The Effects of COVID-19 on Major Occupation Groups by State: A Quantitative Study using National Employment Data

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Abstract

This study sought to understand how the national labor force was affected by the state lockdowns implemented in response to COVID-19. Labor data from the Basic Monthly CPS was used to achieve this goal by measuring the number of workers in each major occupation group as categorized in the survey, along with how these numbers changed in response to the lockdowns and after they were rescinded. Two hypotheses were proposed to answer this research question. The number of workers in each occupation group would decrease in 2020 with service workers losing the greatest number and recovering slightly in 2022. Also, states with more service workers during 2018 would lose the highest number of service jobs in 2020 but would recover in 2022. Findings suggest that both of these hypotheses were supported by existing labor data. Relevant literature illustrates that this was due to the face-to-face nature of service work that put these occupations in more direct conflict with lockdown regulations than other occupations. However, there are few studies that analyzed how this trend varied depending on state despite the fact that each state implemented their own lockdown procedures. Existing sociological theory proposed by Davis and Moore suggested that essential work inherently receives more benefits, but findings suggest that this is not accurate as essential occupations experienced higher risks of contracting COVID-19 than most non-essential occupations.

Introduction

The state level lockdowns implemented in response to the COVID-19 pandemic directly led to job loss in occupations across the U.S. economy. The Bureau of Labor Statistics reported that the unemployment rate jumped in 2020 for all occupation groups with service occupations possessing the highest unemployment rate of 13% (Smith, Edwards, and Duong 2021). Since the lockdowns were implemented differently in each state, the composition of the workforce in each state must be taken into consideration. Using available labor data, this study seeks to understand exactly how the lockdown affected the U.S. labor force. Achieving this goal required the employment values of each occupation group before, during, and after the lockdown in the Basic Monthly Current Population Survey (CPS) data. Since service workers were more likely to lose their jobs due to the in-person nature of service work, it was expected that the service occupation group would suffer the greatest employment loss. Next, U.S. states were categorized based on the proportion of service workers they possessed before the lockdown. This allowed the study to observe whether states with more service workers lost more service jobs as the lockdowns were implemented. This included how these states responded when lockdown orders were rescinded in 2022. These methods and overarching theory were used to test two hypotheses; first, that all occupation groups lost workers in 2020 due to the lockdown and regained workers in 2022, but it was service occupations that suffered the greatest proportional loss of workers. The second hypothesis tested whether states with higher proportions of service workers in 2018 lost more service jobs in 2020, but they also experienced a worker recovery in 2022.

The new labor dynamic created by the lockdowns seemed to conflict with established sociological theory proposed by Davis and Moore (1945), who argued that important occupations inherently provided the

most benefits to workers such as stable working hours and higher salaries. According to their theory, a functioning society consists of a hierarchy of social positions which must be filled and carried out by members of that society. In order to motivate an individual to enter and perform the duties of that position it must incentivise them with rewards which contribute to the individuals physical comfort or ego. Davis and Moore also argued that certain positions are more important to maintaining a functional society than others and that these important positions attract individuals with the proper skill set by offering them greater rewards. It is this reality which creates social stratification as the most essential positions inherently provide greater benefits to attract workers, placing them in a different socioeconomic position than those in less essential positions. As individual states implemented their own lockdowns they consciously labeled certain positions as essential to the continued functioning of society. Occupations such as frontline healthcare workers were still allowed to operate during the lockdown despite working in-person but in doing so the workers were at a higher risk of contracting COVID-19. Other non-essential occupations were no longer allowed to work in person but many were moved to remote working environments essentially reducing the risk of contracting the virus. The lockdown not only suggested that the definition of important work can change depending on social context as these changes would not have been performed without the pandemic. It was also implied that essential work does not inherently offer greater benefits as essential workers were risking their own health and comfort in order to perform their work.

Literature Review

Existing literature on this subject tended to group around three main research ideas. These were the impact on employment from variables outside of the lockdown, how occupations in different industries reacted to the lockdown, and the effects of occupation instability on employment.

Impact of Variables Outside the Lockdown

Female and non-white workers tended to suffer higher unemployment rates since they formed the main labor body in the high-risk occupations. Research carried out by Holder, Jones, and Masterson (2020) suggested that this particularly affected African American women since they composed the majority of the labor body in occupations that experienced the most job loss. These were “food preparation and serving” and “personal care and service”. Not only were these occupations unable to be performed remotely, but they were also notorious for their low wages and demanding working conditions. Other researchers revealed that this was the reality for women across the frontline occupations that were considered essential but could not be performed from home (Blau, Mayerhofer, and Koebe 2020). In general, women with children were more likely to be unemployed than men with children during the pandemic. This was attributed to the higher likelihood that a woman would be employed in service work as well as the increased need for childcare after the lockdowns were put into effect (Albanesi et al. 2021). There was no clear evidence as to why married women bore most of the childcare as opposed to married men, but traditional gender norms could have been a contributing factor (Albanesi et al. 2021).

