Team Project

Project Title:
COVID, Population Density and affects on Real Estate

Links
GitHubL
Slack: **room-6-project-team**
Presentation:
https://docs.google.com/presentation/d/1F2Dh25CzWyWjSOse6C5RTEbfC5tasX8Wplr1wVo0cBU/edit?usp=sharing

Team

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Project Outline and Problem Statement

Our project is to uncover patterns in real estate pricing relative to population in the year of the COVID pandemic. We'll examine relationships between price, location and COVID infection rate; purchase prices and locations; trends in purchases over the course of the year; and related questions, as the time permits.
Understand baseline growth without COVID - to determine if growth/decline is purely COVID related.

Questions & Data

Core Hypotheses

- The higher the covid infection rate in a given area, the greater the negative impact on real estate volume and pricing post-COVID.
- The lower the covid infection rate in a given area, the greater the positive impact on real estate volume and pricing post-COVID.
- The higher the population density, the higher the COVID infection rate.
- The higher the population density, the greater the positive impact on real estate volume and pricing, pre-COVID.
- The lower the population density, the greater the negative impact on real estate volume and pricing, pre-COVID.

A negative impact could be defined as a decline or slowed growth in price and volume.
A positive impact could be defined as an increase in price in volume or accelerated growth rate.

Questions (potential questions to ask of the data)

- Covid infection rate by Zip/Postal code, city or geo code
- Real Estate price/volume/growth rate by Zip/Postal code, city or geo code
- Population density by location

What we want to show:

- Aggregate Real estate growth in volume and pricing over time (last 60 months) by location, by population density and covid infection rate
- COVID infection rate and volume (absolute volume)
- Population density to infection rate
- Population density to real estate pricing

Datasets needed (link potential datasets to use)

- Real Estate pricing and total market volume by year, month and location (US, CANADA or ALL NA)
    - https://www.crea.ca/housing-market-stats/mls-home-price-index/hpi-tool/
    -
- COVID infection rate by year, month and location (US, CANADA or ALL NA)
    - https://github.com/M-Media-Group/Covid-19-API
- Population Density by year, month and location (US, CANADA or ALL NA)

Rough breakdown of tasks

- ~~Problem Statement/Outline~~
- ~~Determine questions to ask~~
- Determine if data exists
    - Get Real Estate Data-https://assets.cmhc-schl.gc.ca/sites/cmhc/data-research/publications-reports/housing-market-assessment/2020/housing-market-assessment-68456-2020-12-en.pdf?rev=e25fb1ca-ec01-4468-96b7-837a4a75a039
    - https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpiea2020212-print-pdf.ashx.
    - Get Codvid data-https://data.ontario.ca/dataset/covid-alert-impact-data/resource/37cfeca2-059e-4a5f-a228-249f6ab1b771
    - https://www150.statcan.gc.ca/n1/en/type/data?subject_levels=45%2C4510&geoname=A0000(we can filter data sets here)
    - Get population datahttps://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-density-rev11/data-download
    - https://www150.statcan.gc.ca/n1/pub/71-607-x/2020010/71-607-x2020app-eng.htm, geographical visualization of housing prices

    - https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getMainChange&Id=1293147
    - Please review the above data links
- **Create requirements (we are here)**
- Clean up data
- Set views of interest
- Determine best way to display and create data visualizations

Team Assignments

Task	Team Member Assigned	Link to Task
create two visualizations	Mengxia	
create two visualizations	Mel	
create two visualizations	Ali	
Slides/ presentation		
README.md		

Technical Requirements

The technical requirements for Project 1 are as follows.

- Use Pandas to clean and format your dataset(s).
- Create a Jupyter Notebook describing the **data exploration and cleanup** process.
- Create a Jupyter Notebook illustrating the **final data analysis**.
- Use PyViz, Panel, Plotly Express, and Hvplot to create six to eight visualizations of your data (ideally, at least two per question you ask of your data), and then aggregate these visualizations into a dashboard.
- Save PNG images of your visualizations to distribute to the class and instructional team and for inclusion in your presentation and your repo's README.md file.
- Use one new Python library that hasn't been covered in class.
- Optionally, use at least one API, if you can find an API with data pertinent to your primary research questions.
- Create a README.md in your repo with a write-up summarizing your major findings. This should include a heading for each question you asked of your data and under each heading a short description of what you found and any relevant plots.

- Inspiration from the Web for visualizations and research

Questions and Data Decisions

- core message or hypothesis
    - Hypothesis: **covid** caused a shift in **real estate** demand in **Canada** that had the effect of lower/declining HPI growth in higher density CMAs and raising/accelerated HPI growth in lower density CMAs (**Census Metropolitan Areas**)
    - Core question: What effect did covid have on consumer investment patterns in Canadian real estate?
- IMPORTANT Alternative: if we are unable to find pricing and market volume by market then we will use Google Trends to analyze interest in real estate over time by CMA
- Primary relationships to expose
    - The relationships between:
        - Real Estate HPI and:
            - Canadian CMAs
            - population density
            - Covid infection rate
        - Real Estate Benchmark Price and:
            - Canadian CMAs
            - population density
            - Covid infection rate
        - Covid Infection rate and:
            - Canadian CMAs
            - population density
        - Real Estate volume and price growth and:
            - Other industries/market consumer spending
            - Other industries/market volume/output (market volume)
            - Other investments/capital allocations (market price growth/decline)
            - Labour market by CMA
            - International and Intranational immigration/emigration by CMA
            - *These are to be used as comparisons to control for other factors in real estate spending, investment and growth/decline*
- Questions to be asked (what do we need to know), why and how would we prove with data?
    - What is the historical real estate demand and how is it connected to population density?
        - Why: We need to show the demand has shifted
        - Why: main control criteria to show that the historical pattern has been
            - lower density = lower demand, growth and pricing
            - Higher density = Higher demand, growth and pricing
        - How: The history of price and growth over time by CMA
    - What other products/services (other industries) went up/down in demand during covid?

