

Queen's University  
Department of Economics



**AN INQUIRY INTO THE TORONTO AND VANCOUVER  
HOUSING MARKETS AND ASSESSING THE IMPACT  
OF THE CHANGE IN MORTGAGE RULES AND  
FOREIGN BUYER'S TAX POLICY**

By  
Rachel Allan

An essay submitted to the Department of Economics  
in partial fulfillment of the requirements for the degree of Master of Arts

Queen's University  
Kingston, Ontario, Canada  
December 2019

copyright © Rachel Allan 2019

## Acknowledgements

First, I cannot express how grateful I am to have been able to complete this project under the supervision of Dr. Charles Beach from Queen's University. His extensive set of knowledge allowed for an interest to evolve into an empirical study. I would like to thank Janet Lemoine, the Data Administration and MLS Statistics Coordinator at the Canadian Real Estate Association for making this analysis possible by providing the MLS data.

Additionally, I am very thankful to have received so much guidance, continuous support and positive encouragement in this project from Dr. Amy Peng at Ryerson University's Economics Department. Lastly, I would like to say thank you to the PhD students and Dr. Leo Michelis at Ryerson University for sharing their knowledge and expertise.

## Table of Contents

<i>Acknowledgements</i> .....	2
1. Introduction:.....	4
2. Background: .....	8
2.1 <i>Canadian Financial System</i> .....	8
2.3 <i>Foreign Buyer's Tax</i> .....	11
3. Literature Review .....	13
3.1 <i>Housing Market Information for Vancouver and Toronto</i> .....	13
4. Data Used in Study: .....	21
5. Empirical Methodology Used in the Study:.....	24
6. Housing Demand Regression Results: .....	28
6.1 <i>Initial Regression Results</i> .....	28
6.2 <i>Adjusted for Simultaneity</i> .....	35
6.3 <i>Reduced Form Effects Policy Shifts</i> .....	40
7. Conclusion: .....	49
<i>References</i> .....	54
<i>Appendix 1: Structural Breaks in Prices</i> .....	58

# 1. Introduction:

Canadians, particularly young adults, are facing higher barriers to entry than ever when trying to enter the real estate market in the two hottest metropolitan cities, Toronto and Vancouver. Both cities have seen substantial run-ups over the last six years, which has resulted in tighter regulations and new policies from policymakers to cool the housing markets. According to Toronto Real Estate Board (TREB) following the implementation of the Foreign Buyer's Tax Policy in Toronto, their Second Quarter 2017 Condo Market Report saw an 8 percent fall in sales compared to the year earlier (TREB, 2017). This was out of the norm since the market had seen continuous growth for nearly a decade. Toronto adopted the foreign buyer tax policy on April 21<sup>st</sup>, 2017 following Vancouver's move on August 2<sup>nd</sup>, 2016. The goal was to discourage foreign buyers from purchasing Canadian assets and driving up the markets.

2019 predications show that there will still be some interest in Canadian real estate by Chinese and Hong Kong-based investors; however, the increase will be slim due to Canadian policy makers (Ireland, 2019). The Globe and Mail article by Carolyn Ireland (2019) states that a Shanghai-based real estate portal has experienced significant increase in 2018 real estate searches relative to 2017 for Calgary (234.4%), Halifax (394%) and Montreal (35.7%) (Ireland, 2019). This is allegedly a result from Toronto and Vancouver's high prices and tax policies (Ireland, 2019). Thus, Canadian policy makers must be alert and aware to protect the markets from being potentially saturated with foreign investments given these heightened results from Chinese investors alone.

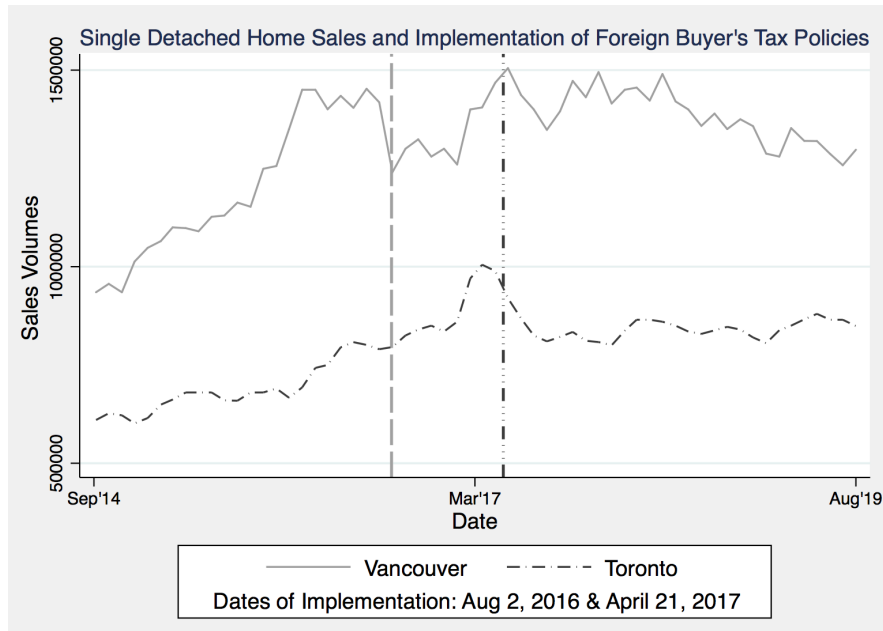
According to CEO Carrie Law of Juawai.com, the number of overseas searches for Canadian property surged 76.1 percent in 2015 and 43.4 percent in 2016 (Ireland, 2019). This was around the same time the Vancouver and Toronto markets were heating up before demand dropped

in the first two quarters of 2018 (Ireland, 2019). The searches had flatlined at 1.3 percent in 2017 (the year after the Foreign Buyer's Tax Policy in Vancouver) and enquires from China for Vancouver properties dipped 2.8 percent in 2018 relative to the year before (Ireland, 2019). Notably, Toronto fell further as there was a 10.3 percent fall during 2018 (following the policy implementation for Toronto in 2017) (Ireland, 2019).

After searching for recent work on the impact of these policies, there has been a lack of transparency between the reports published and where the numbers have come from. Thus, the present more formal analysis is useful in assessing the effectiveness of the Foreign Buyer's Tax Policies and the changes to Canadian mortgage rules.

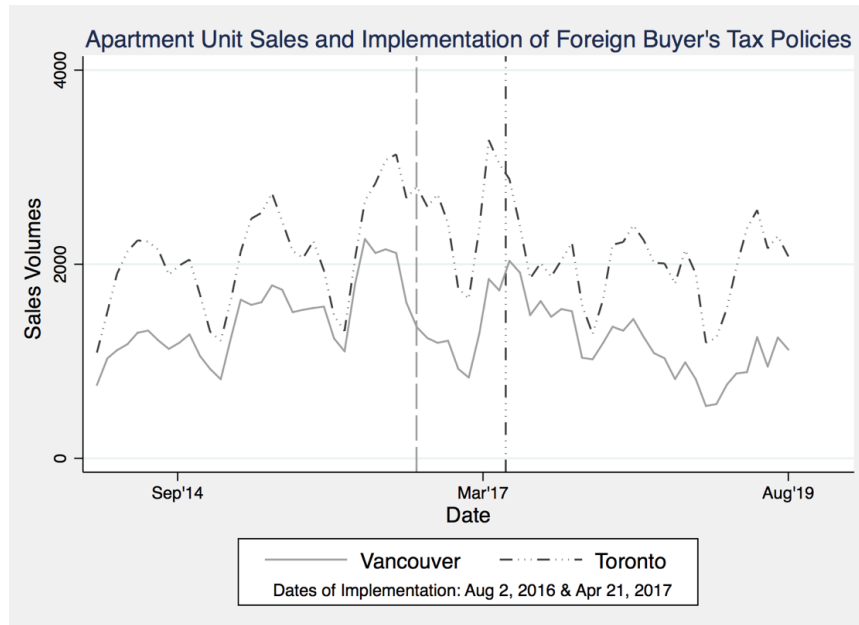
The following graphs include the structural breaks of the implementation of the Foreign Buyer Tax in Vancouver and Toronto on the Volume of Sales from the Canadian Real Estate Association (CREA). The Figure 1 shows the sales for single detached family homes and Figure 2, for the apartment unit sales.

Figure 1:



*Figure 1: Total monthly volume of sales from September 2014 to August 2019 for single detached family homes. Marked are the structural breaks of the Foreign Buyer's Tax Policy in Toronto and Vancouver (Canadian Real Estate Association, 2019).*

Figure 2:



*Figure 2: Total monthly volume of sales from January 2014 to August 2019 for apartment units. Marked are the structural breaks of the Foreign Buyer's Tax Policy in Toronto and Vancouver (Canadian Real Estate Association, 2019).*

This paper is motivated by the sharp run-ups in housing prices in major cities and their surrounding areas in Canada. According to Zochodne (2019), the foreign buyers tax policy, change in mortgage rules and increase in interest rates have put a damper on real-estate activity just as the findings of this paper suggest. The Toronto Real Estate Board's (TREB) (2017) Quarter 2 report saw an 8 percent fall in sales in condominium apartment sales compared to 2016 following the implementation. Likewise, the Real Estate Board of Greater Vancouver (REBGV) monthly report (2016) for August stated that residential sales fell 26 percent after falling off record-breaking pace the month before. This was primarily a result of the implementation of the Foreign Buyer's Tax Policy.

The following research uses data gathered from Statistics Canada and the Canadian Real Estate Association to model the housing demand equations for Toronto and Vancouver. The analysis runs independent regressions on sales volumes for single detached family homes and apartment units for the Toronto and Vancouver area. This paper's major contribution is highlighting the impact of the Foreign Buyer's Tax Policies and change in Canadian mortgage rules in each of the four separate regressions. The goal of the paper is to better understand the implications of the intervention methods as it aims to prove whether they are truly improving the overall health of the Canadian real estate markets in the Greater Toronto and Vancouver Areas. This research contributes to assessing the overall welfare of Canadian citizens pertaining to those trying to enter the real estate market and whether the federal entities have enabled policies to facilitate accessible to affordable housing.

## **2. Background:**

### *2.1 Canadian Financial System*

The Bank of Canada's (BOC) role is to advise federal authorities while overseeing Canada's mortgage and housing markets. The Financial Systems 2018 Review highlighted key vulnerabilities in the Canadian Financial System. The two key issues relating to the mortgage and housing market were the elevated level of household indebtedness and the imbalances in the Canadian Housing Market. Prior to this report, the 2016 Bank of Canada December report stated four key risks to the Canadian Financial System: (1) household financial stress and a sharp correction in house prices, (2) a sharp increase in long-term interest rates driven by higher global risk premiums, (3) stress emanating from China and other emerging-market economies and (4) prolonged weakness in commodity prices. The first three risks were evaluated at elevated, moderate and elevated, respectively, and relate closely with the unstable economic situations, which were prevalent in Toronto and Vancouver at that time (BOC, 2016). There has evidently been a lack of stability for many years until new policies were implemented.

The Financial System Review (FSR) (2017) was accurate in predicting the risks of correction in housing prices in overheated markets, and a sharp increase in long-term interest rates driven by higher global risk premiums (BOC, 2017). There have been claims that foreign investors influence the Canadian housing markets and financial systems. The threat of foreign buyers remains a liability to Canada as they are purchasing Canadian debt securities and potentially saturating our markets.

In the FSR (2017) report, the Office of the Superintendent of Financial Institutions (OSFI) outlined the revised changes to the Guideline B-20 to supervise underwriting scrutiny on



underwriting practices going forward. The reoccurrence of default on loan payments and the fall in collateral values have a negative impact on the Canadian macroeconomy (BOC, 2016). Consequently, there is less credit available, ultimately increases borrowing costs (BOC, 2016). This policy change was effective on January 1<sup>st</sup>, 2018 and was implemented to help reduce financial instability in Canada.

Household financial stress is evident as one source claims that 46 percent of Canadians are \$200 or less away from insolvency (The Canadian Press, 2019). This number increased by 6 percent from the last quarter after an increase in interest rates which is harmful to financial stability (The Canadian Press, 2019). The number of indebted households is increasing which is leading to less consumption spending and in turn, affects housing prices. With the growing number of indebted households, increasing interest rates and heated real estate markets, fewer Canadians are able to support a family and meet basic living necessities. Therefore, it is up to the federal authorities and policy makers to address these concerns.

## *2.2 Mortgage Rules*

The Minister of Finance and the Governor in Council make Canada's mortgage regulations under the *National Housing Act*. The *Eligible Mortgage Loan Regulations* has seen substantial changes which tightened the criteria for mortgage qualifications, making mortgages less accessible. According to the Report of the Standing Committee on Finance (2017), the *Eligible Mortgage Loan Regulations* set the minimum amount required for a down payment on a home and the maximum debt service ratio that a borrower may have with a mortgage (Easter, 2017). Additionally, these regulations outline the maximum amortization period for a mortgage and decide which mortgages require insurance (Easter, 2017). Furthermore, the Minister of Finance

and the Governor in Council monitor *The Insurable Housing Loan Regulations* and collaboratively decide the types of loans that are eligible for mortgage insurance.

