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IZA DP No. 13334

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ISSN: 2365-9793

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ABSTRACT

COVID-19 Employment Status Impacts on Food Sector Workers*

Food production and distribution is essential for human well-being, but the food sector has experienced a number of difficulties maintaining worker health and productivity during the COVID-19 pandemic. We examine employment status changes of persons recently employed in the U.S. food sector with a focus on food manufacturing and grocery stores. We find that the pandemic significantly reduced the probability of continued active employment for previous workers in both food manufacturing and grocery stores. Individual-level analysis confirms that the COVID-19 infection rate in an individual's local labor market is a strong and significant factor. The employment changes are not just due to unemployment during facility closures. Previous workers increasingly exit the labor force as the severity of the COVID-19 infection rate in their local area worsens. The considerable risk of infection drives many previous food sector workers to stop working altogether. Maintaining worker health and safety is essential for a stable food supply.

JEL Classification: J2, Q1

Keywords: COVID-19, coronavirus, pandemic, food sector, employment, worker safety

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* The authors received no funding related to this work and have no conflict of interest to declare. The data analyzed in this study are publicly available from IPUMS at https://cps.ipums.org/cps/.

1. Introduction

COVID-19 has imposed enormous costs and complications around the world with rapid and widespread decreases in economic activity. The United States unemployment rate rose to 14.7 percent in April 2020, the highest rate since the current measure began in 1948 (BLS 2020). However, food production and distribution is essential to human well-being and much of the food sector has continued operating, albeit with substantial challenges and some disruptions. Many workers in the food sector operate in close proximity to other workers or customers, and the risk of infection is considerable. Numerous coronavirus outbreaks have occurred in food processing facilities, requiring some to temporarily shut down to clean the facilities and assess the extent of spread among employees (Effron 2020; Perez 2020). The meat packing industry has been hit particularly hard with thousands of workers infected (Mak 2020). Plant closures and increased social distancing of workers reduced meat processing capacity by up to 40 percent (Lusk 2020a). Grocery store workers have also faced considerable exposure with some tragic outcomes (Dungca et al. 2020; Kornfield 2020; Meyersohn 2020). For the most part, food processing and grocery stores have continued to operate and workers are a critical need for these industries (Artiga and Rae 2020; Jung, Freger, and Myers 2020). Food sector employers have used bonuses, higher wages, and various forms of hazard or hero pay to recruit and retain workers, but labor force challenges are still a critical concern for the food sector (Kang and Terlep 2020; Premack 2020; Shanker and Skerritt 2020; Werner 2020).

The current paper examines the early employment status impacts of COVID-19 on food sector workers in the U.S. We utilize data from the Current Population Survey. Our primary focus is on workers in the food manufacturing and grocery store industries. We also examine workers in the agricultural production and restaurant industries. We examine employment status

changes for workers previously employed in these food sector industries. Previous workers may continue working in the same industry, switch to working in another industry, become temporarily absent while still having a job, become unemployed, or exit the labor force. We expect all industries to experience labor disruptions due to the pandemic, but the severity and manifestation are likely to vary by industry.

The effects of the COVID-19 pandemic on employment status changes will depend on labor demand, labor supply, and labor market frictions. Labor demand will decrease in some industries due to business closures and reduced product demand by consumers, but labor demand should increase in other industries that experience increased product demand as consumers alter their buying patterns. Labor demand impacts by industry also depend on the extent to which the industry is essential, the extent to which work can be done in low proximity to others, and other factors. Labor supply should decrease somewhat in all industries because some workers get sick and many others wish to avoid getting themselves or others sick. Some individuals may have to leave the labor market to take care of family members including children displaced from school. Eligibility for unemployment insurance, including expanded benefits from the CARES Act, should also reduce labor supply, especially for workers with low wages and generous unemployment benefits (Ganong, Noel, and Vavra 2020). Imperfect information and other labor market frictions may prevent workers from moving to new jobs quickly even where matches are mutually beneficial.

Among the four food sector groups we consider, we expect employment losses to be especially severe in the restaurant industry because the industry is generally considered non-essential and it requires close proximity. Food manufacturing, grocery stores, and agricultural production are all largely considered essential industries, but they differ in other aspects. We

expect agricultural production to have the least labor responsiveness because the work is often done in more open spaces (including outdoors) and many workers in the industry lack unemployment insurance protection, especially seasonal workers and undocumented workers. Food manufacturing and grocery store workers are expected to have employment impacts somewhere in between restaurant and agriculture production workers.

We find that COVID-19 substantially decreased the percentage of previous workers who continue actively working in food manufacturing and grocery stores. This decrease manifests as increased unemployment, increased exit from the labor force, and increased frequency of workers who have a job but are temporarily absent from work. We do not find significant evidence that these workers are shifting to other industries. On the contrary, the weak overall labor market appears to make it harder for food sector workers to shift to other industries, but results for this are typically not statistically significant. Notably, we do not find similar decreases in continued employment among workers previously employed in agricultural production, at least during April 2020 for our sample. Restaurant employment was severely reduced as expected due to closures and reduced consumer demand for restaurants.

We also conduct an individual-level analysis on the April 2020 labor market transitions of persons previously employed in food manufacturing and grocery stores. We find that the COVID-19 confirmed infection rate in an individual's local labor market has large and statistically significant effects on their labor market status in April 2020. The local infection rate reduces continued employment and increases unemployment in both food manufacturing and grocery stores. Importantly, the bulk of the reduction in continued employment manifests as workers exiting the labor force, especially in the grocery store industry. COVID-19 disrupted labor supply to the food manufacturing and grocery store industries and made it much more

difficult for employers to retain workers. The adverse conditions during the pandemic have made many individuals previously employed in food manufacturing and grocery stores no longer willing to work in these industries. We also take a brief look at hiring of new workers not previously employed in food manufacturing and grocery stores; we find no significant evidence of increased hiring, suggesting that these industries may struggle to build and retain an effective workforce.

The current paper connects two important streams of research. First, our research relates to a large wave of recent research examining the various early economic impacts of the COVID-19 pandemic. One major focus of this literature has been the extent to which jobs can be done working from home or in low physical proximity to coworkers and customers (Dingel and Neiman 2020; Gottlieb, Grobovšek, and Poschke 2020; Irlacher and Koch 2020; Mongey, Pilossoph, and Weinberg 2020; Saltiel 2020).[1] Many food sector jobs require physical proximity to other people and cannot be done remotely but are also essential to maintain a stable food supply. Another strain of the COVID-19 economic literature has examined the disruptions to agriculture and food industries including price changes and economic losses (Goddard 2020; Hailu 2020; Hart et al. 2020; Ker and Caldwell 2020; Richards and Rickard 2020), but the previous research does not specifically examine individual employment status changes during the pandemic as done in the current study. Second, our research builds on a long and extensive literature on labor supply and employment outcomes in the food sector. This includes notable examples for agricultural production (Huffman 1977; Tokle and Huffman 1991; Hurley, Kliebenstein, and Orazem 1999, 2000; Richards 2018, 2020; Barham, Melo, and Hertz 2020; Li

[1] Individuals who are younger, less educated, and racial/ethnic minorities experienced the largest early employment losses due to COVID-19, largely because of the types of jobs they have had (Adams-Prassl et al. 2020; Cho and Winters 2020; Mongey and Weinberg 2020).

and Reimer 2020), food manufacturing (Huang 1991; Goodwin and Brester 1995; Artz Jackson, and Orazem 2010), and food retail (Budd and McCall 2001; Basker 2012; Volpe 2014). Our paper examines COVID-19 labor market impacts in the food sector by focusing on employment transitions of workers previously employed in the U.S. food sector, and we know of no previous research paper providing empirical evidence on this topic.