        - Why: We need to show that Canadian went from buying real estate to buying essentials
        - Why: use as a control to account for other (noncovid) reasons for shift
        - How: The history of price and growth over time by major industries relative to real estate - CPI and Market volumes
    - What happened to savings/investment patterns?
        - Why: We need to show that consumers went from real estate investing to savings/GICs
        - Why: use as a control to account for other reasons for shift
        - How: The history of price and growth over time by consumer investment in savings products relative to real estate
    - What were the shifts in population density and growth?
        - Why: We need to show population has moved from higher to lower density areas
        - Why: We need to show that the history of growth has been more concentrated areas of population to lower density areas
        - How: The history of Canadian CMAs by population density over time
    - What were the covid infection rates in Canadian CMAs?
        - Why: We want to know the relationship between population density and covid infection rate
        - How: The pattern of infection by CMA and population density

Requirements

Data Sources

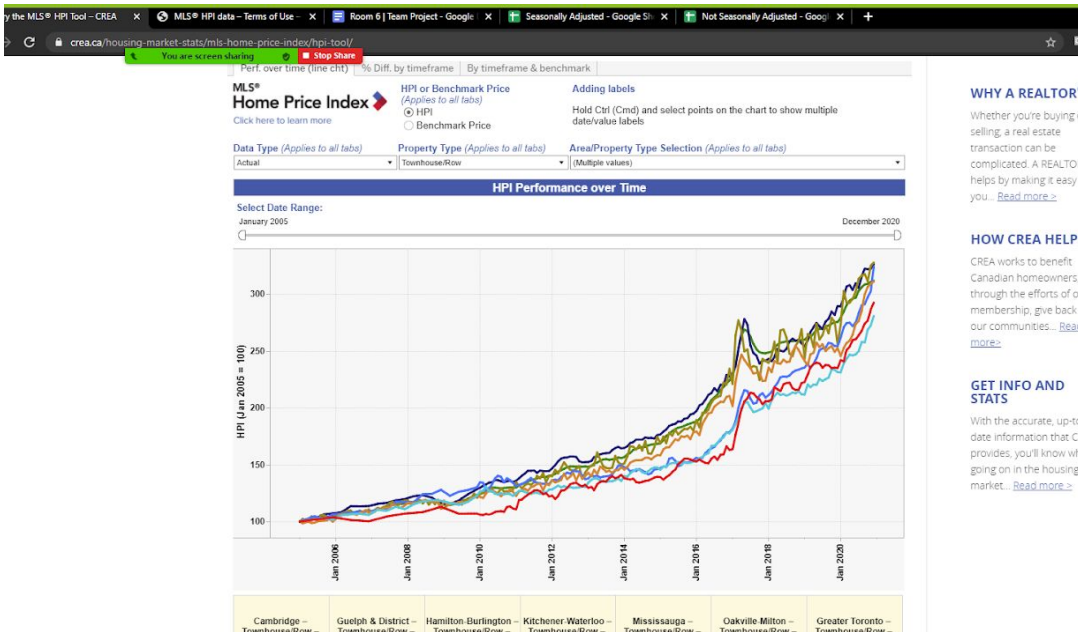
COVID:
https://data.ontario.ca/dataset/covid-alert-impact-data/resource/37cfeca2-059e-4a5f-a228-249f6ab1b771
HPI and Benchmarks: https://www.crea.ca/housing-market-stats/mls-home-price-index/hpi-tool/

Definitions:
A **house price index** (HPI) measures the price changes of residential housing as a percentage change from some specific start date (which has HPI of 100).
Benchmark Price: Each month, the MLS® HPI uses more than 15 years of MLS® System data and sophisticated statistical models to define a "typical" home based on the features of homes that have been bought and sold. These benchmark homes are tracked across Canadian neighbourhoods and different types of houses.

Widgets for Dashboard

Series 1 - Real Estate HPI and Benchmark Price

- Composite HPI by CMA per Month (line graph) from Jan 2015 to Dec 2020
    - CMAs: Toronto, Mississauga-Brampton, Oakville-Milton, Hamilton-Burlington, Cambridge, Kitchen-Waterloo, Guelph



- Benchmark Price by House Type per Month

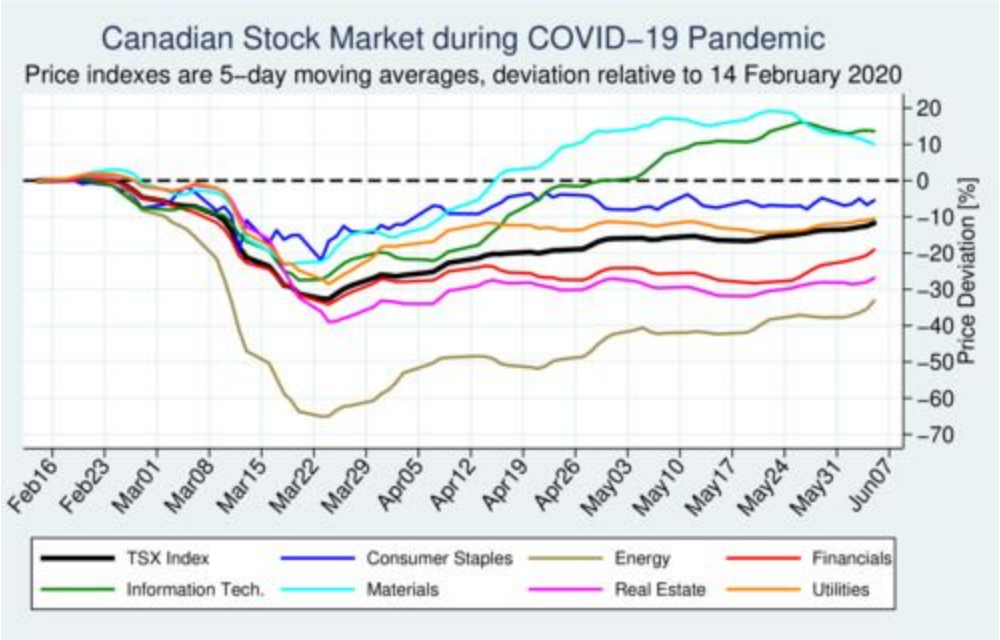
- HPI/Benchmark Price by CMA per Month
-