The original Guidelines B-20 and B-21 were published by OSFI in November 2014. The objective of Guideline B-20 was to put in place the best practices for mortgage underwriting. In January 2018, OSFI enforced a stress test for low-ratio mortgages in the revised Guideline B-20 (Bilyk and Tenyenhuis, 2018). The goal was to improve the quality of new mortgage lending; and to do so, these stress tests checked whether the borrowers could still handle payments (including principal and interest) in the case that interest rates increased (BOC, 2018). As Toronto Dominion Bank (TD) clarified, the new rules affect homebuyers with a down payment of 20 percent, and use the benchmark for the stress test as the higher rate between the 5-year benchmark published by the Bank of Canada, or the mortgage interest plus 2 percent. The overall improvement of mortgage laws was to improve financial stability amongst Canadians, however primarily effected first time home buyers. The new rules are enforced only on new mortgage loan agreements rather than refinancing existing mortgages. The new mortgage rules which came into effect January 2018 are included as an indicator variable in this analysis (see Section 5 under Methodology).

The stricter laws, increasing interest rates and increased 5-year fixed-mortgage rate together have likely reduced the number of highly indebted households in Canada. A high borrower is more susceptible to unfavourable situations, which is why the change in regulations has been effective in improving the quality of lending. As a result of the revised mortgage rules, the Bank of Canada (2018) reported the loan-to-income ratio over 450 percent. Borrowers who want to take on loans that are more than 4.5 times their annual income fell 20 percent in the second quarter of 2018, relative to the year before. Furthermore, the proportion of new high-ratio mortgages with loan-to-income ratios above 450 decreased from 20 percent in the fourth quarter of 2016 to 6 percent in

the second quarter of 2018, which is a positive result for Canada's financial stability (Bilyk and Tenyenhuis, 2018).

The federal authorities worked vigorously in 2017 to attack the vulnerabilities reported in the December Bank of Canada (2016) report which resulted in revised rules of January 2018. The Canadian Mortgage and Housing Corporation (CMHC) and Department of Finance (2017) stated in the House of Commons that the new test will lead first-time homebuyers in two directions - either they save more or take on less debt - which is a vital trade-off in improving Canada's financial stability (Easter, 2017).

### *2.3 Foreign Buyer's Tax*

The Government of British Columbia announced B-28 Miscellaneous Statutes (Housing Priority Initiatives) Amendment Act on July 25<sup>th</sup>, 2016 (Chisholm et al., 2016). On August 2<sup>nd</sup>, 2016, a foreign buyer tax was implemented in Vancouver (Alini, 2019). This resulted in all residential purchases registered with the Land Title Office, on or after August 2<sup>nd</sup> being subject to an additional 15 percent tax. This was only effective if the property is transferred to foreign buyers under the *Property Transfer Tax Act* (Chisholm et al., 2016). According to the Real Estate Board of Greater Vancouver, residential property sales in August 2016 fell 26 percent relative to the year before dropping from 3,362 to 2,489. Following consecutive quarters of substantial run ups in prices, the market is showing signs of recovery according to Royal LePage (2017) following the Government of British Colombia policy implementation.

The Bank of Canada (2016) reported that areas such as the Greater Toronto Area (GTA) and Greater Vancouver Area (GVA) are likely to see a more pronounced decline in house prices as they have experienced strong run-ups. CBC News (2019) confirms the Bank of Canada

prediction in their remark that the Vancouver-area market has seen correction following the implementation of foreign buyer tax, the vacant home and other speculation taxes imposed in the B-28 Amendment Act (The Canadian Press, 2019).

The Bank of Canada Financial Systems Review (2017) report outlined the Foreign Buyer's Tax Policy implemented by the Ontario Government. This 15 percent tax was enforced on all non-citizens and non-residents of Canada who purchase (or obtain through acquisition) residential property in the Golden Horseshoe area of Durham, Peel, York, Toronto, Halton, Hamilton and Niagara (BOC, 2017). This tax policy was one of multiple initiatives put into place under the Fair Housing Plan of April 2017. The goal of this plan is to make housing more affordable and bring stability to the real estate market.

### **3. Literature Review**

#### *3.1 Housing Market Information for Vancouver and Toronto.*

As outlined in the Standing Committee on Finance & Depository Services Program, the Canadian Mortgage and Housing Corporation (CMHC) was established in 1946 under the *National Housing Act* (Easter, 2017). This Federal Crown corporation's goal is to facilitate access to affordable housing which includes protecting and distributing funding, and financing options for low income housing to ensure a balanced and healthy housing sector (Easter, 2017). The CMHC uses loans, subsidies and homebuyer's insurance to effectively achieve the objective of the Act. This Crown corporation works alongside many federal agencies such as OSFI and the BOC, and even advises the Minister of Finance about Canada's mortgages and housing markets. These authorities work together in unity with the hopes of mitigating homelessness and improving the overall quality of life for Canadians through proficient monitoring and policy implementation.

Canadians can benefit from more accessible and affordable housing which for low-middle income families is hard to access in the Toronto and Vancouver markets (CANCEA and CUI, 2019). According to the Canadian Center for Economic Analysis (CANCEA) and the Canadian Urban Institute (CUI) for the Affordable Housing Office of the City of Toronto, their January 2019 Housing Market Analysis explained that Toronto is likely to experience strong population growth over the next 20 years, in fact almost double the growth by 2041 (CANCEA and CUI, 2019). Consequently, it is the low-middle income families, seniors on fixed incomes and immigrants who are suffering to find affordable and suitable housing and are experiencing worsening conditions. Without government intervention rent prices will continue to increase and the lack of social and affordable housing will continue to grow (CANCEA and CUI, 2019). The government's

interventions are key in maintaining cohesion, equity and economic prosperity in Toronto and across all metropolitan cities (CANCEA and CUI, 2019).

The Canadian housing markets have been infused with foreign investors which likely has and continues to drive up the cost of real estate, making homes unaffordable for many locals (Ireland, 2019). Just as Toronto and Vancouver have experienced record-breaking prices, other cities are beginning to experience the heightened prices as well which is why government intervention mechanisms are of utmost importance (Ireland, 2019).

The housing markets in Toronto and Vancouver have seen a vigorous amount of change as the shortage of supply has caused price predictions to increase significantly. According to the Anonymous (2016), Canadian Real Estate Association predictors forecasted that Toronto and Vancouver charge ahead of expectations compare to other Canadian cities. Consequently, the predicted sales in Toronto, Vancouver and Montreal were up 18.7 percent from 2015 (Anonymous, 2016). This report outlines that excluding the Vancouver and Toronto area housing markets, the national average home price sold in February 2016 was \$355,235 after 8.7 percent growth. When including Toronto and Vancouver markets, the average national price was \$147,822 higher (Anonymous, 2016).

Following these predictions, the Canadian Broadcasting Corporation (April, 2016) confirmed the Toronto area's housing market sales were up more than 16 percent in the first quarter of 2016 relative to the previous year. TREB statistics explained that the average price of detached homes sold in the City of Toronto area in March 2016 was \$1.17 million and for the GTA as a whole was more than \$910,000 (CQ-Roll Call, 2016). Jason Mercer, the Director of Market Analysis for TREB expressed the demand was strong, however buyers were aggravated by the supply of listings as there was a fall in listings on the MLS system compared to the first quarter in 2015 (CQ-Roll

Call, 2016). The Real Estate Board of Greater Vancouver said residential property sales were up 24 percent in March 2016 compared to February 2016 resulting in a record holding sales month according to the president Dan Morrison (CQ-Roll Call, 2016). During this period, the average price for detached properties reached above \$1.34 million (a 27.4 percent increase from the year before) and the composite benchmark price for all residential properties across GVA was \$815,000 (23.3 percent increase from the year before) (CQ-Roll Call, 2016).

### *3.2 Housing Market Studies*

Head, Lloyd-Ellis and Sun (2014) conducted research on the dynamics of house prices, construction, sales and population growth in 106 cities across the United States. The model used was a structural panel vector autoregressive (VAR) model to assess the impact of the shocks at the city level. Their study focuses on the city-level data as they agree with other authors that the time series variation is most prominently local in nature (Head et al., 2014). They characterize housing market dynamics in three ways: housing prices and sales growth are volatile relative to income per capita, price growth exhibits strong positive serial autocorrelation and population growth is more volatile than construction however less persistent (Head et al., 2014). The present study experiences strong positive serial autocorrelation which is corrected for using the Cochrane-Orcutt method in Section 6. Their work highlights the impulse response functions for employment, wages and rents and models the steady state equilibriums. The framework constructed uses construction of new houses and the entry of new buyers as endogenous.

To model the buyer and sellers' environment Head et al. (2014) use buyers' expectations of prices and incomes for each city, and idiosyncratic shocks for sellers to find a unique stationary growth path characterized by constant rates of population growth, migration and construction. As suspected, their theory suggests that when one observes an increase in the value of living,

immediately there is an increase in search activity. There is a lag in the period of time that buyers purchase homes and the new construction development begins thus; they assume existing homes become rental properties to meet the high demand (Head et al., 2014). Thus, the ratio of buyers to sellers rises over the future periods which in turn drives prices up.

The Vancouver and Toronto housing markets relate strongly to this research as there have been extreme run-ups in housing prices and housing market activity which is likely related to people expectations on future returns— whether it be for employment opportunities or returns on real estate investments. The speculation of the seller side is that, if there are increasing prices and a growing number of buyers, then it is beneficial to sell at an increased price as houses sell more quickly due to the tightening of the market. Thus, as Head et al. (2014) suggests, the ongoing increase in sales, also known as the liquidity of houses, results in expected resale value to grow. The continuous speculation and anticipations of increased prices continues to fuel the price growth and volume of sales as housing is seen as an easy commodity to make a gain on through resale. Following this dynamic study, Head and Lloyd-Ellis furthered the real estate’s housing market research in their 2016 study “*Has Canadian price growth been excessive.*”

Head and Lloyd-Ellis (2016) were motivated by the increasing housing price-rent growth ratio in major cities across Canada. They assess whether the price growth has been excessive or appropriate following dramatic increases since the 1990s. Their paper focuses on the price-rent ratio growth under the assumption that factors affecting house prices normally affect rents as well. One of the factors noted is construction costs. Construction costs are similar to the construction wage rate instrument used to capture a supply side cost shift when addressing a possible simultaneity issue in the present paper below— see Results under Section 6.



The empirical portion of Head and Lloyd-Ellis' (2016) paper includes a canonical pricing framework. Specifically, they used changes in rents, real interest rates and property taxes to explain the growth of housing prices (Head and Lloyd-Ellis, 2016). Their sample used aggregated census metropolitan area rents from Statistics Canada, and prices from Canadian Mortgage Housing Corporation to construct price-rent ratios. There were two main contributions to their findings: first, their ability to create an unadjusted real rental index for Canada dating back to 1970, and second, the development of a tractable analytical framework. They used the new unadjusted index to compare with the United States' real rent index and found similar long-run properties. The development of their tractable analytical framework was essential in accounting for the heterogeneity in rent growth, property taxes and mortgage financing across cities.

The challenge of the current paper relates to the heterogeneity of several factors in the city and surrounding areas of Toronto and Vancouver. For example, building codes, property taxes, land transfer taxes and development regulations are subject to municipal regulation which cannot be accounted for in this paper. Furthermore, as mentioned in Head and Lloyd-Ellis' (2016) paper, income growth helps to drive up house prices, which is what household disposable income is used for as a control variable in the current analysis.

Head and Lloyd-Ellis' (2016) model's predictions depend heavily on expectations of interest rates, which relates to the 3-month and 6-month lag instruments included for the price variable in the current paper. It is assumed that if one expects prices to increase on the supply side, it will produce more today –if prices are suspected to decrease, then less will be produced today. Overall, Head and Lloyd-Ellis' (2016) findings reveal the overvaluations of housing prices in major cities across Canada. These residential housing valuations were constructed by equating the price with costs for the marginal buyer. Notably, in the case of Vancouver, the excess valuation is

substantially high even when accounting for various factors that proved to rationalize the statistics from other cities (Head and Lloyd-Ellis, 2016).

More recently, Rherrad et al. (2019) test the existence of real estate bubbles in Canada following the significant imbalances in housing markets across Canada. Their approach follows the GSADF approach which was developed in by Phillips, Shi and Yu (2015). Phillips et al. (2015) GSADF's approach was a new recursive flexible window method of the sup augmented Dickey-Fuller (ADF) test approach which was better suited for practical implementation with long historical time series (Phillips et al., 2015). Their new method delivers a consistent real-time date-stamping strategy for the origination and termination of multiple bubbles. This was key to the Rherrad et al. (2019) results that there are indeed bubbles in the real estate markets of Toronto and Vancouver. Included in their sample was monthly real estate market prices from January 1988 to January 2018 for Vancouver and Toronto, and Montreal prices from January 2000 to January 2018. The GSADF test results generated 3.14 and 4.13 t-statistics for Vancouver and Toronto, respectively, indicating there is a bubble (Rherrad et al., 2019). Their findings confirm that the real estate markets in Toronto and Vancouver are experiencing exuberant increases and their results suggest that Montreal is now starting to experience this risk (Rherrad et al., 2019).

