

Employment Trends Analysis in Canada: 2015-2019 vs. 2020-2024

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Introduction

Employment trends are a key indicator of economic performance and recovery, particularly during periods of disruption. In this report, we analyze how employment in Canada has evolved over two distinct periods: the pre-pandemic years (2015–2019) and the post-pandemic years (2020–2024). The goal is to identify changes in employment trends across industries and regions, using data spanning from 2015 to 2024. In this study, we will be researching the questions: How were employment trends in the major industries in Canada affected by the COVID-19 pandemic? We will look at different factors of this data and compare employment levels across different industries and geographical regions. We will group these industries into two different groups: Goods producing industries and service producing industries. The goods producing industries are made up of Construction, Manufacturing, and Mining, and the service producing industries are made up of Accommodation and food services, Healthcare, and Transportation and warehousing.

Provenance

We found our data on Kaggle, and it is sourced from the Survey of Employment, Payrolls, and Hours. This data was collected to provide information about employment levels and includes variables such as geographical region, industry, and employment level. Each case is represented by the employment of a specific industry in a specific geographic region for a given month and year.

Literature Review

Employment trends have been extensively studied, especially during periods of economic recovery following major events like the COVID-19 pandemic. Studies have identified regional and industry-specific disparities in employment recovery post-pandemic. For instance, service-based industries often experience slower recovery compared to technology-driven sectors. This section will explore relevant literature on employment trends in Canada and similar economies, emphasizing regional and industrial differences.

The COVID-19 Pandemic had a drastic effect on the Canadian economy and labor market, causing changes in employment levels. The article from StatCan (2022) mentions that between January 2020 and May 2020, Canada saw roughly 3.4 million jobs lost (nearly 20% of employment). RBC (2022) highlights the change in employment across different sectors, and how employment seemed to rise post pandemic in low contact industries, such as finance, but fell in high contact industries, such as accommodation and food services. Environics Analytics (2021) goes into detail on how population growth decreased across regions in 2020, as compared to the growth it experienced in 2018 and 2019. It also mentions an overall decline in mental health amongst Canadians, illustrating the fact that COVID had great impacts in Canada beyond just employment.

Methodology

We use a publicly available dataset covering monthly employment data from 2015 to 2024. The dataset includes fields for regions, industries, and employment numbers. Data were filtered to include only the years of interest (2015–2024) and were classified into two periods: Pre-Pandemic (2015–2019) and Post-Pandemic (2020–2024).

Statistical analysis and visualizations are used to identify trends and significant differences between these periods.

Our main goal is to investigate employment trends across major industry sectors in Canada and how they were affected by COVID-19. Through statistical analysis and data visualization, we will see how employment level was affected by the pandemic, and how different industries rebounded from the pandemic. We will look at factors such as geographic region to compare these trends across different regions in Canada.