Other researchers explored how immigrant, Latino, and Hispanic workers were affected by the COVID-19 lockdowns. Historically, immigrant men possessed higher employment rates then native men while native women had higher employment rates than immigrant women. However, this changed during the lockdown as the employment rate for native men exceeded that of legal and undocumented immigrant men. Employment rates for immigrant women declined as well while native women were still more likely to be employed. The reasoning can again be attributed to the fact that immigrant men were more likely to be working in jobs that could not be transitioned to a remote environment (Borjas and Cassidy 2020). Latino and Hispanic workers were also subject to higher rates of unemployment for similar reasons as immigrant workers. They tended to compose the majority of employees in occupations that could not be performed remotely such as leisure and hospitality. This trend was most prominent in metropolitan areas such as Las Vegas and Orlando which relied heavily on leisure and hospitality work (Klein and Smith 2021). One study to apply this avenue of research at the state level was conducted by Roy, Dutta, and Ghosh who revealed that states with lower white populations tended to suffer higher unemployment (2021). However, this work was not concerned with measuring occupation trends over time.

Workers with less experience and mental capabilities were also more likely to lose their jobs during the lockdown. This has had a particular impact on younger workers with little working experience as it was expected that the loss of potential revenue for this group would be more damaging to their future than the pandemic itself (Wacher 2020; Polyakova et al. 2020). A different study by Mojtahedi et al. (2021) sought to directly measure a subject's mental capabilities to understand if it had any impact on their lockdown work experience. They measured a subject's mental toughness based on four criteria: their ability to control their own life and emotions, their ability to commit, overall confidence, and their ability to recognize challenges (2021). Findings from this study suggested that individuals who scored highly in these categories tended to have better emotional health during the pandemic. This attention on mental capabilities appeared in literature on the modern trend of mass resignations known as The Great Resignation, as well as literature discussing how workers with various educational backgrounds were affected. According to Daly, Buckman, and Seitelman workers with a bachelor's degree or more education tended to retain their jobs more frequently since they were more likely to be working in a position that could be performed remotely (2020). This was reaffirmed in a study by Furman et al. who noted that women were more likely to leave their occupation if they had a child and less than a bachelor's degree (2021). After states began lifting their lockdown orders a mass exodus of workers from their previous jobs became known as the Great Resignation. Available literature on this subject cited stress as the most significant cause overall behind this trend (Schmid and Melkote 2022; Avitzur 2021; Jiskrova 2022), suggesting that those following the great resignation would have scored lower for mental toughness as the stress of their work led them to leave. Interestingly, an influx of workers in the gig economy demonstrated lower cognitive abilities than before the pandemic, but it was not known if high mental toughness as measured by Mojtahedi et al. (2020) equated to high cognitive abilities. What could be said was that younger workers trying to enter the workforce may have experienced the high stress associated with poor mental toughness affecting their ability to work and remain employed in the lockdown economy. This stress was also felt for older workers as many of them transitioned their work to remote environments. It was not known if this stress translated to job loss since older workers tended to be more focused on economic security and saving for retirement than finding new employment

(Abram, Finlay, and Kobayashi 2022). Overall, the mental capabilities of an individual played a direct role in their job retention during the lockdown as individuals with less professional experience and a lower resistance to stress were more likely to lose their jobs during the lockdown.

Impact of the Lockdown on Different Industries

Employment decreased across the entire economy, but industries that retained more of their employees tended to rely on jobs that could be easily moved to remote environments. For example, industries such as banking and finance which relied on high-skilled technological labor experienced their own hardships as the economy responded to the pandemic, but these hardships didn't translate to job loss as frequently as in other industries (Delardes et al. 2020). Industries that lost jobs more frequently tended to be service oriented and relied on in-person labor. As previously mentioned, service-related occupations experienced the sharpest rise in unemployment out of five occupation categories of 13% while the unemployment rate for Management, Professional, and Related occupations only reached 4.5% in 2020 (Smith, Edwards, and Duong 2021). This occupation category was composed of the same type of work involving high-skilled labor discussed by Delardes et al. (2020) demonstrating the scale of difference between occupations that could adapt to remote work and those that could not. Employment loss was heavily felt in the service, transportation, childcare and tourism industries that relied on individuals performing their work face-to-face with others (Lund et al. 2021). The structure and context of these occupations caused conflict with state level social distancing guidelines and stay-at-home orders. Along with the drop in demand for travel and dining, employment prospects for occupations related to service became slim (Brodeur et al. 2021).

