KEEPING UP WITH THE JONESES: AN INVESTIGATION OF HOUSE PRICES IN TORONTO & VANCOUVER CANADA

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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 AUGUST 2016

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ACKNOWLEDGEMENTS

I'd like to thank Warren Jestin. Warren, thank you for taking a chance on a university undergrad desperate to prove that he had what it takes to succeed in the world of business. You gave me my first job & it is no over-exaggeration to say that without you I would not be where I am today. I owe you a debt that I fear I'll never be able to repay.

To Aron Gampel, Adrienne Warren, Mary Webb & the rest of the Scotiabank Economics Department. Thank you for providing such a great workplace environment. You all truly made coming to work everyday such a joy. You all helped me make the decision to pursue an education & career in economics easier, and for that I'll forever be in your debt. I count each & every one of you among my friends.

To Dr. Frank Milne, thank you for agreeing to be my supervisor (after a few weeks of convincing), having an open door policy, not just for school but for life as well (which I took full advantage of). And lastly, thank you for the time and effort you put into making this paper a reality.

To the 2016 Queens Master of Economics Cohort, I came in considering you competition but left calling you friends. I'm sure each and every cohort considers their cohort the best, but they're all wrong. I made many life-long friends and look forward to laughing with you over a schooner, finding the best wing joint in town or facing you in a round of FIFA.

To a very special someone, you came into my life at just the right moment and took the biggest chance of all. You corrected my math, made Kingston a great place to be, made my year and you continue to make everyday wonderful. Thank you.

Lastly, my parents. Mom & Dad I wouldn't be where I am today without you. You've been there for me every step of the way. You have supported me in every decision I've ever made, your help and support of this lifelong student has made him who he is today and I truly do owe you both everything. Yours is the biggest debt I'll never be able to repay, but I can promise you that I'll never forget it or what it meant to me.

To my mother Ramona, you sacrificed so much for me and I'll never forget it. You gave me my love for learning and I'm eternally grateful. You were always there, from fighting dragons with me at the local library to proofreading an essay at 3am. Mom, quite simply, I am who I am because of you. Thank you.

ABSTRACT

The Toronto and Vancouver housing markets are prime examples of markets which are overly resilient despite deteriorating economic conditions throughout the rest of the country. The problem is that as the relationship between traditionally coupled variables deteriorates, new variables are introduced which serve as a crutch, allowing the housing markets in these two centres the ability to continue hobbling towards perceived infinity. The purpose of this paper is to use an augmented economic model characterizing the imputed rent of ownership to estimate a reasonable long-run average house price, deemed to be the equilibrium price. This model will then be used as a means of generating a reasonable estimate of a correction in these two markets. Finally, the Canadian and U.S. markets will be compared on a number of relevant credit metrics in an attempt to appraise the potential fragility of the current Canadian market.

INTRODUCTION

Every economic event can be fundamentally broken down into two principle forces, supply and demand. The recent massive run-up in the housing market in two of Canada's largest centres, Toronto and Vancouver, can be attributed to these two forces. On the demand side an upward pressure on prices can be seen due to relatively cheap money and an overarching idea that housing will continue to trend upwards therefore it is perpetually underpriced. On the supply side, both cities have reached a saturation point in available land for development, which has essentially curtailed supply growth. This stunting in supply growth has stimulated growth in the condominium market, but this acts only as a palliative solution. As families and incomes grow so does the desire for more space and a single structure free from common ownership that the family can call its own.

The issue with this picture, however, sprouts from the convoluted underpinnings of the demand side of the story. The commonly held belief that housing in these two markets is perpetually underpriced has led to irrational consumer behaviour, devolving into spirited price-wars over barely habitable properties in an attempt to 'enter the market' and join the ranks of the other 'risk-free' investors. The embers of this belief have been fanned to life by a real estate industry which restricts the public release of detailed data in an attempt to restrict the natural movement of the business cycle by crippling the ability of the public to holistically view the underlying fundamentals of these markets.

The Toronto and Vancouver housing markets are prime examples of markets which are overly resilient despite deteriorating economic conditions throughout the rest of the country. The problem is that as the relationship between traditionally coupled variables deteriorates, new variables are introduced which serve as a crutch, allowing the housing markets in these two centres the ability to continue hobbling towards perceived infinity. The purpose of this paper is to use an augmented economic model characterizing the imputed rent of ownership to estimate a reasonable long-run average house price, deemed to be the equilibrium price. This model will then be used as a means of generating a reasonable estimate of a correction in these two markets. Finally, the Canadian and U.S. markets will be compared on a number of relevant credit metrics in an attempt to appraise the potential fragility of the current Canadian market.

This paper will use publically available sources of data in an attempt to offer a correction to the inefficiencies of the current system where a single institution holds all the pertinent data. To this end, data is gathered from the Canadian Real Estate Association (CREA), the Canadian Mortgage & Housing Commission (CMHC), Statistics Canada, The Federal Reserve Bank of St. Louis, the U.S. Tax Foundation and various municipal websites in order to construct an economic model which will produce an equilibrium housing price. The equilibrium housing price will then be compared to an estimate of current house prices. The findings of this exercise show that the Greater Toronto Area and the Greater Vancouver Area are indeed overvalued, 18% and 35% respectively. However, this paper also shows that this overvaluation does not seem to deviate too far

from an established Canadian trend in the case of Toronto, but does show an unconventional and potentially unstable path currently unfolding in Vancouver.

Section One will give an in depth review of current and previous work on the economic dynamics of the housing market and its recent developments from an academic perspective. The second section will give an overview regarding the collection, construction and methodology behind the data used in this paper. Furthermore this section will also review the theoretical economic model used in the estimation of housing market dynamics and its augmentation. The third section consists of an analysis of the findings offered by the economic model and data mentioned in section two, as well as a comparison to the U.S. experience using a similar methodology. Lastly, the paper will examine the current Canadian and U.S. experiences in an effort to establish potential similarities.

The findings of this paper are that Toronto and Vancouver home prices truly are trending above their respective equilibrium prices, However, the trajectory of Toronto is much steadier than that of Vancouver. Toronto's price movements do bring it a fair deal above the established equilibrium price level both nominally and in relation to its Canadian counterparts. However, Toronto more closely mirrors the predominant trend amongst Canadian cities and has maintained a fairly consistent spread between actual and equilibrium prices, signalling that although elevated, pricing behaviour has not yet become irrational. Vancouver on the other hand has experienced a massive appreciation in its pricing, vastly different from the experience of Toronto or any other Canadian centre. Vancouver's current pricing trend is much more reminiscent of the pre-

crisis US experience and therefore augurs a more painful correction or potential disaster.

1. Literature Review

Gallin (2004) examines the time-series relationship between rents and house prices. The driver behind the investigation is the exploration of the valuation of housing and whether the rent-to-price ratio can yield an estimate of the future movement of rents and house prices. Gallin posits that rents are a fundamental determinant of housing value and as such the rent-to-price ratio should therefore not deviate too far from its long term benchmark level. Gallin uses an error-correction model and long-horizon regression approach to test his hypothesis in a similar fashion to what Campbell and Shiller (2001) used in their investigation of the dividend-to-price ratio and its effect on stock prices. Gallin uses quarterly data from 1970-2003. More specifically Gallin uses the Conventional Mortgage House Price Index (published by Freddie Mac) and the index for tenant rent from the Consumer Price Index (CPI). Finally to construct the user cost of housing Gallin uses: the 30 year fixed-rate mortgage, the property tax rate, the marginal tax rate and the rate of depreciation on residential structures. Gallin uses a standard model of user costs and rents in a frictionless market as a basis for his investigation, which states that rents should in theory cover the user cost of housing ($R_t = C_t$). Gallin uses this relationship to inform his study, namely that prices should be high relative to rents when the expectations of future interest rates are low and expectations of future rent increases are high.

Gallin's findings reinforce his argument, specifically that periods which experienced higher prices relative to rents were followed by periods where rents grew exponentially faster as compared to prices. However, one of the more important findings from Gallin's study is that there is empirical support for the idea that low rent-to-price ratios indicate over-valued house prices. Moreover, introducing the user cost of housing variable does not change this finding. Meaning that the user cost of housing is a viable explanatory variable.

Blackley and Follain (1996) argue that many academic papers explore the relationship between residential rents and the user cost of housing but fail to explore the strength of this connection nor the speed of any corrections on either variable when faced with a movement in the other. Blackley and Follain use annual data from 1964-1993 to generate a 2 stage least squares estimate of a structural model. They find that a relationship does exist between rent and user cost however they are quick to specify that the link is a weak one with only half of the movement in user cost being reflected in rents. They highlight that these movements are slow to occur, generally in excess of 10 years. An important finding of this paper is how the user cost and the rent interact. Blackley and Follain find that housing supply is the linkage between movements in the user cost and rent. This is discovered through the inclusion of a supply equation in their structural model. Therefore moving forward it may be pertinent to more closely investigate housing supply as a potential input variable when investigating the relationship between user cost and rent.

Ayuso and Restoy (2006) attempt to quantify over-valuation in the housing market using a general intertemporal asset-pricing model. The asset-pricing

model is estimated using equations for equilibrium returns and asset prices from a previous paper by Restoy (Restoy and Weil (1998)). The model generates a benchmark asset price which is then used as a benchmark in order to determine over- or under-valuation in Spain, the United Kingdom and the United States. The data used in this study was quarterly data from 1987-2002, and includes GDP, financial and non-financial wealth and the 3-month interbank rate. The study finds that in all three countries house price-to-rent ratios have been trending above their equilibrium values, meaning that house prices have been outpacing the cost of rentership. Much of this over-valuation is explained by Ayuso and Restoy as a reaction to a price correction overreaction suffered after peak prices in 1991. They do however acknowledge that taxes are not considered by their approach.

Himmelberg, Mayer, and Sinai (2005) sought a different approach to judge the house price level in 46 different US metropolitan centres. Their approach entailed estimating the annual cost of a single family dwelling and comparing this cost to the area rents. The reasoning behind this exercise that conventional metrics such as price-to-rent and price-to-income fail to account for the time series fluctuations in the interest rate and the long-run appreciation in housing prices. The core of the argument stems from the misuse of current metrics of house valuations which treat the price of a house the same as the cost of the house. Himmelberg, Mayer, and Sinai argue that this is wrong and that annual user cost is a more important gauge as to the over- or under-valuation in housing. In order to explore this idea the paper examines the period from 1980-2004. Through their model Himmelberg, Mayer, and Sinai find that during the 1980's housing in many centres was over-valued and these same centres suffered large

corrections afterwards. As part of their findings they make the argument that without taking into account long-term interest rates, expected inflation, house appreciation and local taxes, the true value of a house cannot be accurately computed. Himmelberg, Mayer, and Sinai have furthered the study of house price dynamics by demonstrating that traditional methods of quantifying the state of the housing market are not necessarily the best approach due to their static, "point-in-time" view. Himmelberg et al have shown that a more dynamic approach which factors in market demand drivers must be considered in tandem with the cost of housing.

