

ENSF 692 Project

Group 7

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Introduction

This project explores interprovincial migration trends in Canada and their correlation with key economic factors such as housing prices, employment, wages, and cost of living. Motivated by the article “Seeking affordability, young families flee Canada’s big cities for cheaper options” [7], the project group aimed to understand why residents are moving away from provinces like Ontario and British Columbia. By statistically examining key socioeconomic and demographic factors — such as housing prices, employment rates, wages, and cost of living, the group planned to uncover which factors most strongly influence people’s decisions to move between provinces.

Datasets

Six datasets were selected from Statistics Canada, each providing monthly data from 2005-01 to 2025-01. The group’s initial focus was on interprovincial migration, so they looked for datasets that may have some sort of correlation. In no particular order, the chosen datasets were:

- Interprovincial migration: Data on migration patterns between provinces. [1]
- Population: Quarterly estimates of the population in different provinces. [2]
- Labour force characteristics: Data on employment rates and workforce characteristics. [3]
- Wages/Salaries: Monthly data on wages, salaries, and employer contributions. [4]
- Consumer price index: Monthly changes in the cost of living. [5]
- Housing index: Monthly index tracking changes in housing prices. [6]

Net migration Eq. (1) calculated to clearly determine if the migration trend was in or out of a given province, using the following equation:

Equation 1: Net migration calculation

$$\text{Net migration} = (\text{Out} - \text{migration}) - (\text{In} - \text{migration})$$

This could then be plotted against and statistically compared to the other relevant datasets. Correlation coefficients could be calculated to statistically prove what likely affected interprovincial migration the most.

UI Input/Output

The program is designed to interact with the user through a Command-Line Interface (CLI). It guides users through various stages of data exploration, allowing them to make specific choices for provinces, time periods, and datasets. Please find the demo video on Github.

Primary Flow

1. **Introduction:** The user is first introduced to the project. A snippet of the merged dataset is displayed, along with summary statistics (using the `describe()` method), providing a brief overview of the available data.
2. **Proving Article Claims:** a demonstration that proves the claims made in the referenced article. The migration and housing price trends of specific provinces (e.g., BC, ON, AB, SK) are analyzed and presented through graphical visualizations.
3. **Correlation Analysis:** Analysis of the correlation between net-migration and housing prices across provinces. The program calculates and displays correlation coefficients for all the provinces.
4. **Interactive Exploration:** The core feature of the CLI allows users to interactively explore different datasets. Users can:
 - Select up to 4 provinces.
 - Specify two time periods for comparison.
 - Choose a main category (e.g., population, employment) and a subcategory (e.g., average wage, unemployment rate).
 - Generate comparison graphs for their selected data, enabling a deeper understanding of the data.
5. **Conclusion:** The program wraps up with a printout of conclusions, showcasing key findings. The user is shown which provinces are seeing the most migration and what factors (e.g., wages, housing prices) are driving these trends.

Input/Output Example

Interactive Exploration Example

Users are given the ability to compare trends between 2 time periods, among 4 provinces on a specific socioeconomic factor. Input validation is added for the user to re-enter an input when the user input is invalid. Fig. 1 and Fig. 2 below shows an example.

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From the comparison above, the article is supported by the data, especially in Alberta and Ontario.

Enter any key to continue >
Let's explore other factors that may have caused these trends.
You can compare up to 4 provinces.
You can compare the trends between two different time periods.
Type "exit" anytime to go to conclusion.


Enter the number of provinces you want to compare. We can have up to 4 provinces. >
Invalid input. Please enter a valid number or type 'exit' to quit.
Enter the number of provinces you want to compare. We can have up to 4 provinces. > 4


Enter province 1 (e.g., AB, ON, QC)> AB
Enter province 2 (e.g., AB, ON, QC)> BC
Enter province 3 (e.g., AB, ON, QC)> ON
Enter province 4 (e.g., AB, ON, QC)> SK


Choose the first time range
time range:2015-01 to 2025-01
Enter the start date (YYYY-M, e.g., 2015-1) > 2015-1
Enter the end date (YYYY-M, e.g., 2025-1) > 2020-13
Invalid input. Please enter the date in the format YYYY-M (e.g., 2025-1).
time range:2015-01 to 2025-01
Enter the end date (YYYY-M, e.g., 2025-1) > 2020-1