Not all occupations that required face-to-face interaction were immediately canceled. Further research into Unemployment Insurance (UI) claims and job vacancies showed that essential retail and nursing positions did not experience vacancy spikes despite being performed face-to-face. UI claims across all states were also compared, but there were no unique insights to be drawn (Forsythe et al. 2020). There was a noticeable spike in absenteeism among frontline nursing and healthcare workers. However, this was the result of injuries and sickness received on the job and was not considered as loss of employment (Groenewold et al. 2020). Similarly, teaching positions did not experience a sharp decrease in employment. Most teachers conducted their work using online communication tools such as Zoom to teach their classes (Chitra 2020). Other occupations in areas such as construction and some manufacturing could not be performed at home but could still be carried out in person due to the lack of face-to-face interactions. This trend was measured by Avdiu and Nayyar who used data from a labor database named O*NET to measure which occupations were mostly performed within close proximity to consumers or other workers since this work was more likely to conflict with lockdown policy. They found that even though a job may not be able to be performed remotely it could still be carried out if there was little risk of contracting COVID-19 through face-to-face interaction (2020). Overall even if an occupation was deemed essential this didn't guarantee that the occupant would remain employed. Research suggests that in-person occupations could still function as long as the work could be performed remotely or it did not require the labor to be performed face-to-face or in close proximity to others.

Even in industries where job loss was not a high risk, loss of supplies and expensive material had a direct impact on industry performance. This reality was expressed in the construction industry that not only struggled to keep employees but also suffered a decrease in materials and demand. As the pandemic continued, stakeholders adopted new safety measures and practices that allowed construction work to be performed while following COVID-19 guidelines (Abdullah et al. 2021). This reality was reflective of the mining industry in the early pandemic that also suffered from decreased economic demand and supply chain issues early in the pandemic (Laing 2020). Eventually, demand for industrial metals rose late in 2020 following a decrease in COVID restrictions, similarly to the construction industry (Delardes et al. 2020). These developments were consistent across the world as countries like China struggled to maintain its manufacturing output, which had a direct impact on the manufacturing and building capabilities of the United States (Qin 2021). Even though many of these industries did not directly conflict with stay-at-home orders, macro level trends in the economy still caused economic insecurities that made it difficult for workers to remain employed and secure.

Instability in Occupational Structure

In response to these market fluctuations, many workers moved to the gig economy to earn extra income. However, gig workers also suffered from lack of work due to the insecure nature of gig jobs. Relevant literature defined insecure employment as those in which workers had little authority over their own work, little control over their schedules and pay, and tended to receive little material benefits (Wen-Jui and Hart 2021). This reality was felt heavily in the gig economy in which the work tended to consist of irregular tasks and work schedules while also requiring it to be performed face-to-face. This put the gig workers in direct conflict with lockdown orders as discussed previously (Cao, Zhang, and Huang 2022; Federal Reserve Bank of St. Louis 2020; Herrera et al. 2020). Despite this reality, the gig economy experienced a sharp influx of workers after the lockdowns were implemented. This influx reached its peak in early 2020 but dropped off once restrictions were lifted. This was likely caused by large-scale job loss and uncertainty of working arrangements in regular occupations brought about during the early pandemic (Cao et al. 2022). However, this transition did not guarantee that an individual would receive a new source of steady income, as not all workers had access to secure gig wages (Cao et al. 2022). Despite this reality, workers were not dissuaded from participating after the pandemic affected their regular occupations.

Alternatively, larger firms tended to offer jobs with greater security allowing them to retain more highly skilled employees, but they heavily cut back on job postings for those secure positions. Since larger firms were able to offer more secure working hours and salaries, many workers were able to remain employed. Smaller firms with less than 1,000 employees tended to be plagued with uncertainty as the pandemic and lockdown orders led to unpredictable economic changes. This trend persisted regardless of economic sector but was most pronounced in industries that relied on work that could not be performed at home (Lin, Aragão, and Dominguez 2021). Other research suggested that larger firms also downscaled their labor force during the early pandemic which could be surmised by job postings for high-skilled occupations decreasing among larger firms while their proportions of low-skilled vacancy postings decreased at a slower rate (Campello, Kankanhalli, and Muthukrishnan 2020; Forsythe et al. 2020; Brodeur et al. 2021). This could have been an attempt by larger firms

to retain more of their remote workers in order to continue making revenue while also rebuilding their in-person workforce as they adapted to the COVID-19 economy. Further studies revealed that this trend was most prevalent at the firm level, and that there were no obvious trends among U.S. states (Brodeur et al. 2021). Overall, it was clear that despite job loss across all occupations, larger firms were able to retain more of their highly skilled employees by offering secure working conditions while placing more emphasis on hiring for low-skilled positions.

The consequences of this shift in work demand may be felt long after the COVID-19 pandemic as the demand for highly skilled labor may increase. Future work was expected to be more cognitive in nature and require a more diverse skill set from individual workers while placing higher value on education (Shutters 2021). This was already evident by the demand for students with high quality education studying public health (Galea and Vaughan 2021). The anticipated rise of economic protectionism will also play a role in incentivizing companies to hire from a more local pool of educated workers in the future (Ciravegna and Michailova 2021), which may lead to a more competitive market for highly skilled labor. The theme of government interventionism appears again as researchers suggested that the government should be responsible for keeping jobs afloat and stimulating the economy. Fine et al. (2020) suggested that the government could achieve this through tactics focused on increasing consumer demand and reskilling employees through online government backed programs. Other researchers proposed that more protections can be implemented to add more security to gig labor by implementing a minimum gig wage, prioritizing the input of the gig worker in their own job, and better classifying gig workers (Herrera et al. 2020). Though more security would assist gig workers in future crises, most literature suggested that firms ought to focus more on accumulating highly skilled labor after the pandemic.

