Rapid Transit: Housing Affordability

Alvin Lin, Tom Black, Jenil Doshi

Policy Question

Should the Broadway Subway project be extended to UBC?

Research Question

How does extending the Broadway Subway project to UBC influence regional housing affordability?

Background

- The Broadway Corridor is one of BC's more important economic centres
  - Second largest employment hub
  - Connects UBC and Vancouver General Hospital
- Lack of sufficient transportation
  - According to the C.D. Howe Institute, congestion can cost anywhere from $0.5B to $1.4B

- In Summer 2018, Phase Two of Translink's 10-Year Vision was approved, confirming the construction of the Broadway Subway

- The Broadway Subway project includes:
  - Extension of the Millennium Line from VCC-Clark to Arbutus St.
  - Planning for a further extension to UBC (approximately 7 kms)

- According to 2016 Conference Board of Canada Report, the net present value of benefits of extending the Millennium line to UBC are estimated to exceed $4 billion

Evaluating the Benefits of Rapid Transit

- Conventional Benefits - Reduced travel costs, reduced operating costs
- Impact on Housing Affordability
- Agglomeration Benefits - Productivity gains

Literature Review

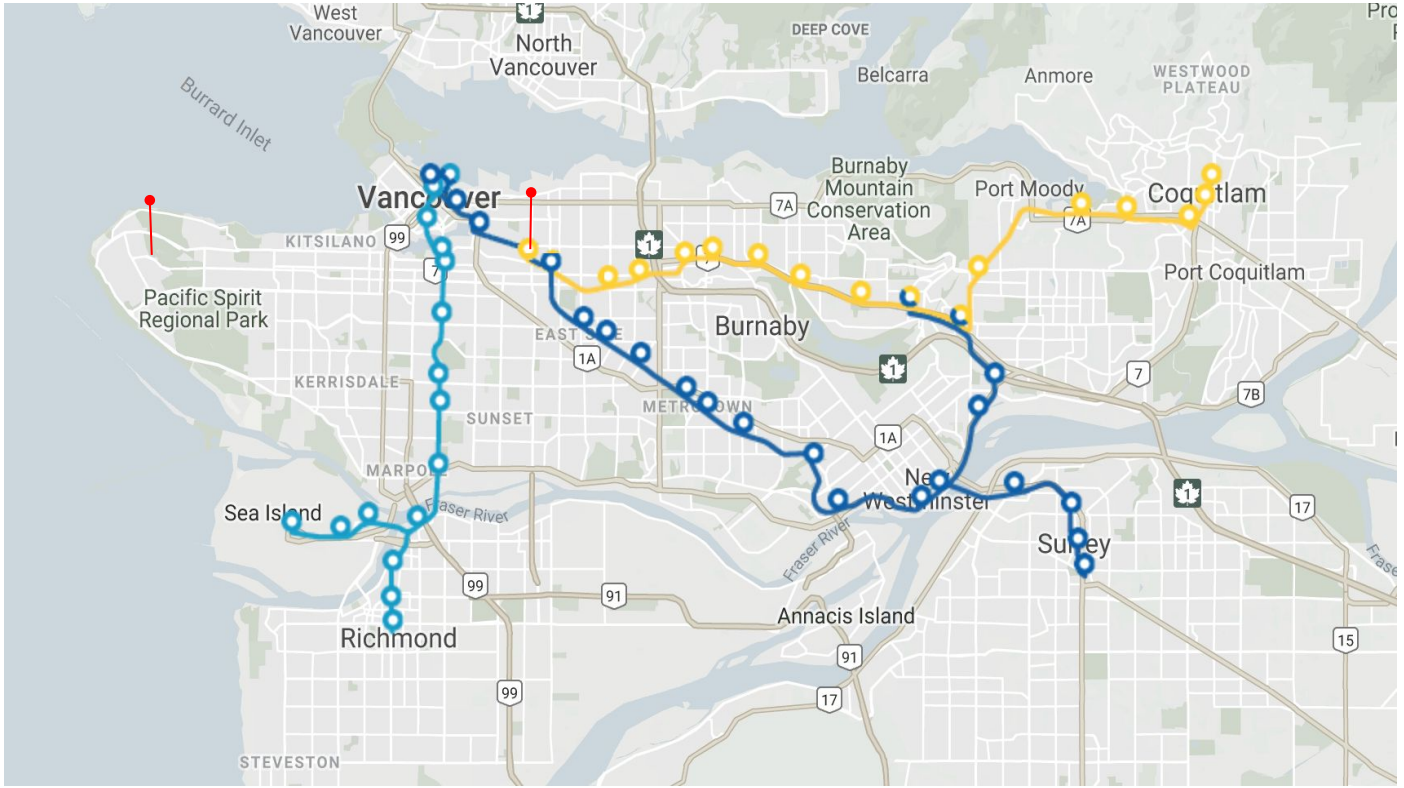
Baum-Snow and Kahn (2000):

