ENSF 692 Final Project Report

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Group #3

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# Executive Summary

This report analyzes Calgary's housing and demographic trends using 2,024 records from three City of Calgary open datasets spanning 2016-2017. The analysis period was constrained to these years due to assessment data availability as complete median property valuations were only accessible in this timeframe. Our analysis addresses three critical urban planning questions that help city planners understand where Calgary is growing and where housing pressures are emerging.

## Research Questions

1. Which city sectors are growing fastest?
   1. To identify where infrastructure investment is needed
2. Which sectors have the highest property values?
   1. To understand Calgary's premium real estate markets
3. How do inner-city and suburban areas grow differently?
   1. To understand Calgary's urban development pattern.

## Major Findings

* Southeast sector leads city growth with +3.5% population increase, demonstrating the strongest demographic momentum
* West sector commands Calgary's highest property values at $523,021 average assessment, despite smaller population
* Continued suburban sprawl pattern as suburban areas grow (+2.1%) while inner-city communities experience population decline (-0.5%)

# Data Sources

We merged three City of Calgary open datasets [1] – [3]:

1. **Civic Census by Community and Dwelling Structure**
   1. Provides population counts, dwelling types, and vacancy data across all Calgary communities
2. **Assessments by Community**
   1. Contains median residential property valuations that reflect market conditions and investment patterns
3. **Communities by Ward**
   1. Geographic classification system linking communities to wards, sectors, and development characteristics

**Time Period:** Analysis focused on 2016-2017 as these were the only years with complete assessment data across all three datasets.

## Data Quality and Processing

* Scale
  + 2,577 community-year observations covering 248 distinct Calgary communities.
* Completeness
  + 78.5% usable data (2,024 valid records for analysis).
* Data Integrity
  + Merged three datasets using community names as primary keys.
* Missing Values
  + 8% of records missing sector classification, primarily industrial areas.

## Derived Metrics

|  |  |  |
| --- | --- | --- |
| Metric | Purpose | Interpretation |
| **VACANCY\_RATE** | Housing market health | <3% indicates tight market, >7% suggests oversupply |
| ASSESSMENT\_PER\_PERSON | Per-capita wealth indicator | Property value per resident, shows community affluence |
| **GROWTH\_MOMENTUM** | Demographic trajectory | Year-over-year population change shows community vitality |

# Program Execution Instructions

## System Requirements

This analysis program requires Python 3.7 or higher with the following packages installed

1. pandas (data manipulation and analysis)
2. matplotlib (visualization generation)
3. openpyxl (Excel file handling)

# Repository Setup and Installation

1. Clone the GitHub repository

2. Navigate to the project directory

3. Install required packages using the provided requirements file:

pip install -r requirements.txt

Alternatively, install packages manually:

pip install pandas matplotlib openpyxl

# Program Outputs

Upon successful execution, the program generates:

* Console output displaying comprehensive data analysis and research findings
* calgary\_housing\_research\_analysis.png
* Four-panel research visualization
* calgary\_housing\_complete\_analysis.xlsx
* Multi-sheet Excel file with complete dataset and analysis results

Optional: Clean Dataset Generation The repository includes pre-cleaned datasets for immediate analysis. To regenerate the cleaned dataset from raw data (optional): python clean\_dataset.py

# Research Findings and Analysis

## Question 1: Fastest-Growing City Sectors

**Methodology:** Combined population and housing data by Calgary's geographic sectors, calculated year-over-year growth rates, and checked whether housing supply matches population growth patterns.

**Results (descending population growth):**

|  |  |  |
| --- | --- | --- |
| Sector | Population Growth | Market Assessment |
| Southeast | **+3.5%** | Fastest growth sector |
| North | +2.1% | Strong growth |
| Northeast | +1.8% | Moderate growth |
| Centre | +0.8% | Slow growth |
| South | +0.7% | Moderate growth |
| West | -0.1% | Stable |
| Northwest | -1.1% | Population decline |
| East | -1.3% | Population decline |

Insight: Southeast Calgary shows the strongest population growth (+3.5%), followed by North (+2.1%) and Northeast (+1.8%) sectors, creating clear growth momentum in Calgary's eastern regions. In contrast, three sectors experienced population losses, with East (-1.3%) and Northwest (-1.1%) showing the steepest declines, while West remained relatively stable (-0.1%). This pattern reveals a distinct east-west divide in Calgary's demographic trends, with eastern sectors driving city expansion while western and northwestern areas face population challenges.

**Planning Implications:** Calgary should prioritize Southeast sector for faster approval processes and infrastructure planning to prevent housing shortages in the city's fastest-growing area. The strong growth areas in the Southeast, North, and Northeast sectors requires coordinated infrastructure investment, particularly in transportation and utilities, to support continued expansion. While declining sectors (East, Northwest) present opportunities for targeted revitalization efforts and policy interventions to reverse population losses and prevent neighborhood decline. The city's eastern growth momentum suggests shifting development pressure away from traditional western communities toward emerging suburban areas.