Overall, literature on the lockdowns and their impact on the U.S. economy was used as a framework to build on with the two hypotheses used in this paper. The first hypothesis tests whether the number of workers in each occupation group decreased in 2020 with service workers losing the greatest number, and recovered slightly in 2022. The second hypothesis tests whether states with higher proportions of service workers during 2018 lost the highest proportion of service workers in 2020 but recovered in 2022. Literature focused on analyzing variables from outside the lockdown suggested that the demographic groups which composed the main labor body of in-person occupations tended to lose their jobs after the lockdowns were implemented. Research conducted on specific industries argued that the industries which relied on in-person labor tended to suffer the most employment loss as the work directly conflicted with lockdown order. This area also suggested that in-person occupations with no remote ability could still be performed if the labor did not require close face-to-face interaction (Avdiu and Nayyar 2020). Occupational instability either caused by the lockdown or existed before the orders was also a contributing factor as the literature suggested that insecure jobs tended to fall victim to lockdown orders or economic instability.

It must also be noted that two large gaps exist in the literature. First, most of the research used to reach these conclusions used data from early in the pandemic before the effects of the lockdown could be measured such as. Second, most of the studies involved did not analyze how occupation trends differed depending on state. One exception was the research on the number of in-person occupations by state conducted by The Federal Reserve Bank of St. Louis (2020) but their study only used data from before the lockdown. This paper adds to

this body of literature by analyzing how pre-lockdown employment compared to employment during and after the lockdown with an emphasis on in-person service occupations. The findings were attributed to individual state workforces to understand how states with more service-oriented labor experienced unemployment during the lockdown and their reactions after the state lockdowns were rescinded

Methods

Data for this study uses the Basic Monthly Current Population Survey (CPS), a government survey administered and published by the Bureau of Labor Statistics and the U.S. Census Bureau. Each sample group in the data was created using a probability selected sample of around 60,000 households in all 50 U.S. states and the District of Columbia. Each household is in the study for 4 consecutive months, removed for 8 consecutive months, and then returned for another 4 months. During the interview week, CPS representatives and telephone interviewers attempt to contact an individual living in a given household and interview them on their occupation details over the previous week. In order to participate in the interview, the respondent must be 15 years of age or older, not currently in the Armed Forces, not serving a prison sentence, and not enrolled in a long-term care hospital or nursing home. The answers given by a respondent were only published if they were 16 years old while no upper age limit was used. This overall methodology not only ensures that the data is being drawn from the civilian labor force, it also assists the generalizability of the findings due to its probability based sampling method.

For the first hypothesis, the independent variable time was measured using data from the Basic Monthly CPS which is a monthly dataset published by the Bureau of Labor Statistics and the U.S. Census Bureau. Responses from the February, March, and April datasets from 2018, 2020, and 2022 were used to compare the labor market before, during, and after the COVID-19 lockdowns. This negates the influence of potential seasonal variation by measuring data from the same months over the six year study period. The number of jobs in each occupation group was the dependent variable and used CPS classifications. Respondents were responsible for providing their own occupation title and information while the CPS administrators recoded their occupation into one of seven major groups: Management, Professional, and Related; Service; Sales and Office; Construction and Maintenance; Farming, Fishing, and Forestry; Production, Transportation, and Material Moving; and Armed Forces. Since the focus of this study was on the civilian labor force, the Armed Forces group was omitted from this analysis

The second hypothesis measured the independent variable time using the same months and years. In addition to the occupation details noted above, CPS respondents indicated their residential state. The total percentage of service workers in each state workforce was computed to easily compare states with different amounts of service workers. Using natural breaks in the distribution, states were categorized into four groups based on this percentage during February 2018. Group 1 states possessed the lowest percentages between 11.6% and 15.3%. Group 2 possessed all states with percentages between 15.4% and 19.0%. Group 3 represented the high values between 19.1% and 22.8%. Group 4 served as the high outlier and only contained Nevada with 26.7% service workers.

The visualizations and statistical tests used to support the research agenda were constructed using Microsoft Excel, SPSS 27, and RStudio. Figures 1 and 2 were built in Microsoft Excel. The regression values within Figure 2 were calculated using RStudio. Paired Samples T-testing was carried out exclusively in SPSS 27 but the pairs, mean differences, standard deviations, and significance values were organized into a table using Excel.

