SDA 490 Capstone Project

Final Report

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SDA 490 Spring 2024 Capstone Project Final Report:

Immigration, Population Growth and Canadian Rental Prices

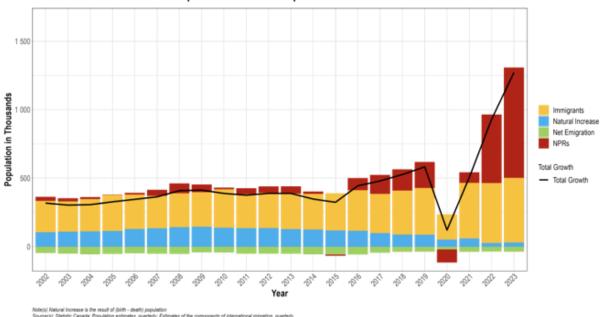
Over the past 3 years Canada has experienced a sharp increase in its population growth. According to Statistics Canada, roughly 98% of Canadian population growth from July 1, 2022, to July 1, 2023, came from net international migration (immigrants, returning emigrants and net non-permanent residents, subtracted by emigrants and net temporary emigration). Whereas 2% of population growth was contributed from natural increase (births minus deaths) (Statistics Canada, 2023). Furthermore, Canada's population growth increased from 536,146 in 2018/2019 to 703,404 in 2021/2022 (Statistics Canada, 2023).

In conjunction with Canada's population growth, Canada has also experienced rises in inflation, housing, and rental costs. Toni Gravelle (deputy governor of the Bank of Canada) noted in his Economic progress report on December 3, 2023, the relationship between the recent increase in population growth and decreasing vacancy rates, denoting the current imbalance between supply and demand in Canada's housing market (Bank of Canada, 2023). More recently, on January 22, 2024, Marc Miller (Minister of Immigration) announced that Canada will put a cap on international student permit applications to "stabilize new growth for a period of two years" (Government of Canada, 2024). This cap will allow for approximately 360,000 new approved study permits which marks a 35% decrease from 2023 numbers (Government of Canada, 2024). So, with all the ongoing policy changes and public narratives we decided to focus our capstone project on immigrants, population growth and Canadian rental prices.

Components of Population Growth

Figure A shows how in recent years Canadian Population Growth is driven by Immigrants and non-permanent residents. It consists of a stacked bar graph showing immigration growth, natural growth, net emigration, and non-permanent residents along with a line graph on top showing the overall trend total growth from 2002 to 2023. The graph displays an interesting change in the Canadian population. From 2002 to 2009, population growth was traditionally driven by natural growth (births minus deaths) and immigration. However, after 2010, we witness a gradual decline in this trend, following a substantial drop by 2021. Immigrant growth on the other hand has a steady increase over the years, except in 2020, where we see an obvious drop due to the COVID-19 pandemic. Turning to non-permanent residents, their trend line has been less predictable over the years, often capped to stay below a fifth of the total growth components. Yet, we observed a pronounced dip in 2015 and again in 2020. Fast forward to 2022 and 2023, there's a striking surge where non-PR account for more than half of our population growth. This change marks a pivotal moment, indicating a redefinition of our demographic structure.

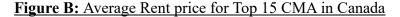
Figure A: Canadian Population Growth is Driven by Immigrants and NPRs (Non-permanent Residents

