CANADIAN HOUSE PRICES ACROSS TWO CRISES:

HOUSE PRICE DYNAMICS IN CANADA

Econ 491

Supervised by Professor Michael Kennedy

Kelston Chen

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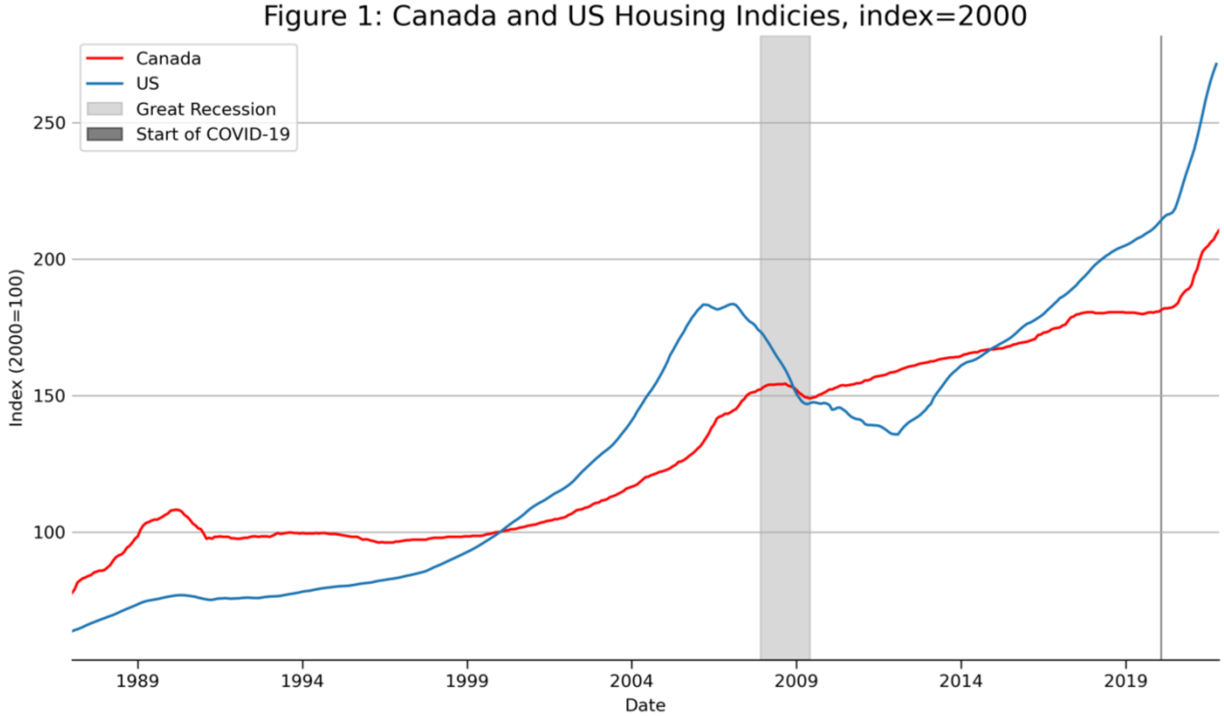
INTRODUCTION

The Great Recession has elucidated the central role that the housing market can have in inciting economic crises. From a quick glance at Figure 1, it is easy to see that the effect of the Great Recession on the Canadian housing markets was not nearly as drastic as in the US, even though both countries faced similar credit easing and monetary dovishness. Moreover, Figure 1 shows the continued resiliency of Canadian housing, as prices continue to rise even amidst a global economic downturn. The peculiar house price behaviour in Canada provokes inquiry into: (i) whether there actually was a housing bubble in Canada, (ii) why prices continue to increase during COIVD-19, and, (iii) what policies could ensure greater stability, or slower price growth. In order to get a good grasp of what is happening with house prices in Canada, we will have to look at Canadian house price dynamics.

Figure 1: Canada and US Housing Indicies, index=2000



To answer the questions from above, this paper will focus on developing a dynamic housing price model for Canada, at the aggregate level. To do this we will derive a long run house price equation – the equilibrium price level – which will supply the fundamental determinants of house prices. We can then use an error correction model which will show how prices behave when they are pushed out of equilibrium. With both the long run equation and the error correction model, we can run a dynamic estimation exercise that will analyze how exogenous shocks in the economy, and changes to our long run price determinants, affect the prices for homes.