- Added convenience of living near transit station tends to increase the housing prices
- The authors argue that potential time savings benefits are reflected in higher housing prices

Glaeser et al. (2008):

- Public transit proximity drives housing prices downward as impoverished households are more likely to converge near the transit stations to capitalize on decreased transportation costs
- Rich households are willing to incur greater transportation costs to possess more land in order to live in larger houses

Our Approach



Data

- British Columbia Assessment Authority
  - Raw Roll Data (from 2014 to 2018)
    - Addresses
    - Floor area
    - Building type
  - Raw Transaction Data (from 2005 to 2015)
    - Sale prices
    - Assessment values

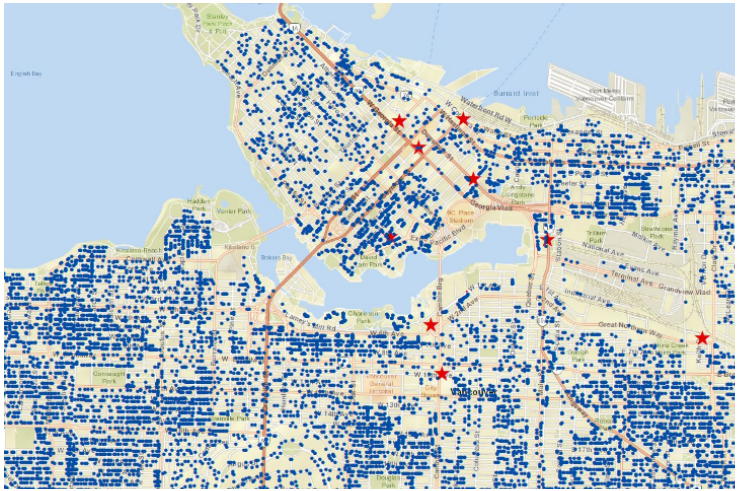
- Acquired through a Data Use Agreement with the UBC Centre of Urban Economics and Real Estate

Economic Framework

Isolating the effect of transit on housing prices

- Regression analysis of a **property's sale price on its proximity to the nearest transit station**
- Compare the effect **before and after the Canada Line is constructed**
- Controlling for:
  - Floor area
  - Condos vs. Detached homes
  - Time trends
  - Neighborhood differences