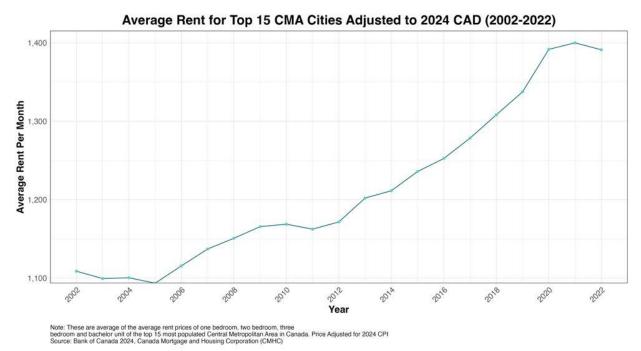


Population Growth Components Estimates

Canadian Rental Prices

The next part of this project we focused on Canadian rental prices. Figure B shows the average of the average rent prices of one bedroom, 2-bedroom, 3 bedroom, and bachelor units in the Top 15 most populated Central Metropolitan Area in Canada adjusted to 2024 CPI. The cities included Toronto, Montréal, Vancouver, Calgary, Edmonton, Ottawa Gatineau, Winnipeg, Québec, Hamilton, Kitchener - Cambridge – Waterloo, London, Halifax, St. Catharines – Niagara, Oshawa, and finally Victoria. An interesting trend we see here is that rental price has a relatively stable increase from 2005 to 2011 and increases more dramatically from 2016 which correlates with the sudden increase in recent immigration. The prices are all adjusted to 2024 dollars, the CPI is 158.8 as of February of 2024.





Similarly, we additionally included a graph (Figure C) on housing price to see if there is any resembling pattern on housing affordability. We used benchmark price to represent dollar value and we collected it for all types of housing units, such as apartments, composite, one-story, single family, townhouse, and two-story units. The benchmark price is a measure used by the board to describe what it calls a typical property in the market, considering number of bedrooms, lot size, and other factors, and is not an average or median price. This trend shows a similar gradual increase from 2005 to 2013. Afterward, a noticeable jump in 2017 across all housing units it diminished before COVID-19, and then another second jump during COVID-19 before peaking during 2021. It decreased again after 2022 when foreign purchase of housing became more strictly regulated. Thus, both rental prices and bench prices in the housing market show similar patterns, reconfirming the phenomenon that recent immigration has had an impact on housing affordability.

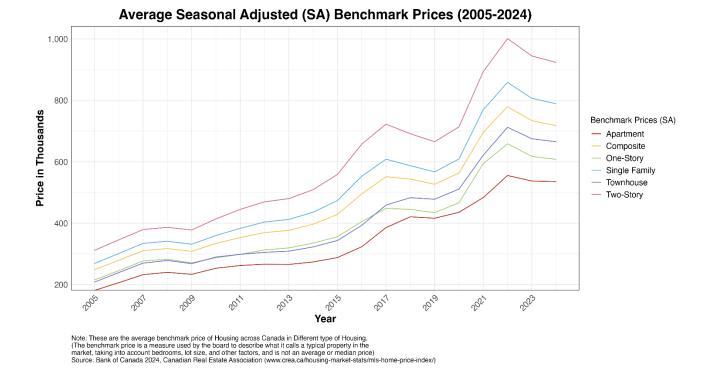


Figure C: Average Seasonal Adjusted Benchmark Prices (2005-2024)

Turnover rent prices also became an important element when exploring the effects immigration has on housing costs. While researching recent turnover rent trends, we came across an interesting quote from the CMHC Rental Market Report based of Statistic Canada's 2021 census: "An estimated 69% of recent immigrants in the Vancouver CMA indicated that they were renters" (CMHC, 2024, p. 11). From this we used data from the CMHC rental market survey to explore how rental turnover has responded to the recent population growth. We discovered that the turnover rent data has some limitations as it is only available from 2021 to 2023 periods. Secondly, the housing price data only represents 2-bedroom units. However, this can still show some data visualization on the impact recent immigration has on turnover rent. "Turnover units are counted as being turned over if it was occupied by a new tenant who moved in during the past 12 months. A unit can be counted as being turned over more than once in a 12-month period" (CMHC, 2024). The data also shows some Percentage change (%) in average rent. The graph (Figure D) compares the difference between turnover rent increase versus the non-turnover rent increase in the period 2021 to 2023 in Vancouver and Toronto. The green being turnover and yellow being non turnover and as we can see that the turnover rent spiked during the recent years

where immigration also spiked. Turnover rent has increased significantly more over the years compared to non-turnover rent. A huge proportion of immigrants renting has shown a great impact on housing rental affordability in these two cities.

