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# **How the COVID-19 Pandemic Affected the U.S. Residential Construction Industry’s Labor Workforce: An Analysis of Interior vs. Exterior Trades in three Metropolitan Areas**

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The coronavirus disease has plagued the United States beginning in March 2020 and extending to today, leaving everyone uncertain. Governmental shutdowns, the spread of infection, and more than a million deaths have threatened communities and industries. The residential construction industry was not immune to these challenges. In particular, the residential construction industry contributes significantly to the United States’ economic health and growth, so it is crucial to understand this industry’s adversities during the pandemic. This study aims to understand the residential construction industry’s employment differences between different construction trades and different geographical areas pre-COVID-19 and during COVID-19. The geographical areas analyzed were three metropolitan areas in the U.S., including Miami, FL., Los Angeles, CA, and Columbus, OH. Six different trades were analyzed within these three metropolitan areas, consisting of three interior and three exterior trades. The results indicated an employment disparity amongst construction trades across different metropolitan areas. With this information, the residential construction industry may understand which trades and their geographical areas are more susceptible to employment hardships during economic and health downturns.

**Key Words:** Pandemic, Employment, Residential, Metropolitan Statistical Areas

## **Introduction**

The coronavirus disease, also known as COVID-19, has left its mark not only on our entire world but it has also left a significant impact on the residential sector of the construction industry. COVID-19 was first detected in Wuhan, China, on December 31, 2019, and continued to spread worldwide for several years. As a result, on March 11, 2020, World Health Organization (WHO) declared COVID-19 a global pandemic (WHO Director-General, 2020). A global pandemic is an outbreak of a disease “occurring over a wide geographic area (such as multiple countries or continents) and typically affects a significant proportion of the population.” (Merriam-Webster, 2022).

The U.S. residential construction sector averages 3-5% of the gross domestic product. The residential construction includes new construction of multi-family housing and single-family homes, residential remodeling, and the construction of manufactured homes. When this residential investment is combined with the consumption spending on housing services such as rents and utilities, the residential construction sector makes up 15-18% of the GDP (NAHB, 2022). The residential construction sector contributes substantially to the health and growth of the U.S. economy. With residential construction being a prominent participant in the health of the U.S. economy, it is essential to understand precisely how it was affected during the COVID-19 pandemic to help insulate this significant economic contributor from adverse effects from potential future health or governmental industry restrictions (Bauer et al., 2020).

Previous studies have been conducted on construction employment and how COVID-19 has affected the industry (Afkhamiaghd & Elwakil, 2020). Still, no studies have been discovered on the employment rates among specific residential trades during the COVID-19 pandemic. Therefore, this research aimed to answer how the COVID-19 pandemic affected the construction industry employment rates among residential interior and exterior trades in Los Angeles, CA., Columbus, OH., and Miami, FL. The research questions were:

- Were there differences in the unemployment rates amongst these trades depending on three different metropolitan cities of the United States that would indicate a geographic disparity?
- Did the construction trades show any difference in employment pre-COVID-19 and during COVID-19?
- If there was a difference in employment, did the construction industry trades show resiliency and bounce back?

This study adds to our understanding of how the pandemic hit trades and the most challenging metropolitan areas in the residential construction industry. Based on these answers, there may be a better understanding of if and why different parts of the country are more susceptible to industry interruptions and if specific trades are more resilient to contagious illnesses because of safety measures implemented.

