Assessing the Canadian Housing Market: A User Cost Approach

Jacob Dolinar

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Dr. Martin Farnham, Honours co-advisor

Dr. Elisabeth Gugl, Honours co-advisor

Abstract

There has been extensive discussion and concern that house prices in Canada have risen to unsustainable levels, and a housing bubble is present. Using an user cost framework developed by Himmelberg *et al.* (2005), I test whether housing price growth in major Canadian cities since 1990 is supported by underlying fundamentals such as low interest rates, or whether it is driven by market speculation. In this paper, I show that often cited conventional housing statistics such as price-to-rent ratios fail to account for the underlying fundamental factors, and may be misinterpreted as evidence of housing overvaluation. I find that the price increases across Canada can be justified by fundamental factors, with the decline in interest rates driving the annual cost of ownership decline. I also find little evidence of a housing bubble in Canadian cities at the end of 2016.

Keywords: Housing prices, Rents, User Costs, Housing Bubbles.

Contents

1 Introduction

In this paper, I test whether housing price growth in major Canadian cities since 1990 is supported by underlying fundamental factors such as low interest rates, or whether it is driven by market speculation. This study is motivated by the extensive discussion and concern about house prices rising to unsustainable levels. According to the Multiple Listing Service (MLS®) Housing Price Index, the average price of a single-family home in Canada has risen by 134% (7.34% compounded annual growth rate, CAGR) since 2005 (Canada Real Estate Association, 2017).

If prices are not justified based on fundamentals, this may indicate the formation of a housing bubble. When a housing bubble is present, homebuyers believe that homes normally outside of their price range are now attainable due to the expected price appreciation (Case and Schiller, 2003). Increases in price-rent ratios, price-income ratios, and nominal price growth are criteria often cited as evidence of a housing bubble. The argument for the use of such criteria is that "when price-rent ratios remain high for prolonged periods, it must be that prices are being sustained by unrealistic expectations of future price gains rather than the fundamental rental value and hence contain a bubble." (Himmelberg, Mayer, and Sinai, 2005, p. 72).

However, these conventional criteria are subject to a number of criticisms. Himmelberg *et al.* (2005) and Head and Ellis (2016) express their concerns with only citing these criteria as evidence of housing overvaluation. Standard criteria such as price-rent ratios are potentially misleading for a number of reasons. First, house price growth does not necessarily translate to growth in the cost of ownership. Therefore, increasing price-rent ratios do not mean that house price growth is excessive if the cost of ownership is not increasing. Second, each city will have varying levels of expected appreciation rates and property taxes. These differences

lead to variabilities in price-rent ratios over time, and across cities.

In order to address concerns with measuring house prices using these aforementioned criteria, I assess prices from a user cost of owner-occupied housing approach. The user cost approach has been widely used by economists such as Poterba (1984), Himmelberg *et al.* (2005), Hendershott and Slemrod (1983), and Glaeser (2014).

This approach assesses house prices based on a set of fundamental factors, and calculates the annual cost of ownership. For homeowners, the annual cost of living in their home for a given year is defined as the imputed rent. The imputed rent is a function of fundamental variables such as interest rates, property taxes, depreciation rates, risk premiums, and expected capital gains/losses in a year. Once I calculate the imputed rent, I can compare it with market rents to determine if individuals would prefer to rent or own an equivalent home. Following the empirical framework of Himmelberg *et al.* (2005), I compute indexes of imputed-to-actual rent and imputed rent-to-income and compare them to price-to-rent and price-to-income ratios to determine if house price growth in Canada is justified by underlying fundamentals.

Although traditional house price statistics can be misleading at times, they are a useful comparison for user cost calculations. If price-to-rent ratios are rising and imputed-to-actual rent ratios remain constant, it is reasonable to argue that the price growth is justified by underlying fundamentals. To test if a housing bubble is present, I compare the imputed-to-actual rent and price-to-rent index values to their long-run averages.[1] If the imputed-to-actual rent index is higher than its long-run average and the price-to-rent ratio is below this level, then this indicates

[1]Due to data availability, I consider the long-run average as being the 26-year average.

overvaluation in the market.

Due to the heterogeneity between markets, housing price dynamics should be analyzed based on historical city level performance, rather than make cross-city comparisons (Amano, Allen, Byrne, and Gregory, 2009). In my dataset, I have access to information on 24 major Canadian cities.

For my empirical analysis, I use MLS® Average Annual Residential Prices for 1990-2016 from the Canadian Mortgage and Housing Corporation (CMHC). I use rental data from the CMHC to construct price-to-rent ratios for each of the 24 cities. I use effective property tax rates from Murell (2008), who estimates provincial rates for three time periods: 1981-83, 1997-99, and 2005-07. Effective property tax rates are calculated by the ratio of average residential property taxes paid to average property values. For 2010-2012, I follow Head and Ellis (2016) and replicate Murell (2008)'s calculation. I assume that property taxes in 2013-2016 are equal to those in 2010-2012. Property depreciation rates are assumed to remain constant, and are set to 1.5% of the house price (Kostenbauer, 2001). I use the 10-Year Canadian Treasury Bond Yield for the interest rate. This represents the opportunity cost of investing in the housing market instead of another financial asset. I use median real after tax income data from the CMHC for price-to-income and imputed rent-to-income calculations.

In the housing bubble literature, there are many definitions of a bubble. Stiglitz (1990) defines the formation of a bubble by stating: "if the reason that the price is high today is only because investors believe that the selling price will be high tomorrow when 'fundamental' factors do not seem to justify such a price - then a bubble exists" (p. 13). Other definitions in the literature are similar to Stiglitz

(1990) because they emphasize prices are deviating from their fundamental value. In this paper I show that an individual's view of expected house price growth plays a key role in the determination of house prices. Although the formation of housing bubbles may follow the same structure as other financial assets in that market prices differ from fundamentals; I emphasize that real estate bubbles should be analyzed differently due to the frictions and large transaction costs in the housing market.

The remainder of this paper is organized as follows. Section 2 provides a review of the housing market literature, defining and identifying asset bubbles, and housing bubbles. Section 3 presents an empirical framework for assessing housing prices following the methodology of Himmelberg *et al.*, (2005), and describes the data sources used in the user cost calculations. Section 4 presents the empirical results for the 24 major Canadian cities. Section 5 provides concluding remarks and possible extensions for future research on Canadian housing prices.

2 Literature Review

2.1 Housing Markets

There is an extensive literature assessing housing prices and bubbles from a user cost approach. However, there has been little analysis of this type done on the Canadian housing market. Himmelberg *et al.* (2005) construct a framework to determine the annual cost of owning a home for 46 major cities in the United States. Using this framework, they analyze whether the recent price growth is determined by fundamental factors or speculation. The framework developed in the Himmelberg *et al.* (2005) paper forms the basis for the methodology that I will use to analyze the Canadian housing market. The user cost of owning a

home is a function of variables such as the interest rates, property tax rates and expected capital gain/loss on property. The user cost is expressed in terms of cost per dollar of house value. In equilibrium, the expected annual cost of ownership should not exceed the annual cost of renting, and the marginal home buyer should be indifferent between renting and owning a home.