Data Exploration

Table 1: Summary Statistics for Employment Trends

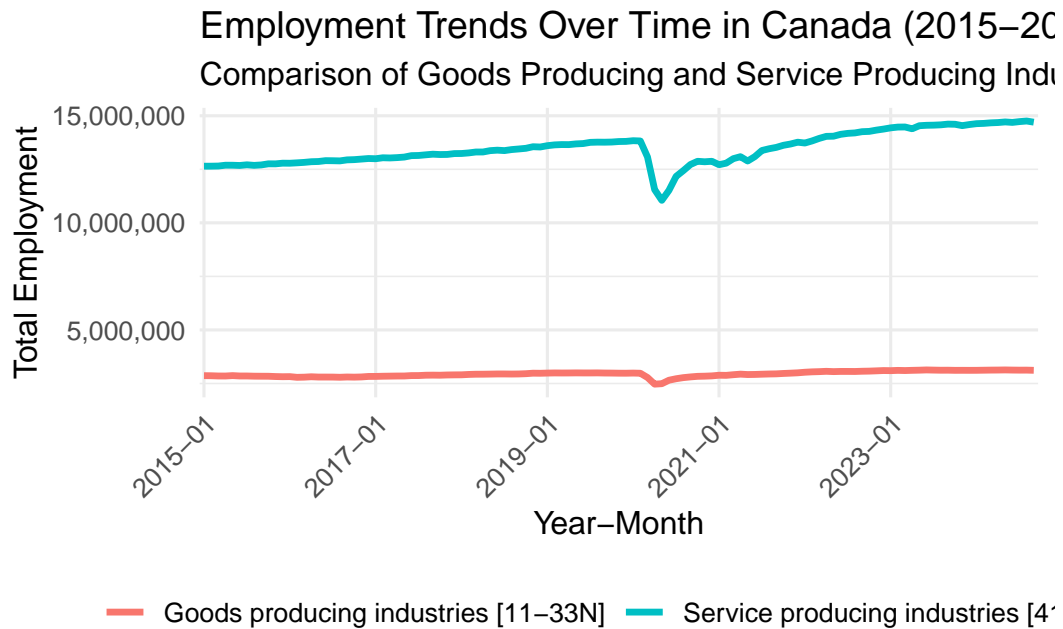
Period	Industry	Avg_Employment
Post-Pandemic	Accommodation and food services [72]	1160
Pre-Pandemic	Accommodation and food services [72]	1292
Post-Pandemic	Administrative and support, waste management and remediation services [56]	811
Pre-Pandemic	Administrative and support, waste management and remediation services [56]	811
Post-Pandemic	Arts, entertainment and recreation [71]	268
Pre-Pandemic	Arts, entertainment and recreation [71]	290
Post-Pandemic	Construction [23]	1095
Pre-Pandemic	Construction [23]	1002
Post-Pandemic	Durable goods [321N]	899
Pre-Pandemic	Durable goods [321N]	901
Post-Pandemic	Educational services [61]	1377
Pre-Pandemic	Educational services [61]	1287
Post-Pandemic	Finance and insurance [52]	795
Pre-Pandemic	Finance and insurance [52]	728
Post-Pandemic	Forestry, logging and support [11N]	37
Pre-Pandemic	Forestry, logging and support [11N]	39
Post-Pandemic	Goods producing industries [11-33N]	2994
Pre-Pandemic	Goods producing industries [11-33N]	2889
Post-Pandemic	Health care and social assistance [62]	2206
Pre-Pandemic	Health care and social assistance [62]	1959
Post-Pandemic	Industrial aggregate excluding unclassified businesses [11-91N]	16777
Pre-Pandemic	Industrial aggregate excluding unclassified businesses [11-91N]	16054
Post-Pandemic	Industrial aggregate including unclassified businesses [00-91N]	17097
Pre-Pandemic	Industrial aggregate including unclassified businesses [00-91N]	16354
Post-Pandemic	Information and cultural industries [51]	356
Pre-Pandemic	Information and cultural industries [51]	353
Post-Pandemic	Management of companies and enterprises [55]	119
Pre-Pandemic	Management of companies and enterprises [55]	101
Post-Pandemic	Manufacturing [31-33]	1531
Pre-Pandemic	Manufacturing [31-33]	1525
Post-Pandemic	Mining, quarrying, and oil and gas extraction [21]	201
Pre-Pandemic	Mining, quarrying, and oil and gas extraction [21]	201
Post-Pandemic	Non-durable goods [311N]	631
Pre-Pandemic	Non-durable goods [311N]	624
Post-Pandemic	Other services (except public administration) [81]	526

Pre-Pandemic	Other services (except public administration) [81]	545
Post-Pandemic	Professional, scientific and technical services [54]	1116
Pre-Pandemic	Professional, scientific and technical services [54]	902
Post-Pandemic	Public administration [91]	1211
Pre-Pandemic	Public administration [91]	1091
Post-Pandemic	Real estate and rental and leasing [53]	275
Pre-Pandemic	Real estate and rental and leasing [53]	293
Post-Pandemic	Retail trade [44-45]	1954
Pre-Pandemic	Retail trade [44-45]	1961
Post-Pandemic	Service producing industries [41-91N]	13783
Pre-Pandemic	Service producing industries [41-91N]	13164
Post-Pandemic	Trade [41-45N]	2759
Pre-Pandemic	Trade [41-45N]	2758
Post-Pandemic	Transportation and warehousing [48-49]	798
Pre-Pandemic	Transportation and warehousing [48-49]	746
Post-Pandemic	Utilities [22]	128
Pre-Pandemic	Utilities [22]	121
Post-Pandemic	Wholesale trade [41]	805
Pre-Pandemic	Wholesale trade [41]	797

