BLS business surveys in the wake of COVID-19 – changes to data collection, imputation, and estimation

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Abstract
The US economy lost a staggering 22 million jobs in March and April of 2020 following the slowdown and shutdown of much of the usual face-to-face business activity as COVID-19 cases rapidly spread. This extraordinary employment decline coincided with evolving rules for social distancing to fight the spread of the novel coronavirus, a substantial increase in continuous work-from-home, and rapid efforts by the Congress and the Federal Reserve Board to provide fiscal support to taxpayers and businesses to reduce the impact of job losses on the economy. As these social and fiscal changes occurred, BLS was faced with huge challenges in data collection, and in the estimation and imputation of massive employment changes. This paper describes the major challenges and the changes made in data collection, estimation, and imputation, and provides an analysis of the success of these rapidly implemented procedure changes. The challenges and changes described are focused on three business surveys: the Current Employment Statistics survey, the Job Openings and Labor Turnover Survey, and the Quarterly Census of Employment and Wages.

Key Words: COVID-19, BLS, estimation, imputation, data collection, business

1. Background

This paper documents changes to procedures three Bureau of Labor Statistics (BLS) statistical programs took in response to the COVID-19 pandemic. I describe the changes, when they were applied, and to the extent possible the impact of the changes. The three programs discussed are the Current Employment Statistics (CES) survey[i], the Job Openings and Labor Turnover Survey (JOLTS)[ii], and the Quarterly Census of Employment and Wages (QCEW)[iii].

On January 3, 2020 the Center for Disease Control and Prevention (CDC)[iv] Director Robert Redfield was notified that a mysterious respiratory illness[v] was spreading in Wuhan, China. The CDC quickly followed this notification by establishing an incident management system, issuing a public alert, and dispatching public health experts to screen incoming airport passengers at major hubs. The first recorded case of COVID-19 was reported on January 20, 2020. The initial progression of the disease in the US was slow, reaching a 7-day moving average of 2 cases on March 1, 2020. Within a short 6 weeks this average daily case count reached 31,928 on April 12, 2020. The average daily case count declined until mid-June 2020, and began to rise again, peaking at 67,230 on July 24, 2020. The case count declined again until mid-September and again began to rise, reaching a 7-day moving average of 248,706 daily cases on January 8, 2021[vi]. As of January 28, 2021, CDC reports 427,626 deaths attributed to COVID-19 in the US, and 25,456,670 cases.

The reported COVID-19 case count went from under 100 in early March 2020, to about 4,000 at mid-month, to 185,764 cases by the end of the month. As the case count began

to rapidly rise in March 2020 and after, Governors around the country began to declare states of emergency, prohibit large gatherings, and institute policies that limited face-to-face interactions. These prudent measures contributed to a rapid state of business slowdowns and closures, with pronounced short and long-term impacts on employment.

The swift and dramatic influence of reactions to the pandemic on the economy required rapid changes in the way that surveys perform typical functions. Data collection efforts had to be evaluated and changed to be more effective in a socially-distanced world. Models that account for business openings and closings had to be adjusted to account for both unusually rapid job loss (and later rapid job gains) and to account for extraordinarily large numbers of businesses temporarily and permanently closing, followed by large numbers reopening as they determined how to best operate in a socially distanced environment. Other procedures had to be rapidly adjusted as well, in order to provide the most accurate and timely data possible. This paper describes these changes from the perspectives of the Current Employment Statistics survey, the Job Openings and Labor Turnover Survey, and the Quarterly Census of Employment and Wages. The remainder of the paper will be organized by survey, and I describe the procedure changes associated with each.

2. Data Programs

Individuals and governments started reacting to the reality of the pandemic in March 2020. The economy, from the pay period that included the 12th day of February to the pay period that included the 12th day of March had a very large employment decline, reported by the CES survey, of nearly 1.4 million employees. The JOLTS data, which measures hires and separations for the entire calendar month, reported an implied employment change (Hires – Separations) of 9.5 million employees. These two data points, together, pointed to a rapidly accelerating shutdown of a large part of the economy as time progressed into late March. The next month, CES reported a catastrophic employment loss of nearly 21 million employees. These substantial, unheard of levels of employment decline were later corroborated by business census data from the QCEW. Later analyses showed that the industries most impacted by these shutdowns were industries with the most face-to-face contact between employees and customers, and those that put people in the closest proximity to one another, for example restaurants and airlines.