## Literature Review

In 2019, the residential construction industry contributed to 4.1% of the total Gross Domestic Product (GDP) in the United States (Biswas et al., 2021). Cities or metropolitan areas hit the hardest during the first wave of the pandemic tended to be those with an international airport and were a global hub for business and travelers, such as Miami, FL. The less connected areas of the country were hit later by the virus when different control measures were in place (Florida et al., 2021). The pandemic calendars from the New York Times showed Miami, FL, was affected harder with infected individuals than Los Angeles, CA. or Columbus, OH (The New York Times, 2022). In addition to the geographical region contributing to the infection rate, the work type also shaped the spread of the pandemic. As office-based workers typically performed their work from home, the public-facing employees remained more exposed to the virus. The communities most devastated by the COVID -19 virus were the working-age Latinx and African American communities (The Atlantic Monthly Group, 2021). The COVID-19 illness in these communities was attributed to comorbidities, crowd housing, and work patterns. Many individuals in these communities worked in what were deemed essential sectors of the economy. Typically, these individuals did not have the option of working from home. Studies showed that the primary source of exposure to COVID-19 for these employees was their workplace. In many cases, these work environments did not provide sufficient social distancing, personal protective equipment (PPE), or adequate ventilation and sanitation (The Atlantic Monthly Group, 2021).

### *Safety Measures Implemented*

In the U.S., the Occupational Safety and Health Agency (OSHA) ensures safe and healthy working conditions for construction workers by implementing and enforcing health standards. This government agency is a part of the U.S. Department of Labor. OSHA implemented guidelines during the pandemic to help protect individuals from contracting COVID-19 while working in the field. At the onset of the pandemic, there were no vaccines, so other risk mitigations were implemented. The steps suggested by OSHA for employers to keep their workers safe were to make sure sick workers stayed home, implement physical distance by more than 6 ft, keep in-person meetings short, provide and instruct all workers to wear face masks, and wear PPE. If necessary, the employers were instructed to use the Environmental Protection Agency (EPA) approved cleaning supplies to clean tools and machines and ensure that shared working spaces had good airflow (U.S. Dept of Labor, 2020). In addition to these new guidelines, OSHA implemented additional procedures for those working in carpentry, plumbing, heating/ventilation/air conditioning/ventilation, and masonry.

### *Employment rates*

This study looks at how the construction industry's employment rate was affected by COVID-19 amongst six construction trades across three metropolitan areas. Out of the six different trades, three were interior trades, and three were exterior trades. The interior trades were associated with being on the job site after the walls, roof, and windows were in. These essentially would be trades working in an enclosed building. The three interior trades selected were drywallers, plumbing/HVAC, and finish carpentry. The exterior trades were trades that worked on the shell of the building and worked outdoors. The three exterior trades researched in this study were framers, roofers, and masonry. Additionally, these six trades were chosen because they were the trades that were diligent and thorough in reporting employment numbers to the U.S. Bureau of Labor Statistics by providing complete data sets for every quarter. Many other trades did not have consistent and complete data sets that could be used for the research. Since the construction industry is one of the largest contributing industries to the U.S. gross domestic product (GDP), it is important to understand which construction trades were impacted the most due to the virus. Unfortunately, there have not been studies on the different trades and the effect of COVID-19 to date. Still, the thought was that because interior tradespeople work in an enclosed space on the interior of the building, they work side by side with multiple trades. In addition, because they work in less ventilated areas, they would be more affected than contractors working on the exterior of the building, where individuals are naturally more distanced from others and benefit from fresh air.

### **Methodology**

This research aimed to quantify the impact of COVID-19 on the United States residential construction industry. The first step was to conduct a thorough and detailed literature review by collecting relevant articles to obtain knowledge on how COVID-19 impacted the construction industry by using search engines such as Google Scholar, American Society of Civil Engineers (ASCE), Center for Disease Control and Prevention (CDC), World Health Organization (WHO), and the Bureau of Labor and Statistics (BLS). Research questions were then formulated based on the limited research on this topic since it was a constantly changing situation. For example, how has the COVID-19 pandemic affected the construction industry's employment? Which trades had the most significant employment impact during the 15 months before the pandemic consisting of January 2019 – March 2020 and then 15 months after the U.S. deemed this pandemic a national emergency in the duration of April 2020 – June 2021?