Calculating proximity to the nearest station



1. Plot properties and Canada Line stations to calculate distances

2. Identify the nearest station

3. Use straight-line distances to create **five "distance rings"** at 200m increments

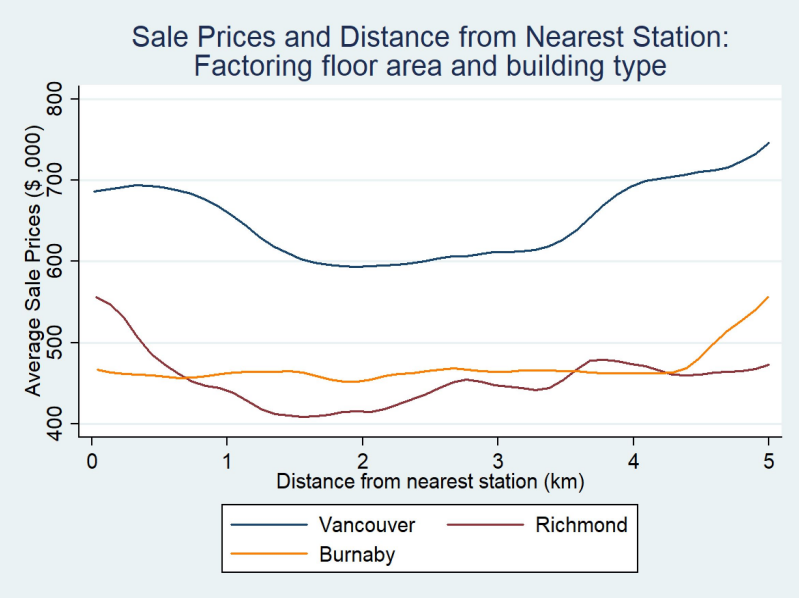
Key variables

- Sale prices of properties from 2005 - 2015
- Distance rings at 200m increments

- Nearest rapid transit station
  - Helps us segment the Canada Line
- Floor area
- Building type
- Transaction dates
- Neighborhood of the property

Results

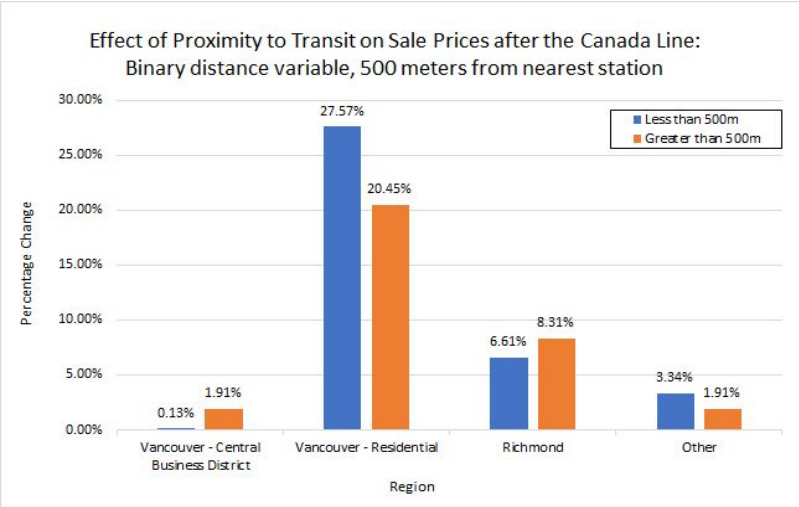
Sale Prices and Proximity to Transit



- Prices start relatively high
- Decrease until 2km
- Increase at greater distances

- Potentially because of the tradeoff between the added **convenience** and **congestion** associated with proximity to transit stations

The Canada Line increased average housing prices throughout Metro Vancouver, but the effect varies considerably by region



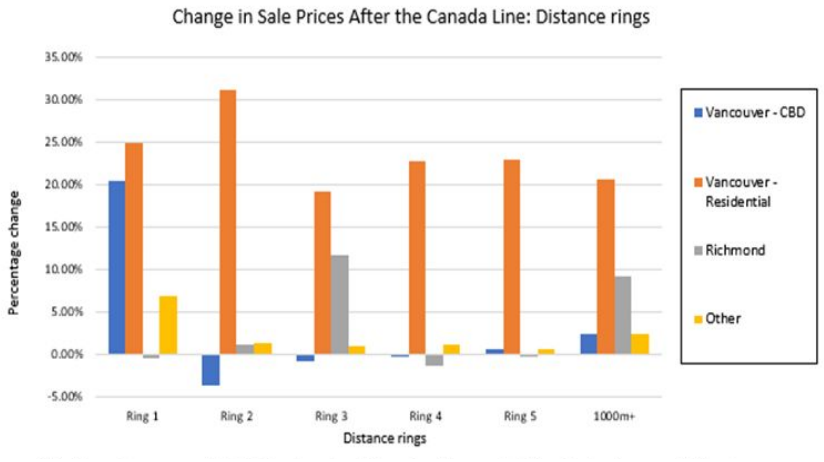
How does the effect of proximity to transit on sale prices change after the Canada Line is constructed?