Concurrent with these rapid business shutdowns, many federal agencies began to operate in a maximum telework posture, and to limit face-to-face contact with the public where feasible. This safety posture created data collection and processing challenges that had to be solved very quickly, while programs were also grappling with how to ensure the production of accurate estimates when the economy was changing at a pace far outside the norms anticipated by the estimation models.

This paper highlights issues associated with the production of data for three Bureau of Labor Statistics programs that, together, tell us about the rapid changes in the supply of and demand for labor by businesses, they tell us about massive job loss and recovery, and they tell us about the quality of these data during the early parts of the pandemic. These three programs are the Current Employment Statistics survey, the Job Openings and Labor Turnover Survey, and the Quarterly Census of Employment and Wages.

3. Current Employment Statistics (CES) survey

The Current Employment Statistics survey is a very large quick response repeated monthly survey of business worksites. Each business is asked to report on employment, hours, and earnings for the payroll period that included the 12th day of the month. The sample size is 671,136 worksites, distributed across state, industry, and employment size class strata. The data are published a few weeks following the reference period, usually on the first Friday of each month. These data, with data from the household-based Current Population Survey, are published together in *The Employment Situation*, a news release designated by the Office of Management and Budget as a Principal Federal Economic Indicator. Given the rapid turnaround between collection and publication, and the monthly frequency, these data were even more closely watched and scrutinized than usual as policy makers and financial markets sought information to better understand the economic impacts during the early days of the pandemic.

3.1 Problems (CES)

CES Problem 1. CES data are collected across several modes. In February 2020, 47 percent of the data were collected by Electronic Data Interchange (EDI). This mode is mostly used by very large companies with many worksites, who want to report electronically for all worksites by submitting a single file. Computer Assisted Telephone Interviewing (CATI) accounted for 24 percent of data collection, while Web reporting accounted for 21 percent, and other methods accounted for the remaining 8 percent. All initiation of new businesses was done by CATI. The CATI data collectors are contractors who work within the federal building, and for cost efficiencies, the equipment that these hundreds of contractors worked on were desktop computer. Only a handful of DCC workers had laptops. Among the very first problems encounter by the BLS as social distancing was enforced was the shuttering of the CES Data Collection Centers (DCCs) where these data collectors worked. With the shutdown of federal buildings these contractors were unable to work, effectively shutting down CATI operations. Data collection for the program was at serious risk.

CES Problem 2. There are three parts to employment change. The largest part is the change associated with business who have employees in two consecutive months. Another large part is employment associated with worksites going out of business, and the third part is employment associated with business births. The first part is estimated through the collection of sample data. A ratio of current month employment to prior month employment is developed. Employment change associated with business deaths is hard to capture in real time. Employers who are going out of business don't always report that fact to the BLS. A different problem exists for new businesses. By the time they make it into the CES sample they may be six months to a year old. In the meantime they have usually been growing, at least as an aggregate group. So we are faced with not only the failure to capture the initial employment associated with these new businesses, but also with the failure to capture the employment change associated with them. The solution to both problems is a two-part model. A defining part of this model is that while business births and deaths are very large individually, they are usually about the same size, and the residual difference between them is regular in size and seasonal. The first part of the model essentially ignores business deaths and treats them like business births by using an estimator that implicitly imputes employment and employment change to them at the same rate as the rest of the industry. This model component accounts for the initial birth employment and employment change associated with that cohort. This means we do not have to go to extraordinary lengths to identify deaths, who mostly look like other nonrespondents, and we don't have to undertake costly efforts to identify and

collect data from new business births. After this implicit imputation, what is left is a model to account for the seasonal residual. Of course, a major assumption with this two-part model is that births, deaths, and the residual difference are regular in size. With the massive disruption to the economy brought on by the pandemic, it was apparent that this assumption was violated in nonignorable ways. With this violation, the quality of the CES estimates, which typically serve as a first bellwether for the economy, were at serious risk.

