

The Canadian Housing Markets:

An analysis on the key-drivers

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Abstract

The Canadian housing markets have experienced a tremendous growth over the past decades, especially in the Greater Toronto Area (GTA) and the Greater Vancouver Area (GVA). Properties valued at 250,000 CAD in the GTA in 2001 are worth \$700,000 today. In the same period, the average housing price in the GVA roared all the way from \$300,000 to \$900,000.¹² As housing prices continues to escalate, the affordability problem for many Canadian families has greatly worsened. In an effort to suggest effective solutions to this issue, this report will analyze the current Canadian housing markets from both the demand and supply perspective and ultimately determine the key drivers behind the booming real estate markets in the GTA and the GVA.

¹ Data source: Toronto Real Estate Board and Real Estate Board of Greater Vancouver

² All dollar signs represent Canadian dollars unless specifically stated

1.1 Housing Demand Variables

In this chapter, the impacts of both local housing demand and the housing external from outside of Canada will be examined. In order to quantify both of the demand, the purchasing power, a dollar amount that illustrates the maximum value of residential properties a household or person is able to purchase, is introduced. In particular, the local purchasing power is affected by income and mortgage rates, and the external purchasing power mainly consists of three components: direct foreign investments, immigration, and international students.

1.11 Purchasing Power Calculation

Local Purchasing Power

Median household income, down payment percentage and mortgage rate are all factors that contribute to the local purchasing power. With reference to both the CIBC and BMO mortgage affordability calculators, a relationship between annual household income (a) and the maximum monthly payment is found:

$$\text{Maximum Monthly Payment} = a \times 0.0267$$

Assume a typical family uses 5-year fixed mortgage rates (r) with 25-year mortgage payment length, the total mortgage available according to the annuity due formula will be:

Mortgage Available Max =

$$a * 0.0267 * (1 - (1 / (1 + ((1 + r/2)^{(1/6)} - 1)))^{300}) / ((1 + r/2)^{(1/6)} - 1).$$

Assume all families pay a 10% downpayment. Thus the final local purchasing power will be:

Local purchasing power =

$$(10/9) * a * 0.0267 * (1 - (1 / (1 + ((1 + r/2)^{(1/6)} - 1)))^{300}) / ((1 + r/2)^{(1/6)} - 1).^3$$

External Purchasing Power

While the calculation of local purchasing power is relatively straightforward, there is no equation for external purchasing power since it is influenced by a variety of factors, both directly and indirectly. In general, the external purchasing power is greatly affected by foreign investments, the number of international students and immigrants, and the exchange rates. The impact of each of these factors will be explained in detail in section 1.14.

1.12 Local Purchasing Power: Direct Impacts of Income and Mortgage Rates

From the calculation of the local purchasing power, it can be seen that while the increase of household income has a positive impact on the purchasing ability of the local residents, the increase of mortgage rates decreases the residents' purchasing ability by

³ Due to the limitation of data resources, median household income is used instead of average household income.

increasing the interest of their mortgage payments. To further illustrate how these two factors have contributed to the overall purchasing power, we have collected the historical five-year fixed mortgage rates as well as medium household income. The corresponding purchasing power in each year was then calculated using the local purchasing power formula. The results are shown as below.