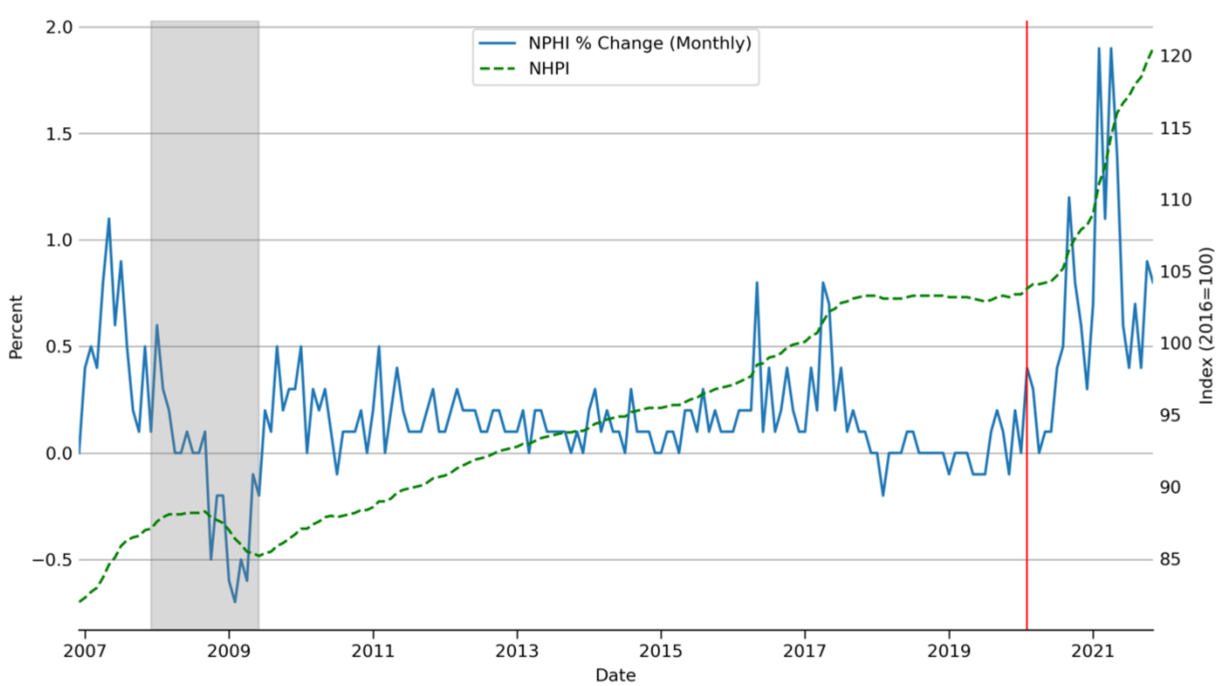
The interest in studying such a topic comes from the fact that housing markets are not, and should not be, treated in a similar fashion to markets for regular goods. The differential treatment comes from three reasons: (i) house prices are central to household wealth and expenditure (Granziera & Kozicki, 2015), (ii) housing, itself, is crucial for basic human welfare, and (iii) housing market stability is important for the stability of the economy through its effects on financial markets, which was clearly displayed in 2008. Therefore, a better understanding of house price behaviour across two economic crises can give valuable insight for future policies.

Previous Literature

Much work has already been done on this topic. Popular research such as, Abraham and Hendershott's (1996) paper on "Bubbles in Metropolitan Housing Markets", show how equilibrium house prices and exogenous shocks can be used to predict the price variations in metropolitan areas throughout the United States. Abraham and Hendershott's paper use the idea of "fundamental" home value and create a model which estimates it. This model then allowed Abraham and Hendershott to compare the market value of a home with its fundamental value; whereby a divergence would spell a bubble.

Similarly, a paper by Malpezzi (1998), used an error correction model on house-price-to-income ratios, to model the dynamic changes in house prices, and showed that house prices do tend to move towards an equilibrium level; meaning that home price variations are "…not random walks…" and are therefore, "…partly forecastable." (Malpezzi, 1998). Malpezzi, also introduces the idea of how strict, and relaxed, policy can slow, or accelerate, the speed that home prices adjust back to equilibrium. In addition, Malpezzi found that changes in equilibrium – income and population growth – factors produced very large price changes for homes. This result was also found in Kennedy's (2021) paper on the drivers of state level home prices in the US. In Kennedy's paper he found that much of the overshooting in home prices came from changes in income and in credit availability. More importantly, both papers had showed that changes in demand resulted in large changes in

Figure 2: New Housing Price Index (NHPI)



price due to a lack of supply of new housing. Paixão (2021), looks at how housing supply elasticities amongst cities in Canada affect price growth. He finds that housing supply elasticity is both heterogenous between cities and a large determinant of house price changes and volatility – cities with inelastic supplies see stronger price growth than cities with elastic supply. The lackluster response from supply has become a staple issue in housing affordability and has been commonly found as the main culprit for rapid and volatile house price growth. Canada's housing price volatility can be seen in Figure 2. Although much of the research on home prices focuses at the state/provincial or municipal level, due to some of constraints in the writing of this paper, the aggregate level will be used instead. This paper also takes much inspiration from Kennedy (2021) as it tries to incorporate a more detailed financial sector, with varying success, in the model. Nonetheless, the results from the model in this paper are significant and coherent. The results of the model will also continue to give insight on the events leading up to the Great Recession, the soaring home prices throughout the pandemic, as well as how monetary policy, may have affected housing prices before and now.

THE MODEL

To begin creating our house price model, we will start by deriving a theoretical model that will allow us to capture the fundamental factors that determine our long run equilibrium house price. In order to do this, we will begin with a Cobb-Douglas utility maximization problem.

In this model we will consider a household that derives utility from two sources: consumption and housing.

$$U = H^{\eta} C^{1-\eta} \tag{1}$$

Where $0 < \eta < 1$, and represents a form of a weighted preference between the two goods. The household is also constrained by their budget which is given by:

$$Y = C + \overbrace{(r + \delta + \tau)p^H}^{user\ cost\ of\ housing} H \tag{2}$$

From the budget constraint we can see that the household's income and spending equality must hold; the household's income must be equal to its consumption on goods, c, plus its expenditure on housing, $(r + \delta + \tau)p^H H$. The term that captures expenditure on housing includes not only the price of housing, p^H, but also the *user cost of housing*, $(r + \delta + \tau)p^H$. The user cost of housing comes with great interest as it captures the additional costs that come with housing, real mortgage rates (or real interest rate), property depreciation costs, and property taxes. In addition, the housing supply is also captured by, H. To proceed, we will conduct a typical utility maximization problem subject to the household's income constraint by solving the following Lagrangian:

$$\max_{H,C} H^{\eta} C^{1-\eta}$$

s.t.