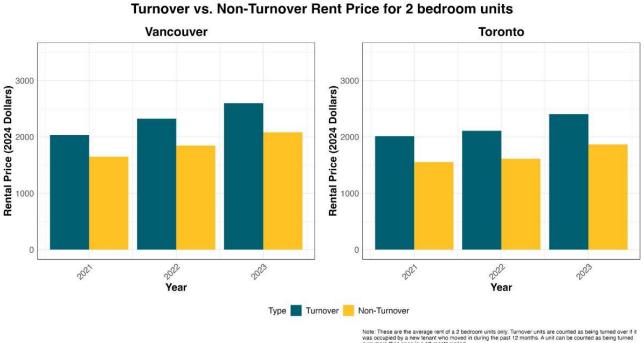
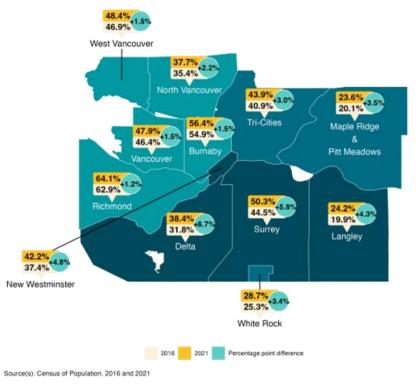


Figure D: Turnover Rent vs. Non-Turnover Rent Price for 2-bedroom units (2021 to 2023)

Note: These are the average rent of a 2 bedroom units only. Turnover units are counted as being turned over if it was occupied by a new tenant who moved in during the past 12 months. A unit can be counted as being turned over more than once in a 12-month period. Source: Bank of Canada 2024, Canada Mortgage and Housing Corporation (CMHC)

Now that we see the pattern of how recent immigration has affected housing rental affordability, we will now look at the changes in immigration population growth and how distribution corresponds to the average rent prices in Metro Vancouver, mainly comparing the data from 2016 and 2021 census. Here are the map diagrams (Figure E and F) we used to demonstrate how the recent immigration growth and some non-permanent resident's population growth look like and how it has affected average rent across different districts in Metro Vancouver.

Figure E: Immigrant and Non-PR Population Distribution in Metro Vancouver



Immigrant and Non-PR Population Distribution in Metro Vancouver, 2016 and 2021

The Metro Vancouver area presents a vivid case study of how our community's demographic structure is being reshaped. Current census data shows immigrants and non-permanent residents forming a substantial two-fifths of the population in metro Vancouver area in 2021. The map (Figure E) we have here uses color intensity to signify growth among these groups. The lightest shade includes areas like Richmond and Vancouver where less than 3% growth has been recorded recently, suggesting that while these areas have traditionally been home to a significant number of immigrants, the rate of new arrivals is modest. In contrast, Surrey, Delta, and New Westminster, marked by the darkest shades, are experiencing a rapid growth, exceeding 4.5%. The change suggests a shifting pattern in newcomer settlement preferences with previously less popular areas now emerging on the map.



Metro Vancouver's Average Rent in 2016 and 2021

Figure F shows the rent prices across Metro Vancouver between the 2016 and 2021 census with a notable 25.6% increase in average rent over five years. In regions marked by the lightest shade on our map, despite having the highest percentage of immigrants and non-permanent residents, there's a minimal population growth of newcomers. These areas also witness the smallest rent increase, 15%-29%, the lowest among our study groups. In contrast, cities with medium to dark shading, have moderate to high rent increase on average 35% - suggesting a phase of "catching up" as these areas develop and attract more people. Furthermore, the above maps and graphs show a correlation between both population growth and rising rental costs. More importantly, figures E and F show us that in areas that experienced greater percent changes in immigrants and net non-permanent residence, these areas also experienced higher increases in rent prices- indicating a potential relationship between the two.

Source(s): Canada Mortgage and Housing Corporation, 'Vancouver - Rental Market Statistics Summary by Zone,' October 2016 and October 2021.