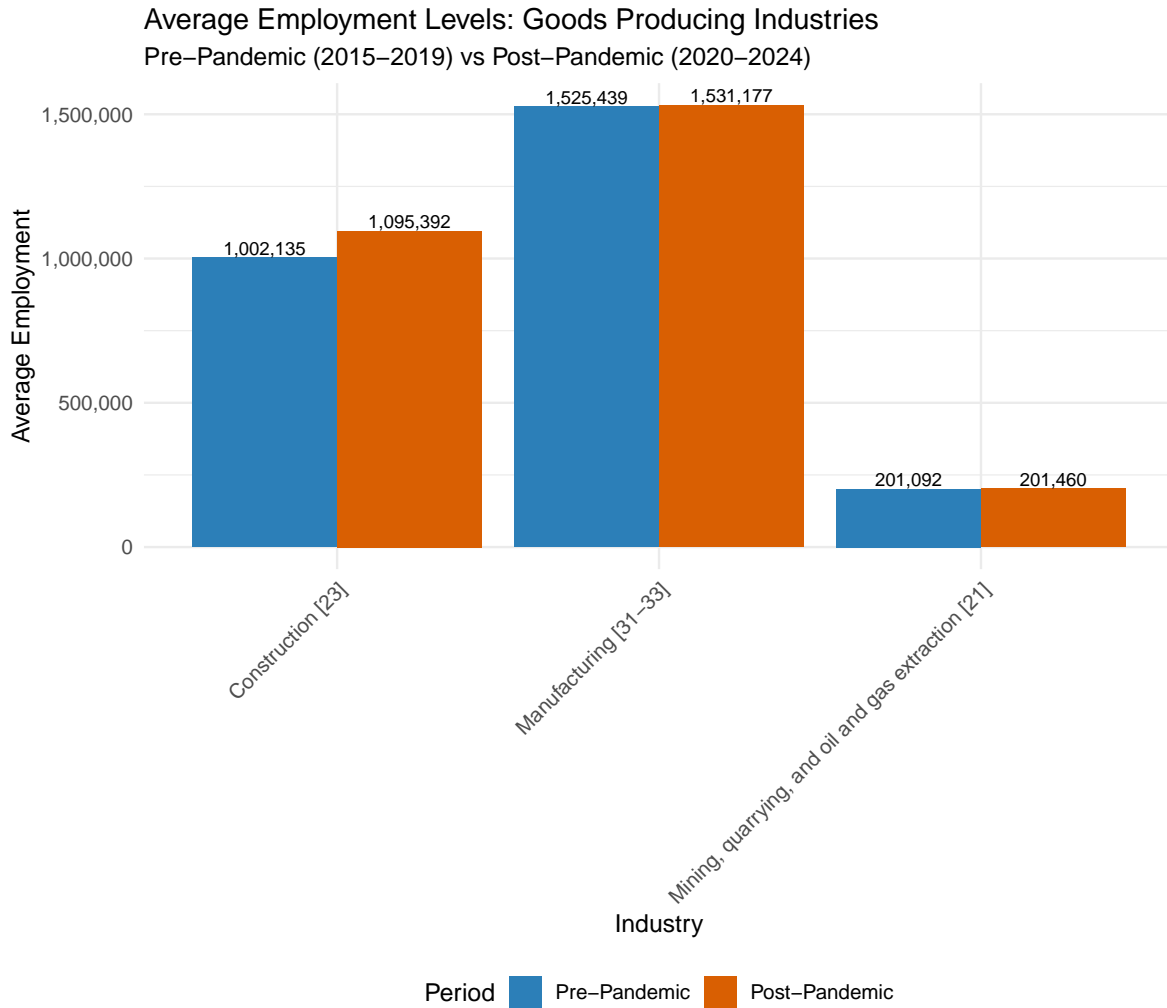
This five number summary table includes key statistics regarding the employment level across different industries both before and after the COVID-19 pandemic and it provides us with an idea of the employment distribution across. The industry “Industrial aggregate including unclassified businesses” groups all the industries together and provides us with insight to the employment of Canada as a whole. The data from the aggregate grouping of industries allows us to compare individual industries to the total employment in Canada, and it sets a baseline for comparing these industries with each other.