The rest of the paper proceeds as follows. The next section discusses the data we use. The third section presents our empirical framework, and the fourth discusses the results. A final section concludes.

2. Data

We use individual-level data from the monthly Current Population Survey (CPS) obtained from IPUMS (Flood et al. 2020). Each month, the CPS surveys approximately 60,000 households to collect information on household demographics, labor market outcomes, and other topics. The CPS is the data source used by the U.S. Bureau of Labor of Statistics (BLS) to compute the national unemployment rate and related statistics including the labor force participation rate, and the employment-to-population ratio. The CPS does not include persons living in group quarters, such as dorm-like facilities common for migrant farm workers. Thus, our analysis is focused on workers living in more traditional housing units.

The CPS utilizes a four in/eight out/four in sampling rotation. That is, each household is initially surveyed for four consecutive months. They then rotate out of the sample for eight months, during which time they are not surveyed. They then rotate back into the sample for four more consecutive months of surveys before rotating out of the sample permanently.

We link individuals over time to examine the employment transitions of persons previously working in a particular industry. We are specifically interested in individuals previously employed in the food sector, but we also briefly examine other industries for comparison. Our sample is limited to civilians ages 16 and over who were employed during the previous year and have industry of employment reported in the previous survey month. This means that we exclude individuals in their first month of the CPS rotation because we have no industry information from a previous survey month for them.

The CPS asks several questions to discern each individual's employment status in the survey reference week for each month.[2] Individuals doing any work for pay or profit or working unpaid at least 15 hours per week in a family business are defined as employed and at work. Another group of individuals report having a job but are temporarily absent from work during the survey week for reasons such as illness, vacation, inclement weather, maternity leave, and family obligations. Persons are defined as unemployed during the reference week if they were not employed, were willing and able to work, and had looked for work during the previous four weeks. Additionally, persons who are temporarily laid off from a job and expect to be recalled to work are to be classified as unemployed even if they did not look for work in the previous four weeks. The BLS defines the labor force as all civilians who are employed at work, temporarily absent from a job, or unemployed. Civilians not in any of these three categories are defined as not in the labor force. Our analysis relies on these categtories but splits individuals employed at work into those working in the same industry as their previous survey month and those working

[2] The survey reference week usually occurs during the Sunday-Saturday seven day period that includes the 12th of the month, with some exceptions during November and December to avoid overlap with major holidays. For April 2020, the survey reference week was April 12-18.

in a different industry than their previous survey month. Thus, we have five employment status outcomes in this study.

We divide industries into five groups: food manufacturing, grocery stores, agricultural production, restaurants, and all other industries. Food manufacturing includes a number of more detailed industry categories including animal food, grain, and oilseed milling; sugar and confectionery products; fruit and vegetable preserving and specialty food manufacturing; dairy product manufacturing; animal slaughtering and processing; retail bakeries; other bakeries and tortilla manufacturing; seafood manufacturing, beverage manufacturing, and other food manufacturing. The employment impacts likely vary across detailed industries within food manufacturing (e.g. especially large impacts for meat processing), but small sample sizes and related concerns incline us to examine all food manufacturing as a single group. Grocery stores in our analysis are restricted to conventional grocery stores because supercenters, warehouse clubs, and discount stores cannot be cleanly separated from general merchandise and department stores in the CPS, and we cannot accurately identify food sector workers in these broader retail industries. Agricultural production includes workers in both crop production and animal production. The restaurant category includes all types of restaurants. The final category includes all other industries not included in the four food sector groups.

We also utilize data on COVID-19 confirmed infections in local labor markets. We obtained COVID-19 confirmed case data from USAFacts (2020) and computed cumulative confirmed cases through April 30, 2020 as a percentage of the local labor market population. Our definition of local labor markets is limited some by available geographic identification in the CPS. The state of residence is reported for all individuals in the CPS. The CPS identifies the metropolitan area of residence for most individuals living in metropolitan areas, but suppresses

detailed information for some individuals living in small metropolitan areas or non-metropolitan areas as part of its confidentiality protections.[3] We define an individual's local labor market as the specific metropolitan area of residence if identified in the CPS. We define state-specific non-metropolitan areas and metropolitan residual areas as the local labor market for the remaining individual observations.

3. Empirical Framework

Our empirical analysis utilizes multiple complementary methods. We first examine changes over time in aggregate rates for each employment status among workers previously employed in each industry group. This includes illustrative figures and examining year-over-year changes between April 2019 and April 2020. We also conduct difference-in-differences (DID) analyses for the employment status rates. The DID approach uses the year-over-year change in each employment status rate between January 2019 and January 2020 as a counterfactual change that would have occurred between April 2019 and April 2020 in the absence of the COVID-19 pandemic and economic disruption. Specifically, the DID analysis computes the effect of COVID-19 as the year-over-year change for April minus the year-over-year change for January. A similar DID approach is used by Cho and Winters (2020) to examine the broader distribution of employment losses for the U.S. across all industries. We report DID standard errors that are robust to heteroscedasticity and computed via linear regression. We believe that both the year-over-year changes for April and the DID estimates are useful.

We also conduct an individual-level examination of the April 2020 labor market status of individuals previously employed in food manufacturing and grocery stores. We estimate

[3] Across all observations in 2020, 74 percent of the CPS sample lives in one of 260 specifically identifiable metropolitan areas.

separate binary logit models with each of the five employment status variables as dependent variables equal to zero or one.[4] The key explanatory variable of interest is COVID-19 confirmed infections as a percentage of the population in the local labor market. We expect that labor market disruptions will be more extensive in areas with higher infection rates. Our logit models also include explanatory variables for individual characteristics including indicator variables for being female, married, having kids in the household, an interaction between female and having kids, age group, race/ethnicity group, and education group. While these variables are largely included as controls, their results are also of interest. Specifically, we expect some groups to have especially large employment changes including females with children, persons who are young or old, and persons with less education.

4. Empirical Results

We first present illustrative figures, and then turn to difference-in-differences results and logit results.

4.1 Monthly Employment Status Rates by Prior Industry

Figure 1 illustrates for each month from January 2019 to April 2020 the percentage of previous workers who are employed and at work in their previous industry for each of the five industry groups we consider. All of the industry groups exhibit some fluctuation over time, including seasonal spikes for crop and animal production. Prior to the coronavirus pandemic, typically more than 80 percent of workers continued employment in the same industry, though crop and animal production had typically lower rates than the other industry groups. The COVID-19 shock substantially disrupted labor markets, and the rate of employment at work in

[4] The independence of irrelevant alternatives assumption required for multinomial logit is unlikely to hold in our setting, so we estimate separate binary logit models.

the same industry for April 2020 was lower than previous months in 2020 for all five industry groups. However, the magnitude of the decrease varied across industry groups. The restaurant industry was severely affected with a same industry employment rate decrease of more than 40 percentage points from its recent peak in April 2019. Crop and animal production appears to have been the least impacted, but the April 2020 same industry employment rate was lower than April 2019, February 2020, and March 2020. Food manufacturing and grocery stores both show considerable decreases in same industry employment in April 2020 that are somewhere between the decreases for restaurants and crop and animal production. Finally, the all other industries group also had a considerable April 2020 decrease in the same industry employment rate, and the decrease for all other industries was larger than all food sector industry groups except restaurants.