Choose the second time range
time range:2015-01 to 2025-01
Enter the start date (YYYY-M, e.g., 2015-1) > 2020-1
Enter the end date (YYYY-M, e.g., 2025-1) > 2019-1
Please make sure the end date is later than the start date
Enter the end date (YYYY-M, e.g., 2025-1) > 2025-1


Select a main category from the following options:
1. CPI
2. Employment
3. Housing
4. Migration
5. Wage
Enter the number of your choice (or type 'exit' to quit)> 6
Invalid input. Please enter a valid number or type 'exit'.


Select a main category from the following options:
1. CPI
2. Employment
3. Housing
4. Migration
5. Wage
Enter the number of your choice (or type 'exit' to quit)> 5


Sub-columns under 'Wage':
1. Total Wage (thousands dollars)
2. Average Monthly Wage
Enter the number of the sub-category you want to choose (1-2), or type 'exit' to quit> 2


Anything else you want to see?
Would you like to reselect provinces and time period? (y for yes, n for no, or type 'exit' to quit)> 

```

Figure 1: Interactive Exploration console interface



Figure 2: Output graph of the Interactive Exploration. Average Monthly Wage compare among 4 provinces during 2 different time periods.

Proving Article Claims Example

The user interacts via pressing any key to continue the flow. The following Fig. 3 in particular is produced by the following procedure:

1. Filter the merged data frame by the province of interest (e.g. AB, BC).
2. Filter the merged data frame by the net migrants sub column.
3. Create two sub data frame by filtering along specific time period

4. Use `groupby()` and `sum()` aggregation functions to get the sum of the migrants in that specific time period.

5. Join the data frame to plot the bar chart in Fig. 3 shown below

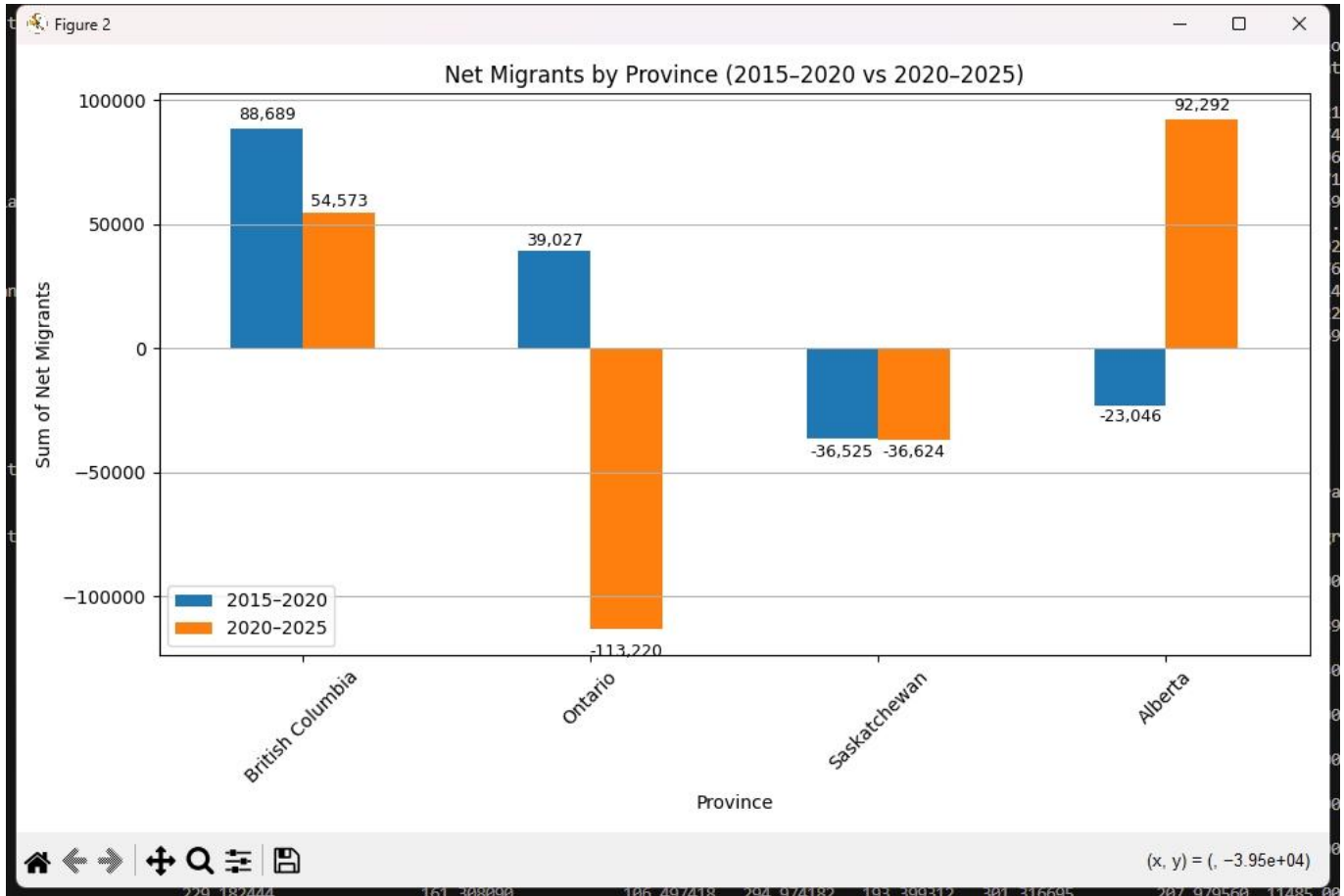


Figure 3: Net Migrants by Province (2015-2020 vs 2020-2025)

Conclusion

Through our analysis of interprovincial migration trends and socioeconomic indicators across Canada, there were strong statistical evidence supporting the article “Seeking affordability, young families flee Canada’s big cities for cheaper options” [7].

Among all provinces, Alberta stood out as the top destination for interprovincial migrants. This trend aligns with Alberta's rising wage levels and relatively affordable housing, which make it especially attractive compared to more expensive provinces like Ontario and British Columbia.