- Binary distance variable
- Segment areas along the Canada Line

Takeaways:

- Positive effect
- No consistent effect of increasing distance
- Largest effects in "Vancouver - Residential" area

Although average prices increased at the municipal level, certain areas within municipalities saw an opposite effect



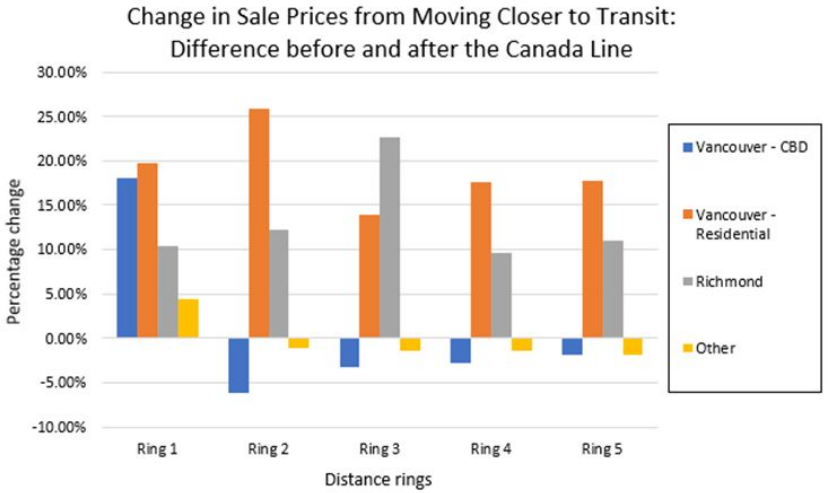
How does the effect of proximity to transit on sale prices change after the Canada Line is constructed?

- Five **distance rings** at 200m increments

Takeaways:

- Properties in "CBD" and "Other" align with narrative
- Prices increase across the board in the "Residential" area
- Unclear pattern "Richmond"

The construction of the Canada Line made properties which are closer to public transit more valuable than those further away



How does the average price disparity between properties close to transit and those far away change after the Canada Line was built?

- Price disparity between properties within 1 km and those greater than 1 km away from a station

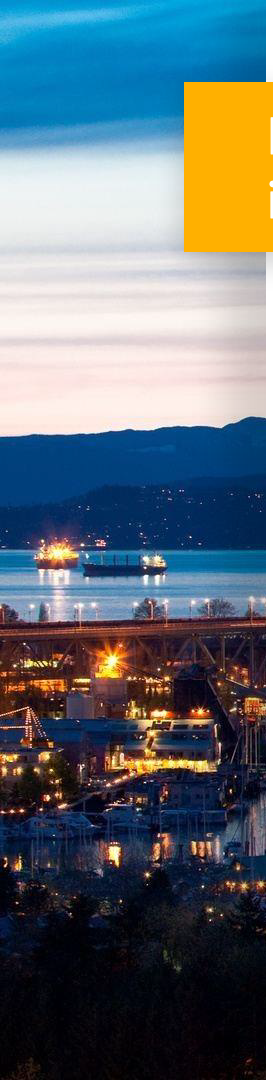
Takeaways:

- All positive effects in Ring 1
  - There's value in living near rapid transit
- Negative effects after Ring 2 in "CBD" and "Other"

Summary of findings

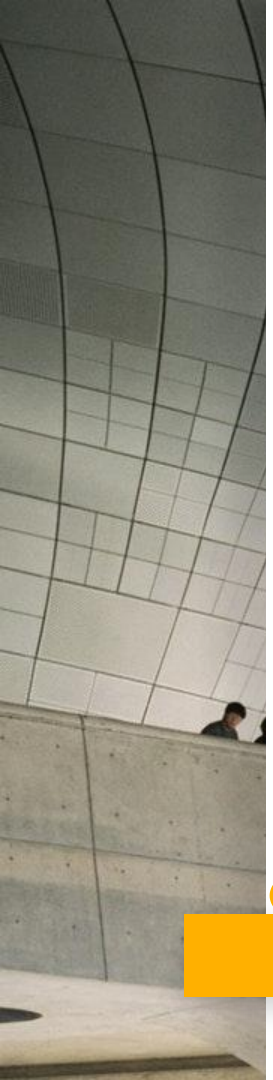
- The Canada Line increased average sale prices in Metro Vancouver
- Effect of proximity to transit on housing sale prices is not uniform
  - Properties in “Residential” and “Richmond” affected the most
  - Some properties in “CBD” and “Other” see price decreases
- Trade-off between convenience and congestion associated with proximity to transit
  - The extent to which residents value convenience and congestion likely vary by region

Conclusion



How does extending the Broadway Subway project to UBC influence regional housing affordability?