Figures 2 – 5 present the monthly rates for each of the other four employment status outcomes by previous industry group. Figure 2 illustrates the percentage of previous workers who were unemployed during the survey week. Many newly unemployed workers were recently laid off or fired, but the unemployed also includes persons who quit their previous job and are searching for a new one. Figure 2 indicates unemployment peaked in April 2020 for previous workers in all industries except for crop and animal production. Restaurant workers experienced the largest unemployment increase followed in order by other industries, food and beverage manufacturing, grocery stores, and crop and animal production.

Figure 3 reports the percentage of previous workers who were no longer in the labor force. Workers may exit the labor force because of health concerns, family responsibilities, and other reasons. Notably, labor force non-participants include discouraged workers and others who would like to work if a suitable job were available, but they are not actively looking for work

because they do not think they will find suitable employment. The percentage of previous workers out of the labor force peaked in April 2020 for all industries examined except for crop and animal production. The restaurant industry again saw the biggest increase, likely due to many workers losing jobs and exiting the labor force because they do not expect to find suitable employment. This also indicates that the unemployment rate likely understates employment losses for workers previously employed in industries like restaurants that experienced adverse demand shocks (Jones and Riddell 1999; Feng and Hu 2013).

Figure 4 illustrates the percentage of previous workers who report still having a job but are temporarily absent from work. This group is intended to exclude persons on temporary layoff, but BLS (2020) notes some potential misclassification of laid off workers. April 2020 had the highest rate for all industry groups, with especially notable increases for restaurants, grocery stores, and the other industries group. The increase for restaurants and other industries largely reflects misclassification of laid off workers, but the grocery store industry increase is more likely to reflect workers who actually still have a job but are temporarily absent for other reasons because grocery store closures were relatively rare and brief.

Figure 5 illustrates the percentage of workers by previous industry who are employed at work in a different industry. These industry change rates are particularly volatile compared to the other figures. There is some decrease in industry changes in April 2020, with the effects most pronounced for crop and animal production and then grocery stores.

4.2 Year-over-Year Changes and Difference-in-Differences

Table 1 reports some similar information as the figures in tabular form and also explicitly reports 2019-2020 year-over-year changes for April and January and the difference-in-

differences (DID) estimates. Each panel is for a different industry, and each column corresponds to a different outcome. Column 1 reports the percentage of previous workers employed and at work in the same industry. Columns 2 – 5 report the percentages of previous workers who are unemployed, not in the labor force, have a job but not at work, and employed at work in a different industry, respectively. By construction, the percentages for a given month and industry add up across columns to equal 100, and the year-over-year changes and DID estimates add up across columns to equal zero. Thus, Columns 2 – 5 are useful to assess how reductions in employment at work in the same industry in Column 1 are distributed among the various alternative employment status categories.

Panel A reports information for food manufacturing. Between April 2019 and April 2020, the percentage of previous workers who remained employ

ed at work in food manufacturing decreased by 11.1 percentage points. Subtracting the January year-over-year change yields a DID estimate of 9.9 percentage points that is statistically significantly different from zero at the one percent level of significance. Columns 2-3 indicate that the reduction in same industry employment in food manufacturing is driven by both increased unemployment and exit from the labor force, with roughly equal magnitudes for the DID estimates. The changes and DID estimates in Columns 4 and 5 of Panel A are smaller and not statistically significant at conventional levels.

Panel B reports percentages and changes for the grocery store industry. The percentage of previous workers employed at work in grocery stores decreased by 7.5 percentage points between April 2019 and April 2020. The Column 1 DID estimate is 8.7 percentage points and is statistically significant at the one percent level. The DID estimates in Panel B are also significant in Columns 2 and 4 but not Columns 3 and 5, though the year-over-change is

significant in Column 3. Notably, the DID estimate is largest in Column 4 indicating that reduced employment at work among previous grocery store workers is strongly driven by temporary absence from work.

Panel C reports data for crop and animal production. The DID estimates are relatively small and not statistically significant except for Column 5, which is negative and significant at the five percent level. Thus, the weak labor market in April 2020 reduced the percentage of previous crop and animal production workers switching to other industries.

Panel D examines the restaurant industry. DID estimates are significant in Columns 1 – 4. Consistent with the figures, restaurant employment was substantially reduced and the reduction manifests as increased unemployment, exit from the labor force, and temporary absence from work.

Panel E considers all other industries. DID estimates are statistically significant in all five columns. Employment at work in the same industry and employment in different industries both decreased, while unemployment, exit from the labor force, and temporary absence all increased.

In Appendix Table A1, we also provide year-over-year changes between March 2019 and March 2020 and DID estimates for March relative to January. The March DID estimates are not statistically significant for food manufacturing nor grocery stores, but the DID estimates do suggest increased March 2020 employment in crop and animal production and reduced March 2020 employment for restaurants and other industries.

We also briefly examine entry rates into food sector employment among persons not previously employed in the food sector. DID results are provided in Appendix Table A2. We find no significant evidence of increased entry into the food sector industry groups, though the

DID estimate is positive for crop and animal production. The DID estimates are negative but not statistically significant for food manufacturing and grocery stores. The DID estimate is negative and statistically significant for restaurants. With the possible exception of crop and animal production, the food sector may struggle to attract new workers during the pandemic.

4.3 Logit Results for April 2020 Labor Market Status

We next discuss logit analysis of employment status changes for the sample of individuals in the April 2020 CPS who were previously employed in food manufacturing and grocery stores.[5] Table 2 reports sample means. The individual-level dependent variables are coded as zero or one, so their means in Table 2 are equal to the corresponding April 2020 rates in Table 1 divided by 100. The key explanatory variable of interest is the COVID-19 infection rate in the local labor market. The sample mean for the local infection rate is 0.278 for food manufacturing and 0.315 for grocery store workers. The infection rate is measured in percentages, so a mean of 0.278 indicates that for the average food manufacturing worker a little more than one-fourth of one percent of their local population had tested positive for COVID-19 by April 30, 2020. The variation across local labor markets varied from very close to zero in a few less populous areas to 1.99 in the New York City metropolitan area. The standard deviation of the infection rate (not shown) was 0.389 for the food manufacturing sample and 0.315 for the grocery store sample. The individual characteristic variable means confirm that these industries have similarities but also differences. Compared to grocery store workers, food manufacturing

[5] We do not conduct logit analysis for previous workers in crop and animal production nor restaurants because the April 2020 employment changes were so severe in the latter and minimal in the former. Previous food manufacturing and grocery store workers are more likely to have important heterogeneities and implications that benefit from individual-level analysis.

workers are more likely to be male, parents, married, middle age, Hispanic, and bachelor's degree graduates or higher.

Table 3 reports logit marginal effects and corresponding standard errors for the sample of workers previously employed in food manufacturing. The employment status outcome variables follow the same order across Columns 1 – 5 as before. We have a relatively small sample and relatively dense set of dummy control variables, so the logit models drop a few observations for which an explanatory variable perfectly predicts the dependent variable; in our case, this occurs when a small group has all zeros for the dependent variable. We also estimated linear probability models in results not shown and found qualitatively similar results.

The results in Table 3 indicate that the COVID-19 infection rate in the local labor market has a substantial impact on April 2020 employment status among previous food manufacturing workers. The estimated marginal effect of -0.182 in Column 1 indicates that a one percentage point increase in the infection rate reduces the probability of employment at work in the same industry by 18.2 percentage points. This is a large magnitude. Column 2 confirms that the local infection rate significantly increases unemployment with a marginal effect estimate of 0.053. Column 3 reveals that a higher local infection rate also pushes previous food manufacturing workers out of labor force participation with a marginal effect of 0.060. Thus, previous workers have not only left their previous industry, but also decided to not work nor look for work in areas with high COVID-19 infection rates. The local infection rate also has a significant effect on the probability that previous food manufacturing workers become temporarily absent with a marginal effect of 0.032. The estimated effect of the infection rate on working in a different industry is relatively small and not statistically significant.