Findings

Figure 1 is a line graph demonstrating that employment dropped dramatically in 2020 for all occupation groups while service occupations lost the greatest proportion of their workforce. All occupation groups experienced their lowest employment values in April of 2020 except for Farming, Fishing, and Forestry which experienced its lowest value in March 2020. There was a period of employment recovery in 2022 for all groups but none achieved their pre-lockdown number of workers. Service occupations began with the third highest employment value with 9,824 workers. Employment loss for Service occupations began in February 2022 and dropped to 5,463 workers in April 2020 which was only 55.6% of their starting value. This suggests that this group lost almost half of its total workforce after the state lockdowns were implemented. This was the highest loss in percentage of workers experienced by all six groups between their starting values in February 2018 and their lowest employment values. Sales and Office occupations began with 12,628 workers in February 2018 and had only 65.6% of that value at their lowest point. Construction and Maintenance occupations began with 4,898 while their lowest point only had 70.3% of that value. Production, Transportation, and Material Moving occupations started with 6,706 and had 71.5% at their lowest point. Management, Professional, and Related Occupations started with the highest employment value of 24,422 in February 2018 and had 79.7% of that value at their lowest point. The group with the lowest starting value was Farming, Fishing, and Forestry with only 476 workers in February 2018 with 80.7% of that value in March 2020. Analysis of Figure 1 did suggest that the first hypothesis was accurate since the number of workers in each occupation group did decrease in 2020 with service workers losing the greatest number and recovering slightly in 2022. All measurable occupation groups did suffer employment loss in 2020, but Service occupations had 55% of their starting employment value in 2020 after the lockdowns were implemented. The other occupation groups still had around 65 - 80% of their starting values at their lowest points.

Figure 2 is a table of bivariate regressions (R^2) calculated to display how predictable the variation in employment values were in each group over time using pre-lockdown values as a baseline. Each R^2 score used occupation employment values from February 2018 to predict the variation in employment values for each subsequent month. All occupation groups experienced their lowest predictability scores in April 2020 while recovering in 2022 but not achieving the same level of predictability as in 2018. The lowest R^2 for the Service group was 0.944 but Farming, Fishing, and Forestry, Construction and Maintenance, and Production, Transportation, and Material Moving all experienced lower predictability scores at the same point as Service. The lowest R^2 overall in April 2020 belonged to Farming, Fishing, and Forestry with 0.739. The groups who were still more predictable than Service at their lowest points were Management, Professional, and Related and Sales and Office with 0.969 and 0.958 respectively. Occupations within the Management, Professional, and

Related group primarily represent the white-collar jobs that could transition to remote working environments. This would have allowed more workers in the group to remain employed thus having a smaller impact on the overall variation of values between February 2018 and April 2020. The high predictability of the Sales and Office group can be attributed to the same reason as Management, Professional, and Related. The high predictability for Service occupations would suggest that the lockdown had a uniform effect on employment in this occupation group even though, as stated previously, this group experienced the greatest overall loss of employment. The fact that the lockdown only prevented jobs that had to be performed with close face-to-face contact could have been the cause of this as these made up the majority of Service occupations. However, the lack of predictability in the other occupation groups suggests that other variables may explain more of their variation besides just the face-to-face factor. Other factors such as supply chain issues, firm size, and general economic uncertainty could have affected the variation within each group in a way that can not be explained just using pre-lockdown employment values.

Figure 3 is a line graph designed to communicate if states with higher proportions of service workers lost more service workers during the lockdowns. All state groups experienced a decrease in percentage of service workers in April 2020 but percentages increased in 2022 for all groups as the lockdowns were rescinded. Again, employment in the recovery period did not reach the same height as their 2018 counterparts. Group 4 (Nevada) began with an average of 26.7% service workers in February 2018 and experienced the most dramatic loss with an average of 12.6%. Group 3 started with 20.4% of service workers in February 2018 and experienced its sharpest decrease to an average of 15.3%. Group 2 began with an average of 16.8% in February 2018 and dropped to 13.1%. Group 1 started with 13.9% and decreased to 11.5%. To summarize, the percent difference between the highest and lowest values in Group 4 was 14.1%, Group 3 was 5.1%, Group 2 was 3.7%, and Group 1 was 2.4%. Interestingly, the recovery period in 2022 surpassed the average value in 2018 with 14.3% in April 2022, suggesting that states with smaller proportions of service workers were able to exceed their 2018 service employment values after the lockdowns. To summarize, these findings do suggest that states with more service workers in 2018 lost more service jobs in 2020 but recovered in 2022 which directly supported the second hypothesis. Groups 4 and 3 had the largest percent differences between their starting percentages in 2018 and their lockdown percentages in 2020. All groups experienced a period of recovery as the lockdowns were rescinded, but only Group 1 seemed to exceed their starting value during their recovery period.