3.2 Solutions (CES)

Solution to problem 1 (disruptions to data collection). CES program staff worked diligently with other BLS offices to round up hundreds of laptops. Most of these laptops had been intended to replace older laptops that were nearing their corporate end-of-life dates but had not yet been deployed. These staff then worked with the BLS warehouse staff, BLS IT staff, and staff in our Office of Field Operations (OFO) to get these laptops set up and sent to interviewers. This is a vast oversimplification of what really happened. Behind the scenes, there were program policies that prohibited DCC contractors from working at home – so there were no policies or practices in place to allow this, either on the government side or on the contractor side. The program office staff worked with the OFO staff to quickly adjust program policies to allow work-from-home (WFH) for the data collectors. OFO staff also worked with the contractor to modify WFH policies. The contractor worked with their employees to determine which of them had the appropriate internet infrastructure and home environment to facilitate WFH. As these things came together – new laptops, policy changes, and a list of contractors who were available to WFH – data collection began to normalize and return towards acceptable levels. A big part of this also was a directed effort to move as many respondents as possible to self-reporting methods, such as web reporting. Another aspect was to quickly stop initiation of new businesses into the survey to focus the reduced collector resources only on collection of already initiated businesses.

There was a short-term impact to data collection rates that these measures quickly mitigated. A longer-term issue was the deferment of initiation. Since the deferred activities didn't result in any savings because resources were redirected to data collection in a difficult environment, it is taking some time to catch up on this activity. However, the overall success of this major data collection activity in an extreme situation is nothing short of a heroic success.

Solution to problem 2 (birth/death model issues). CES program staff implemented several changes to the birth/death model to more accurately account for the disruption to the basic model assumptions of economic stability and the seasonal offsets of employment associated with births and deaths. Two actions were taken. The first action was to identify the increased level of deaths (during the first part of the economic collapse) and the increased returns from zero employment and to explicitly account for this business activity as a modification to the normal birth/death modeling. A second action was to incorporate a new regressor in the birth/death forecast. This regressor allowed the forecast to be more sensitive to current economic conditions and activity. These two actions allowed the birth/death forecast to more accurately reflect what this complex model is intended to capture – employment change among business births and the employment growth associated with those births over a period of time, and to more accurately capture the substantial increase in employment associated with business deaths during the earliest months of the pandemic.

3.3 Results (CES)

Results for problem 1 (disruptions to data collection).

The way that data were collected underwent a rapid and substantial change to meet this challenge. Data collection was redistributed as shown in the following table.

Date	CATI %	Web %	EDI %	Other %
Feb-20	24%	21%	47%	8%
Apr-20	9%	29%	53%	9%
Feb-21	13%	27%	50%	10%

Collection rates for this period are shown in the following table[vii].

First preliminary release												
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2019	60.7	76.1	77.6	72.3	80.7	71.3	70.7	75.2	76.8	70.6	72	81.5
2020	76.1	77.2	66.3	74.9	69.4	63.1	77.8	76.8	70.4	79.3	74.4	76.1
2021	72.5	71.9	67.4	72	65.7	64						
Second preliminary release												
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2019	90.4	89.2	86.8	93.2	92.5	88.7	90.2	88.9	92.5	86.1	87	90
2020	87.5	89.4	85.1	88.4	85.5	85	89.7	87.9	87.5	87.9	85	91.1
2021	91.2	90.8	87.7	88.3	86.7							

Collection for the first preliminary release of CES data can be somewhat noisy, as this is calendar dependent and the number of days available to collect data change from month to month. However, an examination of the data collection history shows that the rate for March 2020 is a substantial outlier, having the lowest rate for March in about 15 years. The 2020 March rate of 66.3 percent was 11.3 percent lower than the prior year rate of 77.6 percent.

The second preliminary collection is also lower than recent history, being the lowest second collection for March in about 13 years. The 2020 March rate of 85.1 percent was 1.7 percent lower than the prior year rate of 86.8 percent.

The collection rates were noticeably impacted for a few months, as we worked to get laptops into the hands of the data collectors, and as we worked to redirect employers to self-reporting methods where possible. However, what could have been a catastrophic failure in data collection, leading to a loss of timely information about the impact of the pandemic, was a huge success due to the work and initiative of BLS employees.

Results for problem 2 (birth/death model issues).

As mentioned above, CES implemented two actions to account for the economic deviations from the normal model assumptions. The first was to utilize the excess number of reported zeros in the estimator, and the other was to include information in the birth/death forecast model about current sample-based employment change.

