

# Pandemic Mobility and Risk Impacts on Commercial Real Estate: Evidence from Canadian REITs

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# Pandemic Impacts

## *Uncertainty over the commercial real estate assets*

- The stock price of Canadian Real Estate Investment Trusts (REITs) declined by 47% in March 2020.
  - Later stock prices recovered.
  - Again, we see declines.
- Uncertainty remains over the future of commercial real estate assets.
  - the future of the market in regard to office space, esp. in downtown cores
  - the surge in relocations to suburban areas
  - long-term impacts on brick-and-mortar retail stores and the need to adapt to changes in consumer behavior.

# A Shock on Human Mobility

## *Pandemic as a human mobility shock*

- Many studies on COVID-19 focused on cases and deaths.
- But, in the end, the pandemic mainly affected human mobility.
  - Health issues,
  - government interventions,
  - voluntary isolation,
  - change in the human behavior

# A Shock on Human Mobility

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- Many studies on COVID-19 focused on cases and deaths.
- But, in the end, the pandemic mainly affected human mobility.
  - Health issues,
  - government interventions,
  - voluntary isolation,
  - change in the human behavior
- As real estate is central to our lifestyles, changes in human mobility affect commercial real estate markets directly.

# Characterization of Pandemic Impacts

## *Focus on mobility changes and Canadian REITs*

- We mainly aim to understand what local characteristics drive pandemic impacts.
  - Cases and deaths are pandemic-specific.
  - We aim to build a pandemic/or mobility risk exposure measure.
  - A machine learning model (LASSO) to determine best predictors

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  - A machine learning model (LASSO) to determine best predictors
- We focus on Canadian REITs.
  - REIT-level cash flows
  - Market reaction

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  - We aim to build a pandemic/or mobility risk exposure measure.
  - A machine learning model (LASSO) to determine best predictors
- We focus on Canadian REITs.
  - REIT-level cash flows
  - Market reaction
- We evaluate the relationship between mobility exposure and REIT cash flows.

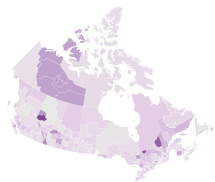
# Data

## *Merging various sources*

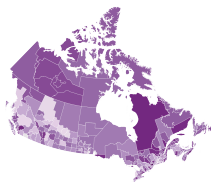
- ▶ Google mobility data
  - Mobility changes relative to 2019
  - Following Ilin et al. (2021), we focus on three categories: transit stations, retail and recreation areas, and workplaces.
- ▶ Big data on neighborhood: Points of interest (POI) data (OpenStreetMap), census data
  - Around 200 neighborhood indicators
- ▶ Canadian REIT data from S&P Global Market Intelligence



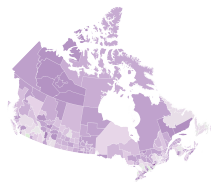
# Mobility Reductions by the Quarters of 2020 and 2021



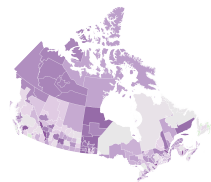
(a) 2020Q1



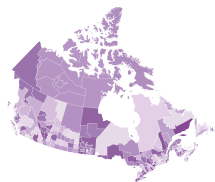
(b) 2020Q2



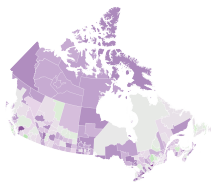
(c) 2020Q3



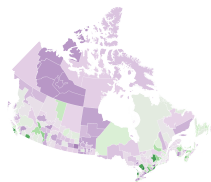
(d) 2020Q4



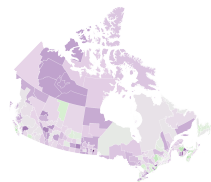
(e) 2021Q1



(f) 2021Q2



(g) 2021Q3



(h) 2021Q4

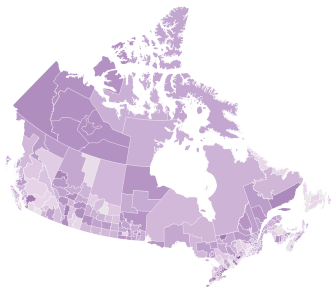
# Best Predictors of Mobility Change by the LASSO Model