Modelling

As noted above, there has been a positive correlation between housing and rental prices and population growth in Canada. Thus, to better understand this relationship, we referenced literature such as Albert Saiz (2007) and Jamie Sharpe (2019) who both found positive relationships between immigrant inflows and changes in rental prices across American statistical areas (which are like what Central Metropolitan Areas (CMAs) are to Canada). Inspired by both the literature and our own ambitions we set off to better explain the relationship between immigration, population growth and their effects on rental prices by using statistical modelling techniques.

Data

Our analysis began by collecting panel data across twenty-nine CMAs across Canada through the years 2006 to 2019. We collected a total of 364 observations within our data frame. Table 1 shows both the independent and dependent variables we used in our models. Our dependent variable was average rent in a given CMA in a given year. To calculate average rent, we took the average costs of a bachelor unit, one bedroom, two bedroom and three bedrooms (plus), and averaged all of these to get the average rent in CMA c in year t. Our main variables of interest were Population Growth and the inflow of immigrants in a given CMA in a given year as a percentage of that CMA's population estimate in that same year. There are several reasons we chose to analyze two different independent variables. Mainly, we wanted to explore the effects of only immigrant inflows as they have been a main driver of population growth in Canada. However, as we know immigrants are not the only factor in Canadian population growth. For example, in more recent years (years not in our data) Canada has seen a drastic increase in the number of non-permanent residence. Thus, to capture a holistic estimate on Canadian population growth we decided to include our Population Growth variable.

Table 1 Model Variables

Dependent Variables	Independent Variables
Average Rent (2024	Population Growth,
CAD)	Inflow of Immigrants as a percentage of total population
	Unemployment Rate
	Vacancy Rate
	Medium Income (2024 CAD)
	Housing Completions
	GDP (Provincial level)

Finally, in order to get more credible estimates of our two key independent variables, we wanted to control for variables that we believed may both effect average rents and our variables of interest. This led us to control for the unemployment rate, vacancy rate, medium income, housing completions, and GDP at the provincial level. Housing completions as noted by Canada Mortgage and Housing Agency is defined as the stage when all proposed construction work on a dwelling unit has been performed (CMHC, 2023). Here dwelling units include single detached houses, semi detached houses, row units, apartments, and others. Our idea behind its inclusion was to use it as a proxy for housing supply.

Fixed Effects Model

The first model we produced where our variable of interest was Population Growth, used what is called a fixed effects regression model. What a fixed regression model allows us to do is to control for unobservable differences between CMAs that do not vary over time (that is they are "fixed" over time). The logic behind using a fixed effects model is intuitive. For instance, we may be concerned that Vancouver's proximity to the oceans and mountains is positively influencing both Population Growth and Average Rent prices. Basically, it implies that because Vancouver is near both the ocean and mountains more people tend to want to come to the Vancouver CMA, and for the same logic average rent prices are higher. Furthermore, the Calgary

CMA (which is another observation in our data) does not have the same landscape that Vancouver does so we can imagine that the effects of Vancouver's landscape have a different effect on both population growth and average rents than that of Calgary. Then by using a fixed effects regression (where we have fixed effects for both CMA and years) we can control for these differences between CMAs by comparing cities to themselves over time which allows us to garner a more accurate representation of population growth effects on average rents.

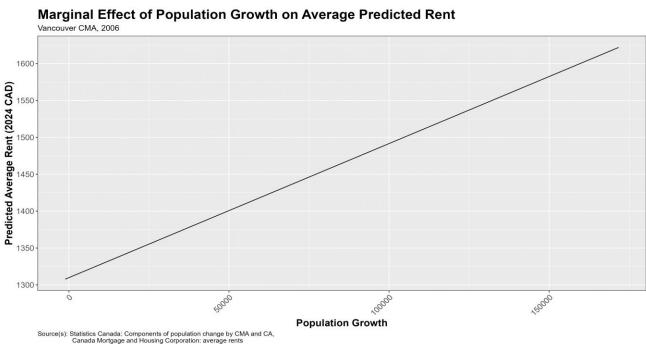
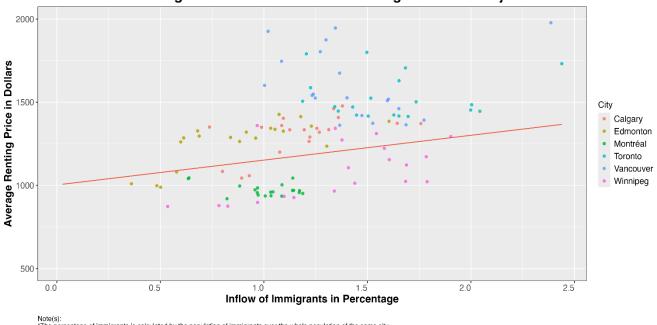