Figure 4 is a table of paired-samples T-tests designed to display the mean difference between two given months of labor data. Each line represents a pair between the pre-lockdown number of service workers and their 2020 or 2022 counterpart of any given month. For each pair there are three values for analysis: Mean Difference, Standard Deviation, and Significance. Within each pair the mean difference is calculated by subtracting the independent mean from the dependent mean. A larger difference suggests that the dependent mean was smaller than the independent mean signifying a decrease over time. The standard deviation measures the average numeric distance between a given point in the data and the mean difference. While significance indicates how likely it is that the mean difference occurred by chance. T-tests were only conducted for groups 1-3 as there was only one state in Group 4 (Nevada). For Group 1, the mean difference and standard deviation started small between February 2018 and February 2020 with a significance score of 0.394. Figure 3 showed that there was no large change in employment between these two months as the lockdowns had not yet had their full effect. This

suggests that this lack of change in Group 1 was likely caused by a factor outside of the data. Mean difference and standard deviation for Group 1 reached their highest values in pair 3 which compares the means from April 2018 with April 2020. As shown in Figure 3, April 2020 was the month that most service workers were lost thus leading to a smaller mean value and a greater difference. This relationship is statistically significant suggesting that the difference in means was not caused by random chance. Each pair after pair 3 decreased in mean difference and standard deviation while remaining statistically significant. This could be attributed to the employment recovery period in 2022 as the lockdowns were being lifted. The same trend persisted in Group 2 except their mean differences and standard deviations were greater than those in Group 1 since states in this group tended to have greater numbers of service workers. Group 3 also experienced this trend as their mean difference for pair three was 106.714 while the highest mean difference in Group 2 was 95.517. However, the accompanying standard deviation in Group 3 was 68.488 which is less than the greatest standard deviation in Group 2 despite the higher proportions. This suggests that although the mean difference was greater in Group 3 the service employment values individual values tended to not be as far from the mean difference. Considering that there are simply less states in Group 3, that means that there were less opportunities for a value to deviate from the mean. Overall findings show that there was a statistically significant mean change over time in each group while groups with more service workers experienced lower mean values of workers over time as demonstrated by the larger mean difference. The only point when the mean difference was not statistically significant was in pair 1 of Group 1 suggesting that its small mean difference was likely due to chance or a variable that was not accounted for in this data set.

Discussion

The first hypothesis of this study argued that the number of workers in each occupation group would decrease in 2020 with service workers losing the greatest number and recover slightly in 2022. Findings suggest that this hypothesis was supported. Due to the in-person and face-to-face nature of service work this placed service workers in direct conflict with lockdown orders more frequently than other occupations (Holder et al. 2020). Resulting in a dramatic loss of service workers after the lockdowns were implemented. It should be noted that occupations which relied on in-person labor could still be performed during the lockdown if the work did not require close face-to-face contact with other workers or customers. Research performed with the O*NET Database suggested that this was prominent in teaching, manufacturing, and construction occupations as the lockdown progressed (Avdiu and Nayyar 2020), explaining why these groups suffered fewer losses than Service occupations while still being less predictable using only pre-lockdown employment data. Despite the fact that unemployment was felt in occupations across all industries many non-essential jobs could still be performed during the lockdown era. Management, Professional, and Related and Sales and Office occupations tended to rely on high-skilled technical work that could be performed remotely, allowing many workers to remain employed (Delardes et al. 2020).

These findings formed the basis of the second hypothesis which argued that states with more service workers during 2018 would lose the highest number of service jobs in 2020 but would recover in 2022. Most literature did not seek to measure occupation trends within each state despite the fact that each state was

responsible for implementing their own lockdown. The most relevant study was performed by The Federal Reserve Bank of St. Louis (2020) who categorized U.S. states based on their number of in-person occupations but this study was only able to use pre-lockdown employment data. Findings from this research address this gap in the literature by using more recent labor data to measure the behavior of in-person occupations within each state before, during, and after the lockdowns were implemented. While categorizing states based on their service employment characteristics to understand how different workforces were affected throughout the study. With these insights, future researchers will have a better understanding of how future pandemics may impact any given state and the U.S. industry as a whole.