The individual characteristic explanatory variables are often not statistically significant in Table 3, but there are some notable exceptions. In particular, females with children in the household are significantly less likely than males with children to be employed at work in the same industry with a marginal effect of -0.194. Females with children are also more likely to be both unemployed and out of the labor force. Compared to the omitted age category, ages 35-44, previous food manufacturing workers ages 16-24 and ages 65 and older are significantly less likely to be employed at work in the same industry in April 2020. Ages 16-24 are also significantly more likely to be unemployed and out of the labor force. Ages 65 and older are significantly more likely to exit the labor force and be temporarily absent from work. The race/ethnicity variables are not statistically significant in Table 3 except for a negative marginal effect on being out of the labor force for Asians relative to whites. The education variables are also only significant in Column 3 with high school graduates and college graduates having significantly lower rates of labor force exit than persons with less than a high school diploma, the omitted education group.

Table 4 reports logit marginal effects for previous workers in the grocery store industry. The COVID-19 infection rate in the local labor market again has a significant negative effect on being employed at work in the same industry with a marginal effect estimate of -0.078. The local infection rate also significantly increases unemployment and labor force exit with marginal effects of 0.018 and 0.072, respectively. The effect on labor force exit is large and nearly equal to the effect in Column 1. Thus, the local infection rate effect has an especially large influence on labor force exit among previous grocery store workers, indicating that workers become more reluctant to supply their labor as the infection risk worsens. We also observe a negative effect of the infection rate on temporary absence from work that is significant at the ten percent level,

which may suggest that risk-averse workers are temporarily waiting to see how things unfold in local areas with lower exposure but leaving jobs and exiting the labor force entirely where infection rates are very high.

The results for individual characteristics in Table 4 also offer some interesting implications. Men with children are more likely to continue employment at work in the same industry compared to men without children, but women with children are much less likely than men with children to continue working in the grocery store industry and more likely to exit the labor force entirely. This is consistent with traditionally greater family responsibilities for women than men and a greater need to take care of children due to closures of schools and childcare facilities (Alon et al. 2020). The age variables are not statistically significant in Table 4. Relative to whites, blacks are significantly less likely to be temporarily absent in Column 4. Asians are less likely to continue employment at work in the grocery store industry and more likely to exit the labor force. The other non-white group is less likely to transition to employment in another industry. Compared to persons without a high school diploma, the more highly educated groups all have higher probabilities of being employed at work in the same industry. High school graduates and persons with some college are also significantly less likely to exit the labor force. Bachelor's degree graduates are also less likely to be temporarily absent.

5. Conclusion

The COVID-19 pandemic has disrupted the global economy and wreaked havoc in many sectors. Continued production and distribution of food is essential for human well-being, but the food sector has faced a number of difficulties maintaining the health and productivity of its workforce during the pandemic. Many workers in the food sector operate in close proximity to

other workers and customers, making social distancing particularly difficult and the risk of infection especially troublesome. This is an important concern for the food sector both during the current pandemic and for future viruses.

We examine the employment status changes of persons who have recently worked in the food sector. Our primary focus is on food manufacturing and grocery stores, but we also examine agriculture production and restaurants. We find significant evidence of workers previously employed in food manufacturing and grocery stores becoming considerably less likely to continue at work in the same industry during April 2020. Individual-level analysis confirms that the COVID-19 infection rate in an individual's local labor market has significant effects on employment changes. Importantly, we document that the employment changes are not just due to unemployment during facility closures. Previous workers exiting the labor force play an especially important role, and the labor force exit rate strongly increases with the severity of the COVID-19 infection rate in their local area. The considerable risk of infection has inclined many previous food sector workers to stop working and not look for alternative work.

We also find massive employment decreases in the restaurant industry. Many of these workers will never return to the restaurant industry, and many restaurants will not recover from the COVID-19 pandemic (Ortega 2020). We do not observe significant employment decreases nor labor force participation changes for crop and animal production workers during April 2020. However, the workforce challenges for the agricultural production industry have the potential to worsen over time despite the limited early impact.

The COVID-19 pandemic has exposed major vulnerabilities in the food sector. The current pandemic will be with us for much longer than anyone would like, and future surges of new cases are inevitable. Furthermore, the SARS-COV-2 virus that causes COVID-19 may be

just one of many viruses to threaten the food sector during the twenty-first century. Industry leaders, public policymakers, and researchers all have an imperative to consider how various aspects of food production and distribution might be restructured to become safer and more resilient. This may include permanently increased social distancing of workers. It may involve increased mechanization and automation of tasks that are particularly critical for production and put human workers at particularly high risk (Molteni 2020). It may also mean the future of the food sector should include many more production facilities with smaller capacity at each, and greater consideration of where facilities are geographically located to reduce future vulnerabilities (Lusk 2020b).

In the near term, we emphasize that the considerable risks involved will discourage some experienced food sector employees from working in the food sector. New workers may be hired, but there will be considerable losses of industry-specific human capital and productivity as experienced workers are replaced with new ones. Increased compensation is likely part of the optimal employer response to help attract and retain workers, but it is unclear how responsive workers will be to higher pay if the risks increase or become more salient. Furthermore, many firms in the food sector already operate on thin margins and may be unable to significantly raise employee compensation and stay in business. Major challenges lie ahead for the food sector. Building and maintaining a productive workforce is essential. Increasing worker safety and minimizing future outbreaks at production facilities will need to be part of the response. This will require actions by industry leaders; but the health policy community also has a critical role to play in the supply of personal protective equipment, testing, treatment, and vaccination to help food sector workers be safe and feel safe at work.