VARIABLES	Mobility Change				
	Std. Dev.	(1)	(2)	(3)	(4)
		All Quarters	2020Q2 Wave	2020Q4 Wave	2021Q1 Wave
Normalized Coefficients (by Std. Dev.)					
Panel A - Point of Interest (thousand counts)					
School (Building)	0.113	-6.814	-9.631	-7.425	-5.782
Parking (Amenity)	1.318	-4.773	-6.570	-3.013	-4.206
Bank (Amenity)	0.060	-1.472	-1.465	-1.370	-0.268
House (Building)	7.258	-1.324	-1.800	-1.148	-0.655
Mall (Shop)	0.009	-0.792	-0.533	-0.607	
Commercial (Building)	0.381	-0.437	-0.146	0.227	-0.233
Residential (Building)	2.891	-0.304	-0.023	-0.154	-0.275
Clothes (Shop)	0.102	0.541	0.204	3.788	1.692
Apartments (Building)	0.622	0.609	0.381	0.405	0.548
Farm (Building)	0.022	0.637	0.640	0.605	0.350
Retail (Building)	0.413	0.714	2.317		1.336
Department (Shop)	0.082	1.062		1.065	
Charging (Amenity)	0.008	1.807	1.524	1.169	1.378
Pharmacy (Amenity)	0.048	2.872	3.832		
Industrial (Building)	0.417	3.626	3.810	2.519	2.941
Fuel (Amenity)	0.053	4.512	8.191	5.372	3.176
Childcare (Amenity)	0.009		-1.591		
Kindergarten (Building)	0.007			-0.417	
Hotel (Building)	0.009			-0.204	-0.179
University (Amenity)	0.004				0.150

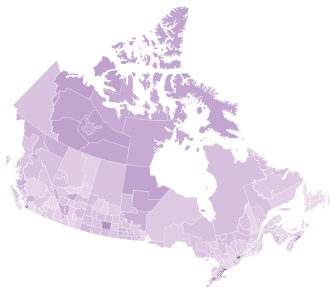
# Best Predictors of Mobility Change by the LASSO Model

VARIABLES	Mobility Change				
		(1)	(2)	(3)	(4)
	Std. Dev.	All Quarters	2020Q2 Wave	2020Q4 Wave	2021Q1 Wave
<i>Normalized Coefficients (by Std. Dev.)</i>					
Panel B - Census Variables					
Population density per km2 (1,000)	0.393	-1.502	0.316	-0.386	-1.007
1 person (%)	2.940	-1.014	-0.920	-2.266	-0.749
Walked (%)	2.348	-0.454	-1.775	-0.607	-0.438
Bachelor's degree (%)	2.600	-0.447	-0.787	-1.165	-1.701
Worked at home (%)	2.383	-0.146		-0.417	-0.503
Unemployment rate	5.287	-0.131	-0.824		-0.753
Median household income (\$1,000)	16.260	0.279	-0.645	1.180	1.356
Interprovincial migrants (%)	2.594	0.793	0.575	1.257	1.591
Median govt. transfers (\$1,000)	2.283	2.791	-1.462	4.747	2.278
Public transit (%)	2.298		-1.407	-0.732	-0.335
Renter (%)	3.654			0.644	
Couples without children (%)	2.854			0.107	