2. Data Methodology

2.1 Theory & Economic Model

This paper follows the approach of Himmelberg et al. where in order to gauge the potential over- or under-valuation of the housing market, the imputed annual rental cost of housing becomes the fundamental factor of interest. Himmelberg et al define imputed rent as the annual cost of renting an equivalent property. Following their outline, this paper rests on the assumptions of a standard arbitrage model with two identical assets. Conventional theory would suggest that if these two assets differ in value a rational consumer would substitute away from the more expensive asset towards the relatively inexpensive asset. However, what prevents this from occurring in practice, and what Himmelberg et al identify as a bubble, is when consumers erroneously assume

that the higher financial returns from the more expensive asset compensates for the heightened cost of that asset. Himmelberg et al argue that this causes consumers to believe that their imputed rent is lower than it actually is.

The difficulty in approaching the idea of an asset bubble is that by its very definition the asset price deviates from the fundamentals which traditionally underpin its intrinsic value. Therefore, since these price movements are not rooted in economic fundamentals it is extremely difficult to determine their existence, movement and eventual collapse. Further complicating this picture is the fact that the economy is an living organism, which grows, evolves, and most importantly, adapts to changing monetary, fiscal and industry specific policies. As a result, it is difficult to gain a clear picture of just when an asset is being influenced by the current and future economic realities, and when these same assets have lost their grip on reality. For this reason, exercises undertaken by papers such as this one and in Himmelberg et al are important in helping reseachers gain a better understanding of how certain economic variables determine prices and how far from these fundamentals prices can deviate before they constitute a bubble.

Therefore, as argued by Himmelberg et al, it is important to appropriately determine the imputed rent of ownership in order to devise a means of determining when consumer beliefs regarding their imputed rent falls in relation to its true value, thus signalling a potential bubble. In order to accomplish this, the opportunity cost of capital must also be considered. The opportunity cost of capital represents the loss in income the consumer would experience if they invested in an alternative asset. Therefore, with this caveat in mind, Himmelberg

et al argue that an estimate of the imputed rent must be compared to existing rental costs in the same jurisdiction in order to determine if the average price is in line with what theory would deem as the logical limit. As a result in order to calculate the imputed rent the traditional economic variables underpinning an economic model of housing must be taken into account; differences in risk, tax benefits, property taxes, maintenance costs, and expected returns must be considered. This model then becomes the basis for their exploration into valuation in the housing market.

In order to perform an investigation regarding the state of the Toronto and Vancouver housing markets house price data must be utilized in tandem with taxes, average maintenance costs and expected gains in an effort to detect whether the predominant trends in house prices is justified. Further as an extension of the economic model posited by Himmelberg et al (above) this paper will consider the issue of supply dynamics, an issue brought to light by Blackley & Follain (1996). In a practical sense, this is an attempt to address the inelastic supply of developable land, which has been cited as a factor forcing demand higher, which in turn continuously keeps upward pressure on house prices in Toronto and Vancouver. Further still, since this paper is evaluating home prices in the Canadian context the tax benefits of mortgage payments are excluded from the model.

It is important to note that this model assumes no uncertainty. It assumes that all pertinent information needed to calculate user cost is known at all times. This is not a reasonable assumption to make in general, as uncertainty lies at the heart of over-valuation and is one of the principle driving forces in the growth of

bubbles. However, this paper is not exploring how bubbles or over-valuation grows and develops, it is merely an exercise in determining what should be an appropriate level of housing prices given current conditions. Later papers may undertake the task of augmenting the model to account for uncertainty.

Consequently, this paper uses an augmented version of the model used by Himmelberg et al to calculate the level of the equilibrium price. The equilibrium price is, for the purpose of this paper, defined as the price of a home, which equates the imputed cost of ownership with the average rental cost of an equivalent property, in accordance with the arbitrage model mentioned earlier. The contribution of this paper is an effort to reconcile the established model of Himmelberg et al with the findings of Blackley & Follain (1996) in the Canadian context.

The model now combines the variables as follows:

Equation (1)

$$CH_t = (P_t \times RF_t) + (P_t \times MC_t) + (P_t \times T_t) + (P_t \times RP_t) + (P_t \times HS_t) - (P_t \times EG_{t+1})$$

Therefore the cost of homeownership (CH) equals the sum of the price of the home (P_t) times the risk-free interest rate RF_t in this case the 10 year Canadian Treasury bond; the price of the home times the annual maintenance costs, $(P_t \times MC_t)$, expressed as a fixed proportion of the total value of the home,

3%[1] of the value of the home in the case of this empirical exercise; the price of the home times the annual property taxes[2] $(P_t \times T_t)$ leveraged on homeowners; the price of the home time the risk premium[3], $(P_t \times RP_t)$, which acts as a risk adjustment factor for uncertainty in the housing market; the price of the home times the house supply excess or deficit, $(P_t \times HS_t)$, which can be thought of as the portion of the house price which is directly affected by underlying supply factors. Finally, the price times the expected appreciation in the price of the house in the following period, $(P_t \times EG_{t+1})$, is then subtracted from the cost of ownership. An assumption of this model is that homeowners have a short memory and believe that the financial returns of housing will continue to yield gains in line with the long-run average. This model uses a 7 year compounded average annual growth rate (CAAGR) to represent the long-run average in housing prices in both Toronto and Vancouver. 7 years is chosen because in recent decades (and the decades relevant for the data in this paper) recessions have plagued the Canadian economy roughly every 7 years. Using this 7-year interval functions as a proxy for irrational consumer beliefs. This is a semi-strong assumption, but it is an attempt to capture the "this time is different" sentiment which dominates popular media following a recession slump and as a result colours consumer beliefs in the process. All of the above variables, except home

[1] The 3% maintenance cost referenced above, was determined by selecting values across housing type such that housing costs are more or less equal. The disparities in price do not necessarily mean a disparity in maintenance costs, a number of factors could be a principle driver behind the price of the home including but not limited to location, lot size, and proximity to amenities.

[2] The residential property tax rates for each city centre were gathered from each city's municipal tax website.

[3] The Risk Premium value was gathered from the work of Liu and Mei (1992) who used a multifactor model with time-varying risk premiums in order to decompose the risk premiums associated with Real Estate Investment Trust (REIT) portfolios. Liu and Mei used a latent variable model and found that the excess returns attributed to REITs were roughly 1.6. For the purposes of this paper this risk premium was rounded to 2 percent.

prices, are expressed in percentage terms. The nominal user cost of housing fluctuates as the price of the house fluctuates; it is not a standardized cost. For this reason it is expressed as a percentage of the total house price; the sum of the above variables multiplied by the price computes the annual imputed rent cost of home ownership. This is a valid approach in that it allows for heterogeneity in nominal values which most certainly exists in a non-homogeneous market.

It is assumed that all of the coefficients on the variables are equal to one meaning they are all equally weighted in the decision process of the homeowner. Part of this exercise is an attempt to estimate home prices with some degree of accuracy and as a result this paper will not make assumptions as to which factors weigh more heavily into the buying decisions of consumers. This is the case because all consumers are not homogeneous, different preferences affect each consumer differently. As a result, and in order to better capture the diverse range of preferences this paper will assume equal importance. Therefore, the formula can then be simplified by defining I_t in the following way:

Equation (2)

$$I_t \equiv (RF_t + MC_t + T_t + RP_t + HS_t - EG_{t+1})$$

Equation 1 can now be rewritten as:

Equation (3)

$$CH_t = P_t I_t$$

Following the theoretical approach put forth by Himmelberg et al the imputed rent (CH) is now set equal to the average annual rental cost of an equivalent property (R_t), in order to define the equilibrium price:

Equation (4)

$$R_t = P_t I_t$$

Rearranging equation (4) we find that:

Equation (5)

$$\left(\frac{P_t}{R_t}\right)_E = \frac{1}{I_t}$$

Meaning that the equilibrium price-to-rent ratio is equal to the inverse of the imputed rent. By taking the inverse of the cost of homeownership a multiplier is yielded, which when multiplied by the average annual rent (R) yields the equilibrium house price level (P_E):

Equation (6)

$$\left(\frac{1}{I_t}\right) \times R_t \equiv P_E$$

As a result in equilibrium the average house price (P_t) will equal the equilibrium house price (P_E):

Equation (7)

$$P_t = P_E$$

2.2 Data Variables

There are three estimated data series for both Toronto and Vancouver used in this paper. The first is an estimation of housing prices. The second is an estimation of the excess or deficit supply of housing. Finally, the third is an estimation of the average rental costs. These series need to be estimated because the data is either proprietary or not easily defined. In the case of average housing prices, the data is proprietary. The Canadian Real Estate Association (CREA) owns all house price data and charges a subscription fee for access. In the case of average rental costs and housing supply, the data is not easily defined. The average rental price is not easily defined as this data is largely self-reported and not centrally tracked. In terms of housing supply, there does not exist a singular variable for housing supply, and therefore for the purposes of this paper an applicable variable needs to be defined and estimated.

2.3 Construction of House Prices

Estimation of the house prices in Toronto and Vancouver is necessary because access to actual reported data is proprietary to CREA subscribers. Therefore for the purposes of this paper, the house prices in both Toronto and

Vancouver were estimated using the New House Price Index (NHPI), CREA reported data and a single month data point.

Toronto

The single data point is the single month average price for each centre as reported by CREA. The data point for April 2016 is used in this paper because it was the most recent month publically reported by CREA at the time of writing. Each month CREA reports the monthly average price for each major metropolitan centre, and when new monthly data is available it replaces the previous month's data. As a result there is no historical series, only point in time data, which means that in order to determine trends in pricing without access to CREA's data archives, a series must be estimated.

The NHPI is made available by Statistics Canada. The NHPI is used to compute the growth in average prices for Toronto as follows:

Equation (8)

$$\frac{(Index_t)}{(Index_{t-1})} \times 100 - 100$$

The NHPI is used because it is assumed that the price of existing homes will follow the pricing trend of newly constructed homes. This is a safe assumption because if the prices of the different classes of homes differed wildly, arbitrage opportunities would quickly correct any pricing imbalances, bringing the

two classes in line with one another. It is also assumed that housing type does not matter to the common consumer, the assumption being that consumers purchases are being driven by location therefore housing type is irrelevant. This is a safe assumption as the recent price acceleration in homes is localized, if housing preference and not location were the driver of demand then the phenomenon would not be so centric. Consequently, barring differences in nominal prices, price movements should largely mirror one another.