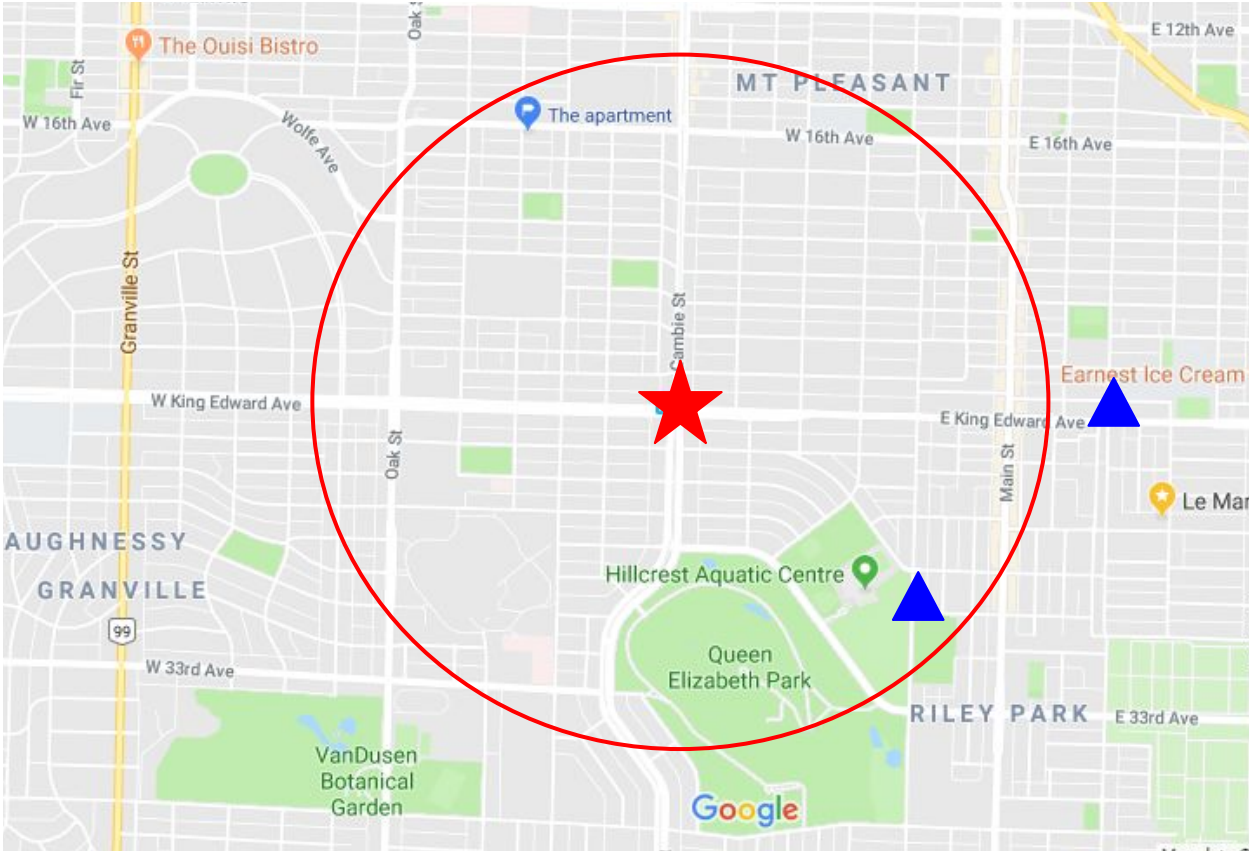
- We preliminarily conclude that the proposed project would have a [redacted]
- This effect varies by region and proximity



Research Limitations

- Distance measures and travel methods
- Net expenditures & access preferences
- Zoning changes

Ring Distance Shortcomings



Net Expenditures & Access Preference

- Changes in net expenditures have not been measured
- How do transit time savings and housing prices affect utility?