We will also use this summary table to get a basis for the major industries we will be researching: Goods producing industries (Construction, Manufacturing, and Mining) and service producing industries (Accommodation and food services, Healthcare, and Transportation and warehousing).

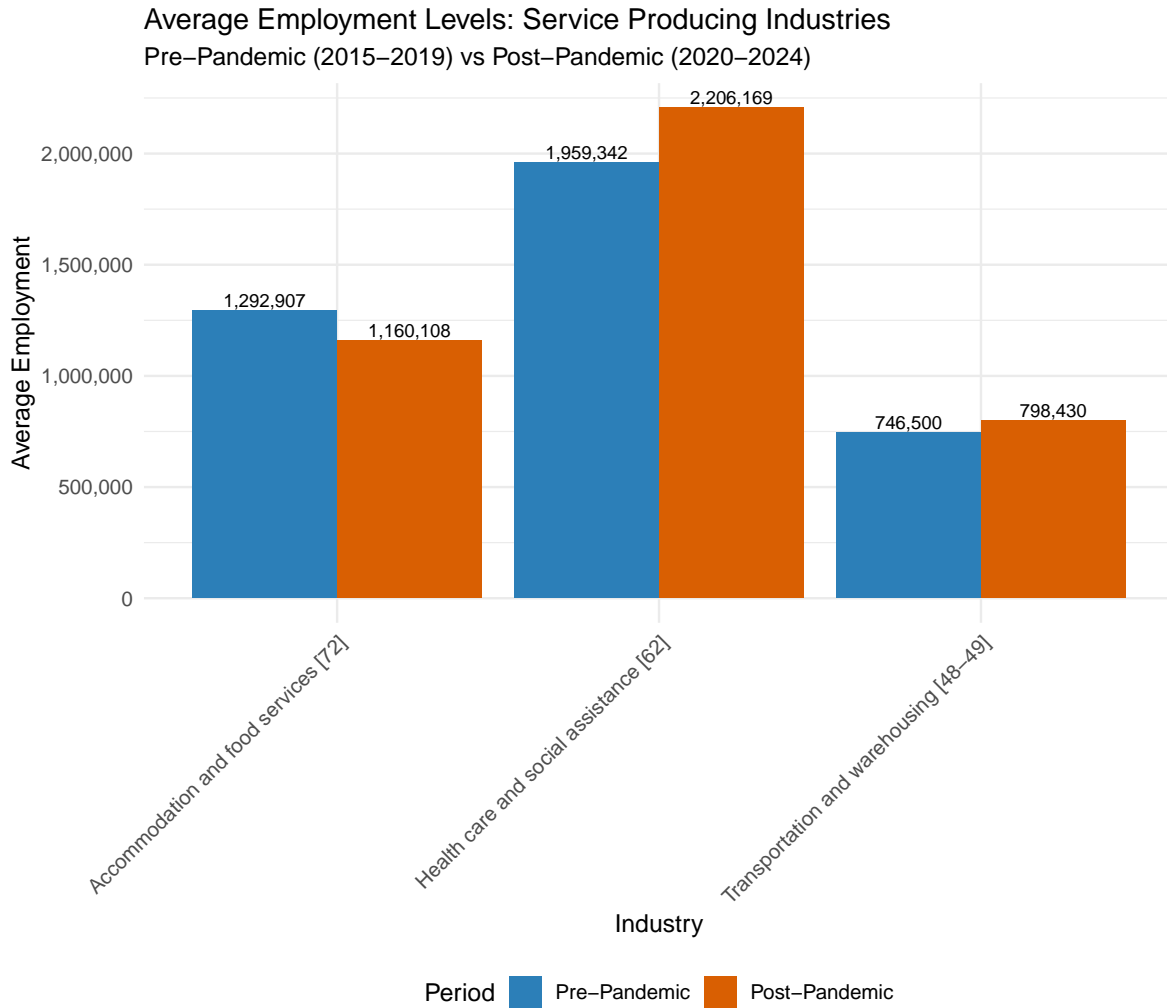
Visualization: Employment Trends Over Time