Therefore, the monthly growth rates of the NHPI were applied to the single monthly price point from CREA in order to determine an estimate for the price in the preceding months. The calculation moving backwards ('Backcast') from the single monthly price point is calculated as follows:

To 'Backcast':

Equation (9)

$$\frac{Average\ Price_{t+1}}{(1 + Growth\ Rate_t)} = Average\ Price_t$$

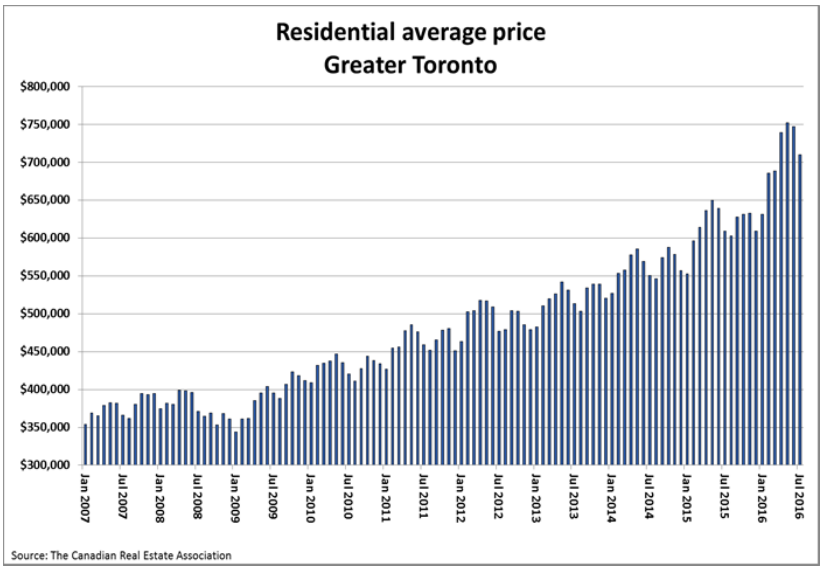
$$\frac{740349}{(1 + 0.0098)} = 733131$$

This process was repeated until all months from January 1, 1988 to April 1, 2016 were populated with an average monthly price. As an accuracy check, the estimated price series was compared to the actual price series, which was unable to be used in this paper due to the proprietary nature of the data. The long-run (1988-2016) average in the difference between the two prices is 50%

below the actual price. However in the most recent decade and a half (2000-2016) the average difference between the two price series drops to roughly 30% below the actual price. Although the large difference in prices early on in the estimation process is vast it does not have a significant effect on the exercise of this paper. This is the case because the empirical exercise of this paper only utilizes data from 2001 onwards for Toronto and Vancouver due to the unavailability of tax data pre-2001.

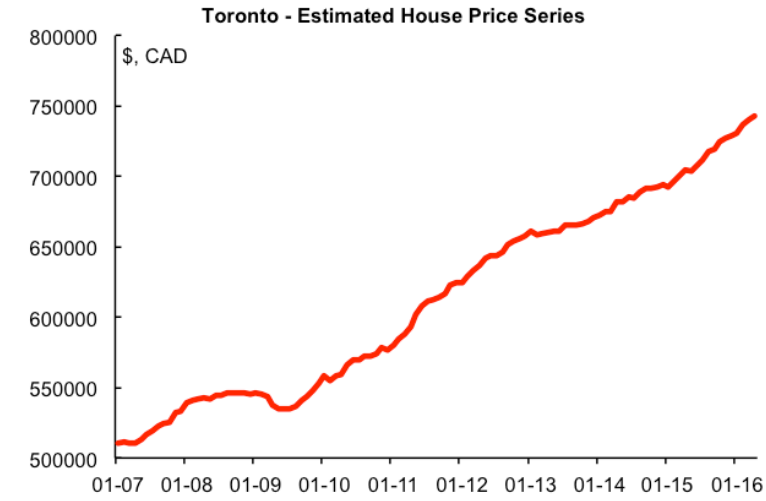
The results of the afore mentioned 'backcasting' of the average house price in Toronto was generated and is displayed in Chart 2 below. The trends in the average house price movements are then compared against what CREA data[4] (Chart 1) in order to test for reasonableness.

Chart 1



[4] CREA charts are created by CREA and retrieved from the CREA website

Chart 2



Source: CREA, TREB.

It can be seen that although a difference exists in the nominal value of the average prices, the trend of the prices are roughly the same when the seasonality in the CREA data is accounted for. This is important because to a large extent it is the aggressively upward trend of house prices in Toronto which has triggered worry and is central to the belief that the market is unstable.

Vancouver

The same logic was followed when computing the average house price for Vancouver. However, in the case of Vancouver data pertaining to the average detached house price was available from CREA through a third-party. Global News Service procured data regarding detached housing in the Greater Vancouver Area (GVA) and created an 'interactive chart'. This data series was used over the NHPI data used in Toronto, because this data source will bring the

estimated even closer in line with the actual data. The monthly average growth rate was calculated from this series as follows:

Equation (10)

$$\frac{(Average\ Price_t)}{(Average\ Price_{t-1})} \times 100 - 100$$

This growth rate was calculated for the same reasons as the NHPI Index was used in Toronto. Nominal values may differ but price trends will largely mirror one another due to the inherent arbitrage opportunities if pricing differences persist, underpinned by the lack of housing type bias, which is fuelled by a location-based demand driver. This average monthly growth rate was then applied to the single monthly price point in order to estimate the average monthly price in Vancouver. The same process for 'backcasting' the average house price was used. The result of this process for Vancouver can be seen in Chart 4, and is compared against CREA data[5] (Chart 3) in order to test for reasonableness.

[5] CREA charts are created by CREA and retrieved from the CREA website

Chart 3

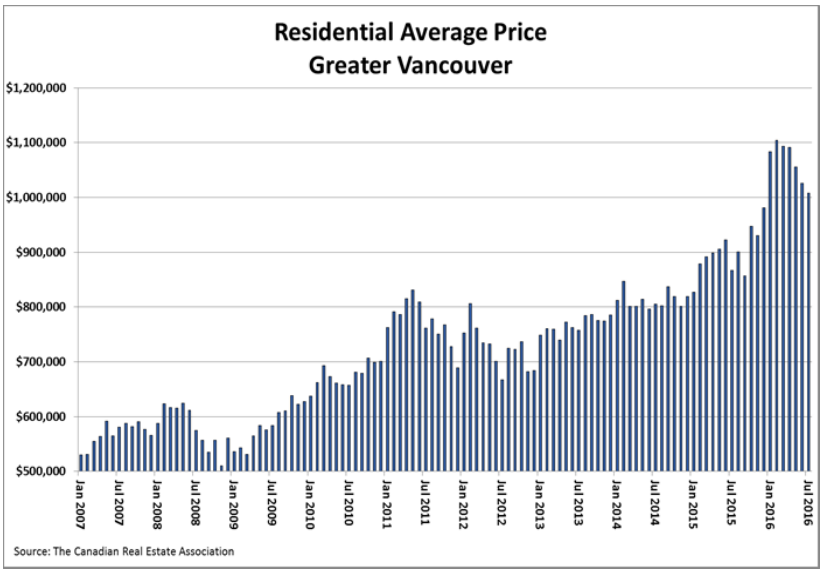
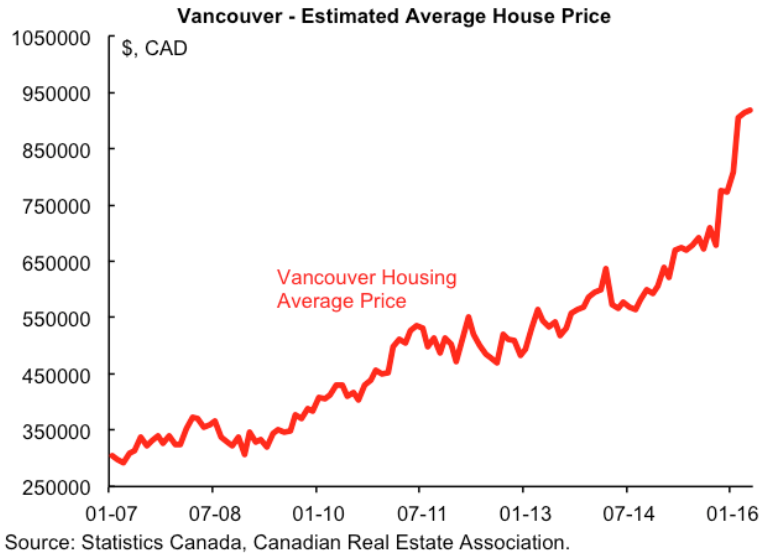


Chart 4



Again it can be seen from the Vancouver data that the trend in house prices is roughly the same. This is important because trend similarity in league with a relatively small nominal difference reinforces the validity of the estimation technique used.

2.4 Estimation of Housing Supply Variable

The second area of estimation needed is housing market supply dynamics. The reason for this estimation is two-fold. Firstly, as discussed in the literature review, the Blackley and Follain (1996) paper found that housing supply is a major contributing force to changes in the user cost of housing. Secondly, an assumption of this paper is that consumers' purchases are driven by location. Therefore, a variable which represents changes in supply in the observed location must be considered. In order to calculate the supply variable the monthly vacancy rate is needed in addition to the total number of housing starts. The Canada Mortgage and Housing Commission (CMHC) and Statistics Canada supply both of these series.

Vacancies in housing starts are chosen because it is a means of quantifying the amount of slack in the market from month to month. It is assumed in this paper that this dynamic drives changes in the user cost of housing. This is a safe assumption because housing supply has a considerable impact on the trend of house pricing. As supply tightens the price necessarily increases. Moreover, given the ever-shrinking supply of developable land in Toronto and Vancouver, consumers armed with cheap credit continue to chase returns, forcing the demand curve outward. As a result, shrinking supply and growing demand keeps a constant upward pressure on prices.

Calculation

In order to determine the number of vacant completed homes the monthly vacancy rate is multiplied by the total housing starts in the same month. The calculation is as follows:

Equation (11)

$$Vacancy\ Rate_t \times Housing\ Starts_t = Number\ of\ Vacant\ Completed\ Homes_{t+1}$$

Using the number of vacant constructed homes is an attempt to gauge market demand forces. Since many new developments construct homes and then rely on post-construction sales this is a viable estimation technique for housing supply. As the housing supply increases, these developments will respond by lowering prices in order to reduce housing stock and minimize potential exposure to losses. As the housing supply shrinks, these developments can demand a higher price.

After the total amount of vacant homes each month is determined, the absolute change in the number of vacant homes is calculated from month to month in order to determine how supply is changing in the market.