Figure G: Marginal Effects of Population Growth on Average Predicted Rent

The results of our fixed effects regression model are displayed in figure G. Figure G plots the Predicted Average Rent on the y-axis and Population Growth on the x-axis in Vancouver in 2006. What the graph displays is how predicted average rent changes in response to changes in population growth. Hence, it is the marginal effect of population growth on predicted average rent. Based on the graph you can see a positive correlation between the two variables. Furthermore, our fixed effects model showed us that a one-unit increase in population growth leads to a 0.0018 dollar increase in rent. Relating this to figure G, in Vancouver in 2006 if the Population Growth were 50,000 then our predicted rent would be in a range around 1400. However, a more accurate way to interpret this graph is that a population growth of 50,000 leads to a roughly 90 dollars change in average rent prices. Finally, although this graph only shows Vancouver in 2006, our estimate for population growth of \$.0018 would be the same for all CMAs in all years. The only thing that would differ is the intercept of our lines across different CMAs and in different years (i.e. The line for Calgary for 2006 may start below Vancouver). The reason for this is our fixed effects model make CMAs and years dummy variables.

Figure H: Predicted Renting Price Based on Growth of Immigrants in Six Major CMAs



Predicted Renting Price Based on Growth of Immigrants in Six Major CMAs

Note(s): "The percentage of immigrants is calculated by the population of immigrants over the whole population of the same city. "Immigrants includes persons who are, or who have ever been, landed immigrants or permanent residents. "Immigrants includes immigrants who were admitted to Canada from 2006 to 2019.

Source(s): Census of Population 2021

Our second model used an OLS regression to estimate the effects of a percent change in inflow of immigrants as a percentage of population as displayed in figure H. For ease of interpretation, we have plotted average rent price on the y-axis, inflow of immigrants (percentage of population) on the x-axis, and have only displayed values for six major CMAs. There are several takeaways we can gather from figure H. First, neither the x-axis nor y-axis have a point that crosses zero. This is indicative of every CMA never having a year where immigrant inflow was zero, and similarly rent prices are never zero as rent prices are never free. Second, the red line is the regression line that is generated by the model. It shows that there is a positive relationship between changes in average rent and immigrant inflow indicating that higher immigrant inflows have an impact on average rental prices. Thirdly, we notice this positive

relationship across all six major CMAs plotted in this graph. Finally, if we use Edmonton as an example, the model predicts that average rental price is roughly 1000CAD when there is an immigrant inflow equal to 0.5% of the CMAs population. Similarly, if Edmonton has an immigrant inflow between 1% to 1.5% of their total population the model predicts average rental prices will be in the range of 1300CAD to 1400CAD.

Model Limitations

Although our models strove to estimate the effects of immigration and population growth on average rent prices within Canada, our estimates are correlation rather than causal. Our models are embedded with various limitations to which we will note several. First, average rent is not a perfect predictor of rental costs in Canada. For instance, we calculated average rent by averaging one-bedroom, two-bedroom, bachelor units and three-bedroom (plus), making average rent and average of averages. This can lead to less variability within our dataset for our model to make predictions on. Second, housing completions is not a perfect proxy for housing supply. Housing supply relies on a plethora of factors including building costs, zoning restrictions and the construction labour force. Finally, our model does not consider provincial rent control guidelines. In Canada, different provinces have different legislations pertaining to how landlords can adjust rent prices among existing residents. Thus, it may be the case that fluctuations in rent prices may differ depending on the rent control guidelines. On a final note, due to data availability our models do not account for the recent spike in population growth experienced post COVID-19.