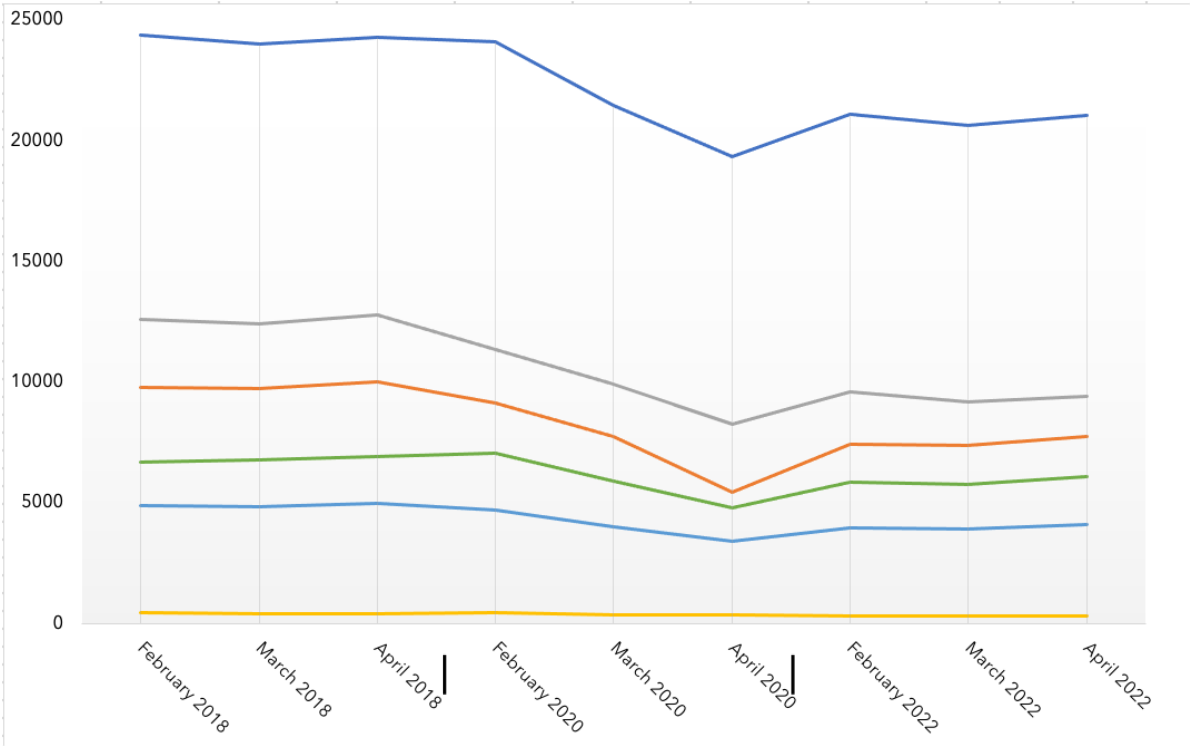
Overall, these findings suggest that imperfections exist in the works of Davis and Moore (1945). The first is that the nature of essential work can change depending on social context and is not as rigid as they suggested. Occupations such as retail workers, healthcare aids, and nurses were not considered as essential to the functioning of society as they were during the lockdown. This only changed when supply and public health issues became a direct threat to individual U.S. citizens. But despite this change, they also did not receive the greater benefits meant to incentivise workers in these essential occupations. In reality the close contact to COVID-19 and the high stress associated with these jobs posed a direct threat to the health of essential workers and contributed to absenteeism in health related work (Groenewold et al. 2020). Rather than incentivising workers to participate in these socially important roles, the high risk acted as a disincentive. Work that was labeled as non-essential in industries such as finance and technology were able to perform their work remotely and still maintained their pre-lockdown benefits (Delardes et al. 2020). This allowed pre-lockdown structures of social stratification to persist despite the fact that the definition of essential work had changed in a way that could not be accounted for by Davis and Moore.

However, there were several weaknesses in this study related to measurement and causal validity. The Service Occupation groups were used as a proxy for in-person occupations but there was no direct way to ensure that this assumption was valid. Relevant literature and the findings from O*NET served as a form of justification as workers in the service occupation group were more likely to say that their work was done in close proximity to others. Besides measuring in-person labor, this study was unable to explore the effects of other variables on employment values such as firm size, ethnicity, education, mental toughness, remotability, essential status, and the role of the gig economy. This reality persisted in the findings as pre-lockdown values alone could not predict all of the variation in lockdown employment values, suggesting that one of these variables may be more accurate predictors. Also, the monthly nature of the study did not account for the irregular implementation of state mandated lockdowns. State lockdowns were implemented at their own times and not all in one month. Since this study incorporated three months from 2020, it was able to show how the implementation of lockdowns over time were felt by each occupation group and state group. Future researchers should address these issues by measuring and comparing the different variables based on the impact they impressed on employment trends within each occupation group. Analysis of gig economy participation could be an extension of this research as workers may have transitioned to gig work rather than remaining unemployed after their regular occupation was canceled. Also, researchers could further the state level analysis by uncovering the exact lockdown procedures of each state and how they influenced occupation trends within each state. This

would help compare the impact on non-essential work to essential work within each occupation group and help future U.S. workers to understand which occupations may become essential in future pandemics.