To assess whether housing price growth is excessive, I can calculate the imputed rent and compare it to market rents. Imputed rents are calculated by multiplying the user cost by the level of house prices in a given year. If user costs are rising, this may not necessarily be evidence of a housing bubble if the income levels are rising at a comparable rate. If there was a housing bubble, user costs would be rising much faster than income. Himmelberg *et al.* (2005) find that there is little evidence of a housing bubble at the end of 2004. While cities such as New York, San Francisco, and Boston exhibit high levels of price growth, they conclude that the price growth is justified by fundamental factors.

Head and Ellis (2016) analyze the recent rise in Canadian housing prices by using a canonical asset pricing model to explain how changes in rents, interest rates, and property taxes affect housing prices. The analysis focuses heavily on an individual's view of the current low interest-rate regime and whether it is seen as a transitory or permanent phenomenon. Their results suggest that excess valuation is present in some cities as of 2015, but that this excess valuation is not as great as conventional statistics such as price-to-rent ratios suggest.

Allen, Amano, Byrne, and Gregory (2009) empirically analyze the long-run relationship between city house prices in Canada from 1981 to 2005. Allen *et al.* (2009) utilize a cointegration approach to test for a link between city level prices

and the MLS Canadian price index. Their results show that there is a lack of cointegration between cities; and therefore analyzing aggregate housing price indexes "will not lead to a deeper understanding of the Canadian housing market" (p. 11). Instead, they suggest that in order to understand a particular market, regional analysis is required. Following the recommendation of Allen *et al.* (2009), I conduct my analysis on a city-by-city basis.

2.2 Asset Bubbles

2.2.1 Defining an Asset Bubble

Over the course of history, there are many examples of the formation and collapse of asset bubbles. This phenomenon dates back to the first recorded asset bubble, known as 'Tulip Mania', taking place in Holland during the 1630's. During this period, the contract prices for tulip bulbs rapidly rose to new heights and attracted less knowledgeable traders, until the price suddenly plummeted (Maurits van der Veen, 2012). At the time, tulip prices were increasing and individual traders were able to purchase tulips with the expectation they could sell them for inflated prices in the future. As more and more traders entered the market based on speculation, the rapid price increase finally halted on February 7th, 1637 when the tulip market crashed and sent Holland into a deep recession (Maurits van der Veen, 2012). The speculative rise and sudden fall in the price of an asset implies there was a bubble in the Dutch tulip market, that eventually burst.

The 'Tulip Mania' of the 1630's certainly fits the criteria for a bubble that most people are familiar with. However, in the asset bubble literature, there are many definitions of what constitutes an asset bubble. The definition provided by Stiglitz (1990) in the introduction is one of the leading definitions in the literature, stating

that a bubble is present if high prices are solely driven by the belief that prices will be greater tomorrow. Flood and Hodrick (1990) state that "if bubbles exist in asset markets, market prices of assets will differ from their fundamental values" (p. 85). Using a similar definition to Stiglitz (1990), Case and Schiller (2003) define a bubble as "a situation in which excessive public expectations of future price increases cause prices to be temporarily elevated" (p. 299). Although each definition of an asset bubble may be slightly different, the common feature is that prices deviate from their fundamental value.

2.2.2 Detecting an Asset Bubble

Determining whether an asset bubble is present is not an easy task for economists and policy makers. Jones (2014) notes that "formal tests of speculative asset price bubbles could be plagued by estimation and measurement limitations to such a degree that they may achieve little of substance in advancing the policy debate over the existence of bubbles, especially in real time" (p. 10). Just as there is no consensus on the definition of an asset bubble, there is no clear consensus on a framework for testing for the presence of an asset bubble. It is important to understand the dynamics of asset bubbles since asset prices have implications for the real allocation of an economy.

Brunnermeier (2008) notes that the literature for asset bubbles can be split into four main strands of models: (i) Rational bubbles under symmetric information, (ii) Rational bubbles under asymmetric information, (iii) limited arbitrage bubbles, and (iv) heterogeneous belief bubbles.

Rational bubbles under symmetric information assume that investors would choose to invest in the bubble asset, under the assumptions that the price will rise. Ratio-

nal bubbles are often modelled by $p_t = v_t + b_t$, where p_t is the asset price, v_t is the fundamental value, and b_t is the bubble component (Brunnermeier and Oehmke, 2012). Froot and Obstfeld (1991) find that a specific form of rational bubble defined as an intrinsic bubble, can empirically account for some deviation in United States stock prices from their fundamental values.[2] For the housing market, it is not realistic to assume that this is the only reason an individual would purchase a bubble asset. Owning a home provides financial benefits (i.e., capital gains) as well as non-financial benefits (i.e., sense of community).

Rational bubbles under asymmetric information offer another explanation of why an individual would choose to hold a bubble asset. An investor may temporarily hold a bubble asset with the belief that they can sell this asset at a later date to a less informed investor. In these models, gains from trade can be exploited by investors only at the expense of another investor (Brunnermeier, 2008). Allen, Morris, and Postlewaite (1992) model finite bubbles under asymmetric information to show that bubbles in the stock market can exist due to the differences in beliefs, and information between investors. This type of model may provide some evidence why individuals in certain housing markets are willing to pay inflated prices, under the assumption that they can resell the house for a higher price. Due to frictions and large transaction costs in the housing market however, this limits the opportunity for some investors to take advantage of potential arbitrage profits.

Bubbles also form from limited arbitrage opportunities because "well informed and

[2]The fundamental values referenced in Froot and Obstfeld (1991) refers to the present value of the stock, calculated by $P_t^{pv} = \sum_{s=t}^{\infty} e_t^{-r(s-t+1)} E_t(D_s)$ where $E_t(\cdot)$ is the markets expectation at time t, D_t is the real dividend per share paid out over period t, and r is the instantaneous real rate of interest. This equation equates the stock price to the present value of expected dividend payments.

sophisticated investors interact with behavioral market participants whose trading motives are influenced by psychological biases" (Brunnemeier, 2008, p. 10). Although an investor may be able to identify an asset bubble, there are frictions that inhibit their ability to capitalize on these profits. Prior to the 2008 financial crisis, Michael Burry correctly identified a real-estate bubble in the United States due to the issue of sub-prime mortgage lending (Foote, Gerardi, and Willen, 2012). With the belief that a housing bubble was imminent, Burry looked for a way to short the entire housing market. At the time, there was no investment vehicle capable of this short position. However, Burry persuaded several of the largest investment banks such as Goldman Sachs and JP Morgan, to sell him credit-default swaps against the housing market.[3] This example highlights the difficulty investors face when betting against the consensus market position for particular assets, such as real estate. Because of the limits on arbitrage, the asset bubble will often continue as more and more individuals try to 'ride the bubble' (Brunnermeier, 2008).

The final strand of models is for asset bubbles under heterogeneous beliefs. Bubbles can emerge under heterogeneous beliefs with short sale constraints because optimistic investors will drive the price of the asset upwards (Brunnermeier, 2008). Xiong (2013) notes that "it is pervasive for traders to form opposite views about the future performance of stocks and bet against each other" (p. 14). Due to the short sale constraints, investors who take a bullish position tend to outweigh the bearish investors. This model also lends itself to comparisons for bubbles in the housing market because many people have different opinions on the future path of the housing market.

[3]Credit default swaps are a form of credit derivatives in which the seller must pay a premium in the event that the underlying asset defaults.