		Monthly Savings	
	Per Trip	1 trip per day	2 trips per day
Arbutus >> UBC	$2.55	$55.47	$110.93

This is evaluated using a time value of $11.41/hour provided by the client

Zoning Regulations

- B.C. Government recognizes RRT encourages transit oriented housing
- Millenium Line extension may encourage densification
- Estimated that zoning Vancouver similar to Langley may lead to 2.3% increase in housing starts (The Fraser Institute)
- Land regulation in Vancouver is estimated to have lead to an average $600,000 increase in prices from 2007-2016 (C.D. Howe Institute)

Further Research:

- Rent Data Analysis
- Network Distance
- Consumer Preference studies

Thank you!

Questions?

Appendix

OLS Regression 1 - Binary distances

Specification 1: Binary Distance

$$\ln(HP_{i,N,t}) = \alpha + \sum_{j=CBD}^{Richmond} \beta_j(Near_i \times Post \times Line_{i,j}) + \sum_{j=CBD}^{Richmond} \gamma_j(Near_i \times Line_{i,j}) + \theta Near_i \times Post)$$
$$+ \varphi\, Near_i + \sum_{j=CBD}^{Richmond} \omega_j(Post \times Line_{i,j}) + \sum_{j=CBD}^{Richmond} \sigma_j Line_{i,j} + \rho Post + \psi_1 Area_i + \psi_2 Area^2{}_i$$
$$+ \psi_3 Condo_i + \psi_4(Area \times Condo)_i + \psi_5(Area^2 \times Condo)_i + \delta_N + \delta_t + \varepsilon_{i,N,t}$$

OLS Regression 1 - Point-estimates

Table 1 – Effect of Distance from Transit on Housing Prices: Binary distance		
Variable	**Point-Estimates**	**Standard Errors**
Near × Post × $Line_{CBD}$	-0.0350***	0.00695
Near × Post × $Line_{Van}$	0.0540*	0.0237
Near × Post × $Line_{Rich}$	-0.0337***	0.00979
Near × $Line_{CBD}$	0.0268***	0.00501
Near × $Line_{Van}$	-0.0529***	0.0150
Near × $Line_{Rich}$	0.110***	0.00869
Near × Post	0.0171***	0.00400
Near	0.00266	0.00289
Post × $Line_{CBD}$	0.00555*	0.00278
Post × $Line_{Van}$	0.188***	0.00401
Post × $Line_{Rich}$	0.0673***	0.00280
$Line_{CBD}$	0.115***	0.00389
$Line_{Van}$	-0.0368***	0.00538
$Line_{Rich}$	-0.0887***	0.00997
Area	0.000212***	0.00000501
$Area^2$	-0.00000000564***	0.000000000725
Condo	-1.444***	0.0134
Area × Condo	0.00108***	0.0000204
$Area^2$ × Condo	0.000000153***	0.00000000753
Constant	13.27***	0.0115
Neighborhood FE	Yes	
Year FE	Yes	
Observations	302,426	
R^2	0.844	

OLS Regression 2 - Distance rings

Specification 2: Distance Rings

$$\ln(HP_{i,N,t}) = \alpha + \sum_{k=1}^{5}\sum_{j=CBD}^{Richmond} \beta_{k,j}(Ring_{i,k} \times Post \times Line_{i,j}) + \sum_{k=1}^{5}\sum_{j=CBD}^{Richmond} \gamma_{k,j}(Ring_{i,k} \times Line_{i,j}) + \sum_{k=1}^{5} \theta_k(Ring_{i,k} \times Post) + \sum_{k=1}^{5} \varphi_k Ring_{i,k} + \sum_{j=CBD}^{Richmond} \omega_j(Post \times Line_{i,j}) + \sum_{j=CBD}^{Richmond} \sigma_j Line_{i,j} + \rho Post + \psi_1 Area_i + \psi_2 Area^2{}_i + \psi_3 Condo_i + \psi_4(Area \times Condo)_i + \psi_5(Area^2 \times Condo)_i + \delta_N + \delta_t + \varepsilon_{i,N,t}$$