CES is unusual for a sample survey; it has an administrative population report from another program, at a lag, that can be used to assess total survey error. We tend to think

of the survey and administrative data as independent estimates each with their own error structure. However, for this purpose we can use the administrative data to gauge how well these changes to the estimator and to the model worked. The CES program aligns its data at the national level to the March administrative data each year, in a process called benchmarking. In March of 2020, CES initially estimated a change in employment – after implementing these changes – of -1,683,000. While this is extremely large historically, it pales in comparison to the employment changes that followed. The population data show a decline in March of -1,373,000, a difference of -310,000. The benchmark revision to the employment level for March 2020 was a downward revision of -121,000 (not seasonally adjusted), or 0.1 percent. This is about the size of the absolute value of revisions for the prior 10 years. Note, however, that the largest ever employment change in the 104-year history of this survey occurred in April 2020, with the following months also having historically very large employment gains. We don't yet have the official data on revisions, but we can compare the CES data to the major contributor to the administrative population data component (the QCEW).

Not seasonally adjusted data, employment changes, in thousands.

2020	QCEW	CES
Jan	(2,657)	(2,791)
Feb	584	913
Mar	(764)	(1,016)
Apr	(19,825)	(19,701)
May	3,417	3,168
Jun	4,273	5,082
Jul	(26)	606
Aug	2,043	1,621
Sep	1,602	1,218
Oct	2,006	1,622
Nov	649	553
Dec	(347)	(519)

Note that there are some regularly occurring seasonal differences between QCEW and CES, so we don't expect each month to line up exactly. What is exceptional here, is that with the implementation of rapidly developed alternative procedures, CES captured the April 2020 change, the largest one-month employment change in the history of U.S. employment, with an accuracy level of 99.4 percent. In the three years preceding 2020, the sum of the absolute values of 12 months of not-seasonally-adjusted employment change averaged 10,830,000. During 2020 this value was nearly four times larger, at 38,3810,000. Even with this unprecedented volatility in employment change, the sums of the QCEW absolute changes and CES absolute changes for the months in 2020 are only different by 2.2 percent. This is a testament to the rapid but thoughtful methodological changes to the CES (and QCEW) estimation procedures. These changes clearly led to high quality estimates at a time when these were sorely needed to guide policy makers, local and national leaders, economists, and others interested in the impacts of COVID-19 on our economy.

Note that an examination of seasonal adjustment models was also conducted for CES data, to determine if changes needed to be made. Most CES models for seasonal adjustment are multiplicative, which are sensitive to large level shifts. A concern was

that the anticipated large magnitude changes might magnify the expected seasonal component and distort the estimate. However, while the employment decline was the largest in history, that decline over March and April 2020 was a 12.8 percent decline. We concluded that this decline did not present enough of a deviation to warrant major model changes in mid-year.

4. Job Openings and Labor Turnover Survey (JOLTS)

The Job Openings and Labor Turnover Survey is a monthly survey that captures labor demand, among other items. It collects data on job openings, hires, total separations, quits, layoffs and discharges, and other separations. These data are published monthly in the *Job Openings and Labor Turnover Summary* report.

4.1 Problems (JOLTS)

The JOLTS program also suffered serious issues as the pandemic descended and began its spread. The first problem, Problem 1, was identical to the first CES problem – its data collectors could no longer collect data.

The second problem, Problem 2, like the second CES problem, was an estimation problem. This estimation problem was, in fact, due to the regular alignment of JOLTS data to CES data – a kind of monthly benchmarking to improve the quality of estimates from the small JOLTS sample. The assumption is that the JOLTS hires minus separations should approximate the CES employment change. In practice, to let the JOLTS data express its own seasonality, the difference between seasonally adjusted JOLTS and CES data is used to adjust the not seasonally adjusted JOLTS data, which are then seasonally adjusted again to produce the published estimate. The problem here arose because the CES and JOLTS reference periods are not the same. The CES reference period is the pay period that includes the 12th of the month, while hires and separations are full month accumulations. Usually, the different reference periods don't have a major impact on this adjustment because the procedure allows differing seasonal effects. However, it was clear from other data that the second half of March 2020 had a massive acceleration of job loss that was not included in the CES estimates for March. The usual procedure would have suppressed the observed full-month March job loss in JOLTS data, and pushed that loss into the April estimate, distorting the actual timing and severity of job losses and the subsequent job openings and rehiring.