There are a number of econometric tests that can be used to determine whether a bubble exists in the aforementioned strands of models. However, the problem in the asset bubble literature is that different econometric tests conducted on the same dataset can reach different conclusions. Shiller (1981) and Leroy and Porter (1981) develop variance bounds tests to determine whether stock prices exhibit excess volatility. This test compares the variance of the actual stock price versus the ex-post rational price.[4] West (1987) develops an alternative test for asset bubbles by testing H_0: the stock price is correctly valued, and H_1: the stock price equals the fundamental value plus a bubble component. West (1987) builds on the work of Hausman (1978) by calculating the present discounted value of a stocks dividends in two ways: (1) regressing the stock price on lagged dividends; (2) using two equations from the discount rate and dividend's ARIMA equation.

There are a variety of opinions on whether the current housing market in Canada is in a bubble, or the prices are justified based on fundamentals. In this paper, I use lessons from each aforementioned strand to test for a housing bubble in Canadian cities.

2.2.3 Housing Bubbles

Glaeser and Nathanson (2014) discuss multiple theories that may explain the formation of real estate bubbles and how policy makers take actions to prevent price crashes. They conclude that although relatively cheap credit may fuel the housing market, temporary periods of low interest-rates cannot be the sole reason for a housing bubble. They also conclude that there are no clear policies that can prevent housing bubbles from occurring and express the need for economists to continue to study housing bubbles to find ways to prevent them.

[4]Ex-post rational price is defined as the present value of the dividends paid out by the firm.

3 Empirical Framework

3.1 User Cost of Housing

I employ Himmelberg *et al.* (2005)'s empirical framework to determine whether the recent price growth in Canada is based on fundamental economic factors, or investor speculation. Many people often mistake nominal house price growth as the annual cost of ownership growth. To accurately judge the housing price increase, I calculate the annual cost of ownership (ACO) for owner-occupied housing, known as the 'imputed rent'. The imputed rent is a function of six fundamental economic components that can increase, or decrease the annual cost of ownership in a given year. The imputed rent is calculated using the following formula:

$$ACO = P_t r_t^{rf} + P_t \omega_t - P_t \tau_t (r_t^m + \omega_t) + P_t \delta_t - P_t g_{t+1} + P_t \gamma_t \tag{1}$$

The first term $P_t r_t^{rf}$ represents the opportunity cost of capital, calculated as the house price times the risk-free interest rate. The second term, $P_t \omega_t$ represents the one-year cost of property taxes, calculated as the the house prices times the effective property tax rate. The third term, $P_t \tau_t (r_t^m + \omega_t)$ represents the tax deductibility of mortgage interest and property taxes, calculated as the house price times the marginal tax rate τ_t, times the sum of the mortgage interest r_t^m and the property tax rate ω_t. The fourth term $P_t \delta_t$ represents maintenance costs as a fraction of housing prices. δ_t can also be defined as the depreciation rate of a given property. The fifth term $P_t g_{t+1}$ represents the expected capital gain/loss during the year. The final term $P_t \gamma_t$ represents an additional risk premium to compensate homeowners for the higher risk of owning versus renting. In Canada, tax laws prohibit the deduction of mortgage interest and property tax payments[5]

[5]Canada does however have a capital gains deduction on your principal residence.

and therefore the term $P_t\tau_t(r_t^m + \omega_t)$ drops out of the annual cost formula and becomes:

$$ACO = P_t r_t^{rf} + P_t\omega_t + P_t\delta_t - P_t g_{t+1} + P_t\gamma_t \tag{2}$$

In equilibrium, the expected annual cost of ownership should not exceed the annual cost of renting an equivalent property (Himmelberg *et al.*, 2005). If market rents are above imputed rents, then individuals would prefer to own their home instead of renting. The marginal homebuyer should be indifferent between renting and owning a home. The equilibrium condition can be expressed as:

$$R_t = P_t u_t \tag{3}$$

Where R_t is the annual market rent, P_t is the price of the home, u_t is the user cost of housing, defined as:

$$u_t = r_t^{rf} + \omega_t + \delta_t - g_{t+1} + \gamma_t \tag{4}$$

u_t is the annual cost of ownership expressed in terms of cost per dollar of house value (Himmelberg *et al.*, 2005). Another way to think about this equilibrium condition is to rearrange the terms and find:

$$\frac{P_t}{R_t} = \frac{1}{u_t} \tag{5}$$

The price-rent ratio, a commonly cited statistic for housing prices should equal the inverse of the user cost in equilibrium. Himmelberg, *et al.* (2005) note that "fluctuations in the user cost (caused for example by changes in interest rates and taxes) lead to predictable changes in the price-rent ratio that reflect fundamentals,

not bubbles" (p. 75). Although many people cite an increase in the price-rent ratio as the sign of a housing bubble, the empirical analysis in the next section will determine whether this increase is justified.

Further rearranging equation (5), I obtain the equilibrium price as a function of economic fundamentals. The predicted price can calculated as:

$$P_t = \frac{R_t}{u_t} \tag{6}$$

Himmelberg *et al.* (2005) also illustrate a simple example to help understand the user cost framework. I modify this example to account for the differences between Canada and the United States. Let the the risk free interest rate be 3.5%; the property tax rate be 1.0%; the depreciation rate be 2.5%; the expected capital gain in house prices be 4%; and the additional risk premium be 2%. Solving the annual cost of ownership in terms of cost per dollar of house value, I find that this equals 5%. Based on this annual cost of ownership, a home with a 5% user cost should sell for 20 times (1/0.05) the annual market rent. If the average house sells for $200,000 in this city, according to the user cost formula this home has an imputed rent of ($200,000 * 5.0%) $10,000. If the annual market rent exceeds the imputed rent, then individuals will prefer to own their home in equilibrium.

3.2 Data Sources

Throughout my study, I use a variety of data sources to calculate the annual cost of ownership for 24 major Canadian cities from 1990-2016. For house prices, I use yearly MLS® Average Residential nominal prices for 1990-2016 from the CMHC. This set of prices is also used by Head and Ellis (2016) when conducting their analysis on the Canadian housing market. The MLS® Housing Price Index is also used in the literature. The HPI uses a repeat sales, and hedonic pricing approach

to track relative price levels for major Canadian metropolitan areas.[6] The major drawback to this data is that the HPI was only introduced in 2005, and only covers 11 major housing markets. Therefore, I use the CMHC data for the purpose of this study.

I use average rents for a 2-bedroom unit from the CMHC as my measure of rent in this study. I use real median after tax household income from the CMHC for price-to-income, and imputed rent-to-income calculations. The CMHC use of a variety of Statistics Canada surveys to collect this income data. In particular, they use the Survey of Consumer Finances for 1990-1993 data; the Survey of Consumer Finances and Survey of Labour and Income Dynamics for 1994-1997; Survey of Labour and Income Dynamics - 1998-2011; and the Canadian Income Survey for remaining years. I use the 10-Year Canada Treasury Bond yield for the risk free interest rate. By using a longer term rate, I capture expectations of future interest rate changes. Himmelberg *et al.* (2005) use the constant yield to maturity on 10-year United States Treasuries for their risk free rate.