Rherrad et al. (2019) address the fact that it is vital for the financial authorities to properly survey and monitor the changes in the markets and they should enforce a reliable regime which will capture the upturns. In Canada's case, the federal authorities monitoring the markets need to stay alert to upturns, especially during inflationary periods. A financial surveillance system is vital in ensuring effective and appropriate policy implementation when necessary (Phillips et al., 2015).

Dachis et al. (2012) conducted a natural experiment in Toronto to assess the effects of the land transfer taxes imposed on real estate buyers in early 2008 to generate revenues to offset the city's financial deficit. The tax was levied on sales or purchases of real estate after January 1<sup>st</sup>, 2008 and closed after February 1<sup>st</sup>, 2018, and their experiment assess the effect on the single-family home market (Dachis et al., 2012). The Dachis et al. (2012) paper estimates the effect of the land transfer tax across the Toronto border by using the Multiple Listing Service (MLS) data of 139,266 single-family houses in the Greater Toronto Area from January 2006 to August 2008. They find that a 1.1 percent increase decreases the volume of sales, thus residential mobility, by about 14 percent (Dachis et al., 2012). Furthermore, they assess the welfare changes of the tax and notice a substantial welfare loss, the loss of residential mobility, to be approximately \$1 for every \$8 in tax revenue or about \$19 million per year for Toronto (Dachis et al., 2012). Thus, this tax burden has a larger negative impact on Toronto residents compared to regular taxes and therefore should be shifted to the burden of public finance through ordinary property taxes to mitigate the welfare loss of the people (Dachis et al., 2012). This research is very influential in reminding policy makers to be aware of the welfare losses associated with policy implementation and that we need to protect the overall health of Canadians financial stability and living needs. For this reason, the impact of the Foreign Buyer's Tax Policy is effective in protecting Canadians from welfare loses as it brings financial stability to our housing markets at next to no cost.

The previous research focuses primarily on housing bubbles, price growth and housing market conditions which relate to the current housing demand analysis on the Vancouver and Toronto housing markets. This paper differs from the above literature as it aims to capture the effects of the intervention methods used to address the issues stated above. In particular, the goal is to assess the effectiveness of the change and mortgage rule and Foreign Buyer's Tax Policy on housing

sales in the Toronto and Vancouver areas. The current research is essential in assessing the impact of these policies and whether they contribute to bringing stability back to our overheated markets.

## 4. Data Used in Study:

Table 1 consists of the summary statistics of the data gathered and used to generate variables in the current analysis. Each variable's abbreviation is explained under the description and is categorized based on the development of the raw data, to the generated variable used in the regressions. The regression analysis includes slightly fewer observations than the 236 due to the lack of data available for household disposable income in quarter 3 of 2019.

*Table 1: Summary Statistics of Data Used in Regressions*

	<b>Description</b>	<b>Var</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>	<b>Units</b>
<b>Sales</b>	Vancouver Singles	VHS	236	1104.254	383.57	286	2139	Sales
	Vancouver Apartments	VAS	236	1143.962	391.8	281	2260	Sales
	Toronto Singles	THS	236	3578.89	1111.55	1218	6724	Sales
	Toronto Apartments	TAS	236	1694.081	515.89	601	3279	Sales
<b>Prices</b>	Vancouver Singles	VHS	236	783815.5	364766.2	300000	1505000	Dollars
	Vancouver Apartments	VAS	236	337914.3	130456.2	140944	630000	Dollars
	Toronto Singles	THS	236	491903.2	201481.9	242000	1005000	Dollars
	Toronto Apartments	TAS	236	278667.7	99029.71	143901	528000	Dollars
<b>Real Prices</b>	Vancouver Singles	VHP	236	655244.7	249466.5	305499	1158584	Real Dollars
	Vancouver Apartments	VAP	236	284644.7	85420.04	144855.1	475643	Real Dollars
	Toronto Singles	THP	236	414033.3	130589.2	251559.3	776661.5	Real Dollars
	Toronto Apartments	TAP	236	235701.1	60867.28	150934.6	389667.9	Real Dollars
<b>Log-Prices</b>	Vancouver Singles	lnVHP	236	12.888	0.2987	12.435	13.563	Log-Real Dollars
	Vancouver Apartments	lnVAP	236	12.34	0.2443	11.925	12.873	Log-Real Dollars
	Toronto Singles	lnTHP	236	13.317	0.3971	12.63	13.963	Log-Real Dollars
	Toronto Apartments	lnTAP	236	12.511	0.3188	11.883	13.072	Log-Real Dollars

<b>Household Disposable Income</b>	Aggregate Canadian	HDI	232	166399.5	14393.48	121971.9	199341	Millions of Dollars
	Adjusted using CPI Index	HINC	232	144755.5	4259.017	129757.3	153717.3	Real Millions of Dollars
	Log-Adjusted	lnHINC	232	11.88237	0.0295	11.77342	11.943	Log-Real Millions of Dollars
<b>Policies</b>	Mortgage Rules	MP	236	0.0847458	0.2790949	0	1	Active
	Foreign Buyer's Tax: Vancouver	VP	236	0.1652542	0.3721992	0	1	Active
	Toronto	TP	236	0.1228814	0.3289987	0	1	Active

This paper analyzes the housing markets in the Greater Toronto Area and Greater Vancouver Area. In particular, the estimations will focus on the monthly median prices and sales of detached single-family homes and apartment units in the two areas. All categories included in the data sample have 236 monthly observations from January 2000 to August 2019. Notably, the estimation sample has slightly fewer observations for reasons to be explained below. The data was collected from the Canadian Real Estate Association (CREA) which includes all sales that were listed on the MLS.

Figure 3:



Figure 1: The geographic region included in the Greater Toronto Area's MLS listings (TREB, 2016). [http://www.trebhome.com/files/market-stats/condo-reports/condo\\_report\\_Q2-2017.pdf](http://www.trebhome.com/files/market-stats/condo-reports/condo_report_Q2-2017.pdf)

Figure 4:



Figure 2: The geographic area of the 21 municipalities included in the Greater Vancouver Area's MLS listings (Editor, 2012). <http://vacouver.ca/vancouver-info/297/greater-vancouver-regional-district-so-what-is-surrounding-vancouver-city/>

## 5. Empirical Methodology Used in the Study:

The MLS defines detached single-family homes as a composite of one-storey and two-storey detached single-family homes. These two indices are generated by the Toronto Real Estate Board (TREB). TREB (2016) classifies a one-storey detached single-family home as a building with one above ground floor where the entrance and associated lesser structures are an integral and inseparable part of the home. The home must also be located on a plot of land that exceeds the footprint of the building on each of its sides. Likewise, the two-storey detached single-family home is defined in the same way, however, has two stories above ground. Therefore, the CREA variable used in this analysis is detached single-family homes which includes both TREB categories.

CREA's apartment unit variable, can be conventionally thought of as "condos" in popular parlance, is based on the MLS definition:

"...being part of a multi-unit building. Occupants of apartment units may or may not have direct access to the lot from their units. There are also no parts of the lot whereby access is reserved for only one of the co-owners or apartment occupants. Several type of homes within this category had originally been duplexes and triplexes and are now treated as condos or apartments according to a formal declaration of co-property. This category includes Property Styles submitted by Participating Boards labeled as: Single Level Apartment, Multi-Level Apartment, Loft, Penthouse, Duplex, Triplex and Studio Suite." (Multiple Listing Service, 2016)

Additionally, real household income and the 5-year fixed mortgage rate are included as control variables in this analysis. Household disposable income was generated from Statistics Canada's quarterly household disposable income series.

The household disposable income variable was retrieved from Statistic Canada's (2019) "Current and capital accounts – Households, Canada, quarterly (x 1,000,000)" table. The variable is not seasonally adjusted and accounts for every quarter from 2000 to quarter 2 of 2019. Furthermore, Statistics Canada's (2019) monthly "*Consumer Price*



*Index (CPI) statistics, measures of core inflation and other related statistics - Bank of Canada definitions*” table was used to convert household disposable income to real dollar terms to account for inflation. Notably, 2002 is the base year where the index is 100. To adjust the frequency of the quarterly variable to monthly, the *EViews linear spline interpolation function* command was used to convert real household disposable income to a monthly frequency. The generated data maintained the original data values and used fractional amounts of the nearest quarters, with more emphasis on the closest month in order from top to bottom while assuming relatively linear growth for household income.

The current analysis uses monthly data gathered from Statistics Canada’s (2019) *“Canada Mortgage and Housing Corporation, conventional mortgage lending rate, 5-year term”* table. The data retrieved covers the months from January 2000 to August 2019 and is used to generate the five-year fixed mortgage variable.

The econometric model used in this paper will consist of a time series regression analysis which will analyze the housing demand equation as the three market intervention variables for mortgage rules and Foreign Buyer’s Tax Policies all operate on demand-side household behavior in the housing markets. For this reason, the housing demand equation is modelled for Toronto and Vancouver housing markets independently. The housing demand equation is expressed as a log-log model meaning the natural log is taken of the level variables on both sides of the equation in order to directly capture the demand, price and income elasticities, and to help attenuate any possible unit root problems in the data. Thus, the estimates presented will show the relative proportional responsiveness of housing demand, the dependent variable, for a one-percentage increase in the independent variables when holding all else constant. Dummy variable coefficients can be interpreted as percentage effects holding all else constant.

There are four housing demand regressions in total to be analyzed: two separate regressions for each of the Greater Toronto Area (GTA) and Greater Vancouver Area (GVA), one for single detached homes, and one for apartment units.

$$\ln THS_t = \beta_0 + \beta_1 \ln THP_t + \beta_2 \ln HINC_t + \beta_3 \ln MR_t + \beta_4 TP_t + \beta_5 MP_t + \beta_6 \sum DM_t + \varepsilon_t \quad (1)$$

$$\ln TAS_t = \beta_0 + \beta_1 \ln TAP_t + \beta_2 \ln HINC_t + \beta_3 \ln MR_t + \beta_4 TP_t + \beta_5 MP_t + \beta_6 \sum DM_t + \varepsilon_t \quad (2)$$

$$\ln VHS_t = \beta_0 + \beta_1 \ln VHP_t + \beta_2 \ln HINC_t + \beta_3 \ln MR_t + \beta_4 VP_t + \beta_5 MP_t + \beta_6 \sum DM_t + \varepsilon_t \quad (3)$$

$$\ln VAS_t = \beta_0 + \beta_1 \ln VAP_t + \beta_2 \ln HINC_t + \beta_3 \ln MR_t + \beta_4 VP_t + \beta_5 MP_t + \beta_6 \sum DM_t + \varepsilon_t \quad (4)$$

Regressions (1) and (2) are for single detached family home sales ( $THS_t$ ) and apartment sales ( $TAS_t$ ), respectively, in the Greater Toronto Area. Regressions (3) and (4) are for single detached family home sales ( $VHS_t$ ) and apartment sales ( $VAS_t$ ) respectively in the Greater Vancouver Area.

Additionally, the monthly median price for single detached homes and apartment units are controlled for in their respective regressions. Let  $THP_t$  denote monthly median prices for single detached homes and let  $TAP_t$  represent apartment units in the GTA. Likewise, let  $VHP_t$  denote monthly median prices for single detached homes and let  $VAP_t$  represent monthly median prices for apartment units in the GVA.

Included in each regression are two dummy variables which assess the effectiveness of the Foreign Buyer's Tax Policy in both the GTA and GVA, and the impact of the new Insurable Housing Loan Regulations. Let  $VP_t$  denote the implementation of the foreign buyer tax policy in Vancouver and let  $TP_t$  denote the implementation of the foreign buyer tax policy in Toronto.

Both indicator variables will assume a value of 1 when the policy is active, thus when  $t \geq$  August

2016 the  $VP_t = 1$ , and when  $t \geq$  April 2017 then  $TP_t = 1$ . Let  $MP_t$  represent the indicator variable of the change in mortgage rules across Canada which were implemented under the revised Guideline B-20 in January 2018.  $MP_t$  will assume a value of 1 for all  $t \geq$  January 2018 which represents the change of mortgage rules for borrowers applying for low-ratio mortgages.