Equation (12)

$$Number\ of\ Vacant\ Completed\ Homes_{t+1} - Number\ of\ Vacant\ Completed\ Homes_t$$
$$= Absolute\ Change\ in\ Vacant\ Housing\ Stock_{t+1}$$

This is done in order to estimate the prevailing supply dynamics within the market and helps to detect whether there is tightness or slack in the supply side of the market.

The absolute change in the supply of housing is then divided by the total starts for the month in order to determine what share of the total starts in the given month remained unoccupied.

Equation (13)

$$\frac{Absolute\ Change\ in\ Vacant\ Housing\ Stock_{t+1}}{Total\ Housing\ Starts_{t+1}} = Vacancy\ Rate\ in\ New\ Housing\ Stock_{t+1}$$

Existing sales were not factored into this calculation due to the fact that they are already occupied and therefore the current owners can choose to enter or withdraw from the market depending on their own beliefs of the current state of the market. As a result an assumption is made that these homeowners are rational and as a result they will be knowledgeable regarding basic supply and demand laws and therefore will not unduly increase supply thereby decreasing their own economic returns in the process.

Chart 5

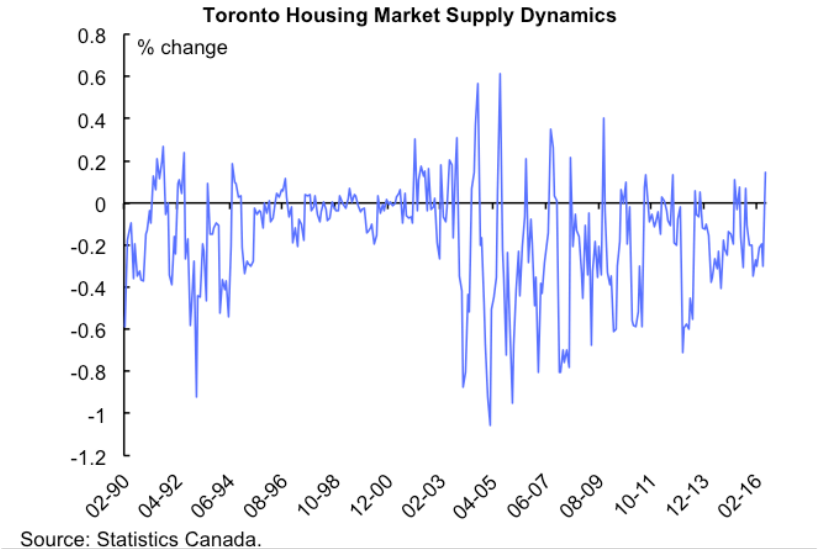
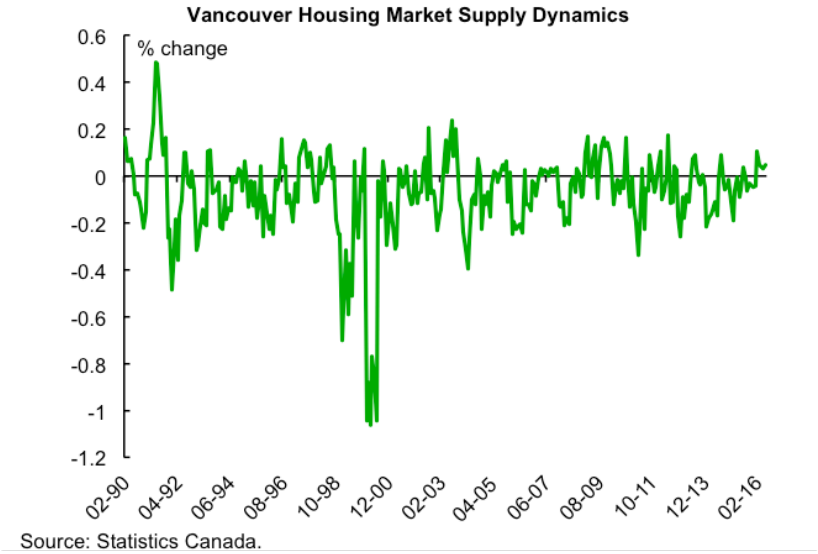


Chart 6



It can be seen from the above charts that in regards to the supply estimation technique there has been increasing tightening in the available supply in Toronto (Chart 5), meaning that there has been a material shift away from vacancies within the city. While in Vancouver (Chart 6) the supply story seems to

be one of stability. The data outlines either a stable vacancy rate or a market which operates with almost non-existent slack, meaning that consumers in the market are willing to enter the market at any point, and supporting the argument for location driving a shift away from housing type bias amongst consumers.

2.5 Construction of Rental Costs

The average rental cost in both Toronto and Vancouver needs to be estimated because as mentioned before, the decentralized nature of the industry prevents the construction of a detailed comprehensive database. Due to the largely private, "off-the-books" aspect of many rental agreements, a comprehensive reliable rental database does not exist and as a result estimation must be undertaken in order to gauge the predominant industry sentiment. In order to accomplish this, average annual rent statistics were gathered from the Toronto Real Estate Board (TREB) for Toronto and Statistics Canada's 2006 Census for Vancouver.

Toronto

In order to determine the aggregate movements in rental costs in Toronto, the maximum allowable rent increases as legislated by the Ontario Ministry of Municipal Affairs and Housing (MAH) were used. This is a viable approach because using the maximum allowable increase removes the threat of underestimating the true rental price, while still remaining within legislated

boundaries. Furthermore, the rapid increase in house prices will result in property yearly tax reassessments and potentially larger mortgage payments for landlords. For this reason it is assumed that rent will be readjusted annually to the mandated maximum amount in order for landlords to minimize losses and maintain margins.

The maximum annual rental increase percentage was applied to an average of a 2 bedroom apartment and 2 bedroom townhouse, in order to arrive at an average rent price for the year. A 2 bedroom was selected because it offers the ability to capture a greater cross-section of demographics. It captures the younger generation of homeowners who are just entering the market either as sole or co-renters, while still capturing families. This average rent price was then 'backcasted' using, the same technique as the house price approximation, using the latest rental data from April 2016 in order to arrive at an annual estimate for the average rent as follows:

Equation (14)

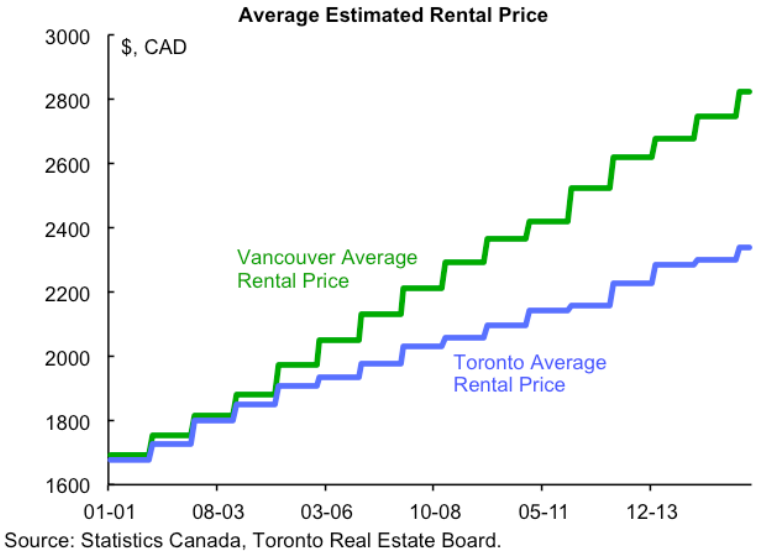
$$\frac{Average\ Annual\ Rent_{t+1}}{(1 + Growth\ Rate_t)} = Average\ Annual\ Rent_t$$

Vancouver

In order to determine the aggregate movements in rental costs in Vancouver the maximum allowable increase in average rental as legislated by the Provincial Government of British Columbia Residential Tenancy Branch was

used. A very similar process to Toronto was followed, however, the 2006 Census did not report the number of bedrooms they instead reported Expensive and Normal priced rental properties. Following a similar tactic to Toronto the Expensive and Normal properties were averaged in order to arrive at an average annual rental price. For the same reasons as outlined for Toronto the Expensive and Normal were chosen in an attempt to capture a greater cross-section of renters. The maximum rental increase percentage was then applied to this average, in order to "Backcast" the average annual rent in Vancouver (Equation (14)). For the same reasons as Toronto this is a valid estimate of annual rental price movements.

Chart 7

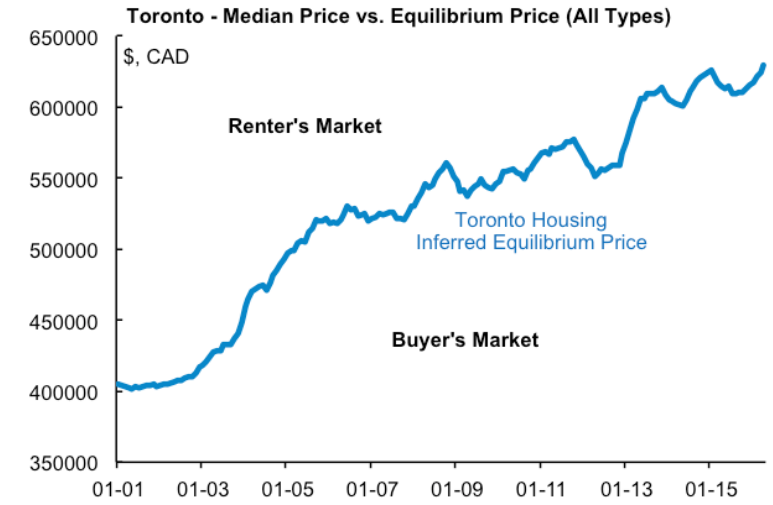


Source: Statistics Canada, Toronto Real Estate Board.