I use property tax data from Murell (2008) who estimates effective property tax rates on a provincial basis for 1981:83, 1997:99, and 2005:07. For 2012-13, I follow Head and Ellis (2016) and replicate Murell (2008)'s calculations. I further assume that property tax rates remain the same from 2013-2016, and I linearly interpolate between years where estimates were provided. Depreciation rates are set at a constant 1.5%, following the recommendations of Kostenbauer (2001). Kostenbauer (2001) argues that the 2% annual depreciation rate used in the CPI by Statistics Canada overestimates the true costs. He finds that the true depreciation rate lies

[6]See MLS® Home Price Index Methodology for further details. https://www.crea.ca/wp-content/uploads/2016/02/HPI_Methodology.pdf

within a range of 1.4% - 1.6%. The risk premium is set at 2%, as estimated by Flavin and Yamashita (2002). The additional risk premium is included to compensate homeowners for choosing to own as opposed to renting. This additional risk encompasses factors such as large changes to the market value of their home, large expenses needed to maintain their house, and also changes in debt-servicing costs from interest-rate shifts.

One of the biggest challenges with calculating the annual cost is to measure an individual's expected capital gain/loss in a year. There are a variety of opinions on how to measure this term. Poterba (1992) suggests that house prices grew at the overall inflation rate, in order to solve the user cost expression used in his paper. This theory is troubling when analyzing the historical price growth in Canada because price appreciation for the past 26 years exceeds the average rate of inflation. Verbrugge (2008) suggests another way to estimate expected capital gains is to use an autoregressive, AR(1), approach that is based upon the previous year's price appreciation. In high price growth cities such as Vancouver, using the AR(1) growth will lead to large variability in expected capital gains from year-to-year. This variability is due to the large yearly house prices changes, that exceeded 15% in a number of years. This high level of growth causes the user cost to become negative, as shown in figure 1.[7] A negative user cost implies negative imputed rents in the market. It is not realistic to assume that a home will rent for a negative amount, therefore this method will not produce interpretable results.

[7]Note that normal growth refers to the long-term average real rate of housing price growth in Canadian cities.

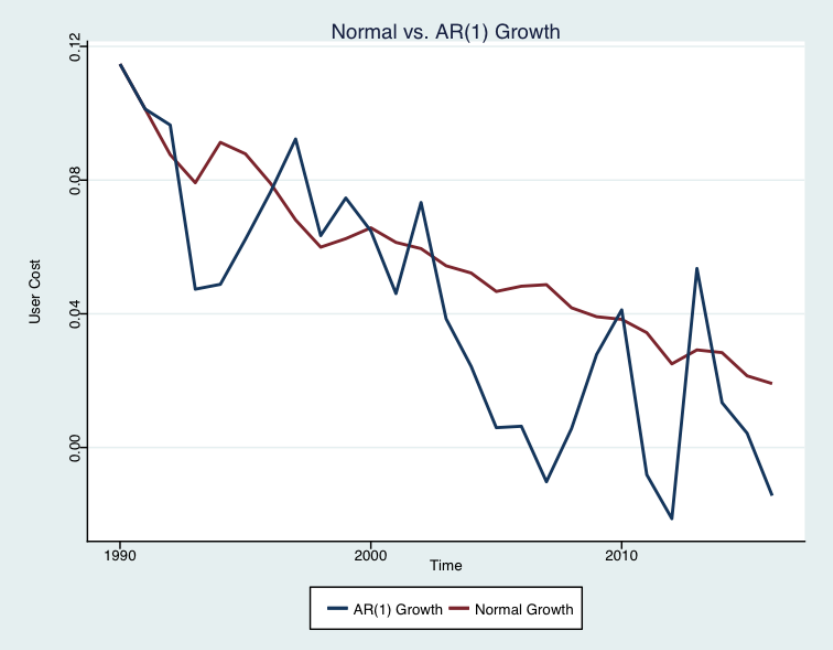

Figure 1: Vancouver User Cost Estimation Using Normal vs. AR(1) Growth

For this paper, I assume that the expected capital gain/loss is equal to the average real rate of housing price growth in Canada. I compute this by calculating the nominal house price growth in a city over the 26-year period, and deflating it by the CPI year-over-year inflation rate.

4 Empirical Analysis

To determine whether recent price growth in Canada is justified by fundamentals, or whether it is driven by speculation, I calculate the annual cost of ownership for each of the 24 cities in my study. I use the empirical specifications found in table 1 to conduct my analysis. From my analysis, I find a number of prevailing trends. First, I find a linear upward trend in house prices since 1990. Figure 2 shows two Canadian cities who have seen nominal price increases ranging from 208% in Windsor, Ontario to 449% in Vancouver, British Columbia from 1990-

2016. Windsor represents the lowest price increase over my sample period, while Vancouver represents the highest. This variability in the price increase since 1990 leads to different expectations about future capital gains between cities. For example, an individual in Vancouver will take into account a higher expected capital gain, compared to an individual from Windsor. A higher expected capital gain will lead to a lower annual cost of ownership.

Table 1: User Cost Framework Specifications

Parameter	*Value*	*Source*
r_t^{rf} - Risk Free Rate	Varies	Canadian 10 yr. Bond Yield (BOC, 2018)
ω_t - Property Tax Rate	Varies	Effective Provincial Rates (Murell, 2008)
δ_t - Maintenance Costs	1.5%	Kostenbauer (2001)
γ_t - Risk Premium	2%	Flavin & Yamashita (2002)
g_{t+1} - Expected Capital Gain	Varies	Based on long-term real growth (CMHC)
P_t - House Prices	Varies	MLS® Average Nominal prices (CMHC)
R_t - Rental Prices	Varies	Average 2-Bedroom Rent (CMHC)
Income	Varies	Real Median After Tax Income (CMHC)

Notes: This table shows the empirical specifications I use to calculate user costs and imputed rents for the 24 cities in my sample. The values I use for the risk free rate vary over time depending on the bond yield. I assume each city faces the same opportunity cost of capital in a given year. The property tax rates, expected capital gains, house prices, rental prices, and income levels are all city-dependent values that vary over time.

When comparing the pattern of Canadian house prices against United States prices over my sample period, I find a number of differences. During the great recession of the late 2000's, the United States housing market collapsed once the bubble had burst. From 2007-2009, many United States cities experienced sharp declines in housing prices as a result of widespread mortgage defaults and foreclosures. In Canada, housing prices remained stable throughout the global recession and did