The third JOLTS problem had to do with the seasonal adjustment models. Most of these were multiplicative, and we were concerned that these might magnify the seasonal effects of an unexpected very large economic change, distorting the published data.

4.2 Solutions (JOLTS)

Solution to Problem 1. The solution to the data collection problem for JOLTS followed the path of the CES solution. Laptop computers were found, configured, and shipped to data collectors as soon as possible, and policies were changed to allow WFH.

Solution to Problem 2. The solution to the estimation problem in JOLTS was to suspend the alignment procedure. Suspending this procedure allowed the JOLTS data elements to represent the reported data without being scaled down or up to align with CES data. This provided more information to the public about the timing of economic events related to COVID-19.

Solution to Problem 3. A multiplicative seasonal effect is assumed to be proportional to the series level. However, a large exogenous shock to the data series is inherently not a seasonal event. Because the size of the shock was expected to be very large in terms of the JOLTS data elements, these series were switched to additive seasonal models, which are generally preferred in times of economic instability of the measured data elements.

4.3 Results (JOLTS)

The JOLTS results don't have a clear comparison like the CES to QCEW result. However, we can review response modes and response rate results, and estimates.

As is seen in Table 1 below, in March 2020 there was a large shift of collection from phone interviews to online collection. Much of that large shift remains in place today to accommodate a more challenging data collection environment for the program.

Table 1. Percent of establishments responding to the Job Openings and Labor Turnover Survey by collection mode

Time period	Phone	Web	Other
12-month average through February 2020	42%	52%	6%
Mar-20	19%	75%	6%
Apr-20	27%	68%	5%
May-20	28%	67%	5%
Jun-20	32%	62%	6%
Jul-20	31%	65%	4%
Aug-20	32%	63%	5%
Sep-20	33%	62%	6%
Oct-20	29%	66%	6%
Nov-20	30%	65%	5%
Dec-20	31%	64%	6%
Jan-21	31%	64%	5%
Feb-21	34%	61%	5%
Mar-21	30%	64%	6%
Apr-21	33%	62%	6%
May-21	13%	81%	6%

Table 2 shows response rates for JOLTS.

Time period	Preliminary rate	Final rate
12-month average through February 2020	54%	58%
Mar-20	46%	51%
Apr-20	44%	49%
May-20	45%	51%
Jun-20	47%	50%
Jul-20	46%	50%
Aug-20	47%	50%
Sep-20	47%	50%
Oct-20	45%	49%
Nov-20	43%	47%
Dec-20	42%	48%
Jan-21	43%	48%
Feb-21	45%	49%
Mar-21	45%	48%
Apr-21	44%	48%
May-21	44%	47%

As is clearly shown in the table above, the response for both the preliminary and final estimates suffered a drop of about 10 percentage rate points at the beginning of the pandemic, and that decline has not been mitigated since. As a repeated monthly survey with multiple data elements, cooperation is challenging in normal times – it is truly amazing that so many businesses continued to provide data during the worst months of the pandemic.

Note that in March 2020 that JOLTS Hires declined somewhat, while JOLTS Separations skyrocketed, increasing from 5,715,000 in February to 16,308,000 in March. This implied employment decline of 11,176 was nearly 10 times the March 2020 CES employment decline. The April JOLTS implied employment decline was modest in comparison to what CES measured. When March and April are taken together, CES measured an employment change of -22,362,000, while JOLTS measured an employment change of -19,016. The JOLTS sample size is very small compared to the CES sample size. When considering this, these measures of catastrophic job loss are remarkably consistent.

Date	CES TNF Employment Change	JOLTS Hires	JOLTS Separations	Implied Employment Change	QCEW
Feb-20	289	5,979	5,715	264	584
Mar-20	(1,683)	5,132	16,308	(11,176)	(764)
Apr-20	(20,679)	3,942	11,782	(7,840)	(19,825)
May-20	2,833	8,272	4,618	3,654	3,417
Jun-20	4,846	7,697	5,180	2,517	4,273
Jul-20	1,726	6,237	5,392	845	(26)
Aug-20	1,583	6,431	4,901	1,530	2,043
Sep-20	716	5,932	5,235	697	1,602
Oct-20	680	6,035	5,427	608	2,006
Nov-20	264	6,019	5,744	275	649
Dec-20	(306)	5,411	5,582	(171)	(347)

* TNF is total nonfarm, data are in thousands, and QCEW is limited to CES scope

5. Quarterly Census of Employment and Wages (QCEW)

The Quarterly Census of Employment and Wages serves as both the business register for the BLS and as a source of published data for very detailed levels of industry employment and wages for each county in the U.S. The data are published about 5½ months after the end of each calendar quarter in the *County Employment and Wages Summary* report.