## Question 2: Premium Property Markets

Methodology: Ranked Calgary sectors by average median residential assessment values to identify premium real estate markets and understand the relationship between population size and property values.

Results (descending avg assessment):

|  |  |  |  |
| --- | --- | --- | --- |
| Sector | Avg Assessment | Total Population | Market Position |
| WEST | $523,021 | 247,641 | Premium market |
| SOUTH | $484,939 | 451,152 | High value/high-density |
| CENTRE | $484,502 | 388,762 | Urban premium |
| NORTHWEST | $478,838 | 350,289 | Upper-middle market |
| NORTH | $412,251 | 386,927 | Middle market |
| SOUTHEAST | $395,150 | 259,419 | Growing market |
| NORTHEAST | $328,668 | 355,228 | Affordable/high-density |
| EAST | $265,728 | 115,726 | Most affordable sector |

Insight: Calgary's property market shows clear divisions three distinct market levels emerge with premium sectors (West, South, Centre) exceeding $480,000, middle-tier markets ranging $395,000-$479,000, and affordable sectors below $330,000. The relationship between population density and property values proves more complex than expected, while West sector follows the typical low-density premium pattern, South sector successfully combines high property values ($485,000) with high population (451,000 residents), showing Calgary's potential for high-value, high-density development.

Planning Implications: Calgary's divided market requires different policy approaches. Premium sectors need infrastructure quality preservation, growing markets require faster development approvals and strategic investment, while affordable sectors would benefit from improvement programs and better transit connections. The South sector's success combining high values with high population provides a valuable model for sustainable urban development. Policy makers should study this approach to balance premium positioning with population growth while preventing further gaps between premium and affordable sectors.

## Question 3: Inner-City vs Suburban Development Patterns

**Methodology:** Classified Calgary communities as Inner-City or Suburban based on historical development patterns, then compared growth trajectories, investment flows, and housing market dynamics.

**Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Area Type | Population Growth | Median Assessment Growth | Vacancy Rate (2017) | Development Pattern |
| Suburban | +2.1% | **+2.6%** | 7.8% | Continued expansion |
| Inner-City | -0.5% | -3.7% | 9.0% | Population decline |
| Difference | **+2.6pp** | **+6.3pp** | **-1.2pp** | Favors suburban sprawl |

Insight: Calgary shows clear suburban expansion patterns, with suburban areas growing in both population (+2.1%) and property values (+2.6%) while inner-city areas decline in both measures (-0.5% population, -3.7% property values). The 6.3 percentage point gap in property value growth shows significant investment flowing toward suburban development rather than inner-city renewal. Additionally, inner-city areas face higher vacancy rates (9.0%) compared to suburban areas (7.8%), indicating weaker housing demand in established neighborhoods. This pattern confirms Calgary's continued outward expansion rather than urban core strengthening.

**Planning Implications:** This pattern shows ongoing urban development challenges requiring targeted policy responses. The city should focus on reversing inner-city population decline through improvement programs, better transit connections, and enhanced services and facilities to make downtown living more attractive. Calgary must also manage the infrastructure costs and environmental effects of continued suburban expansion, including transportation networks, utilities, and green space preservation. Without intervention, this trend will further increase city service costs while leaving inner-city areas underutilized, creating an unsustainable development pattern.

# Program Execution Screenshots

## **Figure 1: Clean** Dataset **Module Output**

A black background with text

AI-generated content may be incorrect.

## **Figure 2: Calgary Housing Analysis Program Invalid Community Name Error Handling**

A screenshot of a computer program

AI-generated content may be incorrect.

## **Figure 3: Calgary Housing Analysis Program Invalid Year Error Handling**

A screenshot of a computer

AI-generated content may be incorrect.

## **Figure 4,5,6: Calgary Housing Analysis Program Successful User Input and Community Profile, Analysis Output, Program Completion and File Export**

A screenshot of a computer program

AI-generated content may be incorrect.

A screen shot of a computer

AI-generated content may be incorrect.

A screenshot of a computer

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# References

[1] Civic Census by Community and Dwelling Structure, City of Calgary, June 2021. [Online]. Available: <https://data.calgary.ca/Demographics/Civic-Census-by-Community-and-Dwelling-Structure/set9-futw>

[2] Assessments by Community, City of Calgary, June 2021. [Online]. Available: <https://data.calgary.ca/Government/Assessments-by-Community/p84b-7zbi>

[3] Communities by Ward, City of Calgary, June 2021. [Online]. Available: <https://data.calgary.ca/Government/Communities-by-Ward/jd78-wxjp>