Craft labor data was collected from the U.S. Bureau of Labor Statistics (BLS) at the metropolitan statistical area (MSA) geographic level. An MSA is classified as an urbanized area with at least a population of 100,000 (U.S. Census Bureau, 2013). This classification is utilized in craft labor data collection, analysis, and publication for federal agencies such as the BLS. Unfortunately, the nature of reporting during the pandemic to the BLS was inconsistent among different metros and trades, which caused some challenges. Many craft trades at the metropolitan statistical area (MSA) level had incomplete data sets, limiting the study to only those trades and metro areas that had reported consistently during COVID-19. Los Angeles, CA; Columbus, OH; and Miami, FL MSAs were selected as case study locations for this study based on three criteria. First, COVID-19 cases and deaths varied widely across different U.S. cities throughout the pandemic. MSAs were chosen as the geographical level for data collection since the labor, and COVID-19 data would reflect localized conditions. Second, these MSAs were chosen because each is in a different location across the United States, with Los Angeles, CA, on the west coast, Miami, FL, on the east coast, and Columbus, OH, on the northern Midwest. Third, the MSAs were chosen because they had complete data sets for three exterior trades (e.g., framing, roofing, and masonry) and three interior trades (e.g., drywall, plumbing/HVAC, and finish carpentry) for all ten quarters (30) months of the study timeframe from January 2019 to June 2021.

The shutdown and restrictions for the three studied MSAs all deemed residential construction as an essential industry, according to the Department of Homeland Security's Cybersecurity and Infrastructure Security Agency (CISA). In Los Angeles, the orders were revised on April 10, 2020, and were in effect until May 15, 2020. The variance was that all people were ordered to stay in their homes, and businesses needed to stop all operations. The exceptions included essential infrastructure, which included the operation, inspection, and maintenance of the construction of residential buildings and housing. In Columbus, construction was allowed as an exception under the CISA classification of essential sectors and critical trades. This restriction was in place from April 2– May 1, 2020. Finally, Miami had the least governmental restrictions. Florida governor issued specific variances for Miami that allowed open construction sites no matter the building type, and other tradespeople who maintain safety, sanitation, and essential operations to residential structures essential (Foley, 2020).

The North American Industry Classification System (NAICS) is the standardized classification of businesses used by Federal agencies when analyzing or collecting data regarding the U.S. business economy. For instance, the NAICS for construction is labeled as number 23. However, each specific trade has other numbers after the general 23 classifications to further classify them. For instance, for the residential framing contractors, the number is 238131; residential masonry contractors are 238141; residential roofing contractors are 238161; residential plumbing and HVAC contractors are 238221; residential drywall contractors are 238311; and residential finish carpentry contractors are 238351 (BLS, 2020). These numbers were then used to look up data in the Quarterly Census of Employment and Wages (QCEW). The QCEW receives a Quarterly Contribution Report (QCR) from private-sector employers. The collected data was the monthly employment rates for each trade in each MSA area from January 2019 through June 2021 (BLS, 2022).

The results from the QCEW were collated in Excel, and a Mann-Whitney statistical analysis was performed. This two-tail t-test test was the recommended standard for data where normality cannot be presumed (Streiner, 2015). The Mann-Whitney test was performed in Excel using XLSTAT. This test is a non-parametric test where two independent samples can be compared. Microsoft Excel (XLSTAT) was used to conduct the Mann-Whitney U test, as shown in Equation 1.

$$U \text{ stat} = \text{Rank Sum} - [n(n - 1) / 2] \quad (1)$$

Two groups were determined to be significantly different using the significance level = 0.05. The pre- and during-COVID-19 employment rates were compared using equal sample sizes. The 15 months of employment before COVID-19 were determined to be January 2019 – March 2020, when the U.S. classified COVID-19 as a national emergency. The second sample was from the following 15 months April 2020 to June 2021.