Conclusion

Through our research, we have explored the components of Canada's and Vancouver's population growth. Moreover, we have showed the change from population growth primarily driven by immigrants and natural increase, to more recently where growth is driven by both immigrants and net-nonpermanent residents. We explored the recent population spike post COVID-19 and have displayed an increase in rental turnover prices within both Vancouver and Toronto. Furthermore, by mapping both average rent prices and population structures from the 2016 and 2021 census, we found that areas outside of the downtown core (Delta, Surrey, Tricities, Langley, Maple Ridge, and White Rock) experienced higher growth in their immigrant

and non-permanent resident population. With this, we also observed that rent prices in these areas increased higher than that of Vancouver, Richmond, or Burnaby.

Although this is shown within our data it does not tell the whole story. There are several factors that could have led to rental prices increasing in these areas outside of the downtown core. For example, individuals could be moving away from the city due to rent being cheaper in these cities. Alternatively, these areas are transitioning into economic hubs which again may lead to people having jobs there. Ultimately though, larger increases in immigrant and non-permanent residents in the overall populations of these cities, are putting pressure on the housing supply. Both of our models confirmed this, and both showed positive relationships between population growth, immigration, and average rental prices.

Based on all our findings, should we conclude that population growth is inherently bad? No, and here is why.

According to Statistics Canada, "one-third of international students who arrived in the late 2000s and early 2010s became permanent residents within 10 years of being in Canada" (Statistics Canada, 2022). And in 2018 alone, international students contributed more than 21 billion dollars to Canada's economy (Government of Canada, 2023). Also, according to Statistics Canada, at least 1 out of 5 people currently of the working age are 55 – 64 years. It means that more than 20% of the labor force participants are set to retire in the coming years, and this can lead to a severe potential labor shortage problem (Statistics Canada, 2022). Therefore, Canada indeed needs population growth – immigrants in particular – to fill the labor shortage gap. In addition, by increasing the labor force participants, provincial and federal governments are able collect more income tax to support infrastructure and an aging population while driving economic growth to improve Canadian communities and neighborhoods while also making us a better, more culturally diverse country (Government of Canada, 2023).

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Appendix

	Fixed Effects (City, Year)	Fixed Effects (City
Population_Growth	0.0018*	0.0020**
	(0.0008)	(0.0007)
Adj_M_Income	0.0035***	0.0046***
	(0.0007)	(0.0010)
Unemployment_rate	4.5489	11.0024*
	(7.6474)	(4.5273)
Housing_completions	0.0106*	0.0105*
	(0.0046)	(0.0049)
Vacancy_Rate	4.2213	7.0075*
	(3.2223)	(2.6578)
GDP_pro	0.0001	0.0007***
	(0.0002)	(0.0001)
Num.Obs.	364	364
R2	0.965	0.958
R2 Adj.	0.960	0.954
R2 Within	0.301	0.621
R2 Within Adj.	0.288	0.614
AIC	3900.3	3940.9
BIC	4075.7	4065.6
RMSE	45.38	49.72
Std.Errors	by: City	by: City
FE: City	х	х
FE: REF_DATE	х	

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

	OLS
(Intercept)	265.8029***
	(67.4963)
Adj_M_Income	0.0080***
	(0.0006)
lmm_pop100	149.2068***
	(22.1477)
Unemployment_rate	-5.6441
	(5.7386)
Housing_completions	0.0052***
	(0.0013)
Vacancy_Rate	-21.3618***
	(4.0917)
GDP_pro	0.0002***
	(0.0000)
Num.Obs.	364
R2	0.680
R2 Adj.	0.675
AIC	4630.2
BIC	4661.4
Log.Lik.	-2307.121
F	126.397
RMSE	136.91

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.00⁻¹