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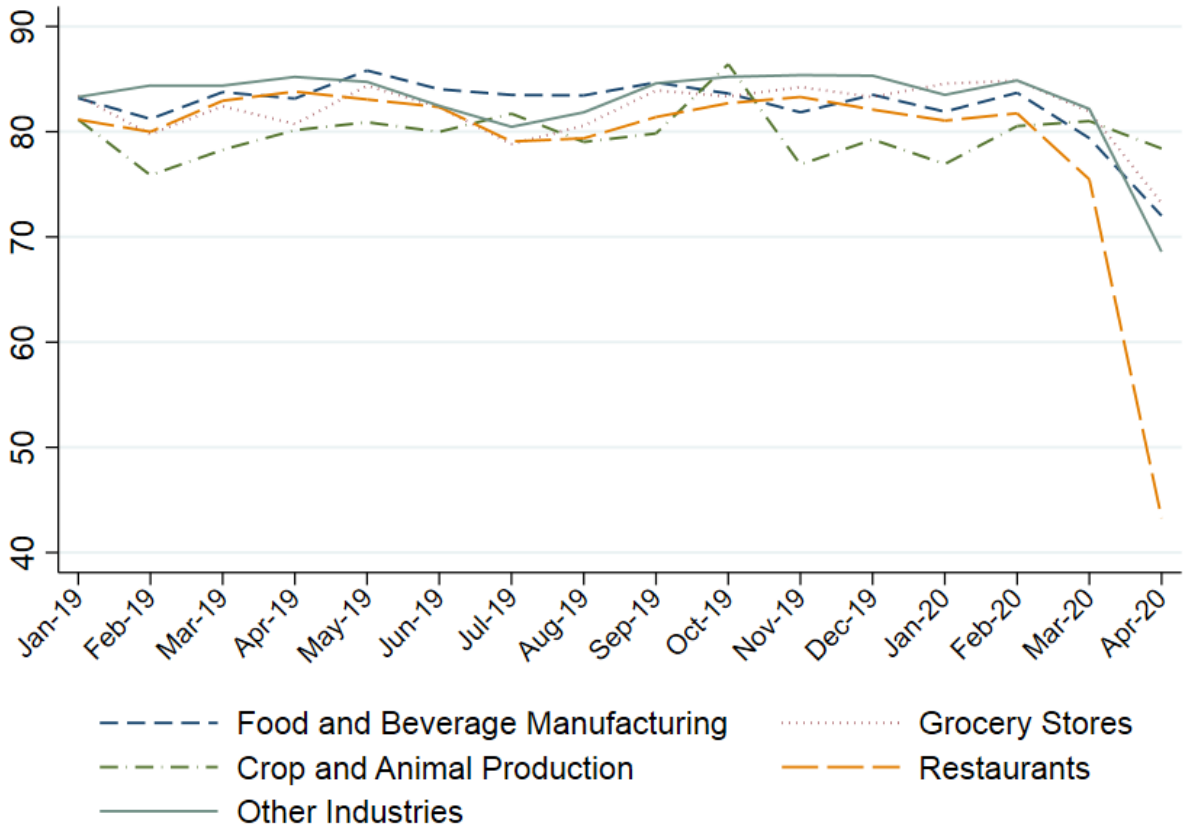

Figure 1: Percentage of Previous Workers Employed At Work in Same Industry

Source: authors' calculations from the U.S. Current Population Survey

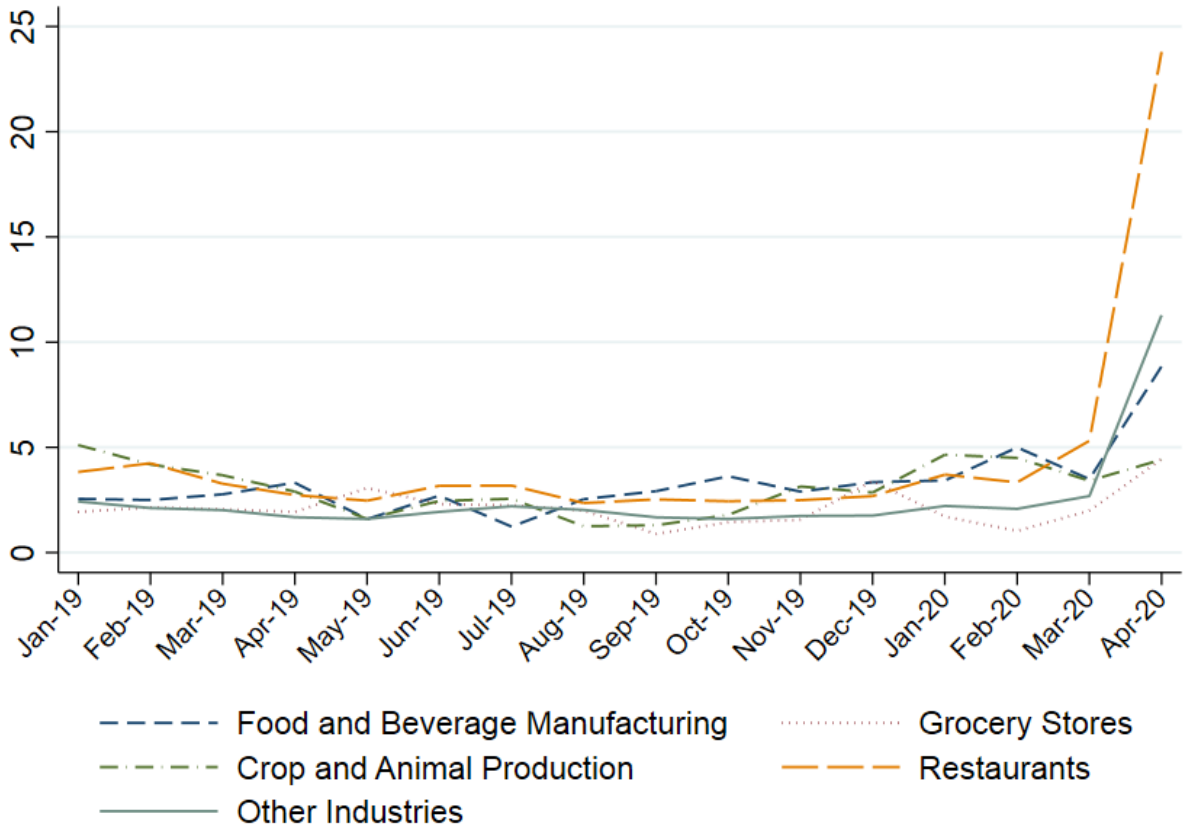

Figure 2: Percentage of Previous Workers Unemployed by Prior Industry

Source: authors' calculations from the U.S. Current Population Survey

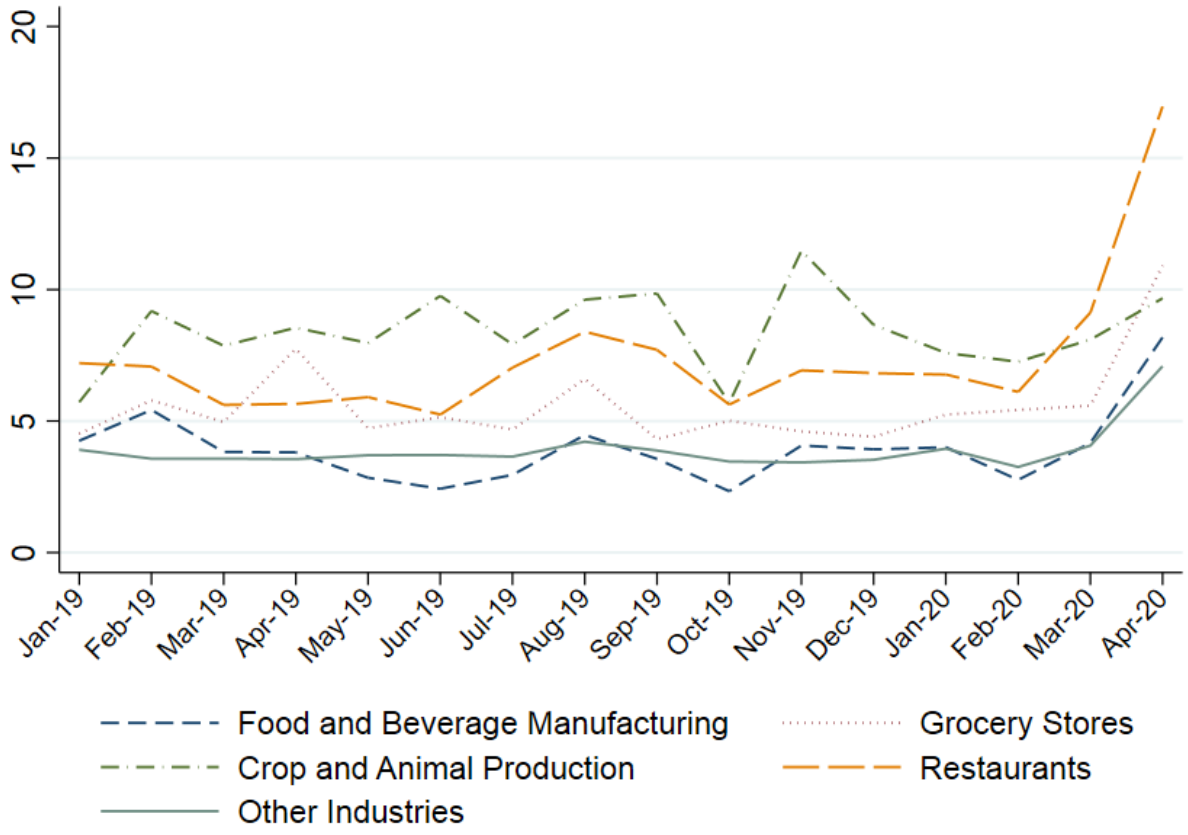

Figure 3: Percentage of Previous Workers Not in the Labor Force by Prior Industry