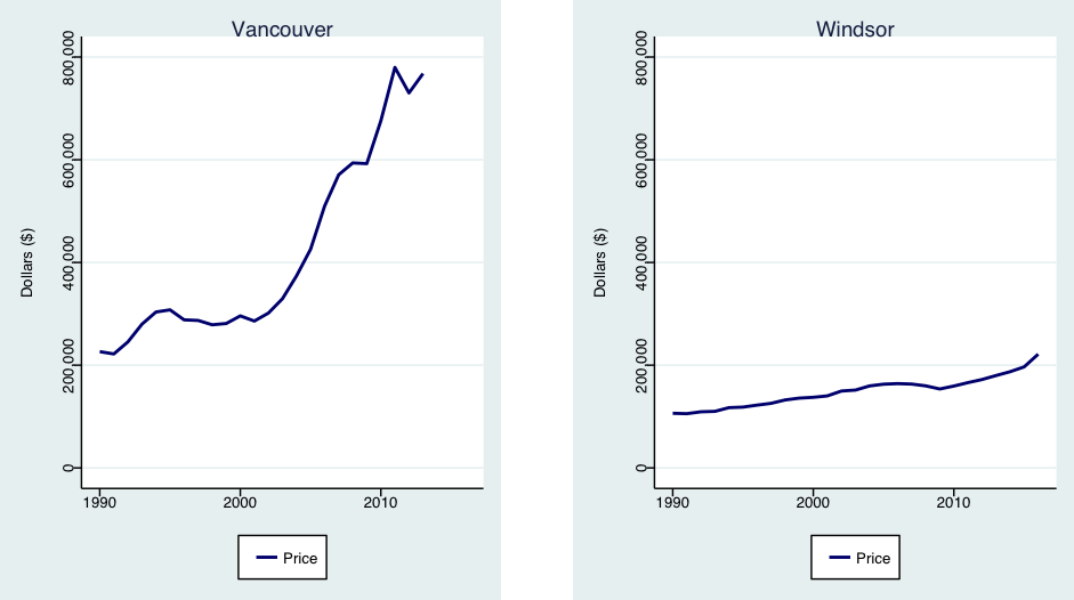

Figure 2: Highest and Lowest City House Price Growth (1990-2016)

not experience large price depreciations. This indicates that Canada's tighter regulation on mortgage lending and other housing regulation enables the Canadian housing market to withstand negative shocks.

My user cost analysis also reveals that there is a downward trend in user costs over time across Canada. In each of the cities I consider, user cost values are at their peak in 1990. This result can be explained by analysing the behaviour of Canadian interest rates. In 1990, interest rates in Canada were high when compared to the current low interest rate regime. Figure 3 shows the path of the 10-Year Canadian Treasury Bond yield from 1990-2016. This bond yield is the long-term interest rate in my study, and represents the opportunity cost of capital. The cost of borrowing was large in 1990, and not everyone in Canada could afford to pay these high debt servicing costs. Throughout the late 1990's and into the 2000's, cheaper credit started to become widely available. This shift allowed households

to obtain larger mortgages, to purchase homes that would normally be outside of their budget. With prices rising over this same time period, an explanation why individuals were willing to pay higher prices is that the cost of ownership was declining. If the cost of ownership is not increasing, then the price increase is justified by underlying fundamentals.

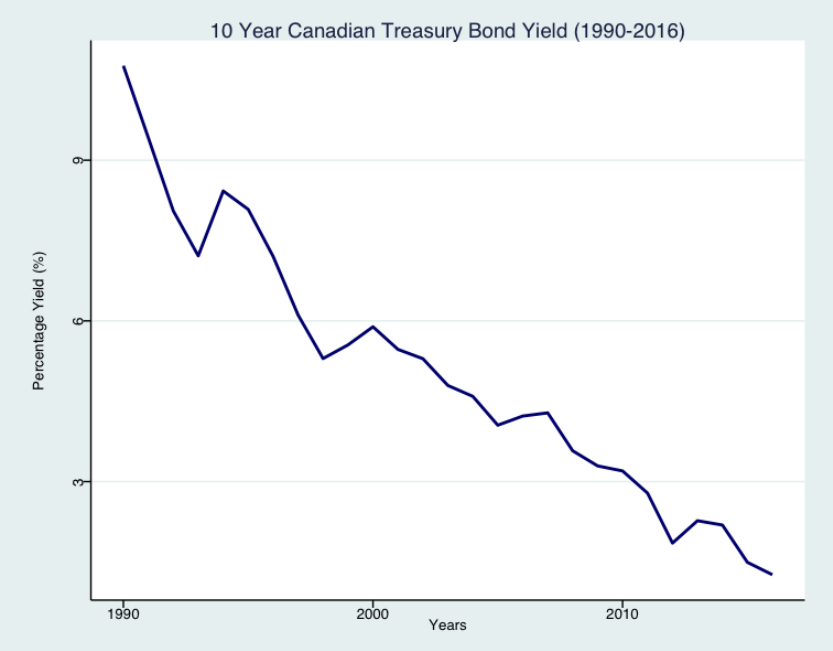

Figure 3: Canadian 10-Year Treasury Bond Yield (1990-2016)

I also find that there is large variability in the user costs across time, and between cities. This result follows what Himmelberg *et al.* (2005) find in their analysis. Due to the heterogeneity between housing markets, differences in property taxes and expected appreciation rates will have a great impact on the user cost calculation. Table 2 highlights these differences in user costs between markets over time.

In Vancouver, low average user costs can be explained by high expected capital

Table 2: How City Level User Costs Vary Across Time

City	*Average User Cost*	*User Cost in 1990*	*User Cost in 2016*
Calgary, AB	5.78%	11.53%	1.89%
Edmonton, AB	6.94%	12.74%	2.60%
Halifax, NS	6.97%	12.67%	3.26%
Hamilton, ON	6.92%	12.64%	3.13%
Kingston, ON	7.83%	13.55%	4.04%
Kitchener, ON	7.68%	13.40%	3.89%
London, ON	8.37%	14.10%	4.58%
Montreal, QC	7.22%	12.54%	2.99%
Oshawa, ON	6.53%	12.26%	2.74%
Ottawa, ON	7.38%	13.11%	3.59%
Quebec City, QC	6.67%	12.42%	2.86%
Regina, SK	6.27%	12.11%	2.19%
Saguenay, QC	7.46%	13.21%	3.66%
Saint John, NB	7.97%	13.42%	4.49%
Saskatoon, SK	5.19%	11.03%	1.11%
Sherbrooke, QC	7.20%	12.95%	3.39%
St. Catherines, QC	7.48%	13.20%	3.69%
Sudbury, ON	7.79%	13.52%	4.00%
Toronto, ON	6.98%	12.71%	3.19%
Trois-Rivires, QC	7.99%	13.74%	4.19%
Vancouver, BC	5.72%	11.47%	1.91%
Victoria, BC	5.64%	11.39%	1.83%
Windsor, ON	8.80%	14.10%	4.58%
Winnipeg, MB	7.02%	12.36%	2.54%

Notes: This table reveals the large variability in the user costs over time and across cities. From formula (6), $P_t = (1/u_t) * R_t$, a home should sell for the annual market rent multiplied by the inverse of the user cost. In Windsor, ON, a user cost value of 8.80% means that a home should sell for 11.36 times the annual market rent. In contrast, a user cost value of 5.72% in Vancouver means that a home should sell for 17.48 times the annual market rent.

gains. As prices have rapidly risen over time in Vancouver, potential homebuyers assume this trend will continue. When choosing to purchase a home, they account for this high expected price appreciation, and assume a lower annual cost of ownership. In contrast, London and other cities with high average user costs can be explained by low expected capital gains. Prices have been slowly increasing over time in these cities; and therefore expected capital gains are relatively low compared to those in Vancouver. The general trend across cities is that user costs have been steadily declining since 1990 across all cities.

4.1 Is There a Housing Bubble in Canada?

To determine if current prices are overvalued, I compare imputed rents to actual rents charged in the market. Imputed rents represent the owner's yearly cost of ownership, and are computed by multiplying the user cost by the house price for a given year. If the imputed rent is greater than the market rent, then an individual would prefer to rent as opposed to owning. After calculating the imputed rents, I create an index of imputed-to-actual rents. This index is calculated by dividing the imputed rents by the market rents. The imputed-to-actual rent index will allow me to determine if the annual cost of ownership has changed over time when compared to the market rents. After computing the imputed-to-actual rent index, I compare these values with the price-rent index. The values of the price-to-rent index for 1990, 2003, and 2016 are found in table 3. By comparing these two indices, I determine the periods which individuals prefer to rent as opposed to owning in the market.