The other control variables included in the regression are  $HINC_t$  and  $MR_t$  which represent real household disposable income and the five-year conventional mortgage lending rate. Both control variables are indexed monthly by  $t$ . The error term  $\varepsilon_t$  includes all unobservables and  $\beta_0$  is the constant in each regression. To control for seasonality,  $\sum DM_t$  is included in the model to account for eleven dummy variables, one for each month. Based on preliminary tests for seasonality, December, the twelfth month was dropped and was the base line for comparison. Notably, the housing demand equation presents a possible endogeneity or simultaneity problem in the housing price variable which is addressed in the empirics of this paper.

## 6. Housing Demand Regression Results:

### 6.1 Initial Regression Results

The following time series regression analysis was conducted once having checked for stationarity in the prices, sales volumes and household income, all in log form. Consequently, the Dickey-Fuller unit root test, command *dfgls* in STATA, was conducted and the results are presented in Table 2. STATA's Augmented Dickey-Fuller test ran a generalized least squares (GLS) regression prior to the Dickey Fuller test. The command used included a trend component as the data presents itself with an overall positive upward trend. The error term,  $u_t$  uses Newey-West standard errors to account for heteroskedasticity. Table 2 examines the null hypothesis of  $Y$  being a random walk to see if a unit root is present. The test is based on the level of significance which does not reject stationarity.

*Equation 1: The Augmented Dickey-Fuller Test*

$$DY_t = a_1 Y_{t-1} + a_2 DY_{t-1} + u_t$$

$$\text{where } DY_t = Y_t - Y_{t-1}$$

Table 2's first row, L., examines the estimated coefficient for the lag in  $Y$  ( $a_1$  in Equation 1) and the second row, LD, is the estimated coefficient for the lag in the change in  $Y$  ( $a_2$  in Equation 1). Thus, based on the results presented there is indeed stationarity in our sales (columns 1-4), prices (columns 5-8), and household income (column 9) variables.

*Table 2: Augmented Dickey-Fuller Test on Log-prices and Log-sales for each City and Housing Category, and Log-household Disposable Income. Robust standard errors in parentheses.*

VARIABLES	(1) VHS	(2) VAS	(3) THS	(4) TAS	(5) VHP
L.	-0.118*** (0.0283)	-0.0677*** (0.0239)	-0.188*** (0.0288)	-0.167*** (0.0311)	-0.0399* (0.0222)
LD.	0.243*** (0.0654)	0.0600 (0.0671)	0.503*** (0.0580)	0.345*** (0.0630)	-0.171** (0.0671)
Observations	221	221	221	221	221
R-squared	0.105	0.036	0.304	0.178	0.051

VARIABLES	(6) VAP	(7) THP	(8) TAP	(9) HINC
L.	-0.0269 (0.0166)	-0.0547*** (0.0198)	-0.0411* (0.0223)	-0.0116** (0.00495)
LD.	-0.267*** (0.0644)	0.213*** (0.0661)	-0.166** (0.0667)	0.514*** (0.0576)
Observations	221	221	221	217
R-squared	0.090	0.067	0.051	0.296

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The findings of this paper suggest that the policies implemented by the federal authorities were effective in cooling activity in the Canadian housing markets. Table 3 includes the results of an initial Ordinary Least Squares (OLS) regression. Additionally, the Breusch-Pagan test is conducted to check for heteroskedasticity in the below analysis. The results reject the null hypothesis, therefore White standard errors are used as heteroskedasticity is present.

Presumably, one would suspect the coefficient of the intervention variables to be negative due to the fact that the implemented Foreign Buyer's Tax Policy and change in mortgage rules should decrease the overall activity in the housing markets. Furthermore, one would assume an increase in household income will increase the housing market activity due to the fact that consumers have more money and can either be a new purchaser or upgrade their current property. Therefore, one would suspect the coefficients on the household disposable incomes variable to be positive. Additionally, one would expect the mortgage rate effects to be negative.

Lastly, the price variables, one would suspect that an increase in price should decrease the number of sales; however, due to the state of the housing market and the history of rapid increases in demand and construction in the market, the pricing variables may be positive due to the supply shortage. In fact, the coefficients on the price variables are primarily positive which will be discussed further below as part of a simultaneity bias concern.

All the regressions presented in Table 3 are conventionally jointly significant based on the F-statistic meaning the variables used as a whole are effectively a good fit for the model. As confirmed by the R-squared, at least half of the variation in the dependent variable, housing sales, is explained in the model. In fact, over 80 percent of the model is explained in the case of the Toronto regressions.

The following estimates can be interpreted as follows for the remaining tables. The five-year fixed mortgage rates show that, holding all else constant, it is with 99 percent confidence that the change in mortgage rules decreased the number of sales by elasticities of 0.355, 0.392 and 0.199 percent for Vancouver single-family homes, Vancouver apartments and Toronto apartment sales, respectively. Additionally, Vancouver foreign buyer tax policy decreased single home sales by 27 percent and apartment unit sales by 9 percent, holding all else constant. These findings are at the 99 percent confidence and 90 percent confidence level respectively. Likewise, with 99 percent confidence, Toronto foreign buyer tax policy decreased single home sales by 34 percent, and apartment unit sales by 32 percent, when holding all else constant. The Vancouver single detached family home price, for a one percent increase, decreases the volume of sales by 0.18 percent while holding all else constant. Notably, this is stated with 99 percent confidence, and it is the only price coefficient in the OLS analysis that is negative. Notably, the Toronto and Vancouver Foreign Buyer's Tax Policy effects show a weaker effect for the apartment unit sales

than for single-family homes which is what one would expect. The household disposable income's coefficients are positive across all regressions as predicted and can be interpreted as follows: from a one percentage increase in household disposable income, while holding all else constant, it is with 99 percent confidence that the Toronto apartment unit sales increases by 0.82 percent.

*Table 3: Ordinary Least Squares Regression Including Seasonal Dummies (omitted December).*

VARIABLES	(1) Van Single-VHS	(2) Van Apt-VAS	(3) Tor Single-THS	(4) Tor Apt-TAS
lnMR	-0.490*** (0.170)	-0.409*** (0.124)	-0.200* (0.108)	0.0850 (0.1000)
lnHINC	2.467*** (0.656)	3.937*** (0.633)	1.078*** (0.328)	0.823*** (0.309)
lnVHP	-0.183* (0.105)			
lnVAP		0.592*** (0.0980)		
lnTHP			0.316*** (0.0902)	
lnTAP				1.326*** (0.123)
<b>MP</b>	<b>-0.355***</b> <b>(0.0655)</b>	<b>-0.392***</b> <b>(0.0686)</b>	<b>-0.0487</b> <b>(0.0663)</b>	<b>-0.199***</b> <b>(0.0442)</b>
<b>VP</b>	<b>-0.268***</b> <b>(0.0611)</b>	<b>-0.0901*</b> <b>(0.0495)</b>		
<b>TP</b>			<b>-0.344***</b> <b>(0.0655)</b>	<b>-0.320***</b> <b>(0.0492)</b>
Jan	-0.0544 (0.0881)	-0.0916 (0.0901)	0.0510 (0.0554)	-0.0324 (0.0488)
Feb	0.387*** (0.0864)	0.299*** (0.0884)	0.427*** (0.0519)	0.245*** (0.0461)
Mar	0.619*** (0.0840)	0.518*** (0.0892)	0.730*** (0.0475)	0.499*** (0.0458)
Apr	0.648*** (0.0781)	0.489*** (0.0864)	0.868*** (0.0458)	0.547*** (0.0410)
May	0.746*** (0.0763)	0.574*** (0.0862)	0.924*** (0.0435)	0.586*** (0.0423)
Jun	0.676*** (0.0829)	0.544*** (0.0887)	0.853*** (0.0487)	0.564*** (0.0487)
Jul	0.513*** (0.0810)	0.430*** (0.0920)	0.657*** (0.0521)	0.447*** (0.0513)
Aug	0.357*** (0.0962)	0.295*** (0.0986)	0.551*** (0.0463)	0.423*** (0.0467)
Sep	0.346*** (0.0867)	0.277*** (0.0902)	0.557*** (0.0457)	0.329*** (0.0477)

Oct	0.390*** (0.0847)	0.335*** (0.0906)	0.583*** (0.0484)	0.389*** (0.0437)
Nov	0.271*** (0.0932)	0.245*** (0.0909)	0.445*** (0.0509)	0.310*** (0.0490)
Constant	-19.48** (8.013)	-46.82*** (7.752)	-8.943** (4.109)	-19.19*** (4.357)
Observations	232	232	232	232
R-squared	0.621	0.550	0.849	0.849
RMSE	0.249	0.265	0.134	0.128
SSR	13.344	15.109	3.873	3.502
F(16, 215)	33.31	20.90	83.84	99.31
d-statistic(17, 232)	0.303	0.326	0.49	0.506

Note : Figures in parenthesis are White coefficient standard errors.

Included are the Durbin-Watson d-statistic to test for autocorrelation in the model. The following regression time series analysis experiences positive autocorrelation as the d-statistic proves to be between 0 and 1. The above OLS results suggest that there seems to be autocorrelation present, therefore it is adjusted for in Table 4 by using the Cochrane-Orcutt technique. STATA *reg* command includes a robust command to control for heteroskedasticity using White's standard errors as well.

Table 4: Regression Corrected for Autocorrelation Using the Cochrane–Orcutt Method

VARIABLES	(1) Van Single-VHS	(2) Van Apt-VAS	(3) Tor Single-THS	(4) Tor Apt-TAS
lnMR	-0.175 (0.305)	-0.239 (0.309)	-0.145 (0.190)	-0.123 (0.165)
lnHINC	0.494 (1.563)	-0.712 (1.716)	-0.168 (0.893)	-0.412 (0.836)
lnVHP	0.00350 (0.204)			
lnVAP		0.222 (0.259)		
lnTHP			0.338** (0.165)	
lnTAP				0.930*** (0.193)
<b>MP</b>	<b>-0.269**</b> <b>(0.126)</b>	<b>-0.0284</b> <b>(0.137)</b>	<b>-0.198**</b> <b>(0.0805)</b>	<b>-0.176**</b> <b>(0.0791)</b>
<b>VP</b>	<b>-0.233*</b> <b>(0.124)</b>	<b>-0.0606</b> <b>(0.134)</b>		



<b>TP</b>			<b>-0.208***</b>	<b>-0.184**</b>
			<b>(0.0764)</b>	<b>(0.0783)</b>
Jan	-0.0653**	-0.109***	0.0610***	-0.0341
	(0.0312)	(0.0337)	(0.0214)	(0.0210)
Feb	0.370***	0.272***	0.432***	0.248***
	(0.0412)	(0.0444)	(0.0280)	(0.0269)
Mar	0.602***	0.489***	0.731***	0.497***
	(0.0478)	(0.0515)	(0.0320)	(0.0308)
Apr	0.631***	0.455***	0.860***	0.541***
	(0.0517)	(0.0557)	(0.0346)	(0.0330)
May	0.710***	0.519***	0.914***	0.577***
	(0.0551)	(0.0593)	(0.0366)	(0.0350)
Jun	0.646***	0.489***	0.843***	0.553***
	(0.0557)	(0.0599)	(0.0368)	(0.0353)
Jul	0.487***	0.380***	0.647***	0.437***
	(0.0553)	(0.0592)	(0.0364)	(0.0350)
Aug	0.336***	0.255***	0.542***	0.411***
	(0.0527)	(0.0565)	(0.0349)	(0.0336)
Sep	0.329***	0.242***	0.549***	0.322***
	(0.0486)	(0.0521)	(0.0323)	(0.0312)
Oct	0.376***	0.314***	0.577***	0.384***
	(0.0416)	(0.0449)	(0.0282)	(0.0272)
Nov	0.262***	0.224***	0.440***	0.307***
	(0.0311)	(0.0336)	(0.0214)	(0.0206)
Constant	0.973	12.79	5.503	0.697
	(19.23)	(21.48)	(10.99)	(10.58)
Observations	231	231	231	231
R-squared	0.659	0.565	0.851	0.784
Adjusted R-squared	0.633	0.533	0.84	0.768
RMSE	0.131	0.141	0.087	0.084
SSR	3.675	4.257	1.614	1.503
Rho	0.874	0.871	0.785	0.767
Original d-statistic	0.303	0.326	0.49	0.506
New d-statistic	2.282	2.470	1.783	2.126

*Note : Figures in parenthesis are White coefficient standard errors.*

The *prais* command was used in STATA with the added *corc* function to correct for autocorrelation using the Cochrane-Orcutt method. The results are present in Table 4. The Cochrane-Orcutt method minimizes the sum of squared residuals and generated new Durbin Watson d-statistics between 1.78 and 2.47. Thus, autocorrelation does not present itself as a problem for the following regressions. The general pattern of coefficients results in Table 3 carries over in Table 4 as well and hence detailed comments are not included. The new estimates have lower regression standard errors, or root mean squared error (RMSE), which increases

accuracy as the results have converged even more to true estimates in comparison to the OLS estimations.

Table 5 and Table 6 express the marginal effects of the sales volumes before and after the implementation of policy and rule changes following the correction of autocorrelation. Table 5 results are presented in percentage form and Table 5's results are converted into units and presented in Table 6.