2.6 Buyer's Market vs. Renter's Market – Computation of Equilibrium House Price (P_E)

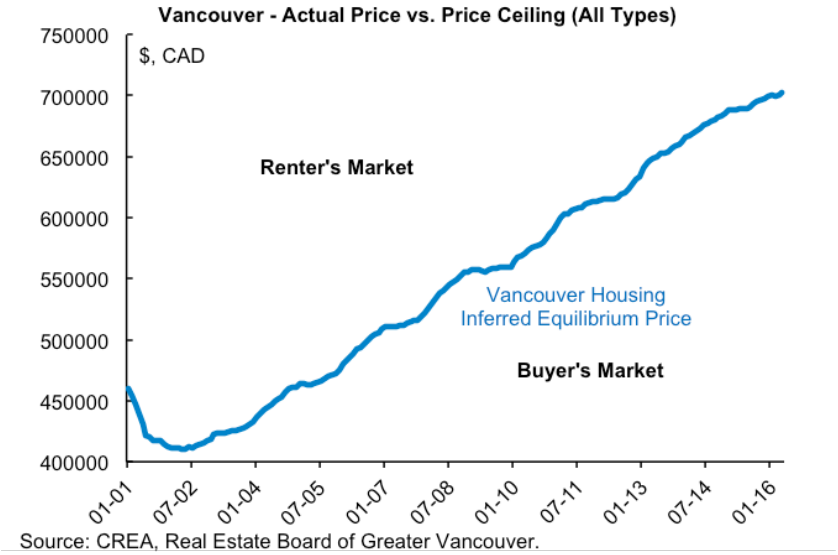
All of the above estimated variables are now combined with collected variables and input into the economic model in order to compute the equilibrium house price (P_E). The model then produces a time series trend for the equilibrium house price based on the computed user cost of ownership in each month. This equilibrium price trend can be seen for Toronto in Chart 8, and Vancouver in Chart 9. When the price of housing lies below this line it is a buyer's market, meaning that the cost of being a homeowner has fallen below the cost of being a renter. When the price of housing rises above this line it is a renter's market, meaning that the cost of being a renter is cheaper in relation to homeownership. As a result when the cost of housing falls below this line increased consumer demand will drive the price of houses back up to its equilibrium level, and when prices are above this level, demand slack and increased rental demand will drive home prices back down to their equilibrium level.

Chart 8



Source: CREA, TREB.

Chart 9



Source: CREA, Real Estate Board of Greater Vancouver.

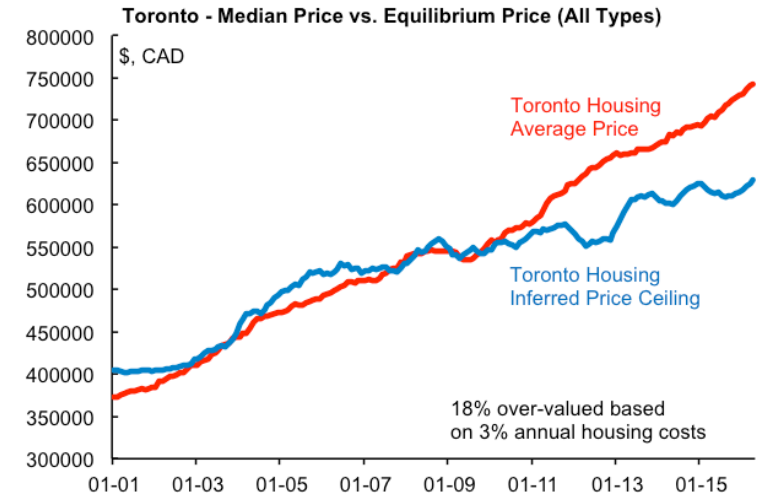
It is important to note that the produced charts use a ‘smoothed' equilibrium price which is comprised of a 12 month moving average (MA) in order to calculate the equilibrium price. This is done for two reasons: to remove the erratic movement from the line in order to get a clearer impression of the

relationship between the two lines, and more importantly to reflect a 12-month lag in decision making amongst consumers. Consumers cannot instantaneously react to supply drivers, property tax changes, or general market conditions, due to informational lag and inability to perfectly time decisions. Therefore consumers are more likely to moderate their decision making process, taking into account both increases and decreases, as well as expectations. Ultimately, (and less theoretically), the 12 month lag is representative of the inability of renters to easily substitute in order to maintain the owner vs. rent cost equality due to contractual obligations and transactions costs associated with the movement between ownership schemes vis-à-vis real estate fees, associated taxes and the general inconveniences associated with the sale and moving process, which cannot be homogeneously quantified.

3. RESULTS & ANALYSIS

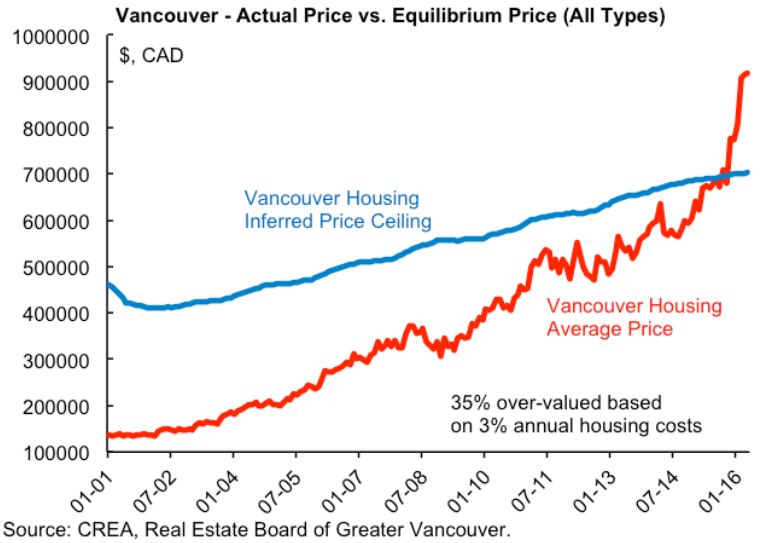
After simulating the above model with the discussed variable values, it was discovered that both Toronto (Chart 9) and Vancouver (Chart 10) are both over valued, 18% & 35% respectively.

Chart 10



Source: CREA, TREB.

Chart 11



Source: CREA, Real Estate Board of Greater Vancouver.

However, the more interesting finding from the model is not so much the over-valuation, but the timing and duration of that over-valuation. In the case of Toronto, the trend in housing prices is more or less in line with the equilibrium price. Although it decoupled in 2011, the spread between the actual and equilibrium has stayed roughly flat. This could be attributable to a number of

factors not least of which is the ‘morning-after effect’ of the Great Recession and the historically low interest rates it left in its wake. The effects of the recession’s shock to consumer confidence left many consumers searching for a bulletproof store of value. The low borrowing rates and the very apparent supply restrictions in Toronto, made housing (not condos) a very likely candidate for a flight-to-quality commodity. This flight caused a surge in demand, which put considerable upward pressure on housing prices. However, recent developments in Toronto such as the Land Transfer tax have tempered any exponential jumps in the price, and therefore resulted in the roughly linear trend of Toronto housing since.

The story of Vancouver is much different from that of Toronto. Although the similar recessionary flight-to-quality story is more than applicable in the case of Vancouver, it could do with some enriching. As can be seen from the above chart Vancouver has in fact been in a state of a perpetual buyers market since the early 2000s, and has only become over-valued in early 2015. Its massive over-valuation relative to Toronto could be a symptom of its previous under-valuation as was the finding of Ayuso and Restoy (2006). Overly ambitious buyers chasing returns could be the reason behind the uptake in prices. The other side of the coin is the foreign investment side. Due to is housing supply constraints, as a result of aforementioned flights to quality, Vancouver is well positioned to receive the outflow of foreign dollars seeking sanctuary; the current dominant contributor being China.

China’s continuing transition away from an external demand-driven economy and towards a more advanced knowledge/service based economy is

one of the principle drivers of uncertainty in the global economy[6]. In order to counter this uncertainty and to prop up its rapid economic growth the Chinese government has enacted many supply-side reforms. These reforms centre around two areas market and economic volatility. Economic volatility smoothing has become a monetary phenomenon in China with monetary easing and falling reserve ratios leading the charge in a bid to boost money and credit growth[7]. However, these actions have been met with considerable reservation amongst China's elite who fear that currency devaluation will shrink their current wealth positions. From the market volatility perspective in a bid to smooth the erratic movements in the local markets the Chinese regulators have enacted a series of laws which severely restrict the ability of large securities holders to have access to liquidity. This has been met with much criticism and catalyzed a withdrawal from markets. Both of these situations have caused a capital flight in China, whereby the wealthy elite are seeking the means of exporting their wealth in an effort to preserve it. Following the creation of many laws aimed squarely at curtailing the outflow of domestic wealth, various global stores of value saw upticks in foreign investment. Vancouver and Toronto housing markets are two such stores of value. The desire to preserve wealth has driven a frenzy of buying which, drives the price of the respective assets much higher. As an example the British Columbia (BC) government collected data on foreign buyers in the GVA and found that over those three weeks foreign investment represented 5% of total

[6] "China Executive Briefing". Scotiabank Economics Publication, http://www.gbm.scotiabank.com/English/bns_econ/china-execbriefing.pdf. 2016-08-1. Retrieved 2016-08-25.

[7] Ibid.

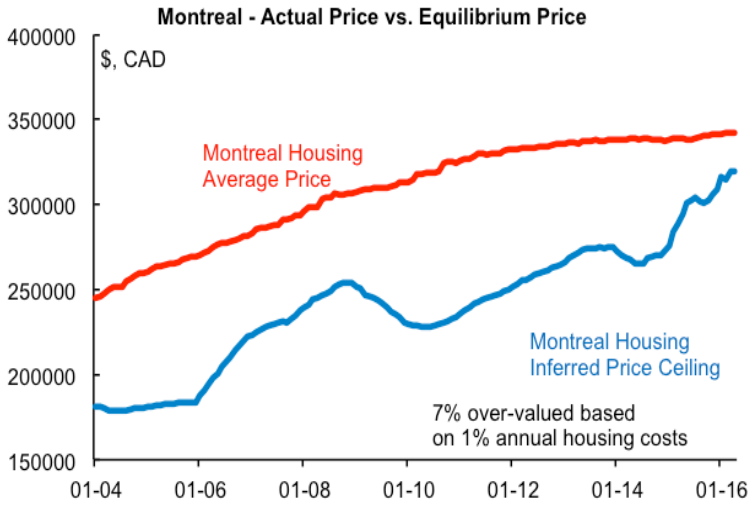
transactions and at an average price $400,000[8] greater than their Canadian citizen counterparts. In response the BC government has since instituted a 15% tax on all foreign transactions. The new tax came into effect on August 1st 2016 and preliminary data has shown a decline in both house prices and total transactions, 17% & 23% m/m respectively. This highlights the precarious state which has come to characterize this market.