$$Y = C + (r + \delta + \tau)p^H H$$

The Lagrangian:

$$L = H^{\eta} C^{1-\eta} + \lambda[Y - C - (r + \delta + \tau)p^H H] \tag{3}$$

The following produces the first order conditions:

$$L_H = \eta H^{\eta-1} C^{1-\eta} - (r + \delta + \tau)p^H \lambda = 0$$

$$L_C = (1 - \eta) H^{\eta} C^{-\eta} - \lambda = 0$$

$$L_{\lambda} = Y - C - (r + \delta + \tau)p^H H = 0$$

After some manipulation we can derive the marginal rate of substitution between housing and consumption:

$$\frac{\partial U}{\partial H} / \frac{\partial U}{\partial C} = \frac{\eta H^{\eta-1} C^{1-\eta}}{(1 - \eta) H^{\eta} C^{-\eta}} = (r + \delta + \tau)p^H \tag{4}$$

From the above we can re-arrange and derive the long run demand and price for housing:

$$H^d = \frac{\eta Y}{(r + \delta + \tau)p^H}$$

$$p^H = \frac{\eta Y}{(r + \delta + \tau)H} \tag{5}$$

Therefore, from *(5)* we can see that the long run house price is essentially a ratio between income that's dedicated to housing and the housing supply, which is affected by the user cost terms. As a result, the price of housing *(5)* is quite simple, prices will vary positively with income – holding all else constant, an increase in income leads to an increase in prices – and negatively with the housing stock and the user cost determinants, $(r + \delta + \tau)$ – an increase in the real mortgage rate, increases borrowing costs therefore reducing demand and prices for homes; holding all else constant.

Now that we have a foundation of how house prices are determined, perhaps a more interesting view would be to look at price to income ratios rather than price levels. To do this we can simply re-arrange the house price by dividing by the household's income. This now gives us the long run house-price-to-income ratio.

$$\frac{p^H}{Y} = \frac{\eta}{(r+\delta+\tau)H}$$

We can then transform the above in terms of natural logs:

$$\ln\left(\frac{p^H}{Y}\right) = \ln(\eta) - (\mathrm{r}+\delta+\tau) - \ln H \tag{6}$$

From *(6)* we can see that our equation becomes a semi-elasticity as our user cost, $(\mathrm{r}+\delta+\tau)$, is in level terms. This new equation also tells us that the elasticity of house prices with respect to income is now unity.

Empirical Model and Data

Now that we have our long run house price equation set, we can prepare our error correction model, which will allow us to run a dynamic estimation process on house prices. Therefore, taking the difference between the current house-price-to-income ratio and the long run house price to income ratio we get:

$$\Delta\ln\left(\frac{p_t^H}{Y_t}\right) = -a_1\left(\ln\left(\frac{p_{t-1}^H}{Y_{t-1}}\right) - \ln\overbrace{\left(\frac{p_t^H}{Y_t}\right)}^{Long\ Run}\right) + \sum_{i=1}^{n} b_i z_t$$

$$\Delta\ln\left(\frac{p_t^H}{Y_t}\right) = a_0 - a_1\left[\ln\left(\frac{p_{t-1}^H}{Y_{t-1}}\right) - \overbrace{\frac{a_2}{a_1}(r+\delta+\tau)_{t-1} - \frac{a_3}{a_1}\ln H_{t-1} - \frac{a_4}{a_1}UR_{t-1}}^{Long\ run\ house\ price\ determinants}\right] + \sum_{i=1}^{n} b_i z_t$$

Knowing that our lagged house-price-to-income equilibrium variable and the other long run determinants are stationary, or cointegrated, we can simply transform our error correction model into an OLS. This heavily simplifies our estimation procedure. Therefore, the following equation will become:

$$\Delta \ln\left(\frac{p_t^H}{Y_t}\right) = a_0 - a_1 \ln\frac{p_{t-1}^H}{Y_{t-1}} - a_2(r+\delta+\tau)_{t-1} - a_3 \ln H_{t-1} - a_4 UR_{t-1} + \sum_{i=1}^{n} b_i z_t \qquad (7)$$

The error correction model then shows that a change in the logged house-price-to-income ratio is dependent on the lagged value of our ratio, its long run determinants – user cost, housing supply and unemployment – and a vector of shocks which include changes in our: lagged price-to-income ratio, lagged housing supply, real disposable income, logged Gini coefficient, and senior loan officer survey (SLOS).

House Price to Income Ratio

The house price variable, p_t^H, comes – in part – from Statistics Canada and the Canadian Real Estate Association (CREA). The house price variable was constructed using the average home price in Canada – which was estimated at $720,850 by the CREA (Hughes, 2021) in 2021 – divided by the growth rate of house indices, from Statistics Canada. Working backwards in time, we get a measure of the *house price level,* which is essentially a transformation of the house price index into a dollar value. Our income variable, Y_t, also comes from Statistics Canada, as *implied* household disposable income. This measure was created by dividing gross GDP by Statistics Canada's disposable income measure, which returns disposable incomes as a percentage of GDP. Then, by multiplying the result by nominal GDP, we come to an *implied* measure of household disposable income for Canada. This allows us to simply divide the two measures and log the result giving us, $\ln\left(\frac{p_t^H}{Y_t}\right)$, for the variable used in the estimation.

User Cost

Given our *user cost term*, we need to create a measure to track the three determinants. The real mortgage rate is found by subtracting the nominal mortgage rate by a measure for inflation expectations, giving us the real mortgage rate. Additionally, we add our tax rate, τ, which comes from property tax revenue divided by the *real estate value* – value of housing based on the percentage of disposable income spent on real estate (in dollar terms) – giving us the tax rate on homes. Similarly, by finding depreciation values on properties (in dollar terms) and dividing it by the *real estate value*, we come to our depreciation rate.

Housing Stock

The housing stock variable is easy to understand and extremely useful for theoretical derivation but finding data on such a variable is difficult. To substitute for the lack of a real-life measure of housing stock, we can use our *real estate value* variable from before, along with our *house price level* variable. In this case, we can treat *real estate value* as an aggregate measure – the value of many homes. Since our *house price level* represents the price per home – in dollar values – we can divide the two and multiply by one million to generate an estimation for the number of houses in supply for Canada. Although not a perfect way to estimate the stock of housing, it provides a measure that's relatively easy to understand and interpret.