Figure 4 plots the imputed-to-actual rent and price-to-rent comparison for the city of Ottawa. The long-run average for each index is set to 1.0. When the imputed-to-actual rent index is greater than the price-to-rent index, an individual would

prefer to rent. In the case of Ottawa, I find that from 1990 until 2004, individuals would prefer to rent rather than own a home. This is due to the level of user costs being extremely high in the 1990's. When user costs are high relative to their long-run average, this indicates that it is costly to finance a home. In 2004, I find that the indexes cross, and it is now more costly to rent in the market. This change means that preferences shift towards home ownership, as it becomes less costly to own a home. The results from the analysis of Ottawa's housing market do not suggest that houses are currently overvalued, and that the price increase observed can be justified by underlying fundamentals. If the annual cost of ownership is rising relative to its long-run average, then this indicates that the price increase may not be justified.

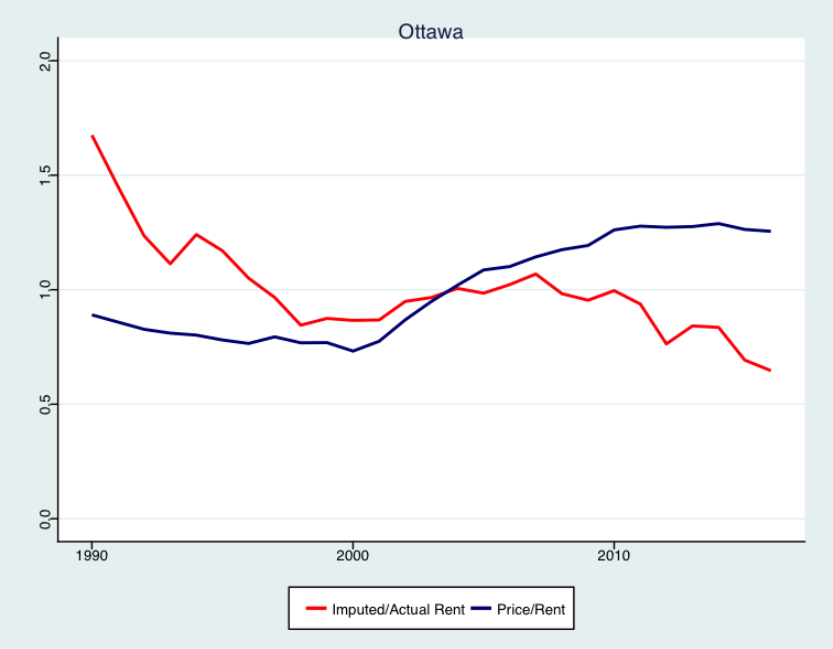

Figure 4: Ottawa Imputed-to-Actual Rent vs. Price-Rent Indexes (1990-2016)

Table 3: Housing Price Statistics

City	*Price-to-Rent Ratio*			*Price-to-Income Ratio*		
	1990	*2003*	*2016*	*1990*	*2003*	*2016*
Calgary, AB	0.75	0.91	1.28	0.62	0.91	1.51
Edmonton, AB	0.77	0.90	1.18	0.60	0.86	1.41
Halifax, NS	0.76	1.01	1.20	0.55	1.06	1.52
Hamilton, ON	1.04	0.84	1.55	0.72	0.83	1.74
Kingston, ON	1.06	0.90	1.19	N/A	0.83	1.32
Kitchener, ON	1.10	1.01	1.31	0.70	1.05	1.38
London, ON	1.06	0.89	1.19	0.74	0.91	1.68
Montreal, QC	0.78	1.02	1.44	0.62	0.91	1.59
Oshawa, ON	0.96	0.91	1.67	N/A	0.79	1.47
Ottawa, ON	0.89	0.95	1.26	0.64	0.99	1.39
Quebec City, QC	0.72	0.93	1.37	0.62	0.88	1.72
Regina, SK	0.69	0.83	1.33	N/A	0.68	1.48
Saguenay, QC	0.76	0.88	1.34	N/A	0.89	1.45
Saint John, NB	0.88	0.96	1.14	N/A	0.93	1.33
Saskatoon, SK	0.71	0.89	1.27	N/A	0.93	0.49
Sherbrooke, QC	0.76	0.94	1.36	N/A	0.73	1.39
St. Catherines, QC	1.03	0.93	1.42	0.76	0.81	1.40
Sudbury, ON	1.04	0.85	1.20	N/A	0.80	1.44
Toronto, ON	1.12	0.85	1.66	0.83	0.86	1.81
Trois-Rivires, QC	0.85	0.94	1.23	N/A	0.90	1.36
Vancouver, BC	0.67	0.76	1.56	0.51	0.77	1.79
Victoria, BC	0.70	0.96	1.16	N/A	0.86	1.44
Windsor, ON	0.92	0.99	1.32	0.80	0.96	1.31
Winnipeg, MB	0.80	0.88	1.39	0.62	0.79	1.73

Notes: The ratios in the table are normalized to their 26-year average. N/A values indicate that income data is unavailable in 1990. These conventional housing statistics are often cited as evidence of overvaluation. The price-to-rent ratio in each city is relatively high in 2016 when compared to its long-run average. When I compare these values to the imputed-to-actual rent index, I find that the price increases can be explained by the fundamentals outlined in my empirical framework.

Figure 5 plots the imputed-to-actual rent and price-to-rent comparison for each of the 24 cities in my sample. The long-run average for each index is set to 1.0. I find that each city in my sample produces similar results to the Ottawa example above. In 1990 it is relatively more costly to own, rather than renting a home. The high imputed-to-actual rents relative to price-to-rents, lead individuals to prefer renting in the market. Imputed-to-actual rents trend downward since 1990 in each of the cities. In the mid 2000's, preferences shift when the imputed-to-actual rent is lower than the price-to-rent. This indicates that the preference to own a home will outweigh the preference to rent. In each of the cities in my sample, the imputed-to-actual rent is relatively low in 2016 when compared to its long run-average.

Another interesting finding is that the deviation of imputed-to-actual rents and price-to-rents is the largest when interest rates are at their lowest and highest values. For example, in 1990 the user cost for Ottawa is 13.11%, and 3.59% in 2016. This corresponds to interest rate values (10-Year Treasury Yield) of 10.76% in 1990, and 1.26% in 2016. Since the user cost is a function of fundamentals such as interest rates, property taxes, and income; changes to these fundamentals will have a direct impact on the user cost. In each of the 24 cities, the imputed-to-actual rent is highest in 1990, and lowest in 2016. This result can be interpreted as the annual cost of ownership is driven by the cost of borrowing.

The results from the overall imputed-to-actual rent and price-to-rent analysis suggest that houses are not currently overvalued. The price increases can be justified by the underlying fundamental factors outlined in the user cost framework. There is no evidence of a housing bubble forming in Canadian cities, even in high growth areas such as Vancouver and Toronto.