Source: authors' calculations from the U.S. Current Population Survey

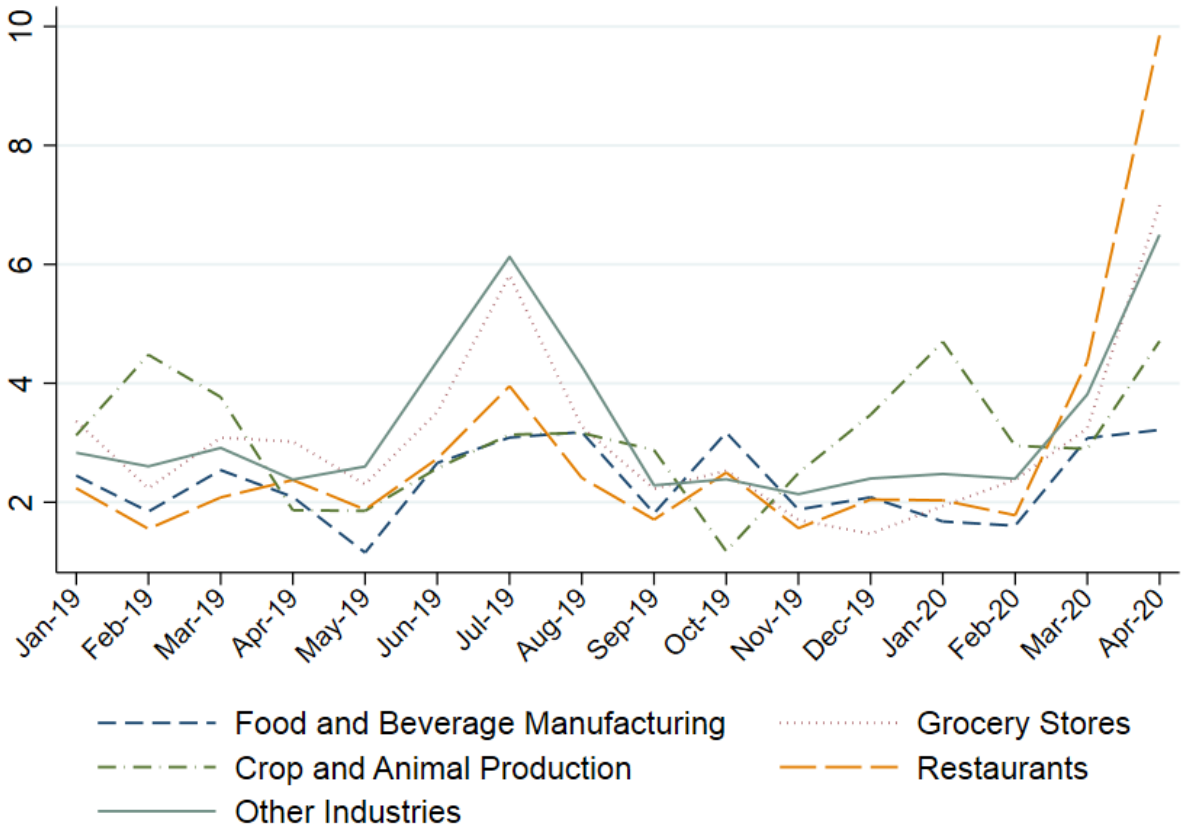

Figure 4: Percentage of Previous Workers with Job but Not at Work by Prior Industry

Source: authors' calculations from the U.S. Current Population Survey

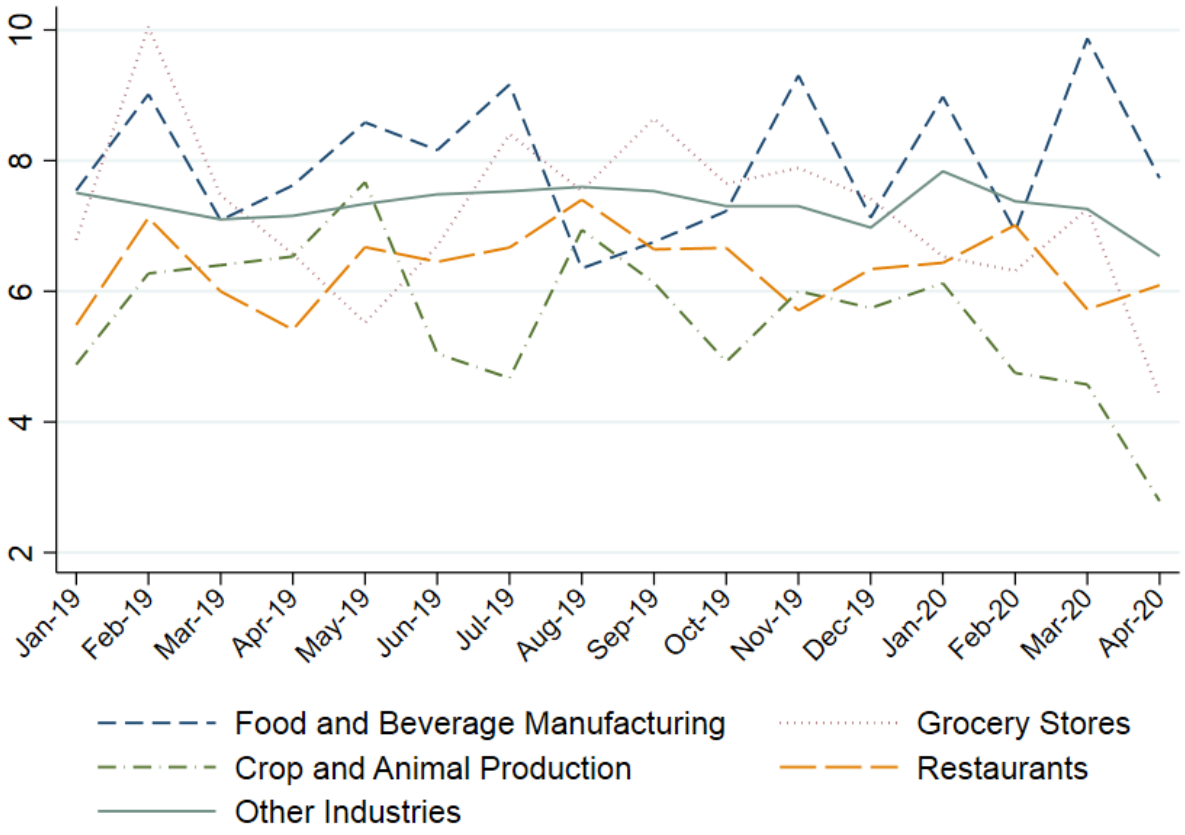

Figure 5: Percentage of Previous Workers Switching Industries by Prior Industry

Source: authors' calculations from the U.S. Current Population Survey

Table 1: Employment Status Rates and Changes for Previous Workers by Prior Industry