3.1 The Canadian Context

However, a more important proxy for how fragile the current state of the housing market in Toronto and Vancouver truly are is a comparison to other major Canadian centres. In the interest of brevity the price, rent and supply dynamics variables were all generated in the same fashion as they were for Toronto and Vancouver, with one notable difference. The average annual rental growth was calculated using annual growth rates calculated by the CMHC. The results of the equilibrium price model for Montreal, Winnipeg, Saskatoon & Calgary are as follows:

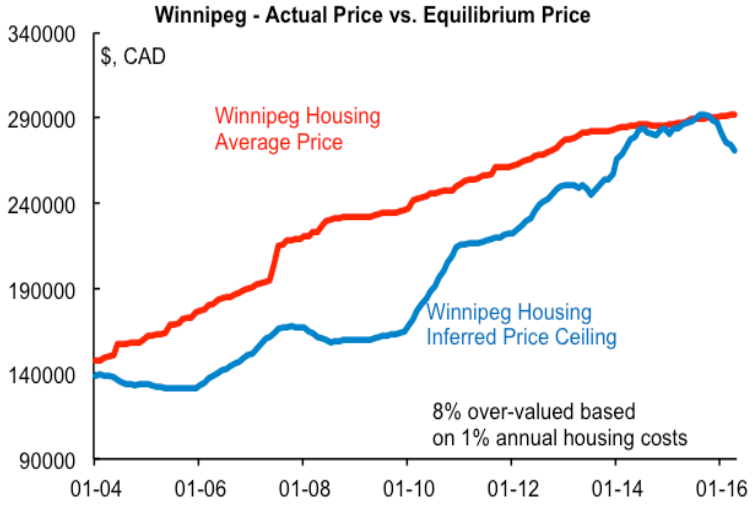
[8] "B.C. releases first set of data on foreign home ownership in Vancouver". The Globe & Mail, http://www.theglobeandmail.com/news/bc-government-releases-preliminary-data-on-foreign-home-purchases/article30790277/. 2016-07-08. Retrieved 2016-08-25.

Chart 12



Source: Statistics Canada, Canada Mortgage & Housing Corporation.

Chart 13



Source: Statistics Canada, Canada Mortgage & Housing Corporation.

Chart 14

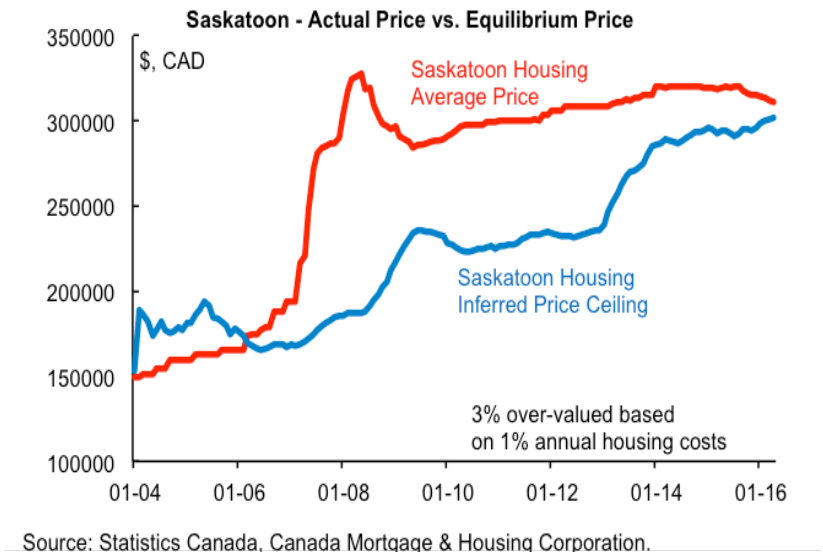
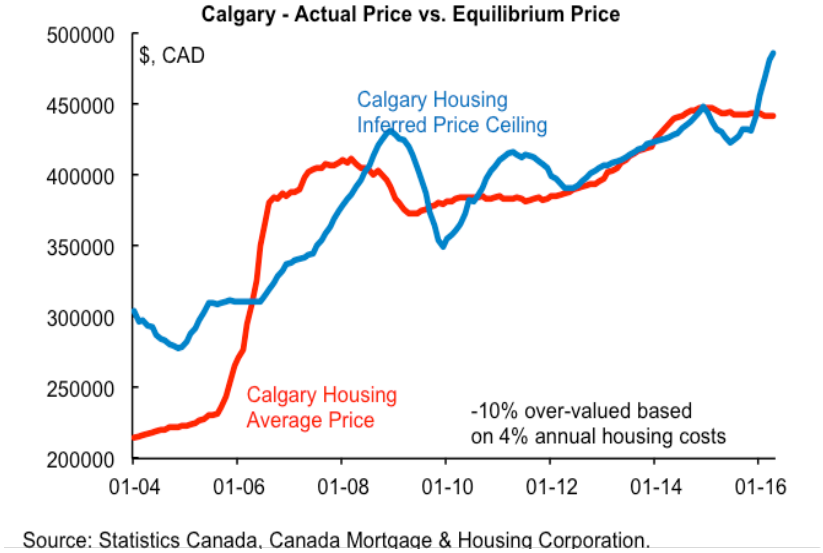


Chart 15



As is clear from the above example, house price over-valuations are not completely out of the ordinary. More interestingly, and quite possibly an attestation to the validity of the model, it can be seen that in all of the above examples, following the recessionary impacts of the financial market crisis of

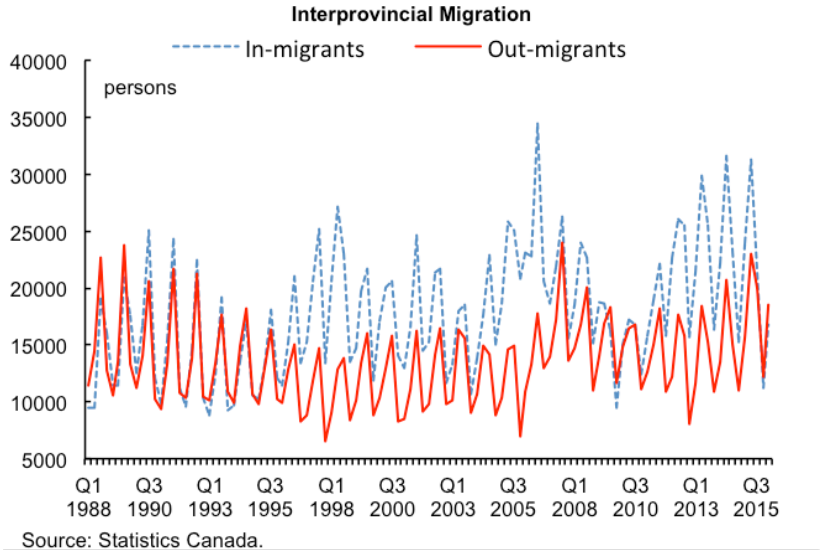
2008/2009, the equilibrium house price suffered a correction. This could be an effect of the devastating blow the US housing market felt, which no doubt sent shock waves through consumer confidence in housing reliability to its northern neighbours.

In all examples house prices were over-valued, the spread between the actual and equilibrium prices remained relatively stable and gradually decreased until parity or under-valuation was realized. This is a fairly accurate representation of how a rational housing market with complete information should theoretically behave. In each instance it is logical to assume that consumers were not irrationally chasing elevated returns in housing as prices did not rapidly deviate from where the model predicted the equilibrium price should reside. In this case the demand side drivers functioned correctly and consumers realized that the higher returns were not necessarily infinite nor would the 'party' continue. As this interest subsided, likely due to consumers substituting away from an over-valued asset and into other under-valued ones, namely rentals, the housing market experienced demand slack and therefore began its downward journey to more sustainable pricing.

More interesting and a potential argument in support of the validity of the model however is the light this model shines on the current state of affairs in Calgary. The equilibrium price is showing the gradual decline experienced by Calgary as the fallout from lower oil prices continues to work its way through the economy. As job losses have mounted, housing demand has abated in favour of a less permanent option, renting. The future role of oil remains uncertain as the economy reshuffles itself, and this uncertainty has filtered into housing choices.

As the residents of Calgary wait for an indication from producers as to what the state of the industry is moving forward will be they refrain from making long-term investments. In the near-past Alberta has been a destination for workers seeking gainful employment on the back of sky rocketing oil prices. This mobility has now become a double-edged sword as the demand this migration once fed has fallen victim to the retreat of the mobile workforce. As is expected this uncertainty drives the demand for temporary housing. This can be seen in the model which shows that higher demand for rental units could be the driving force pushing the cost of being a renter higher and the price of housing firmly into a buyers market situation as outlined previously. The effect of interprovincial migration on housing demand is better illustrated by Chart 16:

Chart 16



During times that migration was flat or negative the model is showing a fall in the actual price versus the equilibrium price level and during times when in-

migration outpaced out-migration the actual price climbed above the equilibrium price. This highlights potential underlying demand drivers in Alberta but more importantly supports the argument made by the model. Namely that while the people of Alberta look for stabilization and eventual resurgence in the oil industry house prices will continue to tumble in lieu of rentals. The Calgary Real Estate Board is forecasting an 8% year on year drop in total unit sales this year and a 3.8% drop in prices over the same time period.

When viewing Toronto through the lens of other Canadian centres it is easy to see the parallels. Toronto like Montreal (Chart 11), Saskatoon (Chart 13) and Winnipeg (Chart 12) experienced a steady spread between the actual and equilibrium prices. However, the cycle seems to take much longer to work its way through. In Montreal, Winnipeg and Saskatoon the over-valuation lasted upwards of 10 years before prices trended back down to their equilibrium levels. This is supportive of the findings of Blackley and Follain (1996). Toronto only recently entered the over-valuation phase of the pricing cycle and is only halfway through the historically experienced cycle (5 years, cycle began in 2011). Another interesting development is the strong parallels between Toronto and Calgary. Pricing in both centres tends to fluctuate around its equilibrium price, likely citing strong fundamentals in those centres, as both Toronto and Calgary can easily be seen as strong economic drivers in the Canadian economy, one from a resource perspective the other from a knowledge-based one. This would attract talent from within and abroad helping to boosting incomes which ultimately would exert positive pressure on affordability rates, buoying house prices in those regions.

Vancouver on the other hand, unlike other major Canadian centres is in the infancy of its over-valuation cycle and is significantly deviating from the other Canadian centres in terms of price spread. As can clearly be seen the price spread in Vancouver is anything but stable and the spread continues to widen each month. This growth is unprecedented in the experience of the other Canadian centres examined and as a result an explanation must be sought elsewhere.

All of these factors considered, Toronto and Vancouver proper are still facing an environment where there housing market is over-valued and quite substantially. However, for instances where greater insight is needed, like in the context of Vancouver it is important to look towards other comparable examples. In order to put the current state of these two markets into context a comparison to a similarly structured market would be a useful exercise. For this reason and in an effort to explore the depths of this relationship, the four hardest hit US cities, with respect to their housing markets, from the Great Recession will be considered.