*Table 5: Margins of Policy Effects Pre and Post Implementation on Volume of Sales by City and Housing Category Using the Cochrane-Orcutt Method*

	Change in Mortgage Rules		City Specific Foreign Buyer's Tax Policy	
	Pre (MP=0)	Post (MP=1)	Pre (0)	Post (0)
<b>Vancouver</b>				
Singles	6.956	6.687	6.972	6.740
(St. dev)	(0.070)	(0.133)	(0.072)	(0.126)
Apartments	6.995	6.967	7.002	6.942
(St. dev)	(0.073)	(0.144)	(0.075)	(0.135)
<b>Toronto</b>				
Singles	8.150	7.952	8.159	7.951
(St. dev)	(0.028)	(0.079)	(0.028)	(0.073)
Apartments	7.401	7.225	7.409	7.225
(St. dev)	(0.025)	(0.077)	(0.025)	(0.074)

*Table 6: Margins Translated into Units of Sales by City and Housing Category Using the Cochrane-Orcutt Method.*

	Change in Mortgage Rules		City-Specific Foreign Buyer's Tax Policy	
	Pre (MP=0)	Post (MP=1)	Pre (0)	Post (1)
<b>Vancouver</b>				
Singles	1049.16	801.83	1066.75	845.35
Apartments	1091.44	1060.91	1099.35	1034.69
<b>Toronto</b>				
Singles	3463.94	2840.85	3494.42	2838.62
Apartments	1637.91	1373.70	1650.63	1373.18

The average sales volumes per month for single detached family homes in Vancouver before implementing the Foreign Buyer's Tax Policy is about 1067, which falls to approximately 845 sales per month following the implementation – a decrease of 20.81 percent. Likewise, apartment unit sales per month in Vancouver on average fell 5.88 percent over the same period of time. Toronto's single detached family home monthly sales on average fell about 18.75 percent, and monthly apartment unit sales post implementation fell on average 16.83 percent relative to before the Foreign Buyer's Tax Policy was active.

Vancouver's single detached home sales fell on average 23.55 percent following the change in mortgage laws, and likewise apartment monthly sales fell 2.7 percent on average. Comparably, Toronto's single detached home sales per month fell 17.98 percent as the average home sales before the change in mortgage rules was implemented was about 3464 sales per month which decreased to approximately 2841 sales per month on average. Likewise, Toronto apartment sales average fell 16.13 percent relative to pre implementation.

## *6.2 Adjusted for Simultaneity*

To address the potential simultaneity problem in the housing price variable in this paper, four instruments are used to capture the supply side's economic behavior. The suspected endogeneity problem is due to the correlation between monthly median prices and error terms in the housing demand equations. Consequently, the price variable is instrumented by the following four instruments: the prime interest rate, city-specific real construction wage rates and housing price lags for 3 and 6 months. Summary statistics on the non-logged instrumental variables are provided in Table 7.

Table 7: Summary of Instruments (Prime Rate and Construction Wage Rates in Toronto and Vancouver).

	Description	Var	Obs	Mean	Std. Dev.	Min	Max	Units	
Prime Rate	Commercial Lending/ Borrowing Rate	PRIME	236	4.001	1.399	2.25	7.5	Percent	
	Raw		236	28.991	4.659	23.37	36.56	Dollars	
Construction Wage Rates	Vancouver	Adjusted using CPI Index	236	24.967	1.67	22.128	27.698	Real Dollars	
		Log-Adjusted	VCON	236	3.215	0.066	3.097	3.321	Log Real Dollars
		Raw		236	30.021	3.025	25.09	35.31	Dollars
	Toronto	Adjusted using CPI Index	236	26.001	0.436	24.93	26.718	Real Dollars	
		Log-Adjusted	TCON	236	3.258	0.0168	3.216	3.285	Log Real Dollars

First, the prime rate which is a major commercial lending/borrowing rate is used. Second, hourly basic construction union wages, in particular the not seasonally adjusted basic construction wage rates, for a labourer are used. This data was retrieved from Statistics Canada (2019) “*Construction union wage rates, monthly*” table for the Toronto and Vancouver geographic areas and are included as  $TCON_t$  and  $VCON_t$ . Construction wage rates for a labourer are used to instrument for the price variables given that they directly influence the supply side as a cost shift and do not affect the housing demand equation. Hourly basic construction union wages were adjusted for inflation using the same CPI index table as above to generate real household disposable income per capita.

The third and fourth instruments are generated based on expectations of housing prices. The expected value of whether the prices will be higher or lower in the future may affect

production plans today. Thus, lagged prices from three months and six months separately will be incorporated as instruments as well. STATA's *Ivreg* command with the *robust* function is used to address the possible simultaneity problem, and control for heteroskedasticity by using White's standard errors as presented in Table 8.

*Table 8: Instrumental Variable Regression Unadjusted for Autocorrelation. Instrumenting Prices with Prime Rate, 3-month and 6-month Price Lags and Construction Wage Rate Respective to Each City.*

VARIABLES	(1) Van Singles	(2) Van Apt	(3) Tor Singles	(4) Tor Apt
lnMR	-0.745*** (0.204)	-0.449*** (0.152)	-0.329** (0.139)	-0.0659 (0.122)
lnHINC	2.031* (1.102)	2.126** (1.042)	0.932** (0.463)	0.407 (0.475)
lnVHP	-0.404*** (0.119)			
lnVAP		0.298** (0.119)		
lnTHP			0.159 (0.104)	
lnTAP				1.049*** (0.154)
<b>MP</b>	-0.323*** (0.0703)	-0.360*** (0.0678)	-0.0349 (0.0686)	-0.161*** (0.0464)
<b>VP</b>	-0.214*** (0.0765)	0.0135 (0.0640)		
<b>TP</b>			-0.301*** (0.0681)	-0.244*** (0.0581)
Jan	-0.0614 (0.0903)	-0.0920 (0.0909)	0.0524 (0.0559)	-0.0333 (0.0503)
Feb	0.380*** (0.0893)	0.292*** (0.0893)	0.425*** (0.0518)	0.242*** (0.0474)
Mar	0.608*** (0.0864)	0.518*** (0.0900)	0.730*** (0.0477)	0.495*** (0.0465)
Apr	0.654*** (0.0802)	0.505*** (0.0836)	0.878*** (0.0465)	0.549*** (0.0420)
May	0.749*** (0.0787)	0.585*** (0.0860)	0.939*** (0.0424)	0.590*** (0.0429)
Jun	0.674*** (0.0853)	0.549*** (0.0874)	0.864*** (0.0486)	0.571*** (0.0485)
Jul	0.504*** (0.0812)	0.410*** (0.0923)	0.655*** (0.0520)	0.443*** (0.0517)
Aug	0.350*** (0.0966)	0.280*** (0.0978)	0.549*** (0.0465)	0.418*** (0.0475)
Sep	0.339*** (0.0860)	0.264*** (0.0903)	0.557*** (0.0458)	0.327*** (0.0477)

Oct	0.388*** (0.0842)	0.329*** (0.0913)	0.586*** (0.0483)	0.388*** (0.0447)
Nov	0.268*** (0.0923)	0.236** (0.0911)	0.447*** (0.0504)	0.309*** (0.0500)
Constant	-10.95 (13.48)	-21.57* (12.96)	-4.984 (5.332)	-10.60 (6.555)
Observations	226	226	226	226
R-squared	0.610	0.496	0.846	0.838
RMSE	0.254	0.265	0.135	0.129
SSR	13.523	14.720	3.801	3.487

*Note: Figures in parenthesis are White coefficient standard errors.*

Additionally, STATA's *Ivreg2* command along with the robust function was used to enhance Table 8's estimates by adjusting for autocorrelation as well. The estimates in Table 9 are robust to simultaneity, autocorrelation and heteroskedasticity. Notably, the estimates presented in Table 9 have smaller regression standard errors, or RMSE, after correcting for autocorrelation which symbolizes that the model is a better fit for the data.

Table 9: Instrumental Variable Regression Adjusted for Autocorrelation. Instrumenting Prices with Prime Rate, 3-month and 6-month Price Lags and Construction Wage Rate Respective to Each City.

VARIABLES	(1) Van Single-VHS	(2) Van Apt-VAS	(3) Tor Single-THS	(4) Tor Apt-TAS
lnMR	-0.745*** (0.196)	-0.449*** (0.147)	-0.329** (0.133)	-0.0659 (0.117)
lnHINC	2.031* (1.060)	2.126** (1.003)	0.932** (0.445)	0.407 (0.456)
lnVHP	-0.404*** (0.115)			
lnVAP		0.298*** (0.114)		
lnTHP			0.159 (0.0996)	
lnTAP				1.049*** (0.149)
<b>MP</b>	<b>-0.323***</b> <b>(0.0676)</b>	<b>-0.360***</b> <b>(0.0652)</b>	<b>-0.0349</b> <b>(0.0660)</b>	<b>-0.161***</b> <b>(0.0446)</b>
<b>VP</b>	<b>-0.214***</b> <b>(0.0736)</b>	<b>0.0135</b> <b>(0.0615)</b>		
<b>TP</b>			<b>-0.301***</b> <b>(0.0655)</b>	<b>-0.244***</b> <b>(0.0559)</b>
Jan	-0.0614 (0.0869)	-0.0920 (0.0874)	0.0524 (0.0538)	-0.0333 (0.0483)
Feb	0.380*** (0.0859)	0.292*** (0.0859)	0.425*** (0.0498)	0.242*** (0.0455)
Mar	0.608*** (0.0831)	0.518*** (0.0865)	0.730*** (0.0459)	0.495*** (0.0447)
Apr	0.654*** (0.0771)	0.505*** (0.0804)	0.878*** (0.0448)	0.549*** (0.0404)
May	0.749*** (0.0757)	0.585*** (0.0827)	0.939*** (0.0408)	0.590*** (0.0412)
Jun	0.674*** (0.0820)	0.549*** (0.0840)	0.864*** (0.0467)	0.571*** (0.0466)
Jul	0.504*** (0.0781)	0.410*** (0.0888)	0.655*** (0.0500)	0.443*** (0.0497)
Aug	0.350*** (0.0929)	0.280*** (0.0941)	0.549*** (0.0448)	0.418*** (0.0457)
Sep	0.339*** (0.0827)	0.264*** (0.0868)	0.557*** (0.0441)	0.327*** (0.0459)
Oct	0.388*** (0.0809)	0.329*** (0.0878)	0.586*** (0.0464)	0.388*** (0.0429)
Nov	0.268*** (0.0888)	0.236*** (0.0876)	0.447*** (0.0485)	0.309*** (0.0481)
Constant	-10.95 (12.96)	-21.57* (12.46)	-4.984 (5.127)	-10.60* (6.304)
Observations	226	226	226	226
R-squared	0.610	0.496	0.846	0.838
RMSE	0.245	0.255	0.13	0.124
SSR	13.523	14.720	3.801	3.487

When correcting for simultaneity and autocorrelation, the null hypothesis for the weak instrument and under identification tests were rejected based on the Cragg-Donald and Kleibergen-Paap, F-statistics and Lagrange Multipliers results. Consequently, it is assumed that the instruments are strong instruments and that the model is identified, and misspecification is rejected.

While assessing the price estimates, the median single detached housing price in Vancouver is the only negative coefficient. The following coefficient can be interpreted as holding all else constant, a one percent increase in single-family home price results in a 0.404 percent decrease in volume of sales. One would suspect that the coefficients for median housing prices would consistently be negative as it would decrease the volume of sales; however, this is not the case here. Perhaps due to the heavy speculations of increasing interest rates and housing prices, the seller's market is captured as the increasing prices dominates the volume of sales. For these reasons, sellers take advantage of the expectation of future prices on the market, hence buyers pay more today despite the growing number of sales. Notably, Sections 6.1 and 6.2 only capture the direct effects of the intervention variables on the housing markets. Thus Section 6.3 will assess the total effects.

### *6.3 Reduced Form Effects Policy Shifts*

To conclude the empirical analysis, this section presents the results of the reduced form regressions which capture the total effects of the mortgage changes and the Foreign Buyer's Tax Policies variables with respect to prices and sales. Table 10 presents the reduced form



regressions using the log-sales by city and housing category as the dependent variable which shows the total effects of the predetermined variables included in the previous regressions.