	(1) Employed at Work Same Industry	(2) Unemployed	(3) Not in Labor Force	(4) Has Job Not at Work	(5) Employed at Work Diff. Industry
A. Food and Beverage Manufacturing					
April 2020	72.02	8.85	8.18	3.22	7.73
April 2019	83.16	3.32	3.81	2.09	7.62
Apr. Diff.	-11.14***	5.53***	4.38***	1.13	0.11
January 2020	81.91	3.43	4.01	1.68	8.98
January 2019	83.20	2.56	4.25	2.45	7.54
Jan. Diff.	-1.29	0.87	-0.24	-0.77	1.43
Diff.-in-Diff.	-9.85***	4.65**	4.62**	1.90	-1.32
DID St. Error	(3.74)	(1.97)	(2.07)	(1.33)	(2.63)
B. Grocery Stores					
April 2020	73.24	4.44	10.91	7.00	4.41
April 2019	80.73	1.93	7.75	3.02	6.57
Apr. Diff.	-7.50***	2.51**	3.16*	3.98***	-2.15
January 2020	84.57	1.71	5.25	1.94	6.53
January 2019	83.39	1.93	4.52	3.37	6.79
Jan. Diff.	1.18	-0.22	0.73	-1.43	-0.26
Diff.-in-Diff.	-8.67**	2.73**	2.43	5.41***	-1.90
DID St. Error	(3.42)	(1.27)	(2.28)	(1.66)	(2.08)
C. Crop and Animal Production					
April 2020	78.41	4.42	9.67	4.71	2.79
April 2019	80.15	2.90	8.55	1.86	6.53
Apr. Diff.	-1.74	1.52	1.12	2.85**	-3.74***
January 2020	76.94	4.65	7.59	4.70	6.12
January 2019	81.16	5.11	5.72	3.13	4.88
Jan. Diff.	-4.23*	-0.46	1.87	1.57	1.24
Diff.-in-Diff.	2.49	1.98	-0.75	1.27	-4.99**
DID St. Error	(3.69)	(1.96)	(2.43)	(1.68)	(1.95)
D. Restaurants					
April 2020	43.29	23.80	16.96	9.85	6.09
April 2019	83.82	2.74	5.65	2.37	5.41
Apr. Diff.	-40.53***	21.06***	11.31***	7.48***	0.68
January 2020	81.06	3.71	6.77	2.03	6.44
January 2019	81.15	3.83	7.20	2.24	5.49
Jan. Diff.	-0.10	-0.13	-0.43	-0.20	0.95
Diff.-in-Diff.	-40.43***	21.19***	11.74***	7.68***	-0.27
DID St. Error	(1.96)	(1.30)	(1.37)	(0.94)	(1.11)
E. Other Industries					
April 2020	68.59	11.28	7.09	6.50	6.54
April 2019	85.22	1.68	3.55	2.38	7.16
Apr. Diff.	-16.62***	9.60***	3.53***	4.12***	-0.62***
January 2020	83.51	2.22	3.95	2.48	7.84
January 2019	83.31	2.43	3.91	2.83	7.51
Jan. Diff.	0.20	-0.22*	0.04	-0.36***	0.33
Diff.-in-Diff.	-16.82***	9.82***	3.49***	4.47***	-0.95***
DID St. Error	(0.46)	(0.24)	(0.25)	(0.21)	(0.31)

Notes: The sample includes civilians age 16 and over employed during the past 12 months. Industry is for each individual's most recent employment reported in the previous survey month. The Difference-in-Differences estimates are computed as the year-over-year change for April minus the year-over-year change for January. DID standard errors are heteroscedasticity robust standard errors estimated via linear regression.

* Significantly different from zero at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table 2: April 2020 Sample Means for Previous Food Manufacturing and Grocery Store Workers

	Food Manufacturing	Grocery Stores
Dependent Variables		
Employed at Work Same Industry	0.720	0.732
Unemployed	0.088	0.044
Not in Labor Force	0.082	0.109
Has Job Not at Work	0.032	0.070
Employed at Work Different Industry	0.077	0.044
Explanatory Variables		
COVID-19 Confirmed Infection Rate	0.278	0.315
Female	0.399	0.468
Has Kids in Household	0.459	0.271
Female*Has kids	0.193	0.155
Married	0.550	0.369
Ages 16-24	0.108	0.254
Ages 25-34	0.212	0.213
Ages 45-54	0.248	0.146
Ages 55-64	0.178	0.159
Ages 65 and over	0.044	0.069
Black	0.119	0.104
Asian	0.062	0.060
Hispanic	0.293	0.198
Other Non-White	0.025	0.031
High School Diploma	0.409	0.370
Some College, No Bachelor's	0.207	0.321
Bachelor's Degree or Higher	0.194	0.141
Total Observations	562	596

Notes: The sample includes civilians age 16 and over employed during the past 12 months and whose most recent reported industry prior to April 2020 is food manufacturing or grocery stores.

Table 3: Logit Marginal Effects for Previous Food Manufacturing Workers

	(1) Employed at Work Same Industry	(2) Unemployed	(3) Not in Labor Force	(4) Has Job Not at Work	(5) Employed at Work Diff. Industry
COVID-19 Infection Rate	-0.182***	0.053***	0.060***	0.032***	0.009
	(0.039)	(0.018)	(0.016)	(0.011)	(0.018)
Female	0.003	0.006	-0.005	-0.013	-0.001
	(0.057)	(0.040)	(0.026)	(0.016)	(0.040)
Has Kids in Household	0.022	-0.046	-0.037	0.020	0.002
	(0.057)	(0.037)	(0.030)	(0.034)	(0.034)
Female*Has kids	-0.194***	0.150***	0.161***	-0.016	-0.042
	(0.058)	(0.047)	(0.049)	(0.028)	(0.027)
Married	0.028	0.008	-0.032	-0.002	0.022
	(0.048)	(0.032)	(0.030)	(0.024)	(0.032)
Ages 16-24	-0.319***	0.155*	0.104*	-0.010	0.078
	(0.098)	(0.079)	(0.058)	(0.014)	(0.086)
Ages 25-34	-0.085	-0.004	0.047	0.033	0.009
	(0.061)	(0.039)	(0.035)	(0.026)	(0.040)
Ages 45-54	0.003	-0.003	-0.004	0.033	-0.033
	(0.057)	(0.034)	(0.026)	(0.025)	(0.039)
Ages 55-64	-0.107	0.010	0.119*	0.002	-0.026
	(0.071)	(0.045)	(0.066)	(0.018)	(0.041)
Ages 65+	-0.219**		0.204***	0.173*	-0.066*
	(0.101)		(0.074)	(0.093)	(0.037)
Black	-0.020	-0.036	0.041	-0.010	0.011
	(0.080)	(0.039)	(0.054)	(0.018)	(0.046)
Asian	0.068	0.064	-0.078***		-0.045
	(0.085)	(0.079)	(0.019)		(0.035)
Hispanic	-0.006	-0.051	-0.001	0.033	0.023
	(0.059)	(0.036)	(0.035)	(0.022)	(0.045)
Other Non-White	0.080	-0.051	0.066		
	(0.102)	(0.060)	(0.081)		
High School Diploma	0.035	0.007	-0.092*	0.009	0.056
	(0.063)	(0.041)	(0.048)	(0.023)	(0.036)
Some College, No Bach.	0.056	-0.013	-0.069	-0.005	0.037
	(0.074)	(0.046)	(0.065)	(0.026)	(0.041)
Bach. Degree or Higher	0.082	0.001	-0.104*	-0.008	0.041
	(0.086)	(0.044)	(0.062)	(0.025)	(0.062)

Notes: The sample includes civilians age 16 and over in the April 2020 CPS who were employed during the past 12 months and whose most recent reported industry prior to April 2020 was in food manufacturing. Standard errors in parentheses are robust to heteroscedasticity. Marginal effects for Female*Has Kids are relative to males with kids in the household. A few specific explanatory variables are dropped in Columns 2, 4, and 5 along with a few corresponding observations because the explanatory variables perfectly predict the specific dependent variable; i.e., all individuals in the relevant group have zero for the particular dependent variable.