Shock Variables

Some interesting variables that have been added into the shock vector include the Gini coefficient and the SLOS. The reasoning for the addition of the former comes from an idea hypothesized by Mian, Staub and Sufi (2020), where they discovered a link between, what they call, "the saving glut of the rich" and increased indebtedness from the non-rich. Their paper showed that since the 1980s, there has been an accelerating trend of higher savings for the top 1%, and, at the same time, no large increase in investment. They concluded that the excess savings by the rich has consequently led to lower interest rates and thus, dramatically higher debt accumulation for the bottom 90% of the income distribution. Therefore, we can connect the findings from Mian, Straub and Sufi, back to our paper, by understanding that a fall in the Gini coefficient is correlated with an increase in the savings glut, which induces a lower interest rate and user cost of housing, increasing the price for homes. Accordingly, we would expect our Gini coefficient variable to have a negative effect on our house-price-to-income ratio. In the same fashion, we also included the SLOS, from the Bank of Canada, as a measure of credit tightness. The survey acts as an index on how willing or unwilling banks are with supply credit to consumers, where an increase in the SLOS means greater credit tightness and a lower SLOS means greater credit availability. We would therefore expect to see a negative coefficient on this variable as well. The rest of our shock vector includes the differenced equilibrium determinants, and the change in real income, measured as a change in our implied household disposable income in real terms. Thus, the Gini coefficient and the SLOS act as our credit channels while the rest of our shock variables are simply changes in fundamentals.

Table 1: Summary Statistics

Max	75%	50%	25%	Min	Std	Mean	Count	
0.092	0.014	0.002	-0.008	-0.125	0.022	0.002	125	Change in log House-Price-to-Income ratio
-0.723	-0.980	-1.029	-1.133	-1.253	0.128	-1.036	125	Log House-Price-to-Income ratio (t-1)
0.126	0.077	0.061	0.045	0.024	0.024	0.063	125	User Cost (t-1)
16.324	16.131	16.038	15.937	15.503	0.193	15.992	125	Log Housing Stock (t-1)
13.100	8.770	7.470	6.870	5.600	1.603	7.890	125	Unemployment Rate (t-1)
0.092	0.012	0.002	-0.009	-0.125	0.022	0.002	125	Change in log House-Price-to-Income ratio (t-1)
0.143	0.018	0.006	-0.003	-0.076	0.025	0.006	125	Change in log Housing Stock (t-1)
0.127	0.012	0.007	-0.002	-0.049	0.017	0.006	125	Change in log Real Disposable Income (implied)
0.030	0.000	0.000	0.000	-0.031	0.009	0.000	125	Change in log Gini coefficient (adjusted)
0.556	0.047	-0.014	-0.059	-0.269	0.128	-0.004	125	Change in SLOS

RESULTS

	Dependent variable: Change in log House-Price-to-Income ratio
	(1)
Log House-Price-to-Income ratio (t-1)	-0.037***
	(0.012)
User Cost (t-1)	-0.361***
	(0.108)
Log Housing Stock (t-1)	-0.034**
	(0.015)
Unemployment Rate (t-1)	-0.004***
	(0.001)
Change in log House-Price-to-Income ratio (t-1)	0.812***
	(0.134)
Change in log Housing Stock (t-1)	0.783***
	(0.128)
Change in log Real Disposable Income (implied)	-0.671***
	(0.114)
Change in log Gini coefficient (adjusted)	-0.278*
	(0.141)
Change in SLOS	-0.005
	(0.009)
Observations	118
R^2	0.450
Adjusted R^2	0.405
Residual Std. Error	0.012 (df=108)
F Statistic	9.836*** (df=9; 108)
Note:	*p<0.1; **p<0.05; ***p<0.01

Starting with the adjustment variable, lagged house-price-to-income ratio, it appears to be significant at the 99 percent confidence level, and negative. The coefficient gives us the speed at which our house-price-to-income ratio will adjust back to its long run equilibrium level after a shock. The negative sign tells us that if the current level of price-to-income is below the long run level, or negative, then the ratio will increase in the next period, slowly pushing prices back to equilibrium. If the current level runs above the equilibrium the negative sign on the coefficient will pull our ratio back down, again towards equilibrium. Thus, the negative sign is what gives us the error correction mechanism, allowing prices to continuously re-adjust over time. The magnitude of our coefficient is also small, -0.037, which tells us, that our house-price-to-income ratio adjusts 3.7 percent, per quarter. In other words, it takes a long time for the price ratio to adjust back to equilibrium given a shock. This result aligns with the previous research, where Kennedy (2021) found an average adjustment speed across the US to be 3.2 percent per quarter.

Our user cost term is also significant and negative, with a coefficient of, -0.361. This result, expectedly, predicts that an increase in the real interest rate, tax rate, and/or depreciation rate will lead to a fall in home prices and therefore, a fall in our house-price-to-income ratio, holding all else constant. Our logged housing stock variable holds a significant and negative coefficient, -0.0341, at the 95% confidence level. This shows that, when all else is constant, an increase in housing supply will reduce house prices. The lagged unemployment variable also holds a negative sign and, while small, is significant. Once again, this result is to be expected, as an increase in unemployment rate is usually accompanied by a weak economy, putting downward pressure on the demand for housing and with it, prices. We can also see that our long run constraint of unity *(6)* also holds with the empirical evidence, as the coefficient on our adjustment term – house-price-to-income ratio – divided by our housing stock coefficient is roughly equal to one.