5.1 Problems (QCEW)

QCEW encountered two major problems during the pandemic; both are imputation problems. The first problem was the use of a formula that imputed to each nonrespondent a value based on that nonrespondents prior-month level and year-ago change. This formula works fine during periods of stable economic growth or decline, but it is not optimal during economic turning points. BLS had scheduled an update to utilize an improved procedure with the implementation of a new software system, but that implementation was several years in the future at the start of the pandemic. The second problem is the QCEW policy of imputing nonrespondents for two consecutive quarters. This policy ensures that we don't administratively eliminate businesses that are delinquent in reporting for a period. The assumption is that a nonrespondent may be a "live" business until a third quarterly nonresponse is obtained. With other evidence in March 2020, that business deaths had substantially accelerated, imputing employment to these dead units was likely to provide an employment estimate that was too high.

5.2 Solutions (QCEW)

Solution to QCEW Problem 1. BLS quickly determined that imputing a year-ago change to nonrespondents as a general method during the volatile period following the start of the pandemic would not provide the highest quality estimates. A new procedure that was sensitive to current economic conditions had already been evaluated, tested, and specified for implementation. The new software system was not ready for implementation, so BLS staff replicated this new imputation procedure outside of our normal estimation process flow. The new procedure uses current rates of monthly employment change from reporting businesses, linked to a prior month employment level for the nonrespondent, to incorporate current information into the imputed values for nonrespondents. This was

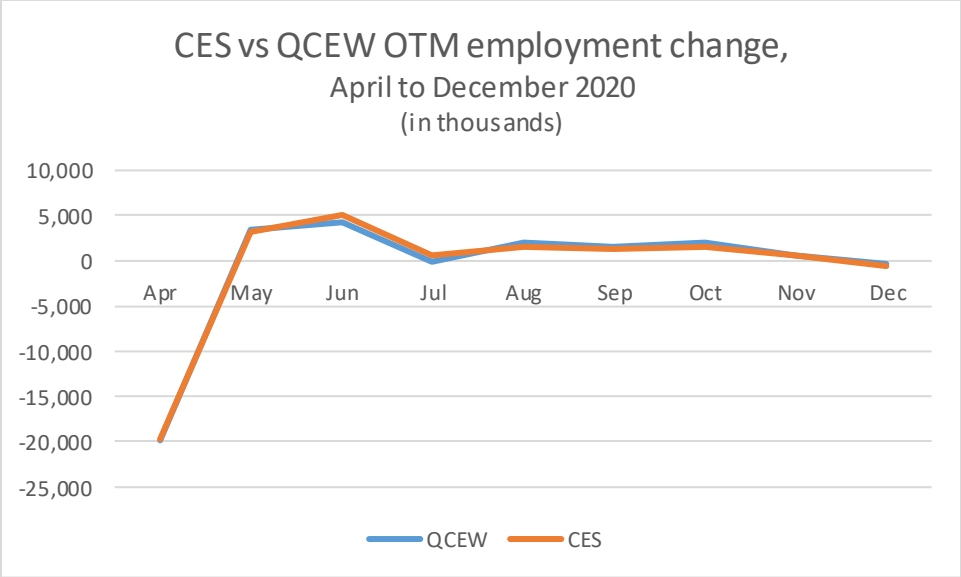
rapidly prototyped, tested, and implemented. This is not how we prefer to implement new procedures; moving into and out of an established production process incurs additional risk of errors. However, the volatility of the economy made the risk/reward tradeoff worthwhile as there was a larger risk of producing estimates that would have been substantially less accurate.