# Mean Mobility and Pandemic Risk Scores



(a) Mean Mobility Change

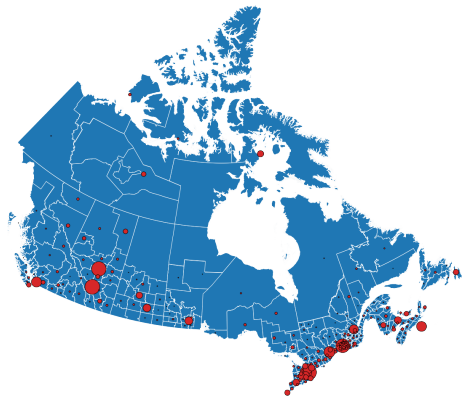


(b) Pandemic Risk Score

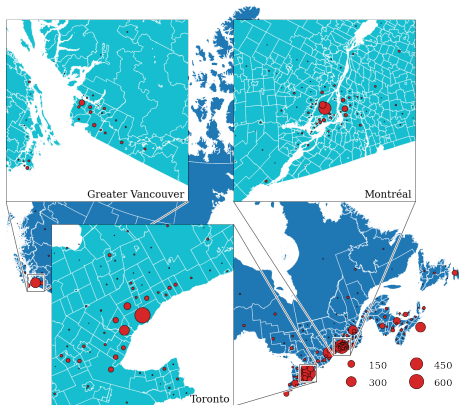
$$MobilityChange_{i,t} = \frac{\sum_j LocalMobility_{i,j,t} * Sqft_{i,j,t}}{Sqft_{i,t}} \quad (1)$$

$$PandemicRiskScore_{i,t} = \frac{\sum_j LocalPandemicRiskScore_{i,j,t} * Sqft_{i,j,t}}{Sqft_{i,t}} \quad (2)$$

# REIT Properties across Canada by 2021Q3



(a) Census Divisions



(b) Greater Vancouver, Montreal, and Toronto

# Descriptive Statistics

## *Pro forma effects*

Variable	N	Mean	SD
Total assets (\$ billion)	620	4.53	4.35
Debt-to-Assets (%)	620	55.54	21.41
Cash-to-Assets (%)	620	1.45	2.63
Market-to-Book	620	1.02	0.22
Rental Revenue-to-Assets (%)	620	3.09	4.65
Rental Operating Expense-to-Assets (%)	620	1.71	4.30
NOI-to-Assets (%)	620	1.38	0.50
Interest Expense-to-Assets (%)	620	0.56	0.38
G&A Expense-to-Assets (%)	620	0.15	0.21
FFO-to-Assets (%)	620	0.77	0.55

# Operational Effects

*Exposure to mobility reductions lower NOI and FFO.*

Variables	(1) Rental Revenue	(2) Rental Opex	(3) NOI	(4) G&A Expense	(5) Interest Expense	(6) FFO
Panel A - Mobility Change						
Mobility Change × (Y=2020)	0.042 (0.042)	0.020 (0.044)	0.021** (0.009)	-0.001 (0.004)	0.003 (0.003)	0.021** (0.009)
Mobility Change × (Y=2021)	0.024 (0.034)	0.009 (0.033)	0.014*** (0.005)	-0.002 (0.002)	-0.003 (0.008)	0.029** (0.014)
ln(Total Assets)	-0.289 (0.250)	-0.229 (0.229)	-0.055* (0.029)	-0.024 (0.015)	-0.011 (0.009)	-0.008 (0.039)
Debt-to-Assets	-0.037 (0.024)	-0.033 (0.023)	-0.004* (0.002)	-0.002** (0.001)	0.016*** (0.001)	-0.018*** (0.004)
Cash-to-Assets	0.865** (0.404)	0.805** (0.376)	0.061** (0.029)	0.040*** (0.014)	0.006 (0.004)	0.015 (0.017)
Market-to-Book	7.008* (3.680)	6.685* (3.587)	0.329 (0.219)	0.224* (0.122)	-0.073 (0.078)	-0.240 (0.322)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	620	620	620	620	620	620
R-Squared	0.659	0.640	0.625	0.630	0.803	0.663