For our shock variables, we see that all but our SLOS variable is significant. Although the negative sign on our SLOS variable is expected, the magnitude of its effects is extremely small, with a coefficient of, 0.005. For the other terms in our shock vector, we see significant and large results for the lagged percentage changes in the house-price-to-income ratio, housing stock, real *implied* disposable income, and Gini coefficient. Interestingly, the sign and significance on our Gini coefficient term, shows the effects described by Mian, Straub and Sufi (2020) but differ from the works of Kennedy (2021) and Kösem (2019); both of which find that an increase in income inequality – or a decrease in the Gini coefficient – will lead to lower incomes, for most households, inducing a decrease in demand and therefore a decrease in house prices. Another important note is the large and positive coefficient on our *Change in Log House-Price-to-Income ratio*, which tells us that our price-to-income ratio will tend to overshoot when adjusting to equilibrium (Kennedy, 2021).

A quick point to note is that the regression only used data up to 2019, leaving out the 2021 data. This was done because the results of the OLS were more significant without the inclusion of 2021. The less significant results were likely due to endpoint issues, as COVID-19 has heavily distorted the data in 2021, impacting the fit of our regression, and the output of our dynamic model (presented below).

DYNAMIC HOUSE PRICE ESTIMATION

Now that we have the regression results, we can begin our dynamic house price model. For easier notation we let, $\frac{p_t^H}{Y_t} = py$. This will allow us change our equation from before to the following:

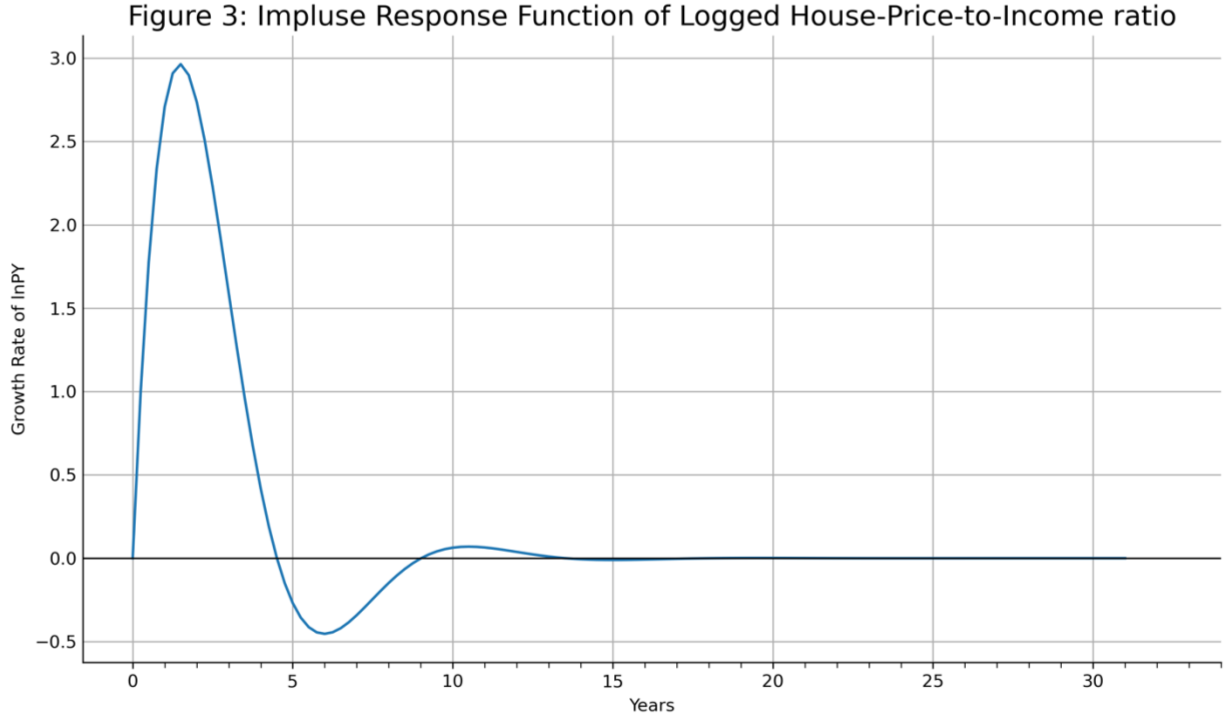
$$\Delta \ln py = -\lambda \ln py_{t-1} + \alpha\, \Delta \ln py_{t-1} + \sum_{i=1}^{n} b_i z_t + const.$$

$$\ln py - \ln py_{t-1} = \lambda \ln py_{t-1} + \alpha \ln py_{t-1} - \alpha \ln py_{t-2} + \sum_{i=1}^{n} b_i z_t + const.$$

$$\ln py = (1 - \lambda + \alpha) \ln py_{t-1} - \alpha \ln py_{t-2} + \sum_{i=1}^{n} b_i z_t + const. \tag{8}$$

To dynamically compute this model, we will feed data into the model for the first two periods and, for the preceding periods, our model will use the estimated house-price-to-income ratio from the period prior. Our shock variables will continue to be fed the data. This process creates the dynamics of our model, as the next period relies on the prediction

Figure 3: Impluse Response Function of Logged House-Price-to-Income ratio



of the last period. The system described above will be conducted in Python, where the process will be turned into a function, which allows the following to be easily reproduced and adjusted.