*Table 10: Reduced Form OLS Regression for Volume of log-Sales*

VARIABLES	(1) Van Single-VHS	(2) Van Apt-VAS	(3) Tor Single-THS	(4) Tor Apt-TAS
lnMR	-0.918*** (0.236)	-0.744*** (0.217)	-0.550*** (0.180)	-0.0808 (0.169)
lnHINC	0.144 (0.823)	0.752 (1.066)	0.0505 (0.470)	-0.550 (0.518)
<b>MP</b>	<b>-0.325***</b> <b>(0.0690)</b>	<b>-0.207***</b> <b>(0.0662)</b>	<b>-0.0380</b> <b>(0.0872)</b>	<b>-0.145**</b> <b>(0.0706)</b>
<b>VP</b>	<b>-0.0862</b> <b>(0.0714)</b>	<b>0.0264</b> <b>(0.0622)</b>		
<b>TP</b>			<b>-0.272***</b> <b>(0.101)</b>	<b>-0.369***</b> <b>(0.0846)</b>
Prime	0.216** (0.0909)	0.0531 (0.0950)	0.111 (0.0675)	0.0758 (0.0649)
VCON	1.300*** (0.423)	-1.229** (0.559)		
TCON			1.748*** (0.650)	3.127*** (0.735)
VHPlag3	2.032*** (0.360)			
VHPlag6	-2.758*** (0.387)			
VAPlag3		3.360*** (0.601)		
VAPlag6		-3.171*** (0.599)		
THPlag3			0.966** (0.466)	
THPlag6			-0.980** (0.487)	
TAPlag3				2.131*** (0.493)
TAPlag6				-1.025** (0.505)
Jan	-0.131* (0.0713)	-0.134* (0.0736)	0.0245 (0.0554)	-0.0324 (0.0508)
Feb	0.337*** (0.0750)	0.337*** (0.0814)	0.406*** (0.0502)	0.285*** (0.0449)
Mar	0.566*** (0.0695)	0.547*** (0.0782)	0.747*** (0.0463)	0.576*** (0.0471)
Apr	0.627*** (0.0694)	0.560*** (0.0822)	0.910*** (0.0458)	0.660*** (0.0469)
May	0.635*** (0.0662)	0.530*** (0.0747)	0.903*** (0.0437)	0.596*** (0.0449)
Jun	0.582*** (0.0723)	0.419*** (0.0799)	0.804*** (0.0516)	0.556*** (0.0515)
Jul	0.441***	0.338***	0.582***	0.405***

	(0.0756)	(0.0821)	(0.0545)	(0.0536)
Aug	0.329***	0.195**	0.515***	0.397***
	(0.0778)	(0.0939)	(0.0442)	(0.0491)
Sep	0.339***	0.292***	0.544***	0.337***
	(0.0666)	(0.0770)	(0.0420)	(0.0459)
Oct	0.427***	0.335***	0.610***	0.411***
	(0.0685)	(0.0732)	(0.0482)	(0.0436)
Nov	0.310***	0.267***	0.476***	0.349***
	(0.0737)	(0.0741)	(0.0501)	(0.0533)
Constant	11.56	0.464	2.244	-10.20
	(9.825)	(12.69)	(4.683)	(6.306)
Observations	226	226	226	226
R-squared	0.732	0.594	0.855	0.831
RMSE	0.213	0.24	0.133	0.133
SSR	9.313	11.853	3.585	3.641

Table 10 results are the total effects of log-sales (in each city by housing category) effect on all independent variables and instruments included in Table 8 and Table 9. Likewise, the dependent variable in Table 11 is log-prices for single-family homes and apartment units by city. Notice many coefficients are statistically significant which infers that the instruments and variables used were significant determinants of total effects on the two outcome variables. Notably, the coefficients for the mortgage change and policy variables are primarily positive as above which is concerning for new buyers trying to enter the real estate market.

Table 11: Reduced Form OLS Regression for log-Prices

VARIABLES	(1) Van Single-VHP	(2) Van Apt-VAP	(3) Tor Singles-THP	(4) Tor Apt-TAP
lnMR	-0.101*** (0.0319)	-0.0873*** (0.0276)	-0.0312 (0.0330)	-0.0177 (0.0319)
lnHINC	0.0801 (0.153)	0.175 (0.142)	0.0399 (0.0750)	0.0106 (0.0831)
<b>MP</b>	<b>-0.0209</b> <b>(0.0179)</b>	<b>-0.0347***</b> <b>(0.0131)</b>	<b>0.0576**</b> <b>(0.0233)</b>	<b>-0.00259</b> <b>(0.0179)</b>
<b>VP</b>	<b>-0.0192</b> <b>(0.0196)</b>	<b>0.0371***</b> <b>(0.0107)</b>		
<b>TP</b>			<b>-0.101***</b> <b>(0.0290)</b>	<b>0.00937</b> <b>(0.0306)</b>
Prime	0.00693 (0.0147)	0.00331 (0.0136)	-0.0150 (0.0117)	-0.0167 (0.0104)
VCON	0.0755 (0.0862)	-0.173** (0.0735)		
TCON			0.632*** (0.122)	0.459*** (0.170)
VHPlag3	0.972*** (0.0675)			
VHPlag6	-0.0231 (0.0654)			
VAPlag3		0.947*** (0.0837)		
VAPlag6		0.0198 (0.0865)		
THPlag3			0.803*** (0.0972)	
THPlag6			0.204** (0.102)	
TAPlag3				0.842*** (0.101)
TAPlag6				0.130 (0.0962)
Jan	-0.00197 (0.0151)	-0.00697 (0.0104)	-0.00343 (0.00656)	-0.00269 (0.00734)
Feb	0.0227 (0.0152)	0.0269** (0.0133)	0.0422*** (0.00862)	0.0317*** (0.00808)
Mar	0.0168 (0.0137)	0.0450*** (0.0119)	0.0605*** (0.00969)	0.0401*** (0.0111)
Apr	0.00652 (0.0162)	0.0336*** (0.0115)	0.0766*** (0.0110)	0.0508*** (0.00995)
May	-0.00855 (0.0156)	0.0427*** (0.0116)	0.0371*** (0.00792)	0.0244*** (0.00719)
Jun	-0.0196 (0.0145)	0.00583 (0.0111)	0.0220** (0.00900)	0.0146* (0.00824)
Jul	-0.0349** (0.0142)	0.0158 (0.0127)	-0.0113 (0.00973)	0.00891 (0.00794)
Aug	-0.0319** (0.0152)	0.00697 (0.0108)	-0.0224*** (0.00786)	-0.00406 (0.00806)
Sep	-0.0155 (0.0140)	0.0174 (0.0108)	0.00199 (0.00685)	0.0133* (0.00682)

Oct	0.0131 (0.0147)	0.0261** (0.0114)	0.0273*** (0.00774)	0.0132** (0.00637)
Nov	-0.00118 (0.0137)	-0.00273 (0.0122)	0.0271*** (0.00768)	0.0153* (0.00794)
Constant	-0.332 (2.014)	-0.982 (1.742)	-2.553** (1.044)	-1.226 (1.541)
Observations	226	226	226	226
R-squared	0.989	0.988	0.993	0.988
RMSE	0.042	0.035	0.026	0.027
SSR	0.37	0.258	0.14	0.145
d-statistic	0.934	1.039	0.817	0.943

The following OLS regression results are improved when controlling for autocorrelation in the reduced form regressions. The findings above can be interpreted as; while holding all else constant, it is with 99 percent confidence that the Vancouver Foreign Buyer's Tax Policy decreases the prices of apartment units in Vancouver by 37.1 percent.

Table 12 and Table 13 repeat the regressions from Table 10 and Table 11 however this time using the STATA's *prais* command with the *twostep* function to control for autocorrelation. This technique is comparable to the Cochrane-Orcutt method however, the Prais-Winsten command used includes the first transformation of correcting for the first ordered serially correlated residuals. Table 12 shows, while holding all else constant, it is with 95 percent confidence that the construction wage rate decreased the volume of sales for Vancouver single detached home sales by 138 percent.

Table 12: Reduced Form Regression for log-Sales Corrected for Autocorrelation using Prais-Winsten Method

VARIABLES	(1) Van Single-VHS	(2) Van Apt-VAS	(3) Tor Single-THS	(4) Tor Apt-TAS
lnMR	-0.783*** (0.274)	-0.783*** (0.266)	-0.717*** (0.213)	-0.368** (0.181)
lnHINC	0.585 (1.229)	1.178 (1.343)	0.0770 (0.909)	-0.595 (0.841)
<b>MP</b>	<b>-0.305***</b> <b>(0.108)</b>	<b>-0.165</b> <b>(0.121)</b>	<b>-0.120</b> <b>(0.0774)</b>	<b>-0.116</b> <b>(0.0811)</b>
<b>VP</b>	<b>-0.185*</b> <b>(0.102)</b>	<b>0.0315</b> <b>(0.106)</b>		
<b>TP</b>			<b>-0.155**</b> <b>(0.0787)</b>	<b>-0.123</b> <b>(0.0811)</b>
Prime	0.111 (0.137)	-0.0140 (0.144)	0.0795 (0.0968)	-0.00940 (0.0883)
VCON	1.380** (0.681)	-0.959 (0.685)		
TCON			0.700 (1.157)	1.387 (1.099)
VHPlag3	-0.0466 (0.271)			
VHPlag6	-0.603** (0.282)			
VAPlag3		0.421 (0.349)		
VAPlag6		-0.340 (0.350)		
THPlag3			-0.000897 (0.280)	
THPlag6			-0.172 (0.280)	
TAPlag3				0.473* (0.272)
TAPlag6				0.0833 (0.265)
Jan	-0.0712** (0.0355)	-0.111*** (0.0408)	0.0524** (0.0240)	-0.0402* (0.0235)
Feb	0.368*** (0.0452)	0.276*** (0.0526)	0.427*** (0.0312)	0.269*** (0.0310)
Mar	0.602*** (0.0516)	0.495*** (0.0592)	0.733*** (0.0348)	0.528*** (0.0359)
Apr	0.653*** (0.0542)	0.481*** (0.0623)	0.880*** (0.0380)	0.587*** (0.0395)
May	0.712*** (0.0572)	0.542*** (0.0642)	0.928*** (0.0383)	0.597*** (0.0378)
Jun	0.644*** (0.0575)	0.489*** (0.0654)	0.844*** (0.0405)	0.567*** (0.0382)
Jul	0.491*** (0.0559)	0.393*** (0.0639)	0.644*** (0.0410)	0.442*** (0.0382)
Aug	0.349*** (0.0535)	0.264*** (0.0617)	0.543*** (0.0360)	0.407*** (0.0356)
Sep	0.338***	0.260***	0.554***	0.333***

	(0.0504)	(0.0580)	(0.0329)	(0.0335)
Oct	0.387***	0.328***	0.588***	0.395***
	(0.0449)	(0.0517)	(0.0294)	(0.0297)
Nov	0.275***	0.235***	0.450***	0.319***
	(0.0347)	(0.0405)	(0.0231)	(0.0235)
Constant	4.975	-3.939	7.696	3.357
	(15.50)	(17.10)	(10.06)	(10.01)
Observations	226	226	226	226
R-squared	0.800	0.648	0.921	0.884
Adj. R-squared	0.782	0.616	0.914	0.874
Rho	0.673	0.629	0.714	0.661
RMSE	0.136	0.157	0.088	0.091
SSR	3.822	5.109	1.602	1.694
d-statistic	0.640	0.702	0.556	0.667
New d-statistic	1.814	1.676	1.667	1.78

With 99 percent certainty, the change in mortgage rules decreased the volume of sales for Vancouver single detached family homes by 30.5 percent while holding all else constant. Additionally, with 90 percent confidence, the Vancouver Foreign Buyer's Tax Policy reduced the total volume of single detached home sales by 18.5 percent while holding all else constant. Likewise, with 95 percent confidence, the Toronto Foreign Buyer's Tax Policy reduced single detached family home sales by 15.5 percent while holding all else constant.

The reduced form regressions express the shift to the new equilibrium given the total effect on prices and quantities. This differs from the above tables' estimates as they express the direct effects of the policies on the on quantities as price is included in the structural model. Thus, the reduced form regressions on prices highlight the effects of the mortgage rule and policy changes on prices.