Widget #2 - COVID infection rate by CMA per Month

- Covid infection rate by CMA per Month (line graph) from Jan 2015 to Dec 2020
    - CMAs: Toronto, Mississauga-Brampton, Oakville-Milton, Hamilton-Burlington, Cambridge, Kitchen-Waterloo, Guelph

Widget #3 - Population density and total by CMA per Month

Inspiration and Research



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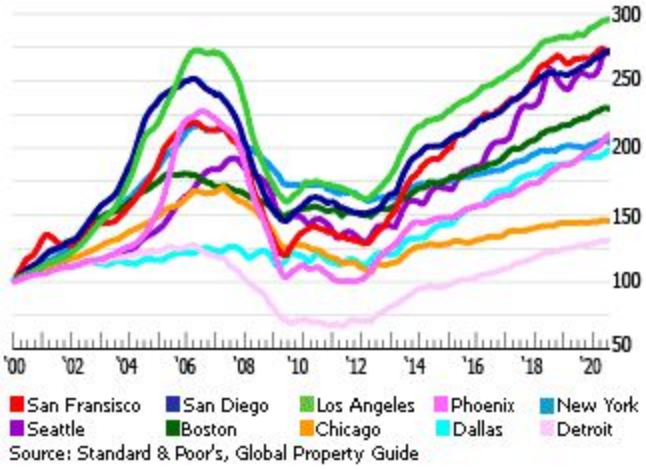
Has the Stock Market Moved On From COVID-19?

Year-to-date performance of major U.S. stock market indices as of June 10, 2020

Source: Yahoo! Finance

House Price Indices, 10 Major Cities

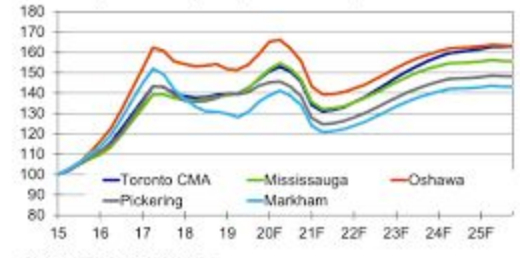


Source: Standard & Poor's, Global Property Guide

Average Rent and Monthly Change in Average Rent for Condo and Rental Apartments by Select Area, Canada, June 2020

Disparity Within Toronto Metro

RPS composite house prices, Jan 2015=100, SA

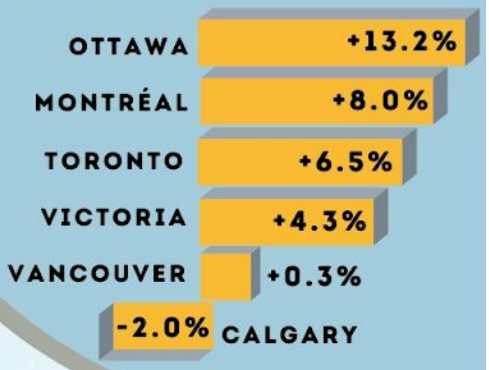


Sources: RPS, Moody's Analytics

THE IMPACT OF COVID-19 ON KEY HOUSING MARKETS

Prior to COVID-19, the price of condominium apartments increased at a faster pace than the price of single, semi-detached and row homes.

From January to March 2020, Ottawa outpaced other key markets for growth of house prices compared with the previous year.



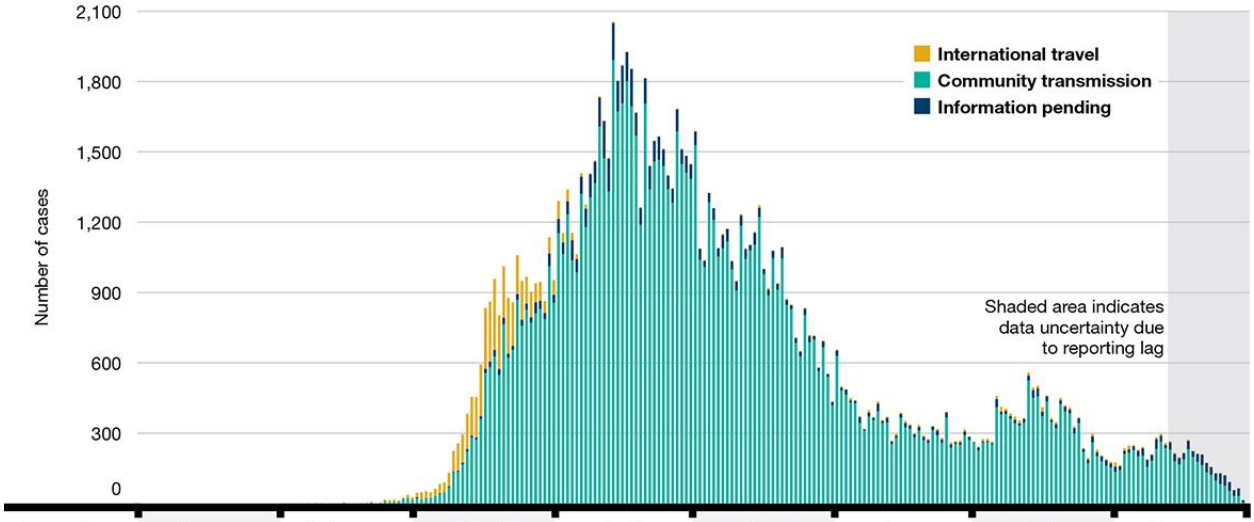
HOUSING MARKET OUTLOOK DURING AND AFTER COVID-19

Builders and buyers have mostly shifted to virtual tours and digital contract signings.

Demand for larger houses has grown as working from home becomes more prevalent.

People will opt to live in the suburbs, where there is more space for families.