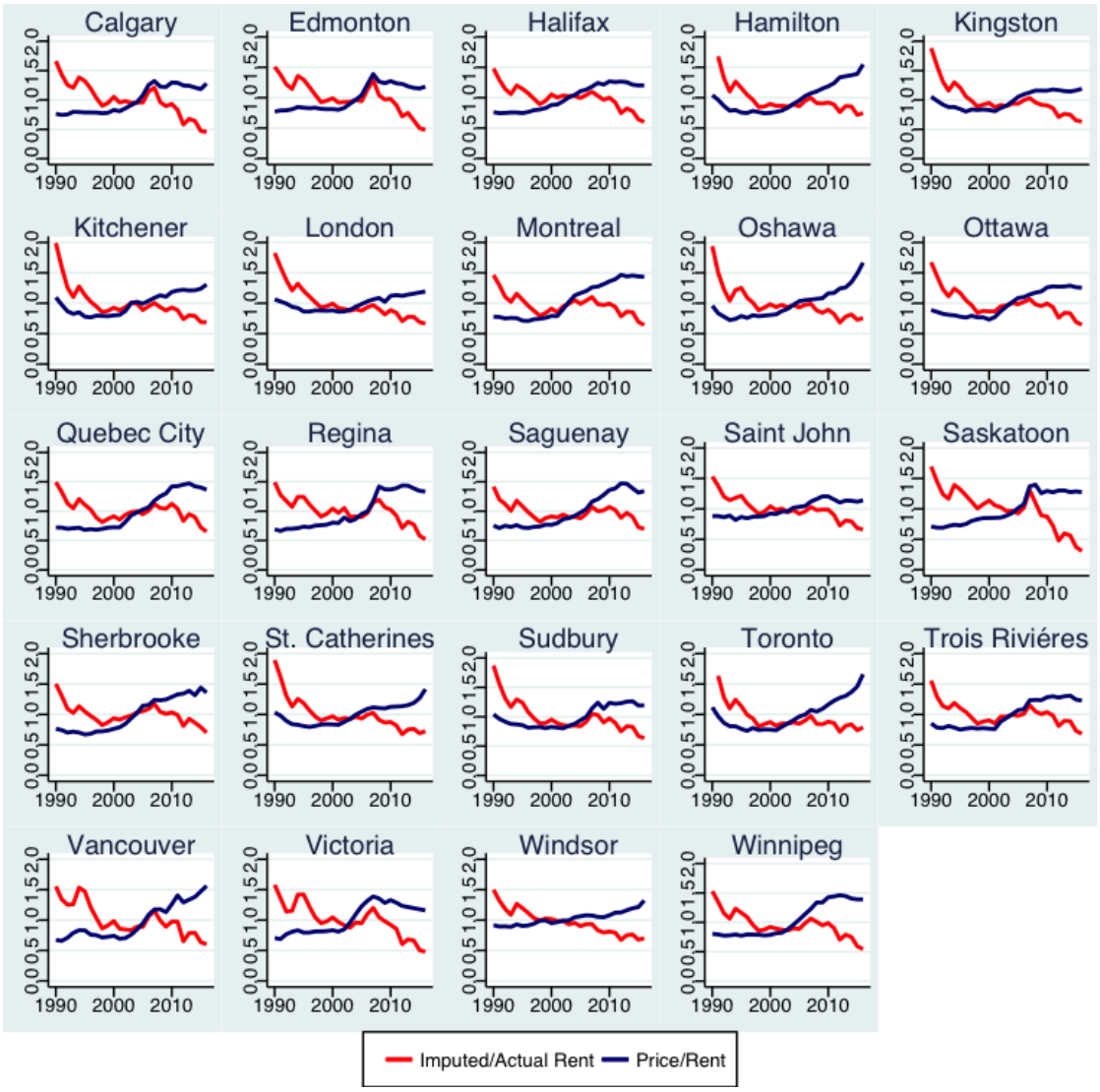

Figure 5: Imputed/Actual Rent vs. Price/Rent Ratios (1990-2016)

Another way to determine if current prices are overvalued is to compute the imputed rent-to-income ratio and compare it with the price-to-income ratio. Imputed rent-to-income is a measure of an individuals ability to afford the annual cost of owning a home. I can compare the imputed rent-to-income ratio to the price-to-income ratio, a commonly cited housing market statistic to determine if individuals are able to afford the current housing costs. The values of the price-to-income in-

dex for 1990, 2003, and 2016 are found in table 3. The measure of income used to calculate these statistics is real after-tax median income from the CMHC.

Himmelberg *et al.* (2005) notes that "rising user costs need not imply that households are being priced out of the market if income are rising, too" (p. 86). If a bubble exists, imputed rents would be rising faster than incomes. This means that individuals are unable to afford the increased cost of ownership, given their income. This results in mortgage defaults, and would have negative implications on the real economy. Therefore, for houses to be valued correctly, it is important that the price and annual cost of ownership increases can be justified by rising income levels.

Figure 6 plots the imputed rent-to-income and price-to-income comparison for the city of Ottawa. The long-run average for each index is set to 1.0. The analysis reveals that the price-to-income ratio is rising over time, and is relatively high in 2016 compared to it's long-run average. Conventional housing valuation methods would take this statistic as evidence of overvaluation. However, as I found earlier, the price growth of a home is not the same as the annual cost of ownership growth. When I compare the price-to-income ratio to the imputed rent-to-income ratio, I find that the price increase can be justified by underlying fundamentals. The imputed rent-to-income remains relatively constant over the entire time period. This indicates that over time, individuals are able to finance their mortgages with an increasing income. The imputed rent-to-income analysis from Ottawa's housing market do not suggest that houses are currently overvalued, and that the price increase observed can be justified by increasing income levels.

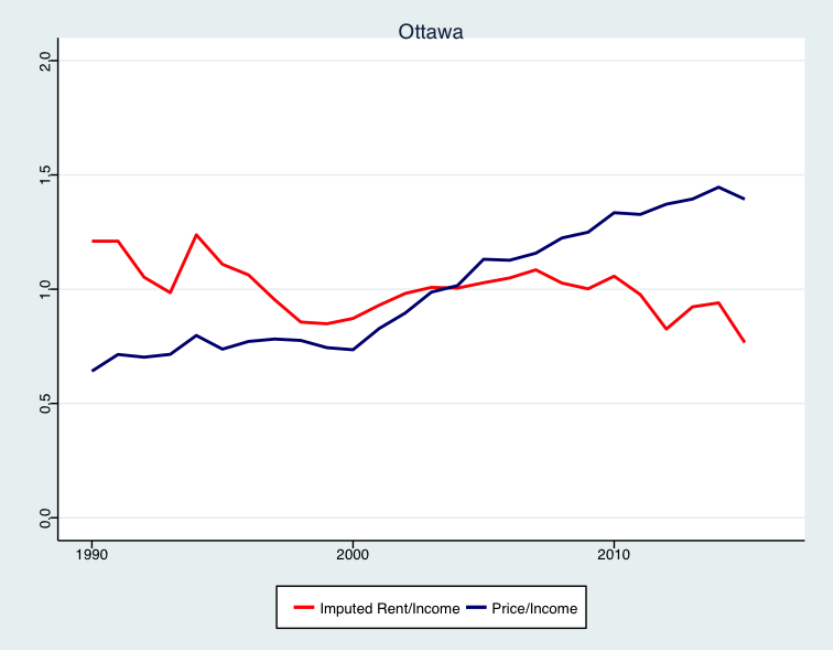

Figure 6: Ottawa Imputed Rent/Income vs. Price/Income Ratios (1990-2016)

Figure 7 plots the imputed rent-to-income and price-to-income comparison for each of the 24 cities in my sample. The long-run average for each index is set to 1.0. I find that each city in my sample produces similar results to the Ottawa example above. I find that although prices have been rising relative to incomes since 1990, this price increase can be justified by the fact that incomes are able to finance the imputed rents. In cities such as Vancouver who experienced rapid price increases, income levels have kept pace with imputed rents. This means that homeowners in Vancouver are able to finance the larger mortgages they take on, due to the annual cost of ownership declining.