Tables

Figure 1: Total Employment Over Time by Occupation Group



Legend

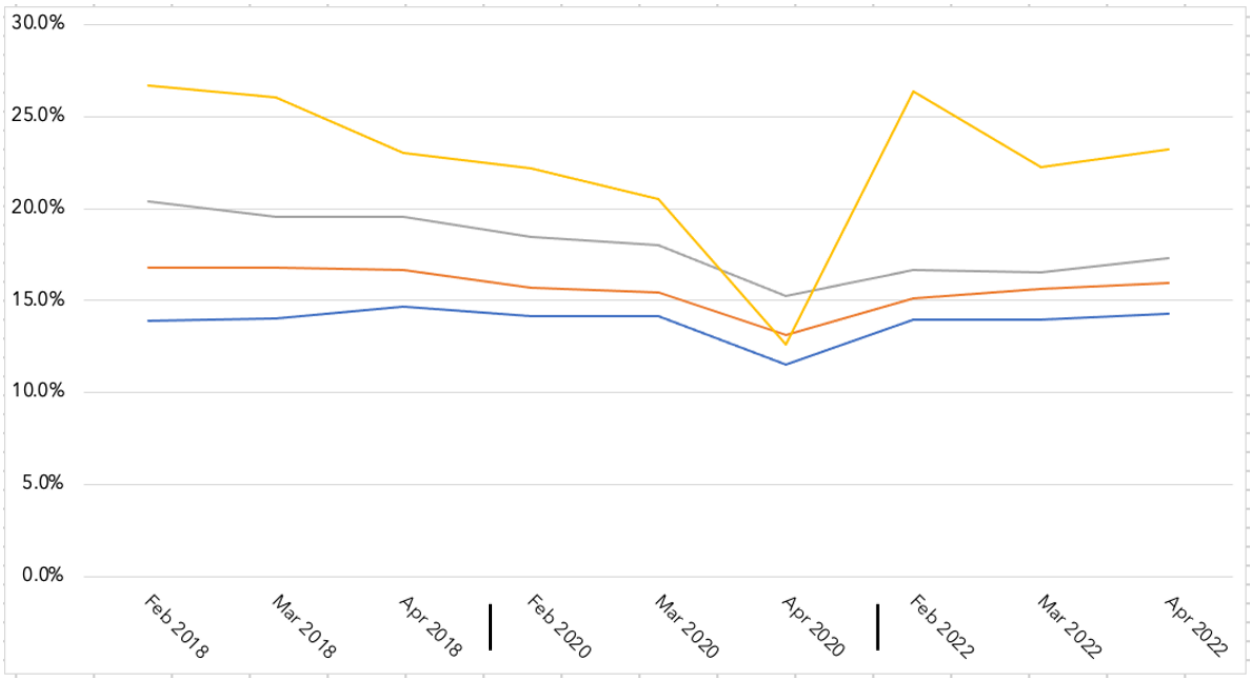
- = Management, Professional, and Related Occupations
- = Sales and Office Occupations
- = Service Occupations
- = Production, Transportation, and Material Moving Occupations
- = Construction and Maintenance Occupations
- = Farming, Fishing, and Forestry Occupations

Figure 2: Bivariate Regressions of Employment Values by Occupation Group

Occupation Groups	Ind. Variable	February 2018	March 2018	April 2018	February 2020	March 2020	April 2020	February 2022	March 2022	April 2022
Management, Professional, and Related	February 2018	1.000*	0.995*	0.989*	0.985*	0.977*	0.969*	0.979*	0.976*	0.980*
Service	February 2018	1.000*	0.985*	0.980*	0.968*	0.967*	0.944*	0.942*	0.945*	0.955*
Sales and Office	February 2018	1.000*	0.993*	0.988*	0.978*	0.970*	0.958*	0.965*	0.973*	0.970*
Farming, Fishing, and Forestry	February 2018	1.000*	0.920*	0.800*	0.744*	0.754*	0.739*	0.819*	0.829*	0.831*
Construction and Maintenance	February 2018	1.000*	0.981*	0.960*	0.955*	0.940*	0.890*	0.950*	0.947*	0.925*
Production, Transportation, and Material Moving	February 2018	1.000*	0.983*	0.982*	0.960*	0.949*	0.906*	0.950*	0.960*	0.953*

*Relationship is significant at the 0.05 level

Figure 3: Average Percentage of Service Workers Over Time by State Group



Legend

= Group 4 (High Outlier)

= Group 3 (High)

= Group 2 (Medium)

= Group 1 (Low)

Figure 4: Paired Sample T-tests of Service Workers Over Time by State Group

State Group 1 (Low)				
		Mean Difference	Standard Deviation	**Significance**
Pair 1	SFeb2018 - SFeb2020	4.500	19.110	0.394
Pair 2	SMar2018 - SMar2020	21.857	25.878	0.008
Pair 3	SApr2018 - SApr2020	68.429	39.289	0.000
Pair 4	SFeb2018 - SFeb2022	24.929	25.110	0.003
Pair 5	SMar2018 - SMar2022	23.643	32.217	0.017
Pair 6	SApr2018 - SApr2022	29.143	32.246	0.005
State Group 2 (Medium)				
		Mean Difference	Standard Deviation	**Significance**
Pair 1	SFeb2018 - SFeb2020	12.276	31.413	0.044
Pair 2	SMar2018 - SMar2020	43.517	30.779	0.000
Pair 3	SApr2018 - SApr2020	95.517	79.024	0.000
Pair 4	SFeb2018 - SFeb2022	50.759	29.939	0.000
Pair 5	SMar2018 - SMar2022	50.034	29.245	0.000
Pair 6	SApr2018 - SApr2022	47.207	39.524	0.000
State Group 3 (High)				
		Mean Difference	Standard Deviation	**Significance**
Pair 1	SFeb2018 - SFeb2020	29.875	9.564	0.000
Pair 2	SMar2018 - SMar2020	52.714	34.693	0.007
Pair 3	SApr2018 - SApr2020	106.714	68.488	0.006
Pair 4	SFeb2018 - SFeb2022	75.857	39.692	0.002
Pair 5	SMar2018 - SMar2022	74.143	36.898	0.002
Pair 6	SApr2018 - SApr2022	65.857	43.667	0.007

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