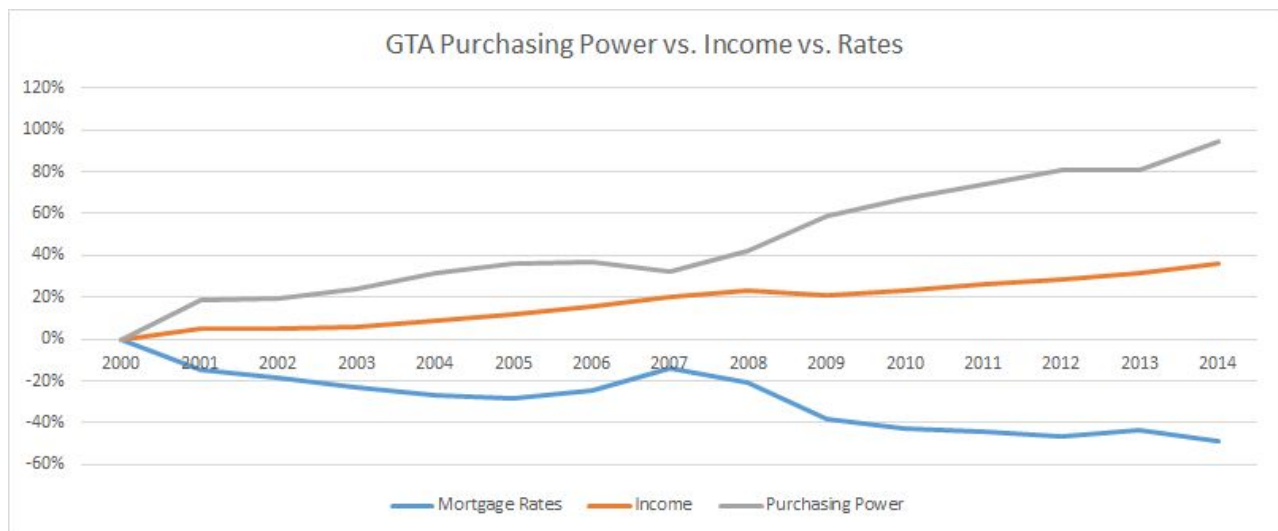


Figure 1⁴

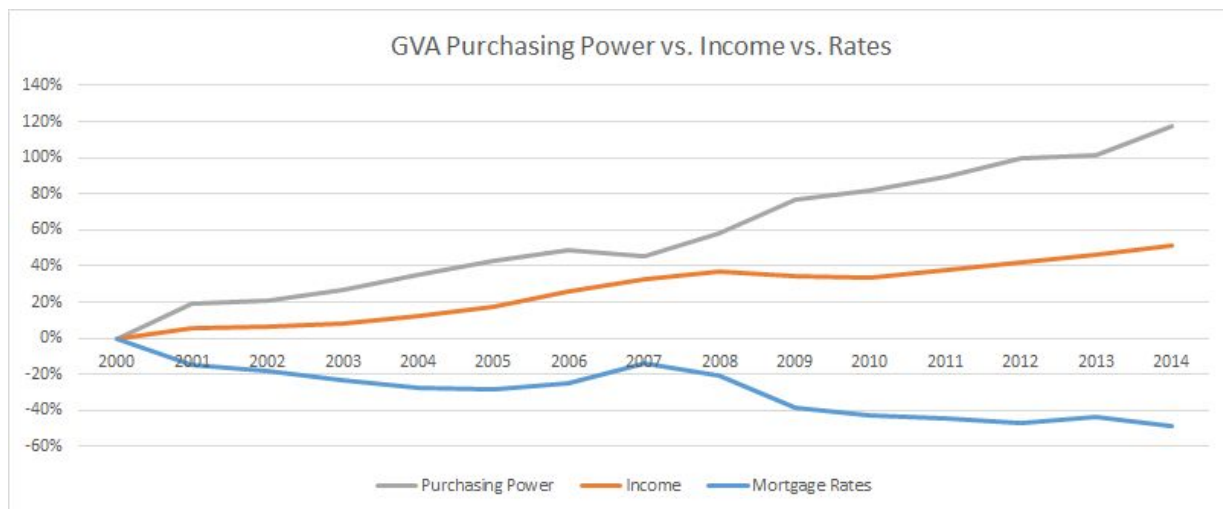


Figure 2

⁴ Primary data source for Figure 1-2: Bank of Canada and Statistics Canada

Figure 1 and 2 show the percentage changes of purchasing power, income and mortgage rates over the years. Although the purchasing power in both the GTA and the GVA have increased relative to 2000, there was a more significant change in the GVA market (120%) than in the GTA market (80%). Given the fact that household incomes in the GVA (50%) have increased more rapidly than the incomes in the GTA (40%) and that both cities share the same mortgage rates, it is easy to conclude the positive correlation between income and purchasing power. Moreover, it was observed that during 2006 to 2007, the purchasing power in both areas slumped while household incomes grew. Based on the previous conclusion that mortgage rates have a negative impact on local purchasing power, we can attribute this change to the sudden increase in the mortgage rates in both cities.