# Operational Effects

*Our pandemic risk score also gives similar results.*

Variables	(1) Rental Revenue	(2) Rental Opex	(3) NOI	(4) G&A Expense	(5) Interest Expense	(6) FFO
Panel B - Pandemic Risk Score						
Pandemic Risk Score $\times$ (Y=2020)	0.008 (0.032)	-0.005 (0.031)	0.013*** (0.005)	-0.004 (0.004)	0.004 (0.005)	0.015* (0.008)
Pandemic Risk Score $\times$ (Y=2021)	0.036 (0.046)	0.015 (0.044)	0.020*** (0.006)	-0.003 (0.003)	-0.001 (0.008)	0.039** (0.015)
ln(Total Assets)	-0.295 (0.252)	-0.234 (0.230)	-0.056* (0.030)	-0.025* (0.015)	-0.011 (0.009)	-0.009 (0.038)
Debt-to-Assets	-0.037 (0.024)	-0.032 (0.023)	-0.004* (0.002)	-0.002** (0.001)	0.016*** (0.001)	-0.018*** (0.004)
Cash-to-Assets	0.870** (0.404)	0.807** (0.375)	0.064** (0.030)	0.040*** (0.014)	0.006 (0.004)	0.018 (0.018)
Market-to-Book	7.071* (3.623)	6.711* (3.536)	0.364* (0.212)	0.224* (0.122)	-0.085 (0.079)	-0.172 (0.301)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	620	620	620	620	620	620
R-Squared	0.659	0.640	0.622	0.633	0.803	0.662



# Operational Effects by Property Type

Variables	(1) Rental Revenue	(2) Rental Opex	(3) NOI	(4) G&A Expense	(5) Interest Expense	(6) FFO
Panel A - Office						
Mobility Change $\times$ (Y=2020)	0.016* (0.009)	0.006 (0.005)	0.010* (0.006)	-0.001 (0.002)	0.001 (0.003)	0.007 (0.007)
Mobility Change $\times$ (Y=2021)	0.019*** (0.007)	0.010** (0.004)	0.009** (0.003)	-0.000 (0.001)	0.007* (0.004)	0.010** (0.004)
Panel B - Residential						
Mobility Change $\times$ (Y=2020)	0.020** (0.009)	0.008 (0.007)	0.012** (0.005)	-0.002 (0.003)	0.007 (0.005)	0.010 (0.009)
Mobility Change $\times$ (Y=2021)	0.032*** (0.008)	0.009* (0.005)	0.021*** (0.006)	-0.002 (0.003)	-0.010 (0.013)	0.044** (0.017)
Panel C - Retail						
Mobility Change $\times$ (Y=2020)	0.023*** (0.008)	0.010* (0.006)	0.013*** (0.003)	-0.000 (0.004)	-0.000 (0.002)	0.013** (0.006)
Mobility Change $\times$ (Y=2021)	0.015** (0.007)	0.009** (0.004)	0.006** (0.003)	-0.001 (0.002)	0.002 (0.002)	0.007 (0.004)
Panel D - Industrial						
Mobility Change $\times$ (Y=2020)	0.001 (0.008)	-0.003 (0.006)	0.004 (0.005)	0.001 (0.002)	0.005* (0.003)	0.011* (0.006)
Mobility Change $\times$ (Y=2021)	0.014** (0.007)	0.003 (0.004)	0.011*** (0.004)	0.001 (0.002)	0.011*** (0.004)	0.014*** (0.004)

# Operational Effects by Property Type

Variables	(1) Rental Revenue	(2) Rental Opex	(3) NOI	(4) G&A Expense	(5) Interest Expense	(6) FFO
Panel A - Office						
Pandemic Risk Score $\times$ (Y=2020)	0.017*** (0.006)	0.010** (0.004)	0.007** (0.003)	-0.002 (0.001)	-0.004 (0.005)	0.006 (0.005)
Pandemic Risk Score $\times$ (Y=2021)	0.023*** (0.008)	0.012** (0.005)	0.011*** (0.004)	-0.001 (0.002)	0.007* (0.003)	0.014*** (0.004)
Panel B - Residential						
Pandemic Risk Score $\times$ (Y=2020)	0.014* (0.007)	0.005 (0.006)	0.009*** (0.003)	-0.001 (0.003)	0.008 (0.005)	0.002 (0.007)
Pandemic Risk Score $\times$ (Y=2021)	0.025** (0.011)	0.006 (0.006)	0.018** (0.008)	-0.002 (0.003)	-0.006 (0.011)	0.035* (0.019)
Panel C - Retail						
Pandemic Risk Score $\times$ (Y=2020)	0.028*** (0.008)	0.011* (0.006)	0.017*** (0.004)	-0.003 (0.003)	-0.001 (0.003)	0.020** (0.008)
Pandemic Risk Score $\times$ (Y=2021)	0.026** (0.011)	0.013** (0.007)	0.011** (0.006)	-0.003 (0.003)	0.002 (0.003)	0.013* (0.007)
Panel D - Industrial						
Pandemic Risk Score $\times$ (Y=2020)	0.003 (0.005)	0.001 (0.004)	0.003 (0.003)	0.000 (0.002)	0.004*** (0.001)	0.010** (0.005)
Pandemic Risk Score $\times$ (Y=2021)	0.011* (0.006)	0.002 (0.004)	0.009** (0.003)	-0.001 (0.002)	0.010*** (0.003)	0.016*** (0.004)