3.2 The U.S. Experience

The same model and methodology was used to generate the equilibrium price of housing in each US centre as was used in Toronto and Vancouver. One notable difference in the model was the consideration of tax deductibility of mortgage interest paid. This was calculated using the approach of Himmelberg, Mayer and Sinai (2005), in their paper Himmelberg et al used this approach as a

means of quantifying the benefit of homeowners with respect to the income tax deductibility of mortgage interest payments as well as the tax subsidy benefit experienced by homeowners related to their imputed rent. Their work in this area is an extension of work done by Hendershott & Slemrod (1983), Gyourko & Sinai (2003) & Poterba (1984).

In order to determine the appropriate mortgage rate values, this paper uses the average across 1, 5 and 30 year mortgages, (MR_t), taken from The Federal Reserve Bank of St. Louis in order to account for heterogeneity in mortgage term structures. Although not exact it is designed to correct for changing mortgage preferences amongst consumers as the prime interest rate changes.

Next, in order to determine the appropriate mortgage deductible rate the median weekly salary across all industries was used. This is a fair assumption, because through the use of the median weekly salary, a greater proportion of US homebuyers can be captured. Moreover, the related income tax deduction is then more in line with the national average. Using an average could have unduly skewed the salary data resulting in a less than accurate picture of the mortgage market. This was then converted into an annual figure and the appropriate income tax rate, (δ), was determined using Tax Foundation data. This augmented the model in the following manner:

Equation (15)

$$CH_t = P_t \times RF_t + P_t \times MC_t + P_t \times T_t + P_t \times RP_t + P_t \times HS_t - P_t \times EG_{t+1} - \delta \times (MR_t + T_t)$$

Basically the change reflects a decrease in the cost of homeownership (CH_t) as the amount of interest deductibility increases, which stands to reason. The remaining process of the model remains unchanged.

In the interest of brevity the housing prices and their trends in each centre was calculated using the house price index in each metropolitan centre, the method of computation was the same as in the Canadian component (refer to Data Methodolgy) the data was provided by the Federal Reserve Bank of St. Louis (St. Louis Fed.). This trend was then validated against a publically available time series from Zillow Research in order to ensure accuracy. The reason for the construction of home prices in light of publically available data was to ensure consistency when comparing the two countries. The rental prices and their subsequent annual amounts were calculated using the Consumer Price Index for All Urban Consumers: Rent of Primary Residence (CPIRPR) provided by the St. Louis Fed.

Equation (16)

$$\frac{Average\ Annual\ Rent_{t+1}}{(1 + CPIRPR\ Growth_t)} = Average\ Annual\ Rent_t$$

The growth rate of the CPIRPR was used to determine the trend in rental prices from a single period in time and then was compared against a publically available time series data series provided by Zillow Research. For comparability the rental data was estimated in the same manner as it was in Toronto and Vancouver.

The housing supply dynamic portion for the US differs slightly as compared to Canada. In the US only regional data was available. As a result, each metropolitan centre was separated into its respective US region (Northeast, Midwest, South or West) and the housing supply dynamic was calculated in similar fashion to Toronto and Vancouver. Using the US regional data is a weakness in the computation of the US model. Although each of the respective US cities studied in this paper is a major metropolitan centre in their respective regions, they are not by any means the only major metropolitan centres. For this reason the housing supply may be over or understated for the cities examined. However, since this portion of the paper is merely for comparative purposes, this potential error is not considered material enough to invalidate or jeopardize the findings of this paper.

The total supply of housing and the absolute month on month change was determined. This absolute change was then divided by the total housing inventory in order to arrive at the vacancy rate in housing stock.

Equation (17)

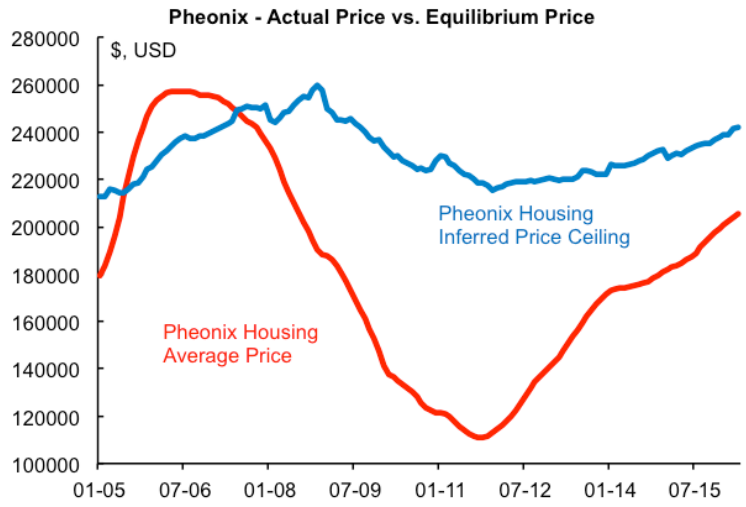
$$Number\ of\ Houses\ for\ Sale_{t+1} - Number\ of\ Houses\ for\ Sale_{t}$$
$$= Absolute\ Change\ in\ Housing\ Stock_{t+1}$$

Equation (18)

$$\frac{Absolute\ Change\ in\ Vacant\ Housing\ Stock_{t+1}}{Total\ Housing\ For\ Sale_{t+1}}$$
$$= Vacancy\ Rate\ in\ Housing\ Stock_{t+1}$$

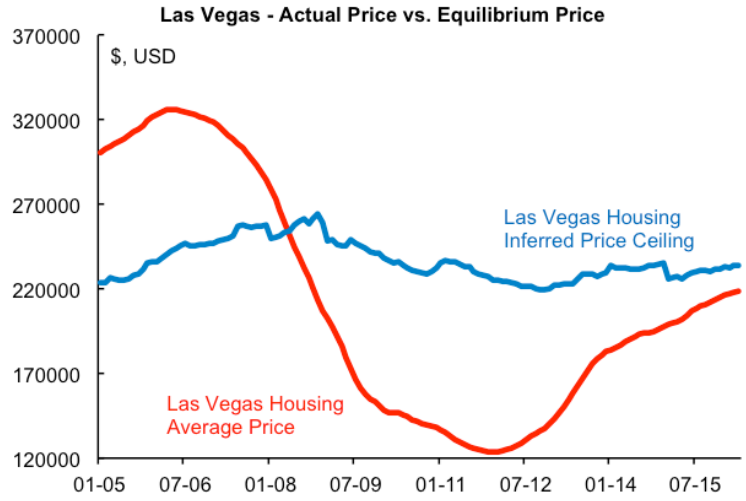
The findings of the US model are as follows:

Chart 17



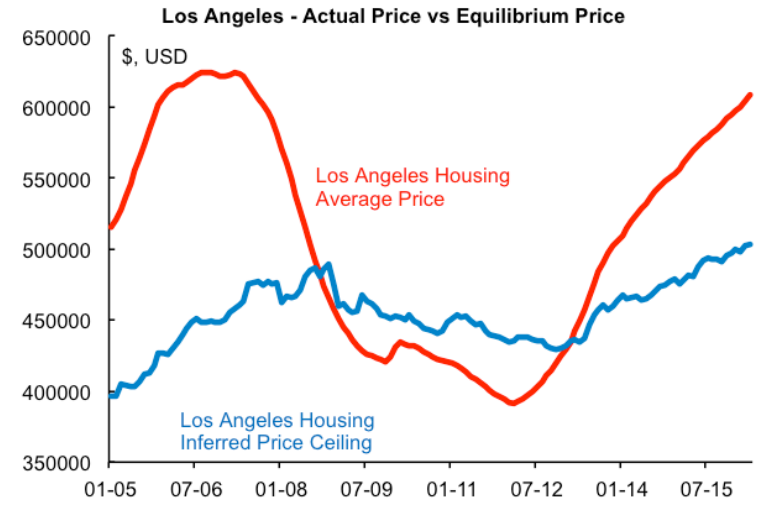
Source: St. Louis Federal Reserve Bank, U.S. Tax Foundation, BLS

Chart 18



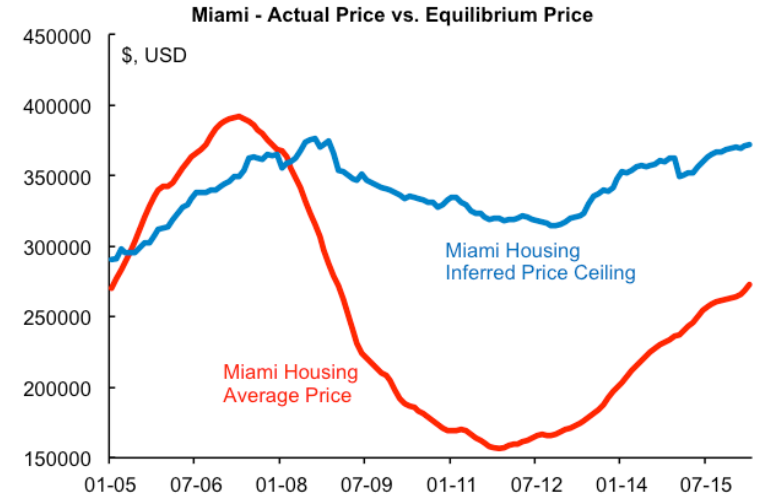
Source: St. Louis Federal Reserve Bank, U.S. Tax Foundation, BLS

Chart 19



Source: St. Louis Federal Reserve Bank, U.S. Tax Foundation, BLS

Chart 20



Source: St. Louis Federal Reserve Bank, U.S. Tax Foundation, BLS

As can be seen from the above charts the level of over-valuation in these four US centres was not unlike the current state in Toronto and Vancouver, neither in magnitude nor duration. The US subprime mortgage crisis which is the name ascribed to the above housing corrections was a phenomenon which

occurred in 2007-2008. Housing prices in the US dropped by an astounding amount, 20% in only 2 years from their 2006 peak[9]. The main reason this drop created such havoc was the weak fundamentals which were supported these elevated prices. During this time period attractive mortgage offers were made available offering very lower variable rate mortgages with minimal to non-existent down payments. This resulted in a large upswing in housing sales driven mainly by demographic groups, which traditionally were excluded from homeownership due to poor financial positioning and lacking or poor credit histories. This led to a massive run-up in housing prices. The ratio of median housing price to median income increased from a relatively stable, long-run average of 3 to a heightened 5 in those same two years[10]. This spawned a new phenomenon where homeowners began to increasingly view themselves as wealthy, falsely believing that the equity contained within their house was stable and could not retreat. On the back of this dominant sentiment, this newly enriched cohort of homeowners began to borrow against the increased equity values of their homes, the amount of debt secured by home equity more than doubled in only 4 years, from $627 billion in 2001 to $1428 billion in 2005[11]. When the 20% house price correction struck in 2008 many over-leveraged homeowners found themselves in negative equity territory, meaning that the value of their homes fell below the amount outstanding on their mortgage loans. As homeowners began to realize the perils

[9] "Economist-A Helping Hand to Homeowners". Economist.com. 2008-10-23. Retrieved 2016-08-25.