For a more detailed analysis, see the article "Price trends and outlook in key Canadian housing markets" at the address: https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00053-eng.htm



DEC 31
First reports of a "pneumonia of unknown cause" in Wuhan, China

JAN 25
First Canadian novel coronavirus case linked to travel from Wuhan, China confirmed

FEB 20
First recorded case in Canada linked to non-China travel (i.e., Iran)

FEB 23
First recorded case in Canada linked to community transmission

FEB 24
First recorded case in Canada linked to travel to the US

MAR 7
First long-term care home outbreak (BC)

MAR 11
Canada surpasses 100 reported cases

MAR 28
First reported outbreak among temporary foreign farm workers (BC)

APR 14
Largest known outbreak in a shelter living setting, with 164 cases (ON)

APR 17
First reported outbreak in an isolated northern community (SK)

MAY 6
Largest known single location outbreak at a meat processing plant, involving 1,560 cases (AB)

JUN 17
First confirmed outbreak in a Canadian religious-cultural community, involving 285 cases by Aug 31 (SK)

Outbreak

JAN 22
Canada implements coronavirus screening requirements for travellers returning from Wuhan, China

MAR 12–22
Physical distancing measures, including school and business closures, implemented across Canada

MAR 13–19
Canada implements additional travel advisories and restrictions for international travellers

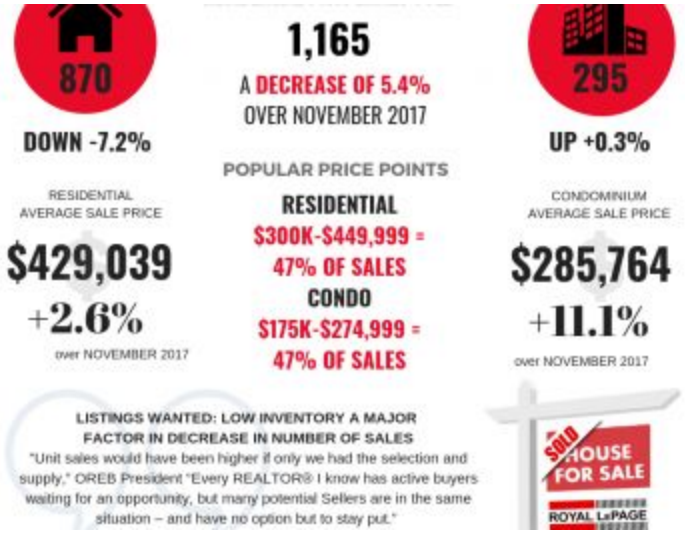
APR 7
Council of Chief Medical Officers of Health issue statement supportive of wearing non-medical masks as an additional layer of protection

APR 15
Public health measures implemented to control largest correctional facility outbreak, involving 162 cases (ON)

APR 24
NB becomes the first province to ease physical distancing measures

Public Health Measure

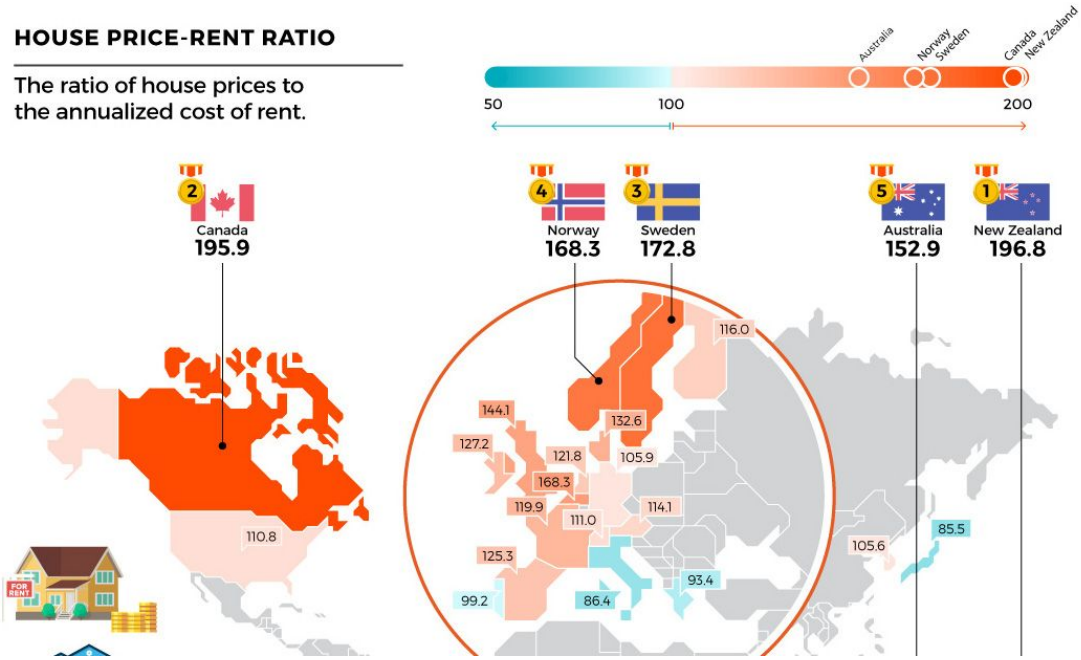

Homes Sales, New Listings and Starts
British Columbia
Index, Feb 2020=100
Home Sales
New Listings
Housing Starts
Pre-COVID baseline
140
120
100
80
60
40
Jan-19
Mar-19
May-19
Jul-19
Sep-19
Nov-19
Jan-20
Mar-20
May-20
Sources: Canadian Real Estate Association, CMHC, and BCREA Economics.
Last data point: June 2020