Table 13: Reduced Form Regression for log-Prices Corrected for Autocorrelation using Prais-Winsten Method

VARIABLES	(1) Van Single-VHP	(2) Van Apt-VAP	(3) Tor Singles-THP	(4) Tor Apt-TAP
lnMR	-0.127** (0.0547)	-0.108*** (0.0397)	-0.0711* (0.0424)	-0.0787** (0.0356)
lnHINC	0.0598 (0.239)	0.126 (0.199)	0.0103 (0.161)	0.00799 (0.152)
<b>MP</b>	<b>-0.0401*</b> <b>(0.0221)</b>	<b>-0.0304</b> <b>(0.0190)</b>	<b>0.0326**</b> <b>(0.0156)</b>	<b>0.0111</b> <b>(0.0167)</b>
<b>VP</b>	<b>-0.00620</b> <b>(0.0207)</b>	<b>0.0491***</b> <b>(0.0163)</b>		
<b>TP</b>			<b>-0.0671***</b> <b>(0.0162)</b>	<b>0.0423**</b> <b>(0.0172)</b>
Prime	0.00633 (0.0261)	-0.000697 (0.0207)	-0.0168 (0.0175)	-0.0248 (0.0159)
VCON	0.166 (0.134)	-0.197* (0.102)		
TCON			0.576*** (0.219)	0.355* (0.213)
VHPlag3	0.651*** (0.0670)			
VHPlag6	0.261*** (0.0690)			
VAPlag3		0.709*** (0.0667)		
VAPlag6		0.230*** (0.0670)		
THPlag3			0.575*** (0.0626)	
THPlag6			0.385*** (0.0632)	
TAPlag3				0.520*** (0.0639)
TAPlag6				0.353*** (0.0630)
Jan	0.00784 (0.00917)	-0.00537 (0.00816)	0.00388 (0.00562)	-0.00400 (0.00573)
Feb	0.0283** (0.0112)	0.0214** (0.0100)	0.0488*** (0.00706)	0.0301*** (0.00723)
Mar	0.0233* (0.0123)	0.0396*** (0.0108)	0.0601*** (0.00762)	0.0332*** (0.00805)
Apr	0.0126 (0.0127)	0.0264** (0.0112)	0.0731*** (0.00814)	0.0406*** (0.00870)
May	0.00594 (0.0133)	0.0428*** (0.0114)	0.0439*** (0.00829)	0.0260*** (0.00830)
Jun	-0.00930 (0.0134)	0.00998 (0.0116)	0.0331*** (0.00881)	0.0177** (0.00838)
Jul	-0.0278** (0.0130)	0.0188* (0.0113)	0.00203 (0.00894)	0.0166** (0.00840)
Aug	-0.0288** (0.0126)	0.0113 (0.0111)	-0.0164** (0.00785)	-0.00183 (0.00791)
Sep	-0.0159	0.0140	0.00395	0.0130*

	(0.0121)	(0.0107)	(0.00731)	(0.00760)
Oct	0.00718	0.0248**	0.0221***	0.0105
	(0.0111)	(0.00987)	(0.00670)	(0.00697)
Nov	-0.00617	-0.00553	0.0213***	0.00995*
	(0.00899)	(0.00813)	(0.00544)	(0.00573)
Constant	0.140	0.0777	-1.348	0.466
	(3.036)	(2.543)	(1.792)	(1.883)
Observations	226	226	226	226
R-squared	0.991	0.991	0.997	0.996
Adj. R-squared	0.991	0.990	0.997	0.995
Rho	0.532	0.472	0.591	0.522
RMSE	0.034	0.030	0.020	0.021
SSR	0.236	0.187	0.083	0.093
d-statistic	0.934	1.089	0.817	0.094
New d-statistic	1.817	1.835	1.570	1.793

The four instrument variables included in Table 8 and Table 9 above were regressed on prices in Table 13. While holding all else constant, the effects of the 3 month and 6-month price lags were statistically significant across all four regressions. With 90 percent certainty, the respective construction wage rates in Vancouver and Toronto decreased apartment unit prices by 19.7 and 35.5 respectively, while holding all else constant. Furthermore, with 99 percent confidence, the Toronto Foreign Buyer's Tax Policy decreased the price of single detached family homes by 6.71 percent while holding all else constant. Likewise, with 95 percent confidence, the Toronto Foreign Buyer's Tax Policy decreased the price of apartment unit prices by 4.23 percent.



## **7. Conclusion:**

Canadian housing markets have been experiencing excessive price run-ups and the federal authorities have intervened through policies and rules such as the change in mortgage regulations and the Foreign Buyer's Tax Policy in Toronto and Vancouver areas. To address the effectiveness of each of these intervention methods, this research assesses their implications on the housing demand equations for these two areas. To do so, a time series analysis was conducted on the Canadian Real Estate Association and Statistic Canada's data modelling the housing demand equation for single-family detached homes and apartment unit sales and prices in the Toronto and Vancouver areas. Two of Canada's most popular metropolitan cities require effective intervention methods in order to be able to keep the housing and financial markets stable. These intervention methods primarily work to keep housing accessible and affordable, which in turn decreases the financial burden of a large mortgage on a buyer.

The findings of this paper are focused on the Toronto and Vancouver housing markets; however, they are limited to the heterogeneity of housing sales. The level of aggregated data used could be improved by incorporating variables that control for housing characteristics and location. Several conditions known to affect the sale of a residential property were not included in the research due to the lack of available data surrounding them. Future studies could expand on this current research by incorporating the heterogenous characteristics of sales across regions, in addition to also incorporating city level demographic control variables.

The main findings of this paper conclude firstly, that there is positive price growth, and secondly that the overall effectiveness of the Foreign Buyer's Tax Policies and change in mortgage laws have decreased the volume of sales. The overall estimates suggest that real estate markets in Toronto and Vancouver are experiencing positive increases in prices for single-family homes and

apartment units in Toronto and Vancouver. The assessed intervention methods are successful at lowering sales volumes; however, this can be harmful to Canadians because it makes housing less affordable. Due to the fact the markets are still experiencing price run-ups, the overall number of sales is decreasing, which leaves a great level of volatility in the markets. It is suspected that the increasing prices are related to the supply shortage, which is expected to increase supplier power in the future. Therefore, to combat the excessive growth in prices, monitoring and policy correction are vital in maintaining equity and cohesion amongst all low-, middle- and high-income Canadian buyers.

Table 14 highlights the findings of the change in mortgage rules and how they have an effect on sales and prices depending on the regression. The results of the mortgage rate and income elasticities presented are as one would expect; however, the estimated price elasticities in many cases are positive which demonstrate that there is still a problem in modelling these two housing markets.

*Table 14: Summary Statistics of Change in Mortgage Rules*

	(1)	(2)	(3)	(4)
<b>MP- Change in Mortgage Rules Effect:</b>	<b>Van Single-VHS/VHP</b>	<b>Van Apt-VAS/VAP</b>	<b>Tor Single-THS/THP</b>	<b>Tor Apt-TAS/TAP</b>
<b>Table 4:</b> Cochrane-Orcutt Method	-0.269** (0.126)	-0.0284 (0.137)	-0.198** (0.0805)	-0.176** (0.0791)
<b>Table 9:</b> IV Adjusted for Autocorrelation	-0.323*** (0.0676)	-0.360*** (0.0652)	-0.0349 (0.066)	-0.161*** (0.0446)
<b>Table 12:</b> Reduced Form Regression for Sales	-0.305*** (0.108)	-0.165 (0.121)	-0.12 (0.0774)	-0.116 (0.0811)
<b>Table 13:</b> <i>Reduced Form Regression for Prices</i>	-0.0401* (0.0221)	-0.0304 (0.019)	0.0326** (0.0156)	0.0111 (0.0167)

Notably, all coefficients in Table 14 are negative except for the reduced form mortgage policy effect on Toronto prices. While holding all else constant, it is with 95 percent confidence that the change in mortgage rules in total increases the average Toronto single detached housing price by 3.26 percent. Lastly, Table 14 in its last line shows the reduced form effects of the changes in mortgage rules on housing prices. Interestingly, the findings here are not consistent across the two cities based on the negative and positive coefficients for single-family homes and apartment units. The MP coefficient under apartment unit prices for Toronto are both positive, and for Vancouver are both negative. The coefficients can be interpreted as follows: while holding all else constant, it is with 95 percent certainty that the change in mortgage laws in total increase the average price of a single-family home in Toronto by 3.26 percent. While holding all else constant, the Vancouver single detached family home price on average decreases in total by 4.01 percent given the change in mortgage laws. Future market analysis should be conducted on the Toronto housing market in order to better understand the price run-ups and to meet the high levels of demand

*Table 15: Margins Translated into Units of Sales by City and Housing Category Using the Cochrane-Orcutt Method.*

	Change in Mortgage Rules		City-Specific Foreign Buyer's Tax Policy	
	Pre (MP=0)	Post (MP=1)	Pre (TP/VP=0)	Post (TP/VP=1)
<b>Vancouver</b>				
Singles	1049.16	801.83	1066.75	845.35
Apartments	1091.44	1060.91	1099.35	1034.69
<b>Toronto</b>				
Singles	3463.94	2840.85	3494.42	2838.62
Apartments	1637.91	1373.7	1650.63	1373.18

Table 15 expressed Table 4’s marginal change pre and post implementation as quantities, thus the average changes in number of homes sold after the regulation changes relative to before. The findings suggest that the number of Vancouver’s single detached home sales fell roughly 23.55 percent and the number of apartment units fell roughly 23.55 percent following the change in mortgage rules relative to the period before. Likewise, Toronto’s number of single detached home sales and apartment unit sales fell approximately 17.98 percent and 16.13 percent, respectively, following the change in mortgage rules relative to the period before.

*Table 16: Summary Statistics of Foreign Buyer's Tax Policy*

<b>VP- Vancouver Foreign Buyer's Tax Policy Effect:</b>	(1) <b>Van Single- VHS/VHP</b>	(2) <b>Van Apt- VAS/VAP</b>	<b>TP- Toronto Foreign Buyer's Tax Policy Effect:</b>	(3) <b>Tor Single- THS/THP</b>	(4) <b>Tor Apt- TAS/TAP</b>
<b>Table 4:</b> Cochrane- Orcutt Method	-0.233* (0.124)	-0.0606 (0.134)	<b>Table 4:</b> Cochrane- Orcutt Method	-0.208*** (0.0764)	-0.184** (0.0783)
<b>Table 9:</b> IV Adjusted for Autocorrelation	-0.214*** (0.0736)	0.0135 (0.0615)	<b>Table 9:</b> IV Adjusted for Autocorrelation	-0.301*** (0.0655)	-0.244*** (0.0559)
<b>Table 12:</b> Reduced Form Regression for Sales	-0.185* (0.102)	0.0315 (0.106)	<b>Table 12:</b> Reduced Form Regression for Sales	-0.155** (0.0787)	-0.123 (0.0811)
<b>Table 13:</b> <i>Reduced Form Regression for Prices</i>	-0.0062 (0.0207)	0.0491*** (0.0163)	<b>Table 13:</b> <i>Reduced Form Regression for Prices</i>	-0.0671*** (0.0162)	0.0423** (0.0172)

Table 16 shows the effects of the Foreign Buyer’s Tax Policy changes across sets of regressions. The following research also supports the effectiveness of the Foreign Buyer’s Tax Policy effective in the Toronto and Vancouver areas. According to Table 9, when holding all else constant, it is with 99 percent confidence that the Foreign Buyer’s Tax Policy reduces Vancouver single detached home sales by 21.4 percent, Toronto single detached home by 30.1 percent and Toronto apartment unit sales by 24.4 percent. Overall, when assessing the direct and indirect

effects of the policies on volume of sales, the coefficients are negative or have a near zero effect. Many buyers could be more inclined to buy an apartment, instead of a very high-priced single-family home. Likewise, it is with 99 percent confidence that the total effect of the Toronto Foreign Buyer's Tax Policy reduces the price of a single-family home by roughly 6.71 percent. This makes sense as the Foreign Buyer's Tax will increase the cost of the purchase by approximately 15 percent, which could deter buyers from purchasing multimillion-dollar single family homes, making the apartment units more attractive. Therefore, more people will want to buy apartment units which will ultimately drive up their price.

To conclude, the findings of this paper suggest that the federal authorities are working to bring neutrality and health to Toronto and Vancouver's overheated housing markets. These elements will continue to be necessary for the future as both population growth and demand will continue to rise, as explained by the Canadian Centre of Economic Analysis and the Canadian Urban Institute for the Affordable Housing Office. Additionally, the authorities need to be aware of the possible negative impacts the intervention methods can have on surrounding rural communities. For example, the extra cost of residential properties due to the Foreign Buyer's Tax Policy may deter buyers and instead incent them to buy in nearby areas where they can avoid the tax, and therefore be a threat to other local buyers. For this reason, other Canadian real estate market prices and sales may be suffering from continuous run-ups due to population growth and foreign investments. Thus, Canada requires consistent monitoring and policy implementation across our nation in order to sustain healthy markets to make living more affordable and accessible for young Canadians. In order to have healthy policy implementation, the government and federal authorities must work together to pursue further research to assess the effectiveness and implications associated with each intervention.