Based on this data visualization, it is apparent that from the beginning 2015 until early 2020, both the goods producing industries and service producing industries experienced stable employment growth. However, both industries experienced a decline in employment between March and May of 2020. To further investigate this detail, we performed some calculations on the data. The service producing industries peak employment of 13,803,575 (December 2019) in the pre-pandemic period experienced a 19.93% decrease, dropping to an employment level of 11,052,028 in May of 2020, its lowest employment level in the post-pandemic period. The goods producing industries saw an employment level of 2,994,154, its highest of the pre-pandemic period, drop to 2,468,268 in April of 2020, indicating a 17.56% decrease in employment. Although they experienced similar decreases in employment, based off the graph it appears that the goods producing industries recovered more steadily than the service producing industries.



This visualization shows us the average employment levels for the three industries we are focusing on in the goods producing industries (construction, manufacturing, and mining) during both the pre-pandemic and post-pandemic periods. From the pre-pandemic to post-pandemic period, construction saw a 9.31% increase in average employment, manufacturing saw a 0.38% increase in average employment, and mining saw a 0.18% increase in average employment. These values indicate that construction recovered strongly from the dip in employment it experienced during the pandemic, while manufacturing and mining leveled out back to their pre-pandemic levels.



This visualization shows the average employment levels between the pre-pandemic and post-pandemic years for the service producing industries (Accommodation and food services, health care and social assistance, and transportation and warehousing). Accommodation and food services saw a 10.27% decrease in average employment between the two periods, indicating that COVID had a significant impact on this industry. Health care and social assistance and transportation and warehousing saw a 12.6% increase and a 6.96% increase in average employment between the two periods, respectfully. This indicates that these sectors recovered strongly from the effects of the pandemic and are now growing.

Results

Conclusion

Code Appendix

```
# Load required libraries
library(tidyverse)
library(knitr)
library(kableExtra)
library(ggplot2)

employment_trends <- read.csv("~/Desktop/Stat 184/employment_trends.csv")

employment_trends_clean <- employment_trends %>%
  filter(REF_DATE >= "2015-01" & REF_DATE <= "2024-12",
         UOM != "Dollars") %>%
  mutate(
    REF_DATE = as.character(REF_DATE),
    Employment = replace_na(VALUE, 0),
    Period = ifelse(REF_DATE < "2020-01", "Pre-Pandemic", "Post-Pandemic")
  ) %>%
  select(-c(DGUID, SYMBOL, TERMINATED, SCALAR_FACTOR, SCALAR_ID, STATUS, DECIMALS, Est
  rename(
    Industry = North.American.Industry.Classification.System..NAICS.,
    Region = GEO,
    Date = REF_DATE
  )

write.csv(employment_trends_clean, "employment_trends_clean.csv", row.names = FALSE)

post_pandemic_employment_trends <- employment_trends_clean %>%
  filter(Date >= "2020-01" & Date <= "2024-12")

pre_pandemic_employment_trends <- employment_trends_clean %>%
  filter(Date >= "2015-01" & Date <= "2019-12")

# Set global options
knitr::opts_chunk$set(echo = TRUE, warning = FALSE, message = FALSE, fig.align = "cent
```



```

summary_stats <- employment_trends_clean %>%
  filter(Region == "Canada") %>%
  group_by(Period, Industry) %>%
  summarise(
    Avg_Employment = mean(Employment, na.rm = TRUE),
    Min_Employment = min(Employment, na.rm = TRUE),
    Max_Employment = max(Employment, na.rm = TRUE),
    SD_Employment = sd(Employment, na.rm = TRUE)
  ) %>%
  arrange(Industry, Period)

kable(summary_stats, caption = "Summary Statistics for Employment Trends in Canada") %>%
  kable_styling(bootstrap_options = c("striped", "hover"), full_width = FALSE) %>%
  scroll_box(height = "500px")
filtered_data_canada <- employment_trends_clean %>%
  filter(
    Region == "Canada",
    Industry %in% c("Goods producing industries [11-33N]",
                  "Service producing industries [41-91N]")
  )
industry_trends_canada <- filtered_data_canada %>%
  group_by(Date, Industry) %>%
  summarise(Total_Employment = sum(Employment, na.rm = TRUE)) %>%
  ungroup()

ggplot(industry_trends_canada, aes(x = Date, y = Total_Employment, color = Industry, group = Industry)) +
  geom_line(size = 1.2) +
  labs(
    title = "Employment Trends Over Time in Canada (2015-2024)",
    subtitle = "Comparison of Goods Producing and Service Producing Industries",
    x = "Year-Month",
    y = "Total Employment",
    color = "Industry"
  ) +
  theme_minimal(base_size = 12) +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1),
    legend.position = "bottom",
    legend.title = element_blank(),
    legend.text = element_text(size = 10)
  )