## Results and Discussion

Results of this study highlight changes in residential contractor employment rates before and after COVID-19 across three metropolitan areas – Miami, FL; Columbus, OH; and Los Angeles, CA. Tables 1, 2, and 3 illustrate the Mann-Whitney t-test results comparing the 15 months of pre-COVID-19 with 15 months of active COVID-19. In addition, a two-sample t-test was performed to determine whether the employment during the 15 months before COVID-19, consisting of January 2019 to March 2020, and 15 months during COVID-19, including from April 2020 to June 2021, was significantly different. As illustrated in these tables, if the p-value is less than 0.05, the residential trade showed a significant change in employment during COVID-19. The mean in the tables represents the number of employees. In these tables, the negative employment change is indicated with a negative symbol (-), with the **bold numbers** showing a significant negative employment change from pre-COVID-19 to during COVID-19. Conversely, the positive sign indicates a positive change in employment, and the **bold numbers** demonstrate a significant positive employment change from pre-COVID-19 to during COVID-19.

Table 1 shows varied results within the trades in Miami, FL. These results showed a significant negative difference in employment between the pre-COVID-19 months and the COVID-19 months, with p-values below 0.05 among the framing contractors, roofing contractors, and masonry contractors and a significant increase in employment for the plumbing/HVAC contractors. On the other hand, drywall and finish carpentry contractors showed no significant difference.

Table 1

### *Differences in Residential Employment in Miami, FL.*

Contractor	Before Pandemic (Jan 2019 – May 2020)		After Pandemic (Apr 2020 - Jun 2021)		P-value	Trade Type	Employment Change
	Mean	SD	Mean	SD			
Framing	825	79	707	44	<b>&lt;0.0001</b>	Exterior	<b>(-) 1,760</b>
Roofing	5,489	116	5,203	183	<b>&lt;0.0001</b>		<b>(-) 4,293</b>
Masonry	1,238	98	1,025	48	<b>&lt;0.0001</b>		<b>(-) 3,185</b>
Drywall	1,759	70	1,723	59	0.170	Interior	(-) 536
Plumbing /HVAC	13,238	309	13,455	311	<b>0.015</b>		<b>(+) 3,245</b>
Finish Carpentry	4,007	57	4,021	161	0.170		(+) 205

Table 2 shows the results for residential contractors in Columbus, OH, indicating a significant positive difference in employment from pre-COVID-19 to during COVID-19: the framing contractors, the roofing contractors, the drywall contractors, and the plumbing/HVAC contractors. The masonry and finish carpentry contractors showed no significant change in employment. The

critical outcome of this study was how resilient the metropolitan area of Columbus, OH was during COVID-19. All six of the residential construction trades had an increase in employment, and four of those trades had significant positive employment results. This finding could be possible due to Ohio being more insulated in the mid-northern U.S. Also, better education and vaccines were being implemented when the virus reached the middle of the U.S. The increase in employment for all trades might also result from the construction lag. The lag and the low-interest rates for residential construction may have lent themselves to the rise in the residential construction industry in that MSA.

Table 2

*Differences in Residential Employment in Columbus, OH.*

Contractor	Before Pandemic (Jan 2019 – May 2020)		After Pandemic (Apr 2020 - Jun 2021)		<i>P-value</i>	Trade Type	Employment Change
	Mean	SD	Mean	SD			
Framing	74	7	89	3	<b>&lt;0.0001</b>	Exterior	(+) <b>218</b>
Roofing	464	31	514	44	<b>0.001</b>		(+) <b>761</b>
Masonry	268	41	277	36	0.662		(+) 137
Drywall	499	21	533	28	<b>0.002</b>	Interior	(+) <b>510</b>
Plumbing /HVAC	3,022	88	3,256	125	<b>&lt;0.0001</b>		(+) <b>3,516</b>
Finish Carpentry	400	13	422	16	<b>0.000</b>		(+) <b>325</b>

Los Angeles' masonry contractors, plumbing/HVAC contractors, and finish carpentry contractors had a significant negative difference in employment, as shown in Table 3. Whereas framing, roofing, and drywall contractors had no significant change in employment. Los Angeles metropolitan area had altering results in employment among the different trades.

