdata to measure aggregate labor market activity," p. 11.

29 For more information, see "Business Loan Program temporary changes; Paycheck Protection Program," *Federal Register*, vol. 85, no. 73, April 15, 2020, https://www.federalregister.gov/documents/2020/04/15/2020-07672/business-loan-program-temporary-changes-paycheck-protection-program.

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