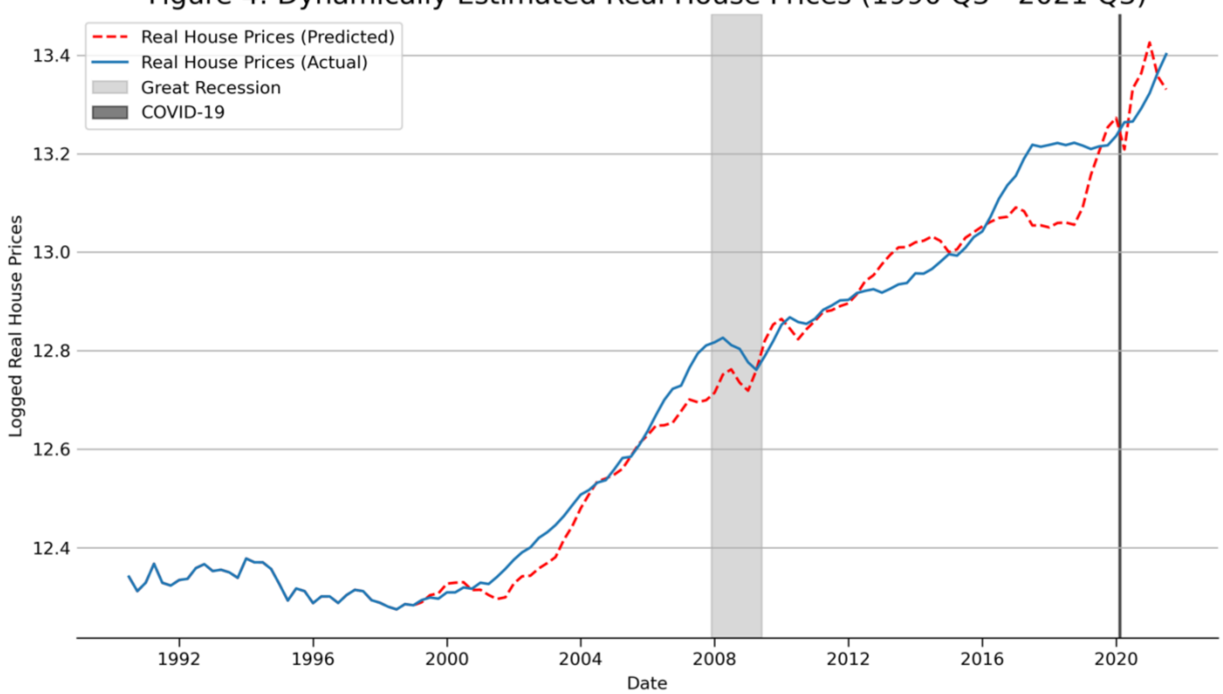
Results from the Dynamic Model

We can use the equation 8 from above – excluding the shock terms and the constant – to analyze how the house-price-to-income responds to sudden shocks to the house-price-to-income ratio. This is done by assuming that the ratio starts in equilibrium and then experiences a shock in the next period. The following procedure will create an impulse response function, which shows the adjustment time and pattern of the house-price-to-income ratio, when knocked out of equilibrium. In Figure 3 we can see house-price-to-income ratios start in equilibrium, then a shock to prices is implemented which launches the house-price-to-income ratio up, peaking in the sixth quarter, before falling back down. Rather than returning to equilibrium, the house-price-to-income ratio slightly overshoots, causing a period of negative growth – about 4.5 years – before slightly overshooting two more times until finally, resting at its equilibrium level. In total, this simulated shock took around 17 years to recover from. The lengthy recovery time and the overshooting tendency is similar to what Kennedy (2021) and Abraham and Hendershott's (1996) found, when modelling at the state level. The causes of overshooting have also been previously explored; most of which can be explained by inefficient markets (Case and Shiller, 1989) and restrictive supply (Capozza et al., 2002), captured in our model by the change in the price-to-income ratio.

A slightly more interesting exercise would be to use equation 8 to plot our house price estimation against actual house prices, over time. To get the estimated results in terms of house price levels, we will simply apply an exponent to our results, multiply it by our *implied* disposable income, and divide by the CPI to bring everything into real terms. We can also turn our actual house price data into real terms and plot both data series against each other to see how they compare. For a more interpretable measure, both predicted and actual house prices become logged. It should also be noted that the dynamic process begins in the second quarter of 1999, and not at the beginning of the data. This was done because of some issues with the estimation results between 1997 to 2000.