# Market Reaction

*Despite cash flows affected, Investors did not price exposure to mobility mainly in 2021.*

	All Sample (1)	Office (2)	Residential (3)	Retail (4)	Industrial (5)
Panel A - Mobility Change					
Mobility Change $\times$ (Y=2020)	0.446* (0.263)	0.563** (0.257)	0.282 (0.396)	0.655*** (0.222)	0.619* (0.329)
Mobility Change $\times$ (Y=2021)	0.145 (0.152)	0.044 (0.173)	0.245 (0.154)	0.054 (0.160)	-0.020 (0.220)
ln(Total Assets)	-0.297 (0.713)	-1.246 (1.224)	0.551 (1.506)	-1.086* (0.643)	-1.400 (0.880)
Debt-to-Assets	-0.113** (0.049)	0.120** (0.050)	-0.107 (0.103)	0.075 (0.069)	-0.076 (0.076)
Cash-to-Assets	-0.419** (0.176)	0.313 (0.431)	-0.241 (0.557)	-0.141 (0.516)	-0.645*** (0.231)
Market-to-Book	17.368*** (5.944)	14.968 (9.394)	17.217 (13.521)	12.552 (9.588)	20.102 (14.415)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes	Yes	Yes
Observations	254	143	114	135	112
R-Squared	0.196	0.447	0.155	0.437	0.387

# Market Reaction

*Despite cash flows affected, Investors did not price exposure to mobility mainly in 2021.*

	All Sample (1)	Office (2)	Residential (3)	Retail (4)	Industrial (5)
Panel B - Pandemic Risk Score					
Pandemic Risk Score $\times$ (Y=2020)	0.299 (0.319)	0.488*** (0.160)	0.144 (0.397)	1.022*** (0.267)	0.599*** (0.196)
Pandemic Risk Score $\times$ (Y=2021)	0.263 (0.182)	-0.079 (0.138)	0.446** (0.171)	0.196 (0.196)	0.213 (0.128)
ln(Total Assets)	-0.392 (0.627)	-1.600 (1.202)	0.486 (1.284)	-0.793 (0.630)	-1.410* (0.828)
Debt-to-Assets	-0.120*** (0.046)	0.111* (0.060)	-0.118 (0.100)	0.066 (0.066)	-0.102* (0.056)
Cash-to-Assets	-0.346** (0.167)	0.200 (0.405)	-0.139 (0.573)	0.007 (0.434)	-0.657*** (0.197)
Market-to-Book	18.253*** (5.545)	16.268* (9.803)	18.777 (13.448)	12.282 (9.983)	14.971 (12.325)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes	Yes	Yes
Observations	254	143	114	135	112
R-Squared	0.193	0.456	0.161	0.448	0.394

## Concluding Remarks

- We analyze the pandemic as a human mobility shock characterizing by local factors.
  - Predict exposure to future pandemics
  - Understand how behaviors are changing
- Local factors such as type of neighborhood buildings, income, education, etc. determine exposure to mobility reductions.
- We find that cash flows from commercial real estate decline by the exposure to local mobility changes.
- Investors do not price the exposure to local mobility reductions.
- Pandemic risk score based on local factors can help predict future impacts.