Solution to Problem 2.
The second problem was complex. We considered inactivating (and thereby not imputing) businesses in our business file earlier instead of waiting for the third occurrence of nonresponse. However, this had implications for record linkage downstream and the quality of data in our Business Employment Dynamics program if we had many inactivated businesses returning to report later. As staff researched this problem, they identified an innovative solution. They were able to get summary counts of claims for unemployment insurance (UI) by UI account. If the claims approached the total employment reported by the business, then that provided evidence that the business was not just a nonrespondent, but that they were out of business or closed. The subset of nonrespondents who had substantial claims were inactivated (and thereby not imputed).

5.3 Results (QCEW)
Results for Problem 1.
With some minor implementation challenges, the new general imputation procedure was developed, tested, and implemented for use with the production of data for the second quarter of 2020. This allowed us to implement these improvements into the second release of the first quarter estimates, and into subsequent estimates. This procedure will be utilized out-of-system until the new software production system is implemented (the implementation is planned to start for selected states in late 2021). Response to QCEW is generally very high, as it is based primarily on mandatory reporting to each states unemployment insurance system. An early concern was that nonresponse might, at least temporarily, increase. BLS had never publicly posted data on response to the QCEW – mostly because response is usually very high. However, in anticipation of rising levels of nonresponse and therefore of imputation, BLS did begin to publicly post information on response rates[viii]. The response rate by employment is higher than the response rate by units – much of the nonresponse is concentrated among smaller businesses.

Results for Problem 2.
The innovation of using UI claims to identify nonrespondents who are likely out of business is not a perfect solution. Some of the businesses identified in this way aren't really out of business, but rather have laid off most employees with the intention of recalling them when conditions improve. To the minor extent that this was encountered, we underestimated employment for a few businesses. However, for the very large number of cases that were identified in this way the business really was shut down, so a decision not to impute employment to them substantively improved the quality of the final estimates.
As seen in the table above with data from CES, JOLTS, and QCEW, data from these programs are all telling similar stories. The similar stories provide confirmation that these estimation procedure changes were successful in capturing what was happening in the economy during this tumultuous economic reaction to the COVID-19 pandemic.

Not seasonally adjusted data from CES (not yet benchmarked) and QCEW, from April 2020 to December 2020, tell a remarkably consistent economic story, even though there are normal seasonal differences between these two data series.



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Sep	1,602	1,218
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6. Transparency

The Bureau of Labor Statistics strives for transparency in its operations and methods. The *Handbook of Methods*[ix] provides information on the methods used to conduct each BLS survey. In addition to the handbook, each program website offers additional details about its methods and the availability of program data. The BLS also strove for

transparency early during the pandemic by hosting a website on the pandemic[x] and Questions and Answers related to the operations of BLS programs during the pandemic.

7. Concluding Remarks

The rapid onset of the COVID-19 pandemic brought with it an unprecedented and rapid reaction by the public, and by the federal, state, and local governments. These reactions were attempts to protect people from contracting the disease, and to keep the U.S. medical infrastructure from being overwhelmed. These reactions challenged statistical surveys in ways we've never seen before. The sheer rapidity of change required a rethinking of data collection methods and data collection infrastructure, and of modifying imputation and estimation models at a speed that would have been unthinkable even a month before. The success of the BLS staff and the broader U.S. statistical system in rising to these challenges is a testament to the expertise in these agencies and to the dedication of their professional staff. I am proud to work with them.

Any opinions expressed in this paper are those of the author and do not constitute policy of the U.S. Bureau of Labor Statistics.

8. References and endnotes

[i] The Current Employment Statistics (CES) website is located at https://www.bls.gov/ces/
[ii] The Job Openings and Labor Turnover Survey (JOLTS) website is located at https://www.bls.gov/jlt/
[iii] The Quarterly Census of Employment and Wages (QCEW) website is located at https://www.bls.gov/cew/
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[vi] CDC COVID-data-tracker website, address_is_here
[vii] Collection rates for the CES survey can be found at CES Registry Receipts by Release (bls.gov)
[viii] QCEW response rates (and by subtraction the imputation rates) can be found at https://www.bls.gov/cew/response-rates/
[ix] The BLS Handbook of Methods website provides access to documentation on the methodology used in each BLS program. The website is found at https://www.bls.gov/opub/hom/. Each of the programs discussed in this paper are found under the Subject Areas dropdown item "Employment".
[x] The BLS Pandemic Questions and Answers website can be found at https://www.bls.gov/covid19/.