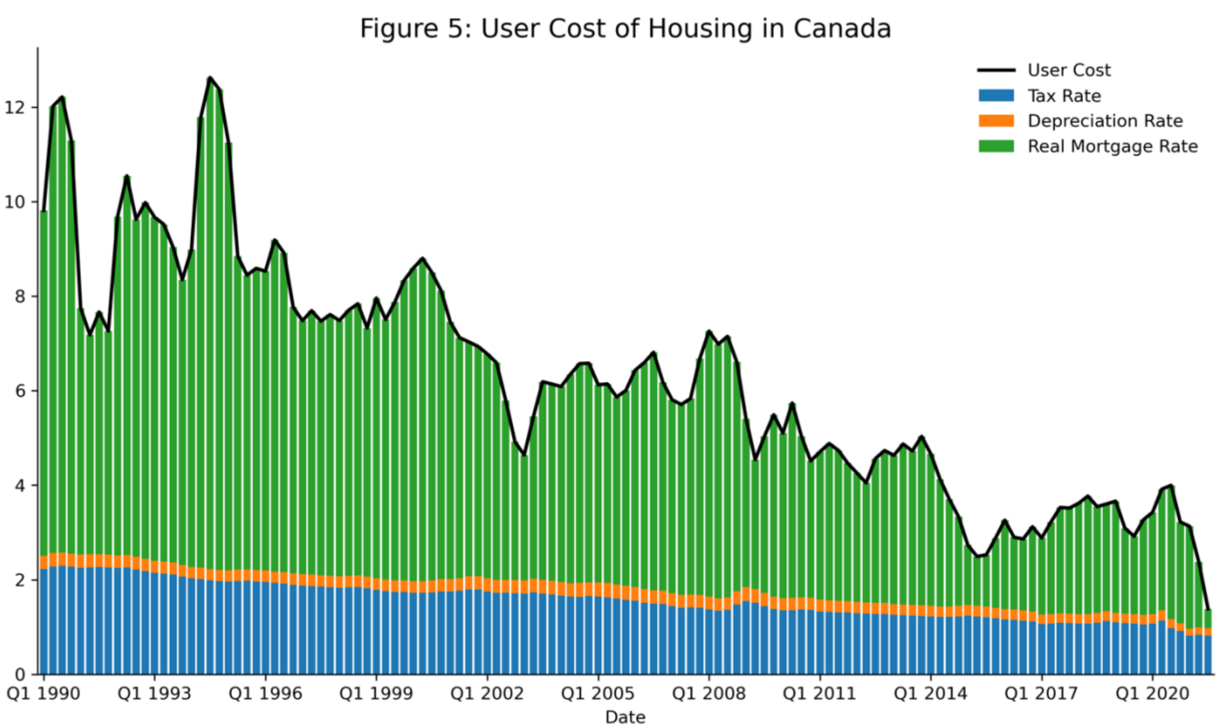
From the dynamic estimation (Figure 4), we can see that the estimation tracks our actual prices quite well. Looking more closely we can see a growing gap between our two series leading up to the Great Recession, and then a convergence post-recession. The divergence between our actual house prices – the market value – and our predicted prices – the fundamental value – show strong signs of over-valuation in the housing market. This tells a simple but important story, that Canadian house prices were in fact over-valued during this period. Looking back at Figure 1, we can see that although Canada's boom and bust was not as large as the US, market speculation on house prices was still prevalent. Another interesting result from our predicted time series is the dip, peak, and dip, that

Figure 4: Dynamically Estimated Real House Prices (1990 Q3 - 2021 Q3)



happens right after the start of the COVID-19 pandemic. By comparison, reality shows that house prices had completely ignored the effects of the pandemic and continued to climb.

Looking past the beginning of COVID-19, some concerning signs begin to appear, namely the growing gap between our actual and predicted prices. It may be tempting to look at this result as a sign of another housing bubble. However, it is important to not read to closely into this result. For one, the model was only regressed to 2019, meaning that the model's parameters do not account for years of 2020 and 2021. The lack of data on the years following the pandemic weakens our model's ability to accurately estimate in the end range. It should also be noted that the effects of the pandemic on household income, would

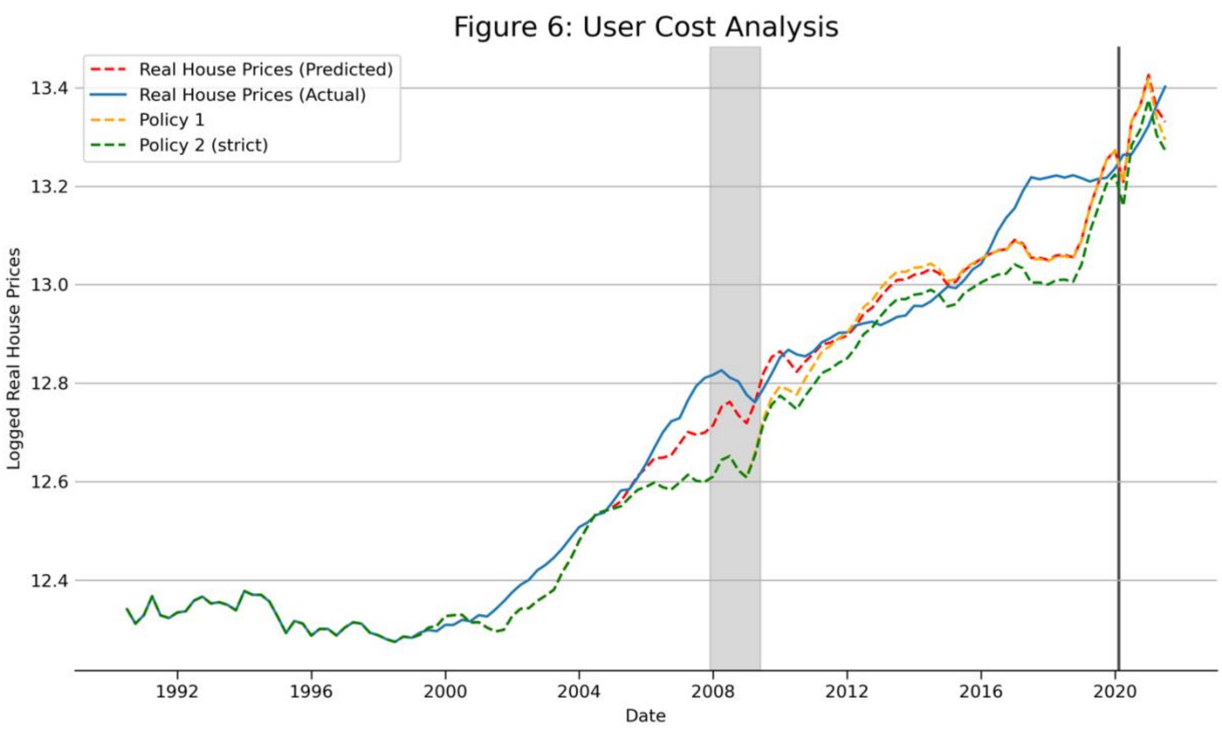


have been a large factor in the regressive behaviour shown by the dynamic model, as well as the plethora of economic shocks induced by the pandemic. As Nobel laureate Paul Krugman put it, much of the current spike in housing prices has to do with the irresponsiveness of housing supply, due to the on-going supply chain disruptions and rising construction costs (Krugman, 2022). This accounts that high house prices is more of a supply issue than a bubble. Falling user costs, has also been a strong determinant in house price growth, and especially so during the pandemic, due to monetary easing. Figure 5 shows that most of the change in user cost comes from the decrease in the real mortgage rate, and our results in Table 2, show the strength that falling user costs have on pushing up house prices. Therefore, we can see that increasing prices is a multi-faceted issue, some of which is caused by fundamental changes (user cost) and some from exogenous shocks to the economy (the pandemic). Next, we can look at how monetary policy can be used to affect current house prices in Canada, and whether it could have prevented the bubble in 2008.