[10] Steverman, Ben; Bogoslaw, David (October 18, 2008). "The Financial Crisis Blame Game". BusinessWeek. Businessweek.com. Retrieved 2016-08-25.

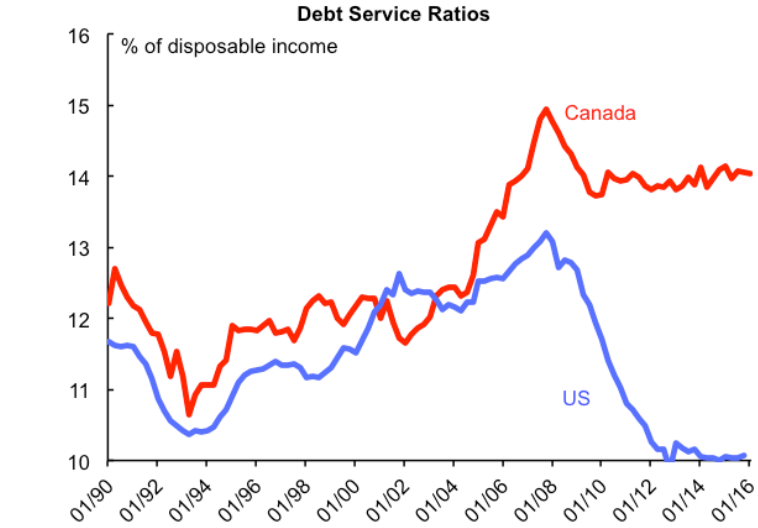
[11] "Reuters-Spending Boosted by Home Equity Loans". Reuters.com. 2007-04-23. Retrieved 2016-08-25.

posed by negative equity the incentive to default increased substantially, this was amplified by the fact that most mortgages in the US are considered “non-recourse loans” meaning that the loan is secured by the underlying asset and as a result the loan holder is not personally liable for the loan itself, essentially meaning they could walk away from their homes with no further liability to the loan holders. As this occurred loan holders sought to minimize their losses by forcing the sale of these and other delinquent homes. This caused a deluge of housing supply, increasing nearly 10 times in year-over-year terms from 2007 to 2008[12]. The massive uptake in supply coupled with a similar downgrade in demand forced house prices to new lows, creating a negative feedback effect which kept downward pressure on home prices for nearly four years.

Although the market fundamentals are slightly different in Canada with respect to subprime rates and non-recourse loans, the “house rich, equity poor” phenomenon is not. Continuously upward trending house prices, coupled with stagnant to mild income growth is widening the median price-median income ratio, and the belief that housing is a store of value is driving homeowners to reinvest in order to amplify returns often through increased borrowing against underlying equity value. This is mimicking the beginnings of the housing storm weathered by the US.

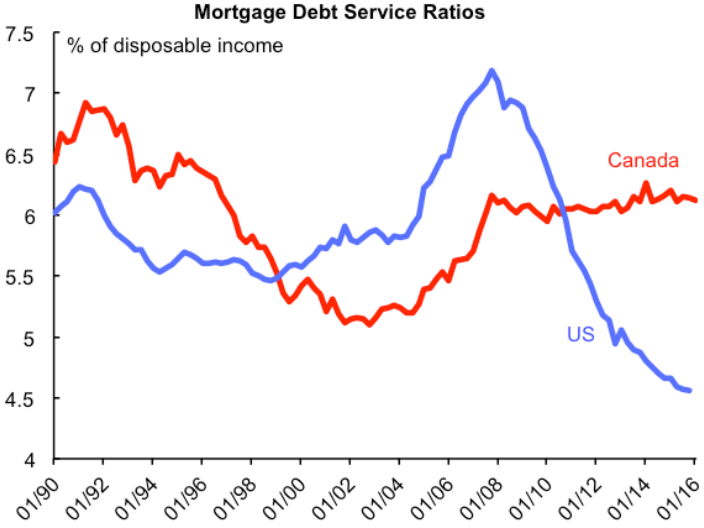
[12] "New home sales fell by record amount in 2007 - Real estate - MSNBC.com". 2008. Retrieved 2016-08-25.

Chart 21



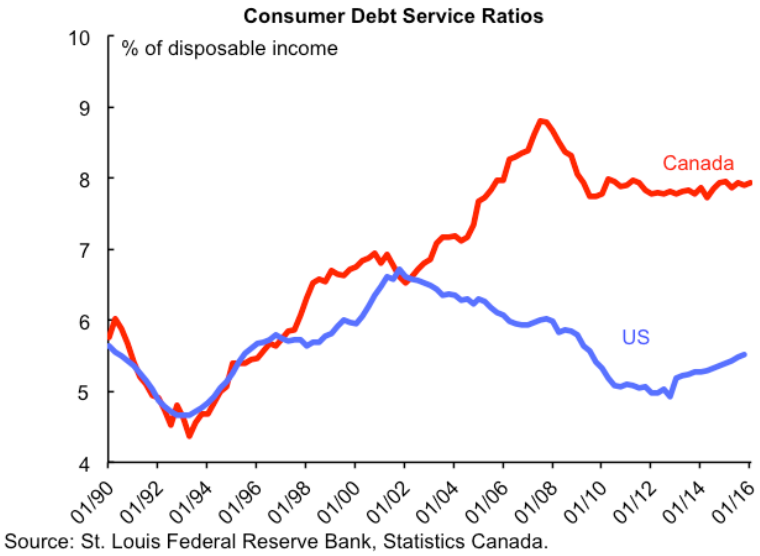
Source: St. Louis Federal Reserve Bank, Statistics Canada.

Chart 22



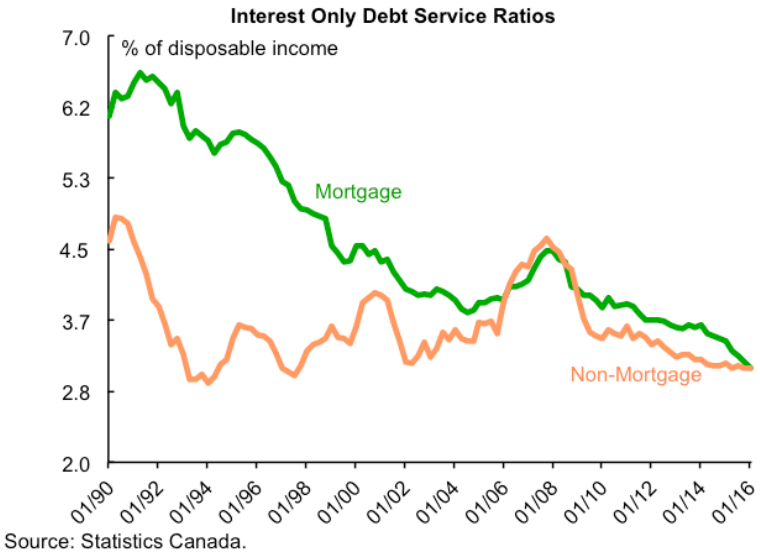
Source: St. Louis Federal Reserve Bank, Statistics Canada.

Chart 23



As can be seen from the above charts Canada has overtaken the US in terms of debt service ratios (DSRs) (Chart 20, 21 & 22). The after-effects on US household balance sheets can very clearly be seen, and the pass through effects on its Canadian counterpart can also be seen. However, the effect in Canada is much more muted. This could be a result of the resiliency of the Canadian housing market over that of the US. This reinforced confidence coupled with the lower interest rate environment could be the result of the elevated ratios in Canada.

Chart 24



One notable feature is that the interest only portion of the DSR on Canadian loans, both Mortgage and Consumer (Chart 23), are steadily decreasing while the aggregate DSR is remaining stable. This can be explained by an uptake in the amount of debt held on Canadian balance sheets. As the interest rate environment moderated, Canadians responded to the new cheaper money by increasing their leverage. This is similar to the response of US homeowners who suddenly found themselves “richer” in the booming housing market and responded by borrowing against their new found “wealth”. However, in both instances, both countries’ consumers are sensitive to the same risk, increases in the interest rate. The low introductory variable rate mortgages in the US became the undoing of homeowners as rapidly increasing interest payments pushed many into insolvency which could be attributed as one of the main catalysts of the subprime crisis. In the Canadian space, a similar phenomena

could be materializing as leveraged amounts increase as interest rates remain low. Moreover the mortgage DSR remains flat (Chart 21) while the mortgage interest-only DSR has fallen (Chart 23), meaning that there has been an uptake in the size of mortgages. This is exposing Canadians to much of the same risk faced by their southern neighbours. However, there is an added dimension to the Canadian space which exponentially increases concern. Mortgages in Canada are not non-recourse loans, Canadian homebuyers are liable for any shortfall not covered by both mortgage insurance and forced sale, meaning that any downturn which causes a systematic decrease in housing value could remain a much longer issue. Liabilities outstanding will further strain consumers either forcing a massive asset sell-off which would destroy consumer sentiment in the near term, or cause a massive increase is bankruptcy claims, which would stifle credit growth in the economy, one of the principle drivers of growth and investment.

Therefore although the Canadian experience is not an exact match for the pre-subprime experience of the US, many of the same fundamentals can be seen lurking at the periphery.

4. CONCLUSION

In conclusion, the above paper has provided researchers and consumers alike with a method which could be used to estimate data concerning the housing sector with reasonable confidence. The pandemonium surrounding the recent trends in the Greater Toronto and Greater Vancouver Area's housing sectors may not be completely overblown. Construction of an economic model has

quantified the potential over-valuation of both markets. However, more importantly, it has shown that the hysteria surrounding the length of this over-valuation has been over-estimated (according to the model used), meaning that public rhetoric is not always grounded in fact.

This does introduce another interesting dimension to the underlying question, that of the role of public opinion. Robert Shiller quite famously remarked that the housing market in the US began to falter when mass media began to scrutinize it and draw the gaze of the public towards it, although he is quick to explain that the fundamentals underpinning the growth were certainly not sustainable. This however, further confounds attempts at determining when corrections will occur. Although there are methods which can be leveraged to quantify the size of the over- or under-valuation, and these estimates can be used to inform stress based scenarios, they cannot solve the more ambiguous issue of consumer sentiment. Although traditional economics teaches that all consumers are homogeneous rational agents using all available information to make the optimal decision given the circumstances, history teaches that this is simply not the case. Therefore, this opens a new interesting option for further research concerning the effects of public sentiment on consumer decision-making.

Another area, which this paper does not cover but requires further investigation, is the importance that individual consumers place on the different variables associated with the user cost of housing. An empirical determination of the weights associated with each of these variables could further define the

relationship between rent and house price and better explain the dynamics of these two variables.

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