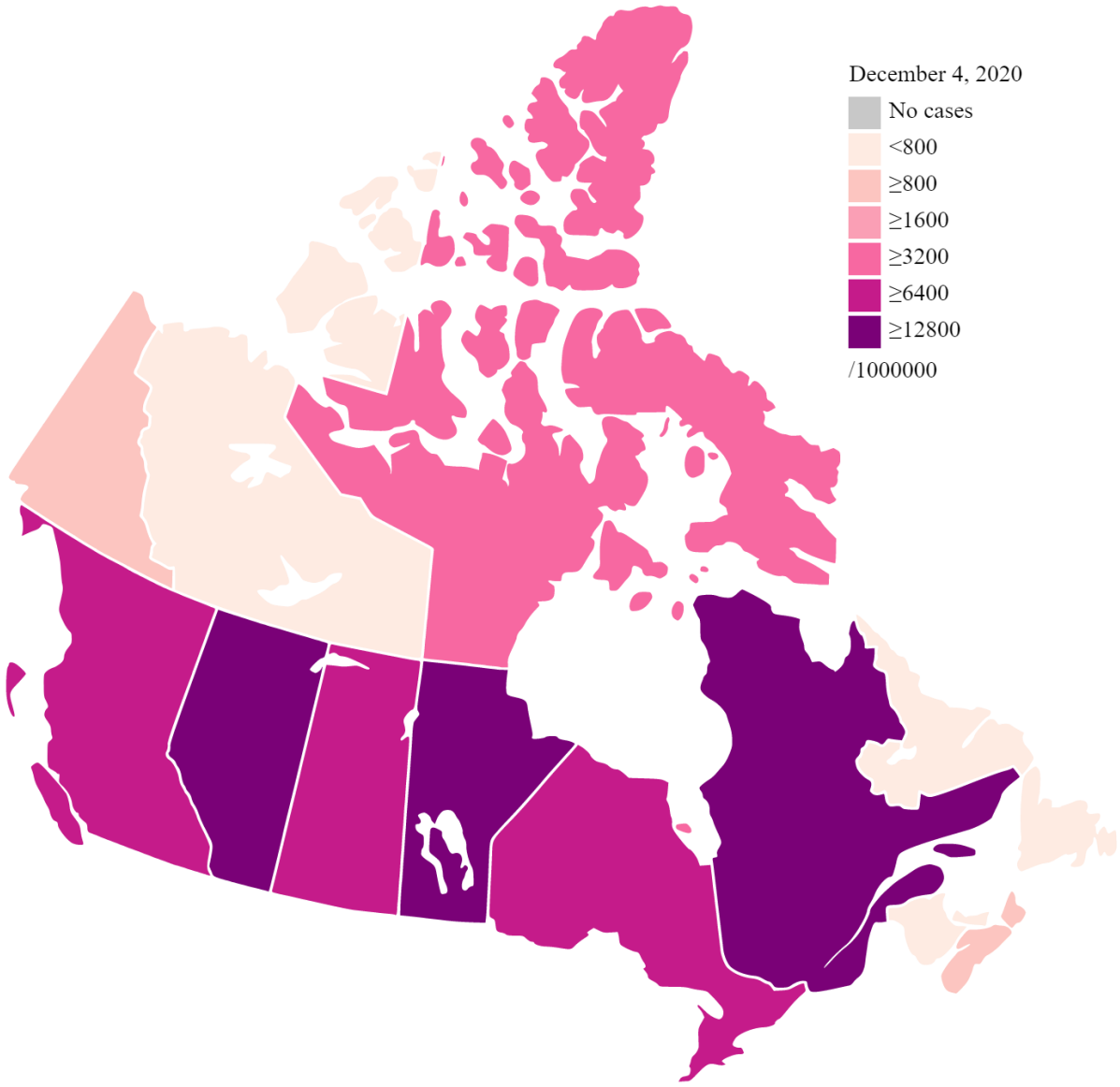

870
DOWN -7.2%
RESIDENTIAL
AVERAGE SALE PRICE
$429,039
+2.6%
over NOVEMBER 2017
1,165
A DECREASE OF 5.4%
OVER NOVEMBER 2017
POPULAR PRICE POINTS
RESIDENTIAL
$300K-$449,999 =
47% OF SALES
CONDO
$175K-$274,999 =
47% OF SALES
295
UP +0.3%
CONDOMINIUM
AVERAGE SALE PRICE
$285,764
+11.1%
over NOVEMBER 2017
LISTINGS WANTED: LOW INVENTORY A MAJOR
FACTOR IN DECREASE IN NUMBER OF SALES
"Unit sales would have been higher if only we had the selection and supply," OREB President "Every REALTOR® I know has active buyers waiting for an opportunity, but many potential Sellers are in the same situation – and have no option but to stay put."
SOLD
HOUSE
FOR SALE
ROYAL LePAGE


House Prices, Annual Change (%)
25
20
15
10
5
0
-5
-10
-15
-20
-25
'12
'13
'14
'15
'16
'17
'18
'19
'20
Nominal
Real
Source: Statistical Office of Montenegro, Global Property Guide

HOUSE PRICE-RENT RATIO

The ratio of house prices to the annualized cost of rent.