Policy Analysis

Now that we have observed that house prices were in fact over-valued in Canada, it begs the question of whether tighter monetary policy could have been used to prevent the housing bubble. To answer this, we can create two policy scenarios, run it through our dynamic model, and analyze the results. In order to implement the effects of tighter monetary policy, we can simply change the value of our user cost since it includes our real mortgage rate variable. This exercise will require some assumptions. The first is that the central bank can target real – rather than nominal – interest rates. Second, we will assume that the central bank is able to accurately predict future economic events. Lastly, we will assume that the transmission period of policy implementation is instantaneous, meaning that changes in the overnight rate, are immediately reflected in a change in our real mortgage rate. Under these assumptions we will create two policy scenarios. The first scenario will see an increase in interest rates by 100 basis points starting in 2005 and ending in 2008. The policy rate will then be left unchanged until 2021, where the central bank will then raise rates by 200 basis points to target inflation. The second scenario will represent more stringent monetary policy, where rates will go up by 100 basis points from 2005 to 2008, but in the following years, rates will only drop by 50 basis points. In 2021 rates will increase again but only by 50 basis points.

The results of the following scenarios can be seen in Figure 5. We can see that in both scenarios, the increase in rates, has a strong and negative effect on real house prices. This result confirms that tighter monetary policy would have dampened house price growth, reducing the risk of a bubble. We can also observe that even after our rate hike ends for our first scenario (in yellow) it still takes around a year for prices to increase beyond our second scenario line (in green). Our "Policy 1" prices also present some more interesting behaviour as it overshoots our baseline case (in red) in 2012. This result shows the interesting effects of house prices rebounding – or overshooting – after being



suppressed by higher interest rates. We can also note that this behaviour is what we have already seen from our impulse response function (Figure 3) but inversed. Then, in 2021, we see our first scenario depart from our baseline case due to the aggressive, 200 basis points, interest rate hike. Interestingly, even though the interest rate response to COVID-19 in the second scenario was less severe than in our first scenario, it is able to keep prices lower. Therefore, our second scenario shows that the more stringent policy creates a more consistent time path, that remains below the baseline case and our first policy scenario for the whole time period.

Although, our model has shown that strict monetary policy would have been effective in curbing the housing price boom, the act of doing so is no “free lunch”. One important fact to note about tightening lending markets, is its universal effects. In the case of the Great Recession, if the central bank did raise rates – to deter speculative investment in housing – it would have supressed house prices, but it would have also likely devastated the rest of the economy. With this respect we can see that a major issue with monetary policy is that its effects are “blunt”. Monetary tightening would also fail in a situation where housing demand comes from foreign investment, as domestic policy would not only be ineffective but harmful to domestic buyers (Lo Duca and Nicoletti-Altimari, 2019). Furthermore, in situations with foreign investors or investors reliant on non-domestic funding sources, monetary policy can create unequal conditions for buyers, and negatively impact housing affordability (Lo Duca and Nicoletti-Altimari, 2019). Therefore, another option for a similar result could come from tax policy, specifically increases in property taxes. Conveniently, our model would treat an increase in taxation rates similarly, as both the effects of interest rates and tax rates come from our user cost term.

CONCLUSION

Our results from the model have shown that: (i) house prices were over-valued during the Great recession, (ii) much of the house price growth during the pandemic can be attributed to falling user costs, as well as, the exogenous shocks induced by the pandemic, and (iii) monetary policy would have been effective in taming house prices during the 2008 housing boom, but the “bluntness” of its effects should be cautioned.

Our first result clearly showed that our dynamic model, which tracks the fundamental value of homes, was well below actual house prices leading up to the Great Recession. The disparity between the two plots confirms that there were factors – unobserved by our model – influencing house price growth, primarily of which was speculation. Our error correction model also gave insight on the behaviour of house prices, namely the speed and path prices take when adjusting to equilibrium, given an exogenous shock. The model’s results also showed the vector our various house price determinants had on house prices, giving perspective on how changes in fundamentals can affect house prices.

The model can also explain some of the fundamental drivers that continue to prop up strong price growth. For one, we have seen, in Figure 5, that monetary policy has continuously led to lower user costs. Housing supply has also failed to keep up with demand, aligning with past research, which have all pointed to inelastic housing supply. In addition, the impact of the pandemic has exacerbated both the effects of low interest rates, as interest rates have plummeted in order to heat up the economy, and inelastic supply, due to faltering supply chains. Whether or not we are in the middle of another housing bubble remains unclear, due to the pandemic’s effects on fundamentals. The worrying signs of a bubble, given by the model, should also be taken with caution as the limited data post pandemic and the exclusion of other potentially important variables (namely supply-side factors) suggests potential inaccuracies in this model.

Lastly, although our model has shown the effectiveness of monetary policy, in both taming the housing boom from 2008 and during the pandemic. The use of policy for controlling sectoral price stability could be inappropriate and detrimental for other parts of the economy. As suggested above, increases in property taxes could be a more targeted and effective policy measure for inducing price stability in the housing market.

Future research could provide a better picture of current and past events by using a more detailed, regional level, model as well as having the luxury of more data for the post pandemic housing market.

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