Table 3

*Differences in Residential Employment in Los Angeles, CA.*

Contractor	Before Pandemic (Jan 2019 – May 2020)		After Pandemic (Apr 2020 - Jun 2021)		<i>P-value</i>	Trade Type	Employment Change
	Mean	SD	Mean	SD			
Framing	4,353	314	4,459	231	0.217	Exterior	(+) 1,582
Roofing	3,430	188	3,346	139	0.054		(-) 1,260
Masonry	2,501	119	2,329	85	<b>0.000</b>		(-) <b>172</b>
Drywall	7,362	242	7,497	316	0.217	Interior	(+) 2,024
Plumbing /HVAC	21,064	335	20,246	700	<b>&lt;0.0001</b>		(-) <b>12,273</b>
Finish Carpentry	4,644	85	4,476	201	<b>0.026</b>		(-) <b>2,517</b>

In Los Angeles, the framing and roofing trades did not see a significant change in employment. However, mason, finish carpentry, and plumbing/HVAC contractors significantly negatively affected

employment during COVID-19. These were surprising results since the other two metropolitan areas had a positive increase in employment for both plumbing/HVAC contractors and finish carpentry contractors. Maybe these contractors were more exposed because they were in enclosed buildings, were not able to socially distance the 6ft, did not have adequate ventilation, did not have enough PPE, or because their work tasks overlapped, so all three of these trades could have been in the buildings at the same time leading to more exposure.

The original research hypothesis was that the interior trades' employment would be more significantly affected by COVID-19 than the exterior trades since exterior workers have more room to distance themselves socially. This hypothesis may have proven correct for the most part for the Columbus, OH, and Los Angeles, CA MSAs. However, the Miami, FL MSA results were unexpected, with the exterior trades being the most negatively affected. A potential reason for this might be that Florida's construction industry, no matter what type of building, was exempt from shutdowns (Foley, 2020). The lack of governmental restrictions in Miami might explain why all three exterior trades were significantly negatively affected by employment after COVID-19 hit. Without restrictions and monitored guidelines, the trades may have been in closer and more frequent contact with each other. Another explanation may be that the exterior trades require more crew members, increasing the virus's risk. For example, the roofers, framers, and masons rely on a multiple-person crew to construct walls, install roofs, mortar, and stone walls, etc. These tasks cannot be completed by a one- or two-person crew. Florida was also known for their residents not complying with safety measures as much as the rest of the country. If safety measures such as social distancing, masking, and hand washing frequently were not enforced, then this might explain why these trades were affected.

Although all or some of these factors may have played a role in the unexpected findings in Miami, it seemed evident that an important factor to investigate might be the lower socio-economic classes. The lower socio-economic classes were shown to have been the most affected by the pandemic, and exterior trade workers are more likely to be classified as low-income (Bauer et al., 2020). Low-income workers are also more likely to live in multi-family households that produce more exposure to the virus. In addition, individuals in this class typically had jobs that did not provide the ability to telework which may have lent itself to more exposure for these individuals (Hershbein & Holzer, 2021). Still, one of the main ideas that were sparked by this research was that there should be more studies on how the pandemic affected the socio-economic classes. Typically, these exterior trades in Miami are employed with individuals from a lower socio-economic class. Previous studies discovered that the virus impacted the lower socio-economic classes and the secondary effects the virus caused (Bauer et al., 2020).

In contrast to the exterior trades of Miami, the interior trades of drywallers and finish carpenters in Miami did not have a significant change which may be attributed to the fact that with both trades, they are typically the only trades in the home during their scheduled construction time. Therefore, they may not have been exposed to many people, limiting their risk of contracting the virus. Another layer of protection for the drywallers is that even before COVID-19, drywallers typically wore N95 masks during some of their duties of mudding and spraying texture. This practice adds a layer of protection from the virus. It may explain why the drywall contractor were the only trade in all three metropolitan areas with no adverse change in employment, only a significant positive change.

Figures 1 and 2 give a more visual understanding of what happened with employment during the 15 months before and during COVID-19 among the three MSAs with the masonry contractors and the drywall contractors. The drywall contractors stayed consistent, but the masonry tells a different story, and it is evident there was a significant decrease in the spring of 2020.