## References

- Alini, E. (2019, January 8). New mortgage rules 2018: A practical guide. *Global News*. Retrieved from <https://globalnews.ca/news/>
- Anonymous. (2016, March 23). Toronto, Vancouver housing markets charging ahead. *Daily Commercial News*, 89(57), 1. Retrieved from <https://proxy.queensu.ca/login?url=https://search-proquest-com.proxy.queensu.ca/docview/1779012647?accountid=6180>
- Bank of Canada. (December, 2016). *Financial Systems Review*. Retrieved from <https://www.bankofcanada.ca/wp-content/uploads/2016/12/fsr-december2016.pdf>
- Bank of Canada. (June, 2017). *Financial Systems Review*. Retrieved from <https://www.bankofcanada.ca/wp-content/uploads/2017/06/fsr-june2017.pdf>
- Bank of Canada. (June, 2018). *Financial Systems Review*. Retrieved from <https://www.bankofcanada.ca/wp-content/uploads/2018/06/fsr-june2018.pdf>
- Bank of Canada. (November, 2018) The Impact of Recent Policy Changes on the Canadian Mortgage Market [Staff Analytical Notes]. Retrieved from <https://www.bankofcanada.ca/2018/11/staff-analytical-note-2018-35/>
- Bilyk, Olga and Maria Tenyenhuis. (November, 2018). The Impact of Recent Policy Changes on the Canadian Mortgage Market [Staff Analytical Note 2018-35]. Retrieved from <https://www.bankofcanada.ca/2018/11/staff-analytical-note-2018-35/>
- Canadian Centre of Economic Analysis (CANCEA) and the Canadian Urban Institute (CUI) for the Affordable Housing Office of the City of Toronto. (January 2019). Toronto Housing Market Analysis. *PH2.5 Appendix 1*. Retrieved from [https://www.toronto.ca/legdocs/mmis/2019/ph/bgrd/backgroundfile-124480.pdf?fbclid=IwAR0bveTYYkmCA6RHLA2OcG8HLH7uAIfuuWO1YXL0IAN\\_WnclqRXj2XhluJE](https://www.toronto.ca/legdocs/mmis/2019/ph/bgrd/backgroundfile-124480.pdf?fbclid=IwAR0bveTYYkmCA6RHLA2OcG8HLH7uAIfuuWO1YXL0IAN_WnclqRXj2XhluJE)
- Canadian Real Estate Association. (2016). Multiple Listing Service Home Price Index Benchmark Home Definitions [PDF file]. Retrieved from [https://www.crea.ca/wp-content/uploads/2016/02/benchmark\\_home\\_definitions\\_for\\_tableau\\_en.pdf](https://www.crea.ca/wp-content/uploads/2016/02/benchmark_home_definitions_for_tableau_en.pdf)
- Chisholm, D., S. Kuehn, H. Sherlock, and S. Wong. (2016). BC Government Targets Foreign Buyers with 15% Tax Hike. *The Canadian Bar Association British Columbia Branch*. Retrieved from <https://www.cbabc.org/Sections-and-Community/Business-Law/Business-Law-Quarterly/Business-Law-Quarterly-Archives/Q1-2017-New-Rules-Impacting-Foreign-Home-Buyers/BC-Government-Targets-Foreign-Buyers-with-15-Tax-H>

- CQ-Roll Call, Inc. (2016, April 5). Toronto, Vancouver housing markets continue record-setting pace. *The Canadian Broadcasting Corporation*. Retrieved from <https://link-gale-com.proxy.queensu.ca/apps/doc/A448485115/CPI?u=queensulaw&sid=CPI&xid=3fbd9be8>
- Dachis, B., G. Duranton, and M.A. Turner. (2012). The effects of land transfer taxes on real estate markets: Evidence from a natural experiment in Toronto. *Journal of Economic Geography*, 12(2), 327-354. doi:10.1093/jeg/lbr007
- Easter, W., Canada. Parliament. House of Commons. Standing Committee on Finance, & Depository Services Program (Canada). (2017). *Canada's housing markets: Benefits, barriers and bringing balance: Report of the standing committee on finance*. Ottawa: Standing Committee on Finance.
- Editor (2012). Greater Vancouver Regional District – So What Is Surrounding Vancouver City? *Vancouver, British Columbia, Canada Information*. Retrieved from <http://vacouver.ca/vancouver-info/297/greater-vancouver-regional-district-so-what-is-surrounding-vancouver-city/>
- Greenaway-McGrevy, R., and P. C. B. Phillips. (2016). Hot property in New Zealand: Empirical evidence of housing bubbles in the metropolitan centres. *New Zealand Economic Papers*, 50(1), 88-113. doi:10.1080/00779954.2015.1065903
- Head, A., Lloyd-Ellis, H., & Sun, H. (2014). Search, liquidity, and the dynamics of house prices and construction. *The American Economic Review*, 104(4), 1172-1210. doi:10.1257/aer.104.4.1172
- Head, A., & Lloyd-Ellis, H. (2016). Has Canadian house price growth been excessive? *Canadian Journal of Economics/Revue Canadienne d'Économique*, 49(4), 1367-1400. doi:10.1111/caje.12237
- Ireland, C. (2019, March 21). Chinese investors still sold on Canadian real estate. *The Globe and Mail*. Retrieved from <https://www.theglobeandmail.com/real-estate/toronto/article-chinese-investors-still-sold-on-canadian-real-estate/>
- Phillips, Peter C. B., Shu-Ping Shi, and Jun Yu; (2015), "Testing for Multiple Bubbles: Historical Episodes of Exuberance and Collapse in the S&P 500." *International Economic Review* 56(4), pp. 1043- 1078.
- Phillips, Peter C. B, Shu-Ping Shi, and Jun Yu; (2015), "Testing For Multiple Bubbles: Limit Theory of Real-Time Detectors." *International Economic Review* 56(4): pp. 1079-1134.
- Real Estate Board of Greater Vancouver. (September, 2016). Metro Vancouver home sales return to typical August levels [PDF]. *News Release*. Retrieved from [https://www.rebgv.org/content/dam/rebgv\\_org\\_content/pdfs/monthly-stats-packages/REBGV-Stats-Pkg-August-2016.pdf](https://www.rebgv.org/content/dam/rebgv_org_content/pdfs/monthly-stats-packages/REBGV-Stats-Pkg-August-2016.pdf)

- Rherrad, I., M. Mokengoy, and L. Kuate Fotue. (2019). *Is the canadian housing market 'really' exuberant? evidence from vancouver, toronto and montreal*. *Applied Economics Letters*, 26(19), 1597-1602. DOI:10.1080/13504851.2019.1588941
- Royal LePage. (2017, July 13). 'Sanity' returning to Toronto housing market, as Vancouver, Calgary show recovery. *The Canadian Broadcasting Corporation*. Retrieved from <https://link-gale.com.proxy.queensu.ca/apps/doc/A498411992/CPI?u=queensulaw&sid=CPI&xid=ea8caa99>
- Statistics Canada. (2019). *Canada Mortgage and Housing Corporation, conventional mortgage lending rate, 5-year term* [Table 17-10-0009-01]. Retrieved from <https://doi.org/10.25318/3410014501-eng>
- Statistics Canada (2019). *Construction union wage rates, monthly* [Table 18-10-0139-01]. Retrieved from <https://doi.org/10.25318/1810013901-eng>
- Statistics Canada (2019). *Consumer Price Index (CPI) statistics, measures of core inflation and other related statistics - Bank of Canada definitions* [Table 18-10-0256-01]. Retrieved from: <https://doi.org/10.25318/1810025601-eng>
- Statistics Canada. (2019). *Current and capital accounts - Households, Canada, quarterly (x 1,000,000)*, [Table 36-10-0112-01]. Retrieved from <https://doi.org/10.25318/3610011201-eng>
- Statistics Canada. (2019). *Population in Canada, Quarterly*, [Table 34-10-0145-01]. Retrieved from <https://doi.org/10.25318/1710000901-eng>
- TD Bank. (n.d). *New Mortgage Rules in Canada: At a glance*. Retrieved from <https://www.td.com/ca/en/personal-banking/products/mortgages/new-mortgage-rules/>
- Toronto, Vancouver housing markets charging ahead. (2016). *Daily Commercial News*, 89(57), 1. Retrieved from <https://search-proquest-com.proxy.queensu.ca/docview/1779012647?accountid=6180>
- The Canadian Press. (2019, November 05). Toronto, Vancouver see home sale gains in October but prices diverge. *CBC News Business*. Retrieved from <https://www.cbc.ca/news/business/>
- The Canadian Press. (2019, January 21). 46% of Canadians \$200 or less away from financial insolvency: poll. *CBC News Calgary*. Retrieved from <https://www.cbc.ca/news/canada/calgary/200-financial-insolvency-2019-1.4986586>
- Toronto Real Estate Board. (2017). *Condo Market Report Second Quarter 2017* [PDF file]. Retrieved from [http://www.trebhome.com/files/market-stats/condo-reports/condo\\_report\\_Q2-2017.pdf](http://www.trebhome.com/files/market-stats/condo-reports/condo_report_Q2-2017.pdf)



Peter C. B. Phillips, S. Shi, and J. Yu. (2015). testing for multiple bubbles: Historical episodes of exuberance and collapse in the s&p 500. *International Economic Review*, 56(4), 1043-1077. doi:10.1111/iere.12132

Zochodne, Geoff. (2019, September 13). Foreign buyer vacancy tax unlikely to derail housing rebound, real estate market watchers say. *Financial Post*. Retrieved from <https://business.financialpost.com/news/economy/foreign-buyer-vacancy-tax-unlikely-to-derail-housing-rebound-real-estate-market-watchers-say>

## Appendix 1: Structural Breaks in Prices

Figure 5:

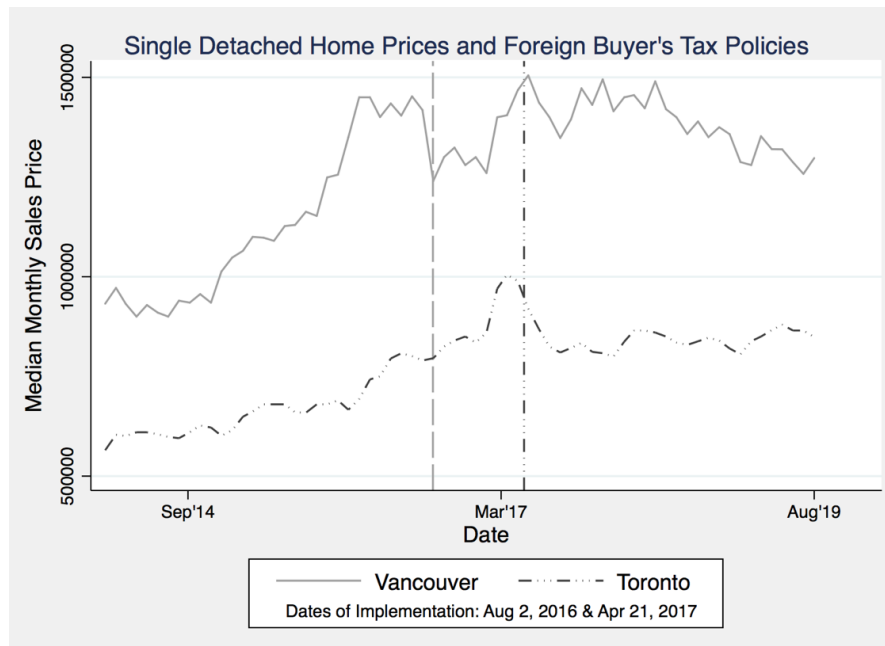


Figure 3: Median monthly sales price from January 2014 to August 2019 for single detached family homes. Marked are the structural breaks of the Foreign Buyer's Tax Policy in Toronto and Vancouver (Canadian Real Estate Association, 2019).

Figure 6:

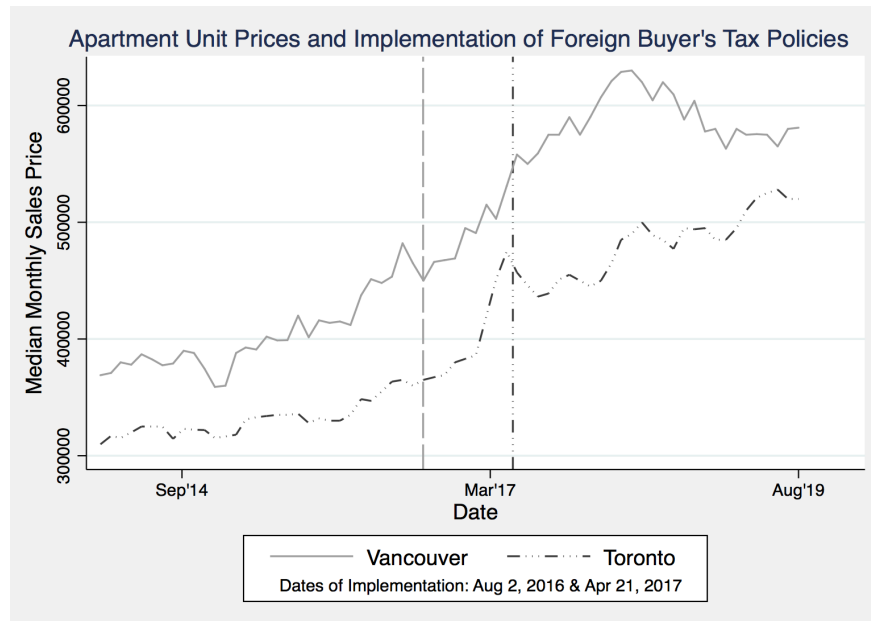


Figure 4: Median monthly sales price from January 2014 to August 2019 for apartment units. Marked are the structural breaks of the Foreign Buyer's Tax Policy in Toronto and Vancouver (Canadian Real Estate Association, 2019).