* Significantly different from zero at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table 4: Logit Marginal Effects for Previous Grocery Store Workers

	(1) Employed at Work Same Industry	(2) Unemployed	(3) Not in Labor Force	(4) Has Job Not at Work	(5) Employed at Work Diff. Industry
COVID-19 Infection Rate	-0.078***	0.018**	0.072***	-0.036*	-0.024
	(0.019)	(0.008)	(0.010)	(0.019)	(0.023)
Female	0.057	-0.022	-0.057	-0.002	0.026
	(0.055)	(0.025)	(0.035)	(0.028)	(0.018)
Has Kids in Household	0.150**	-0.048**	-0.117***	-0.002	0.043
	(0.072)	(0.024)	(0.037)	(0.050)	(0.032)
Female*Has kids	-0.150**	0.011	0.072*	0.013	0.050
	(0.065)	(0.022)	(0.038)	(0.051)	(0.042)
Married	-0.027	0.043	-0.018	-0.019	0.013
	(0.054)	(0.033)	(0.032)	(0.031)	(0.032)
Ages 16-24	-0.070	-0.005	0.044	-0.003	0.051
	(0.089)	(0.029)	(0.050)	(0.057)	(0.053)
Ages 25-34	0.021	-0.009	0.026	-0.033	-0.010
	(0.074)	(0.022)	(0.047)	(0.046)	(0.029)
Ages 45-54	0.107	-0.007	-0.045	-0.062	-0.003
	(0.073)	(0.030)	(0.051)	(0.040)	(0.033)
Ages 55-64	0.054	-0.019	-0.017	-0.003	-0.013
	(0.072)	(0.028)	(0.048)	(0.048)	(0.025)
Ages 65+	-0.170	0.064	0.008	0.124	-0.008
	(0.105)	(0.077)	(0.057)	(0.092)	(0.035)
Black	0.015	0.003	0.021	-0.052***	0.012
	(0.080)	(0.028)	(0.052)	(0.020)	(0.046)
Asian	-0.426***	0.025	0.301***	0.104	0.063
	(0.083)	(0.043)	(0.080)	(0.085)	(0.078)
Hispanic	-0.026	0.011	0.042	0.014	-0.033*
	(0.052)	(0.026)	(0.038)	(0.031)	(0.019)
Other Non-White	-0.018		0.055	0.023	-0.040***
	(0.101)		(0.083)	(0.079)	(0.015)
High School Diploma	0.154**	0.015	-0.077**	-0.070	-0.015
	(0.064)	(0.024)	(0.034)	(0.044)	(0.031)
Some College, No Bach.	0.116*	0.021	-0.080**	-0.061	0.007
	(0.061)	(0.028)	(0.038)	(0.048)	(0.032)
Bach. Degree or Higher	0.144*	0.002	-0.030	-0.101**	0.003
	(0.081)	(0.026)	(0.059)	(0.043)	(0.033)

Notes: The sample includes civilians age 16 and over in the April 2020 CPS who were employed during the past 12 months and whose most recent reported industry prior to April 2020 was in food manufacturing. Standard errors in parentheses are robust to heteroscedasticity. Marginal effects for Female*Has Kids are relative to males with kids in the household. The Other Non-White explanatory variable is dropped in Column 2 along with a few corresponding observations because the explanatory variable perfectly predicts the dependent variable; i.e., all individuals in the group have zero for the particular dependent variable.

* Significantly different from zero at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Appendix Tables

Table A1: Labor Market Impacts for March 2020

	(1) Employed at Work Same Industry	(2) Unemployed	(3) Not in Labor Force	(4) Has Job Not at Work	(5) Employed at Work Diff. Industry
A. Food and Beverage Manufacturing					
March 2020	79.39	3.49	4.17	3.08	9.87
March 2019	83.77	2.77	3.83	2.54	7.09
March Diff.	-4.38*	0.72	0.34	0.54	2.78
Diff.-in-Diff.	-3.09	-0.15	0.58	1.31	1.35
DID St. Error	(3.64)	(1.69)	(1.84)	(1.39)	(2.69)
B. Grocery Stores					
March 2020	81.92	1.99	5.59	3.24	7.26
March 2019	82.42	2.06	4.97	3.09	7.47
March Diff.	-0.50	-0.07	0.62	0.16	-0.21
Diff.-in-Diff.	-1.68	0.16	-0.11	1.59	0.05
DID St. Error	(3.17)	(1.10)	(1.87)	(1.43)	(2.19)
C. Crop and Animal Production					
March 2020	81.01	3.42	8.10	2.90	4.57
March 2019	78.29	3.68	7.86	3.77	6.40
March Diff.	2.73	-0.26	0.23	-0.87	-1.83
Diff.-in-Diff.	6.95*	0.20	-1.64	-2.45	-3.07
DID St. Error	(3.57)	(1.88)	(2.22)	(1.56)	(2.07)
D. Restaurants					
March 2020	75.47	5.31	9.12	4.37	5.72
March 2019	82.95	3.27	5.62	2.08	6.00
March Diff.	-7.48***	2.04***	3.51***	2.29***	-0.27
Diff.-in-Diff.	-7.39***	2.17**	3.94***	2.49***	-1.22
DID St. Error	(1.85)	(0.93)	(1.20)	(0.73)	(1.10)
E. Other Industries					
March 2020	82.17	2.69	4.07	3.81	7.26
March 2019	84.38	2.02	3.57	2.91	7.10
March Diff.	-2.21***	0.67***	0.49***	0.90***	0.16
Diff.-in-Diff.	-2.41***	0.88***	0.45**	1.26***	-0.17
DID St. Error	(0.43)	(0.18)	(0.22)	(0.19)	(0.30)

Notes: The sample includes civilians age 16 and over employed during the past 12 months. Industry is for each individual's most recent employment reported one survey month prior. The Difference-in-Differences estimates are computed as the year-over-year change for March minus the year-over-year change for January. DID standard errors are heteroscedasticity robust standard errors estimated via linear regression.

* Significantly different from zero at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2: Food Sector Employment Entry Rate Difference-in-Differences Results

	Food Manufacturing	Grocery Stores	Crop & Animal Production	Restaurants
April - Jan. Diff.-in-Diff.	-0.053	-0.038	0.055	-0.786***
	(0.037)	(0.044)	(0.036)	(0.083)

Notes: The sample includes civilians age 16 and over who were not employed in the specific food sector industry group during the previous survey month. We first compute the entry rates in percentages for each month and then the difference-in-differences as the April year-over-year change minus the January year-over-year change.

* Significantly different from zero at 10% level; ** Significant at 5% level; *** Significant at 1% level.