OLS Regression 2 - Point-estimates

Table 2 – Effect of Distance from Transit on Housing Prices: Distance rings		
Variable	**Point-Estimates**	**Standard Errors**
$Ring_1 \times Post \times Line_{CBD}$	0.1355918***	0.0192728
$Ring_2 \times Post \times Line_{CBD}$	-0.0493534***	0.0091735
$Ring_3 \times Post \times Line_{CBD}$	-0.0186535**	0.0078166
$Ring_4 \times Post \times Line_{CBD}$	-0.0139638**	0.0067672
$Ring_5 \times Post \times Line_{CBD}$	0.0009552	0.0106571
$Ring_1 \times Post \times Line_{Van}$	-0.0227128	0.0653496
$Ring_2 \times Post \times Line_{Van}$	0.1169498***	0.0294241
$Ring_3 \times Post \times Line_{Van}$	-0.0149939	0.0246583
$Ring_4 \times Post \times Line_{Van}$	0.0358471*	0.0185834
$Ring_5 \times Post \times Line_{Van}$	0.0429159**	0.0197809
$Ring_1 \times Post \times Line_{Rich}$	-0.1413954***	0.0150361
$Ring_2 \times Post \times Line_{Rich}$	-0.0683938***	0.0117295
$Ring_3 \times Post \times Line_{Rich}$	0.0396684**	0.0158731
$Ring_4 \times Post \times Line_{Rich}$	-0.0910496***	0.0160333
$Ring_5 \times Post \times Line_{Rich}$	-0.0738227***	0.0107609
$Ring_1 \times Line_{CBD}$	-0.1379228***	0.0110537
$Ring_2 \times Line_{CBD}$	0.0727176***	0.007063
$Ring_3 \times Line_{CBD}$	0.0685704***	0.0063235
$Ring_4 \times Line_{CBD}$	0.0371307***	0.0055223
$Ring_5 \times Line_{CBD}$	0.0614497***	0.007953
$Ring_1 \times Line_{Van}$	-0.1348103***	0.0374724
$Ring_2 \times Line_{Van}$	-0.0341641*	0.0188839
$Ring_3 \times Line_{Van}$	0.0389715**	0.0163891
$Ring_4 \times Line_{Van}$	0.0132693	0.013799
$Ring_5 \times Line_{Van}$	0.0483283**	0.0138845
$Ring_1 \times Line_{Rich}$	0.2340695***	0.0124975
$Ring_2 \times Line_{Rich}$	0.0453842***	0.0104025
$Ring_3 \times Line_{Rich}$	-0.0166085	0.0132319
$Ring_4 \times Line_{Rich}$	-0.1693098***	0.0106353
$Ring_5 \times Line_{Rich}$	0.0442439***	0.0081737
$Ring_1 \times Post$	0.044374***	0.0092948
$Ring_2 \times Post$	-0.0115955**	0.0051021
$Ring_3 \times Post$	-0.0144826**	0.0049242
$Ring_4 \times Post$	-0.0137556**	0.0042084
$Ring_5 \times Post$	-0.0182761***	0.0043081
$Ring_1$	-0.0162383**	0.0066896
$Ring_2$	0.0294128***	0.0037965
$Ring_3$	0.0234146***	0.0036809
$Ring_4$	0.0315766***	0.0031539
$Ring_5$	0.0147201***	0.0031215
$Post \times Line_{CBD}$	0.0029584	0.003533
$Post \times Line_{Van}$	0.1806293***	0.004267
$Post \times Line_{Rich}$	0.0669751***	0.0030255
$Line_{CBD}$	0.1151955***	0.004426
$Line_{Van}$	-0.0380016***	0.0054658
$Line_{Rich}$	-0.0863898***	0.0101289
Post	0.0249201***	0.0035001
Area	0.0002116***	0.00000501
$Area^2$	-0.00000000563***	0.000000000725
Condo	-1.44379***	0.0133874
Area × Condo	0.0010792***	0.0000204
$Area^2 \times Condo$	-0.000000154***	0.00000000754
Constant	13.26493***	0.0016338
Neighborhood FE	Yes	
Year FE	Yes	
Observations	302,426	
R^2	0.8451	

Graveyard
(To be deleted)

Table of Contents