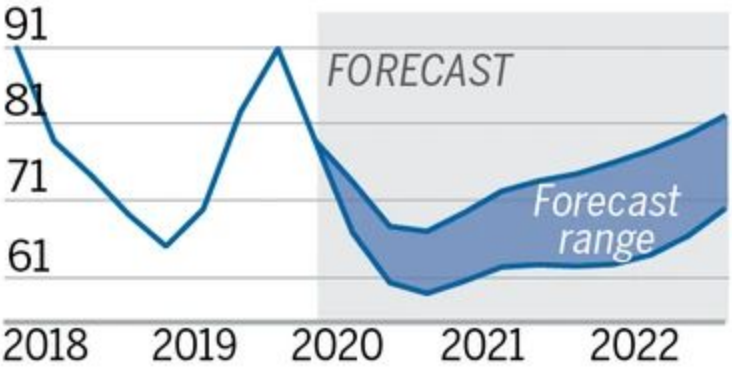



December 4, 2020
No cases
<800
≥800
≥1600
≥3200
≥6400
≥12800
/1000000

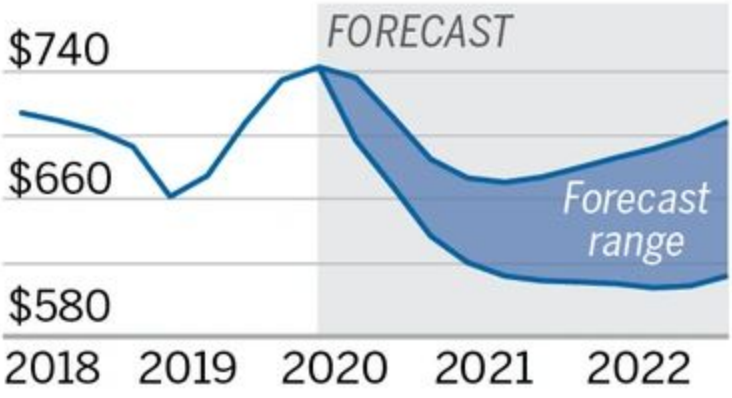
HOUSING FORECAST

The Canada Mortage and Housing Corporation expects a sharp drop in B.C. home prices and sales compared with pre-pandemic levels.