By calculating correlation coefficients between net migration and various socioeconomic variables, it was discovered that average monthly wages and housing prices showed the strongest correlations ($|c| > 0.8$),

Overall, the project demonstrates how data-driven analysis can uncover meaningful insights into migration patterns.

References

[1] Statistics Canada, "Table 17 10 0020 01 – Estimates of the components of interprovincial migration, quarterly," *Statistics Canada*, June 18, 2025. [Online]. Available:

<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710002001>. [Accessed: Jun. 20, 2025].

[2] Statistics Canada, "Table 17 10 0009 01 – Population estimates, quarterly," *Statistics Canada*, June 18, 2025. [Online]. Available: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000901>.

[Accessed: Jun. 20, 2025].

[3] Statistics Canada, "Table 14 10 0287 03 – Labour force characteristics by province, monthly, seasonally adjusted," *Statistics Canada*, June 20, 2025. [Online]. Available:

<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410028701>. [Accessed: Jun. 20, 2025].

[4] Statistics Canada, "Table 36 10 0205 01 – Wages, salaries and employers' social contributions (x 1,000), monthly," *Statistics Canada*, May 30, 2025. [Online]. Available:

<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610020501>. [Accessed: Jun. 20, 2025].

[5] Statistics Canada, "Table 18 10 0004 01 – Consumer Price Index, monthly, not seasonally adjusted," *Statistics Canada*, May 2025. [Online]. Available:

<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000401>. [Accessed: Jun. 20, 2025].

[6] Statistics Canada, "Table 18 10 0205 01 – New housing price index, monthly," *Statistics Canada*, June 20, 2025. [Online]. Available: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810020501>.

[Accessed: Jun. 20, 2025].

[7] J. MacFarlane, "Seeking affordability, young families flee Canada's big cities for cheaper options," *Yahoo Finance*, May 27, 2024. [Online]. Available: <https://ca.finance.yahoo.com/news/seeking-affordability-young-families-flee-canadas-big-cities-for-cheaper-options-192548346.html>. [Accessed:

Jun. 20, 2025].