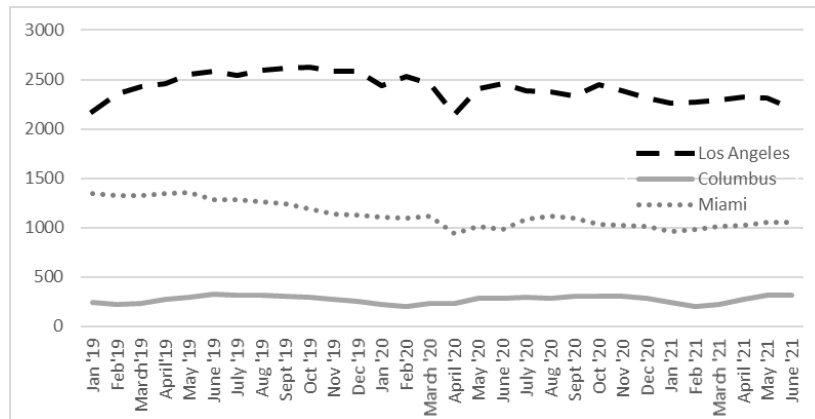


Figure 1. Masonry Employment from Jan 2019 to June 2021

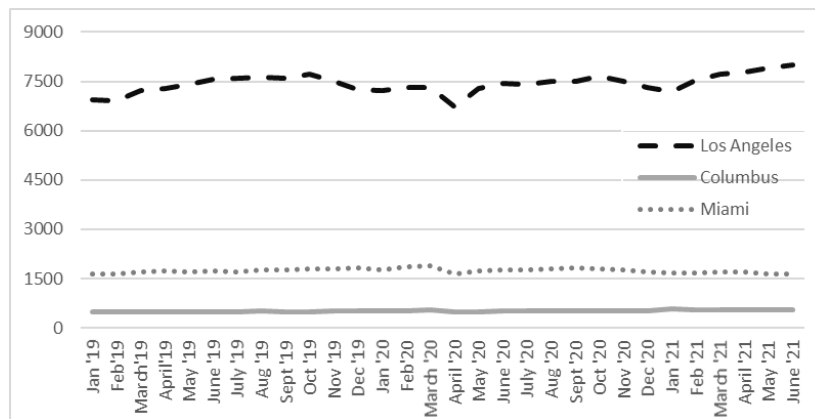


Figure 2. Drywallers Employment from Jan 2019 to June 2021

### Conclusion

This research offers insight into the impacts of the COVID-19 pandemic on the residential construction industry. Research findings indicate that the residential construction industry in Columbus, OH, was resilient and thrived in that region throughout the pandemic. Four of the trades even showed a significant increase in employment. In addition, the trades did show a difference in employment pre-COVID-19 and during COVID-19. However, there was no consistency in the interior trades being more negatively affected by employment than the exterior trades. Although the results did not correlate between exterior and interior trades, they correlated to regions. All the trades had significant employment changes in at least one city; however, they were not always negative.

Some significant positive changes indicated the strength and resilience of the residential construction industry in some geographical regions. This positive change would answer the question of a difference in employment rates and show a geographic disparity. Lessons learned in this research was that geography seemed to play a critical role in employment rates during COVID-19. Another lesson learned was that an important factor not involved in this research study that should be considered in future studies would be the impact of socioeconomic classes and COVID-19. The coastal areas of the U.S. were hit faster and harder with the virus than the interior areas studied in this research, and the employment rates reflected corresponding results. The coastal cities of Miami and Los Angeles were



affected with more infection rates and unemployment as opposed to the interior urban areas such as Columbus, OH, where not only did the residential construction trades survive during the pandemic, they thrived. This research is vital to help industry members understand which construction trades are more vulnerable to employment hardships during health and economic downturns in our society. This study also shed light on different geographic regions and construction trades that were able to thrive with employment during the pandemic and suffered from loss of jobs.

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