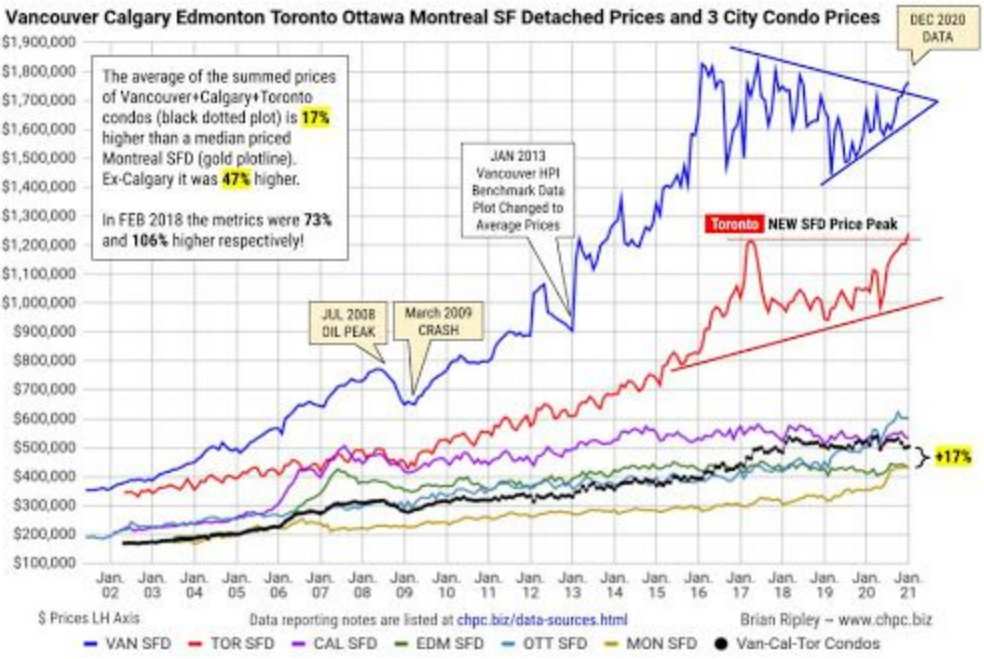
Home sales *(thousands of units)*



Average home price *($000's)*



SOURCE: CMHC, MLS


Vancouver Calgary Edmonton Toronto Ottawa Montreal SF Detached Prices and 3 City Condo Prices
DEC 2020 DATA
The average of the summed prices of Vancouver+Calgary+Toronto condos (black dotted plot) is 17% higher than a median priced Montreal SFD (gold plotline). Ex-Calgary it was 47% higher.
In FEB 2018 the metrics were 73% and 106% higher respectively!
JAN 2013 Vancouver HPI Benchmark Data Plot Changed to Average Prices
Toronto NEW SFD Price Peak
JUL 2008 OIL PEAK
March 2009 CRASH
+17%
$1,900,000
$1,800,000
$1,700,000
$1,600,000
$1,500,000
$1,400,000
$1,300,000
$1,200,000
$1,100,000
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
Jan. 02
Jan. 03
Jan. 04
Jan. 05
Jan. 06
Jan. 07
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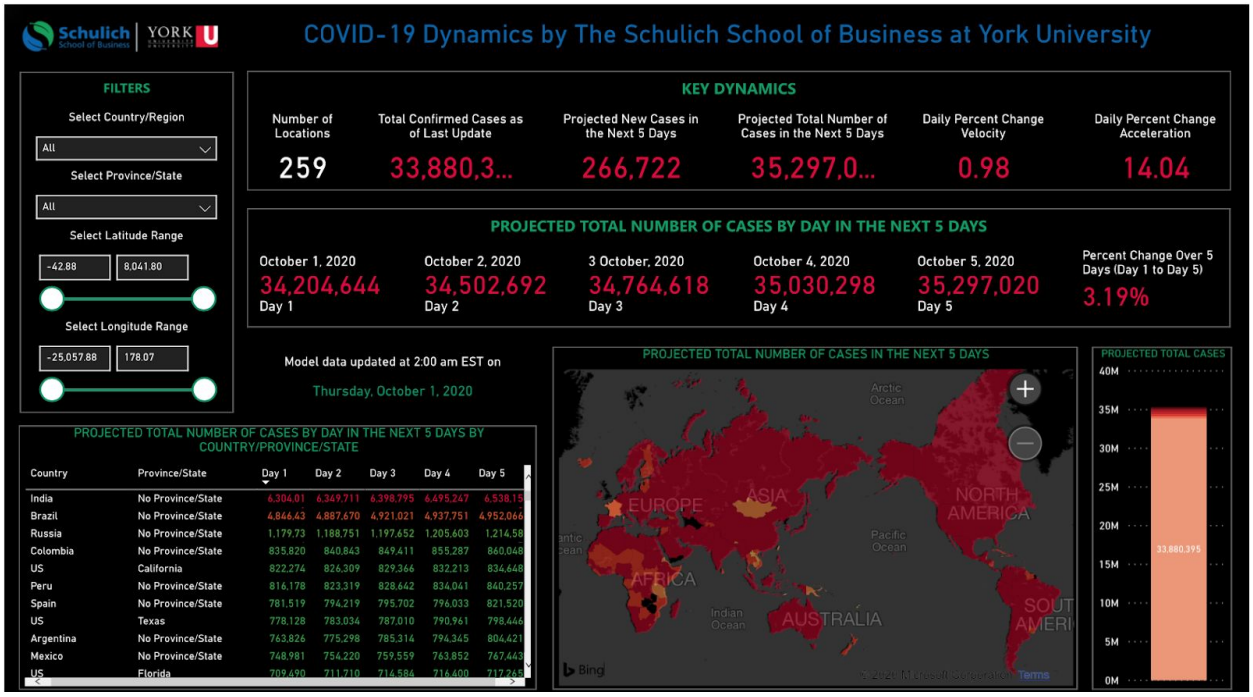
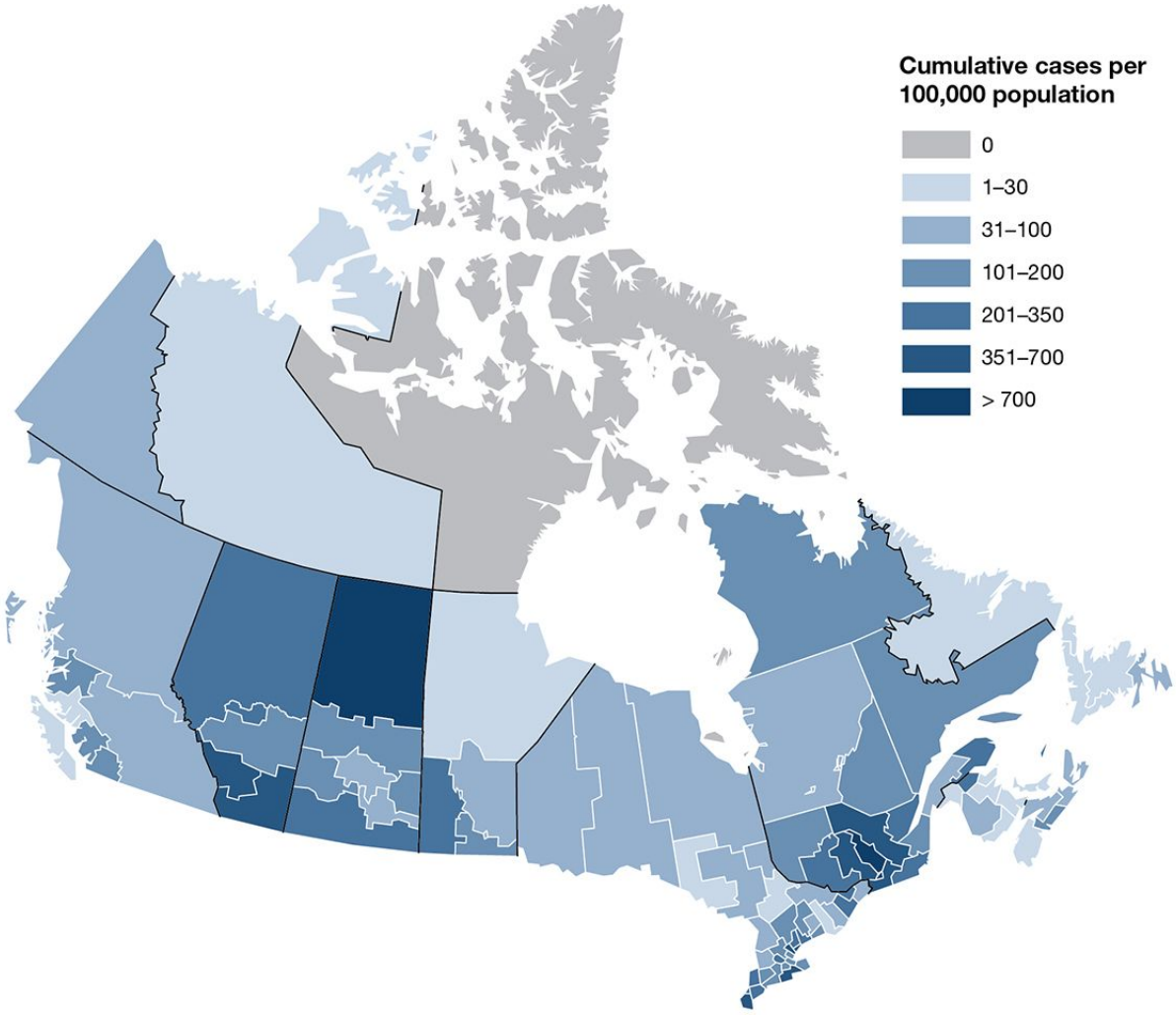
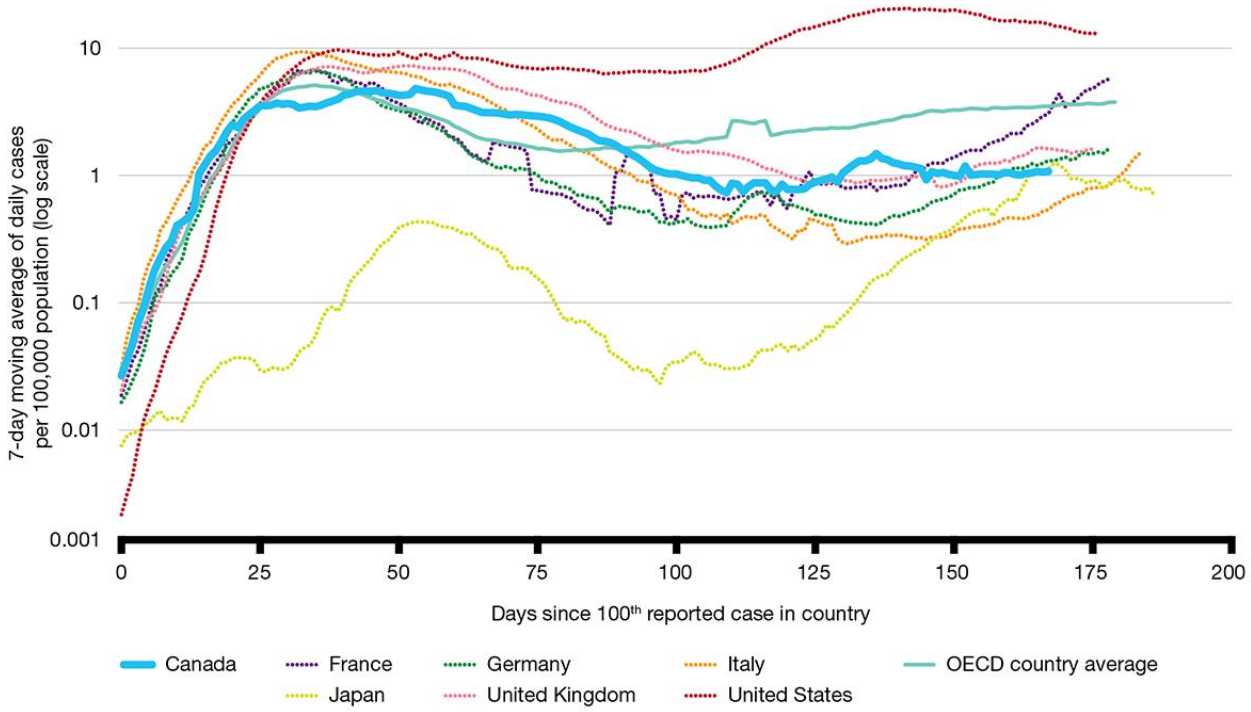
Jan. 09
Jan. 10
Jan. 11
Jan. 12
Jan. 13
Jan. 14
Jan. 15
Jan. 16
Jan. 17
Jan. 18
Jan. 19
Jan. 20
Jan. 21
$ Prices LH Axis
Data reporting notes are listed at chpc.biz/data-sources.html
Brian Ripley – www.chpc.biz
VAN SFD
TOR SFD
CAL SFD
EDM SFD
OTT SFD
MON SFD
Van-Cal-Tor Condos