Overall the results from the imputed rent-to-income and price-to-income analysis suggests that houses are not currently overvalued. The price increases can be justified by the increasing levels of income in each of the cities I sample. This result is

the same as the imputed-to-actual rent and price-to-rent analysis produced. There is no evidence of a housing bubble forming in Canadian cities, even in high growth areas such as Vancouver and Toronto.

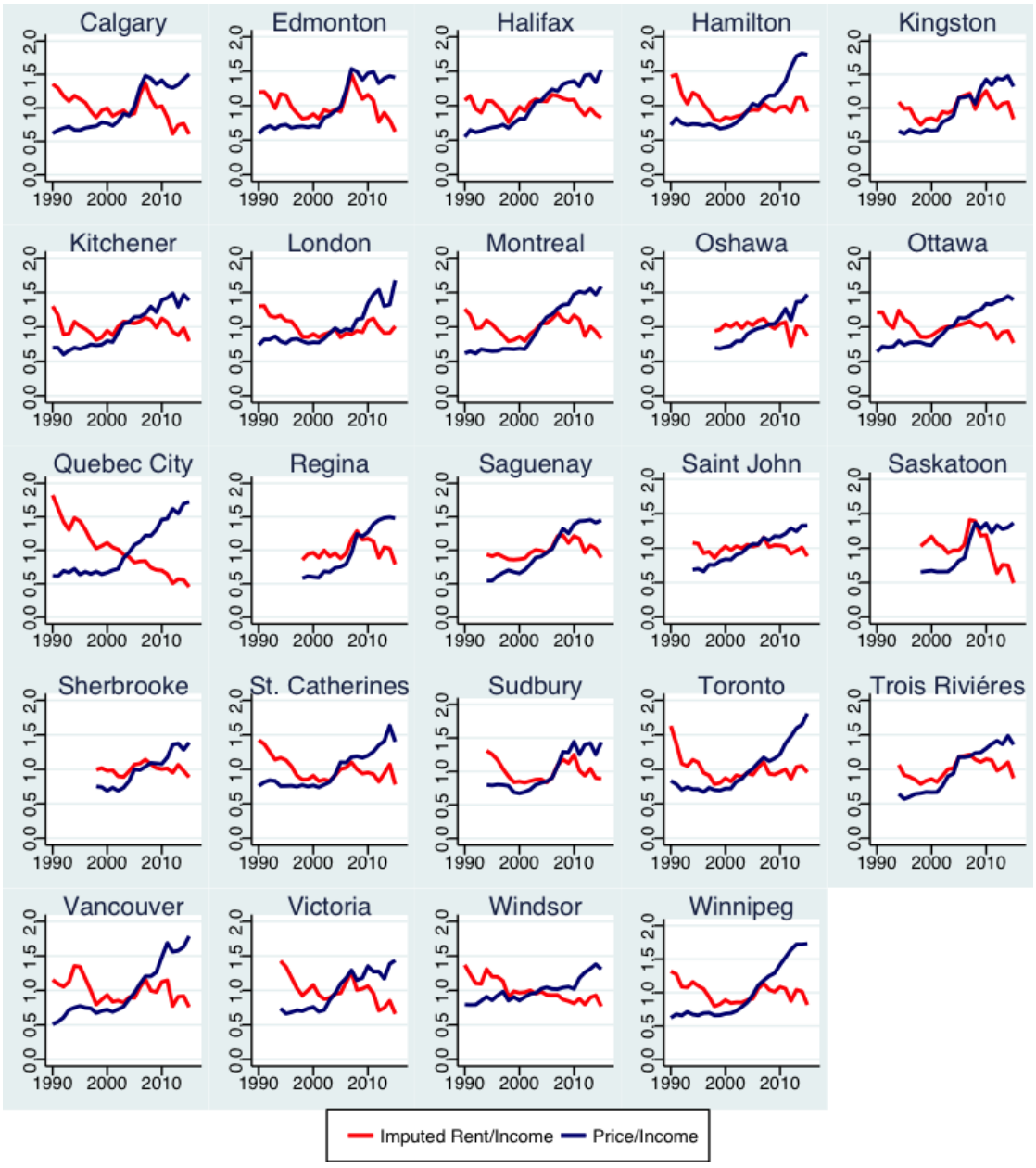

Figure 7: Imputed Rent/Income vs. Price/Income Ratios (1990-2016)

5 Conclusion

When analyzing Canadian house prices using conventional statistics such as price-to-rent and price-to-income ratios, it appears that Canada is in a housing bubble. House prices have risen at a rapid pace when compared to market rents and the income of homeowners. However, as I described in this paper, these conventional statistics fail to account for the underlying economic fundamentals. Increasing house prices, and price-to-rent ratios does not necessarily mean that houses are overvalued. If this price increase can be justified by underlying fundamental factors, then there is no evidence of overvaluation in the market, and no apparent housing bubble.

In this paper, I address the concerns with using conventional housing statistics to test for overvalution by conducting my analysis based on a user cost approach. The user cost approach calculates the annual cost of ownership from a set of fundamental variables such as interest rates, property taxes, depreciation rates, expected capital gains/losses, and risk premiums. For homeowners, the annual cost of living in a home for a given year is defined as the imputed rent. In order to determine whether house price house price growth is justified based on fundamentals, I follow the empirical framework of Himmelberg *et al.* (2005). I compute indexes of imputed-to-actual rents and imputed rent-to-income and compare these indexes with price-to-rent and price-to-income ratios.

From my analysis, I find a number of prevailing trends. First, there is a linear upward trend of house prices across all Canadian cities. Although there has been large price increases, I find a linear downward trend in user costs. A downward trend in user cost means that is is becoming relatively less costly to own your home in a given year. This trend can be explained by analyzing the dynamics of

the Canadian interest rates since 1990. The decline in interest rates since 1990 has led to individuals taking on larger mortgages, as the annual cost of ownership is decreasing.

The price increase in Canadian cities can be explained by the fundamental factors outlined in my empirical framework. Based on my results, I find no evidence of overvaluation in Canadian cities, and there is no apparent housing bubble at the end of 2016. Just because there is no bubble at the end of 2016 does not mean that house prices cannot fall due to sudden changes in fundamental factors. As the Bank of Canada continues to raise interest rates, the annual cost of ownership will also increase. Due to the rise in interest rates throughout 2017 and into early 2018, I want to conduct further research on the results of this increase. This further research will allow for a better understanding of the sustainability of rising prices, given the annual cost of ownership increase.

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