```

```

) +
scale_x_discrete(
  breaks = c("2015-01", "2017-01", "2019-01", "2021-01", "2023-01")
) +
scale_y_continuous(labels = scales::comma)
#goods_industries
goods_industries <- c("Manufacturing [31-33]",
  "Construction [23]",
  "Mining, quarrying, and oil and gas extraction [21]")
goods_data <- employment_trends_clean %>%
  filter(
    Industry %in% goods_industries,
    Region == "Canada"
  )
goods_summary <- goods_data %>%
  group_by(Industry, Period) %>%
  summarise(Average_Employment = mean(Employment, na.rm = TRUE)) %>%
  ungroup()

goods_summary <- goods_summary %>%
  mutate(Period = factor(Period, levels = c("Pre-Pandemic", "Post-Pandemic")))

ggplot(goods_summary, aes(x = Industry, y = Average_Employment, fill = Period)) +
  geom_bar(stat = "identity", position = position_dodge()) +
  geom_text(aes(label = scales::comma(round(Average_Employment, 0))),
    position = position_dodge(width = 0.9),
    vjust = -0.25, size = 3) +
  labs(
    title = "Average Employment Levels: Goods Producing Industries",
    subtitle = "Pre-Pandemic (2015-2019) vs Post-Pandemic (2020-2024)",
    x = "Industry",
    y = "Average Employment"
  ) +
  theme_minimal(base_size = 12) +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1),
    legend.position = "bottom"
  ) +
  scale_fill_manual(values = c("Pre-Pandemic" = "#2C7FB8", "Post-Pandemic" = "#D95F02")
  scale_y_continuous(labels = scales::comma)

```

```

#service_industries
service_industries <- c("Health care and social assistance [62]",
                        "Accommodation and food services [72]",
                        "Transportation and warehousing [48-49]")

service_data <- employment_trends_clean %>%
  filter(
    Industry %in% service_industries,
    Region == "Canada"
  )

service_summary <- service_data %>%
  group_by(Industry, Period) %>%
  summarise(Average_Employment = mean(Employment, na.rm = TRUE)) %>%
  ungroup()

service_summary <- service_summary %>%
  mutate(Period = factor(Period, levels = c("Pre-Pandemic", "Post-Pandemic")))

ggplot(service_summary, aes(x = Industry, y = Average_Employment, fill = Period)) +
  geom_bar(stat = "identity", position = position_dodge()) +
  geom_text(aes(label = scales::comma(round(Average_Employment, 0))),
            position = position_dodge(width = 0.9),
            vjust = -0.25, size = 3) +
  labs(
    title = "Average Employment Levels: Service Producing Industries",
    subtitle = "Pre-Pandemic (2015-2019) vs Post-Pandemic (2020-2024)",
    x = "Industry",
    y = "Average Employment"
  ) +
  theme_minimal(base_size = 12) +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1),
    legend.position = "bottom"
  ) +
  scale_fill_manual(values = c("Pre-Pandemic" = "#2C7FB8", "Post-Pandemic" = "#D95F02")
  scale_y_continuous(labels = scales::comma)

```