Best Canadian Markets for Buying a Home on One Income
Home Price-to-Median-Income Ratios in Canada's Urban Centres
TOP 10 BEST CITIES
SAINT JOHN
GREATER MONCTON
TROIS RIVIERES
FREDERICTON
SAGUENAY
REGINA
ST JOHN'S
THUNDER BAY
SASKATOON
HALIFAX-DARTMOUTH
TOP 10 WORST CITIES
GREATER VANCOUVER
FRASER VALLEY
GREATER TORONTO
OKANAGAN MAINLINE
VICTORIA
HAMILTON
OAKVILLE
DURHAM
VANCOUVER ISLAND
MILTON
ZOOCO


Schulich School of Business | YORK U
COVID-19 Dynamics by The Schulich School of Business at York University
FILTERS
Select Country/Region
All
Select Province/State
All
Select Latitude Range
-42.88
8,041.80
Select Longitude Range
-25,057.88
178.07
KEY DYNAMICS
Number of Locations
259
Total Confirmed Cases as of Last Update
33,880,3...
Projected New Cases in the Next 5 Days
266,722
Projected Total Number of Cases in the Next 5 Days
35,297,0...
Daily Percent Change Velocity
0.98
Daily Percent Change Acceleration
14.04
PROJECTED TOTAL NUMBER OF CASES BY DAY IN THE NEXT 5 DAYS
October 1, 2020
34,204,644
Day 1
October 2, 2020
34,502,692
Day 2
3 October, 2020
34,764,618
Day 3
October 4, 2020
35,030,298
Day 4
October 5, 2020
35,297,020
Day 5
Percent Change Over 5 Days (Day 1 to Day 5)
3.19%
Model data updated at 2:00 am EST on
Thursday, October 1, 2020
PROJECTED TOTAL NUMBER OF CASES BY DAY IN THE NEXT 5 DAYS BY COUNTRY/PROVINCE/STATE
Country
Province/State
Day 1
Day 2
Day 3
Day 4
Day 5
India
No Province/State
6,304,01
6,349,711
6,398,795
6,495,247
6,538,15
Brazil
No Province/State
4,846,43
4,887,670
4,921,021
4,937,751
4,952,060
Russia
No Province/State
1,179,73
1,188,751
1,197,652
1,205,603
1,214,58
Colombia
No Province/State
835,820
840,843
849,411
855,287
860,048
US
California
822,274
826,309
829,366
832,213
834,648
Peru
No Province/State
816,178
823,319
828,642
834,041
840,257
Spain
No Province/State
781,519
794,219
795,702
796,033
821,520
US
Texas
778,128
783,034
787,010
790,961
798,446
Argentina
No Province/State
763,826
775,298
785,314
794,345
804,421
Mexico
No Province/State
748,981
754,220
759,559
763,852
767,442
US
Florida
709,490
711,710
714,584
716,400
717,265
PROJECTED TOTAL NUMBER OF CASES IN THE NEXT 5 DAYS
Arctic Ocean
EUROPE
ASIA
NORTH AMERICA
Pacific Ocean
AFRICA
Indian Ocean
AUSTRALIA
SOUT AMERI
Bing
PROJECTED TOTAL CASES
40M
35M
30M
25M
20M
15M
10M
5M
0M
33,880,395


Cumulative cases per 100,000 population
0
1–30
31–100
101–200
201–350
351–700
> 700


10
1
0.1
0.01
0.001
7-day moving average of daily cases per 100,000 population (log scale)
0
25
50
75
100
125
150
175
200
Days since 100th reported case in country
Canada
France
Germany
Italy
OECD country average
Japan
United Kingdom
United States