1.13 Local Purchasing Power vs. Price Analysis

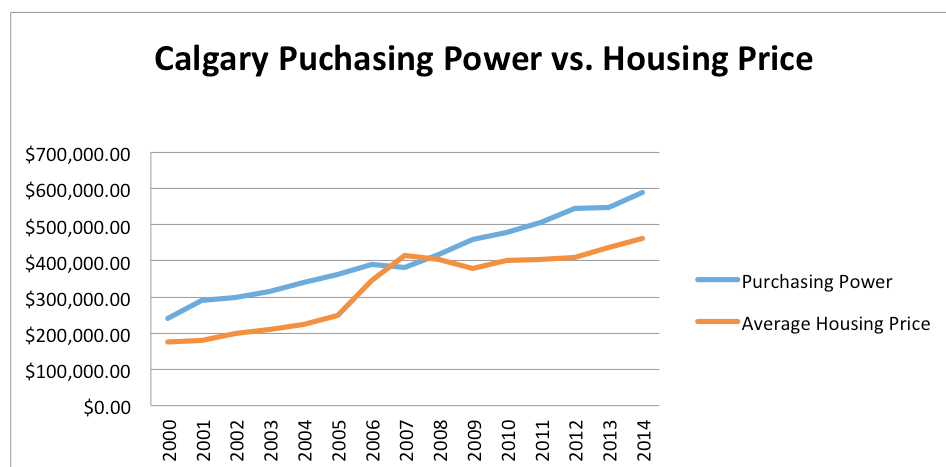


Figure 3⁵

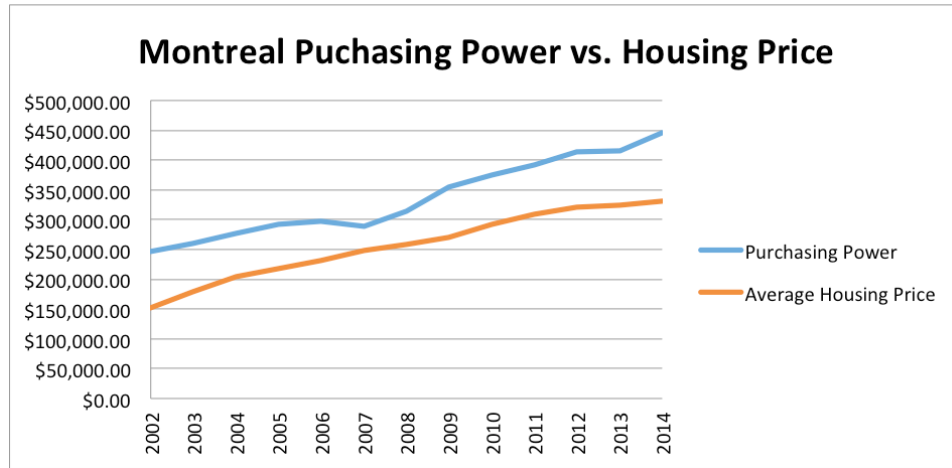


Figure 4⁶

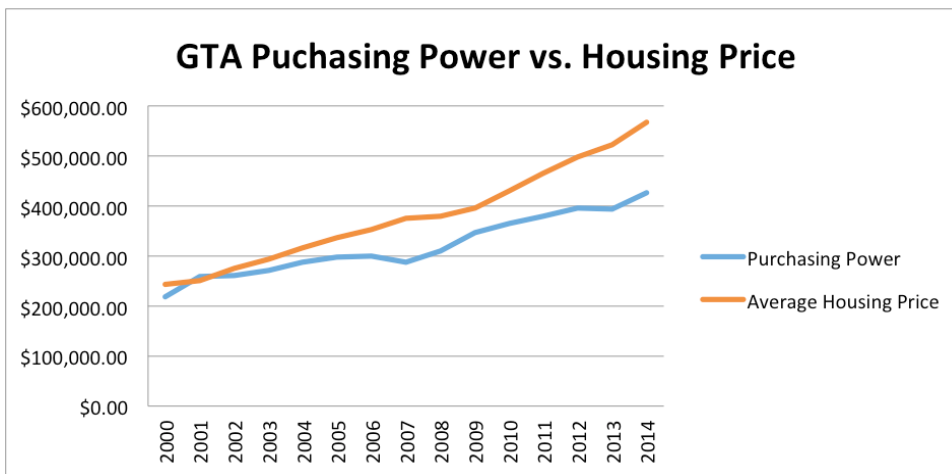


Figure 5⁷

⁵ Primary data source: torontocondobubble.com, CREA, Statistics Canada and Bank of Canada

⁶ Primary data source: CMHC, CREA, Statistics Canada and Bank of Canada

⁷ Primary data source: TREB, Statistics Canada and Bank of Canada

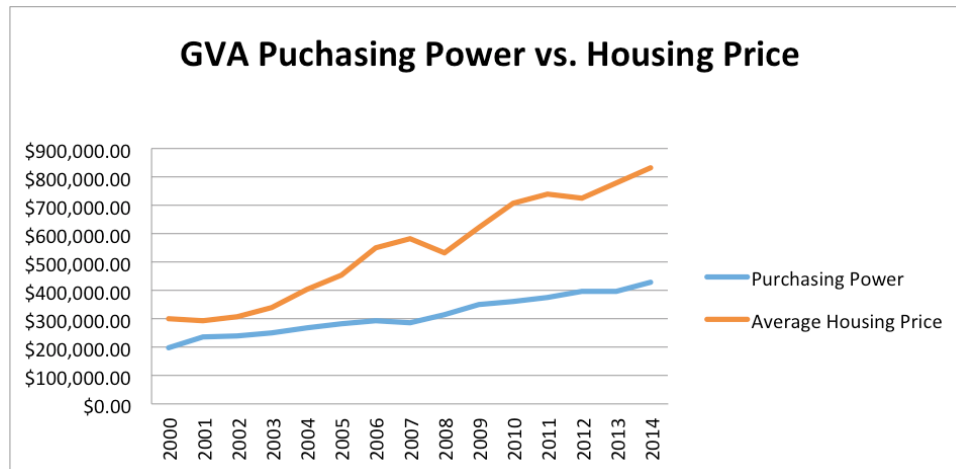


Figure 6⁸

By comparing purchasing power and housing prices in metropolitan areas including Calgary, Montreal, Toronto and Vancouver, distinct irregularities were found despite the fact that both the local purchasing power and the housing prices increased significantly in all four cities.

We first note that unlike Calgary and Montreal, the GTA and the GVA's housing prices are above their purchasing power. Not only this, but the gap between the two is widening. In an economy without any influences from other countries, purchasing power of local residents should not be lower than the price of houses, as price acts as an equilibrium point between supply and demand. However, the increasing difference within the two variables in the GTA and the GVA start in a range of \$50,000-\$100,000 in 2000 to a difference of over \$100,000 in 2014, showing that there must be external factor(s) from outside of Canada that filled in the gap between local purchasing power and housing

⁸ Primary data source: REBGV, Statistics Canada and Bank of Canada

prices. Such result require further investigation into the trends of external forces within the four areas and will be explained in details in the next section 1.14.

On the other hand, Calgary and Montreal's purchasing power is usually \$50,000-\$100,000 above the average housing price. However, between the years 2005 to 2007, the growth of the house prices in Calgary sped up significantly, and in 2007 even exceeded its purchasing power. As we know, the oil industry has always made up a big proportion of Alberta's economy - in 2007, the oil and gas sector (excluding related activities) alone accounted for about 28% of Alberta's GDP⁹. Thus, we analyzed the trends in oil price from 1980 to 2016 from the graph below to see if there was any correlation between the oil price and Calgary's housing prices.

⁹ Data Source: Alberta Finance publication <http://www.assembly.ab.ca/lao/library/egovdocs/2007/altd/167217.pdf>



Figure 7¹⁰

From Figure 7, we note that since 1986, the oil price had been lower than 40 dollars per barrel for most of the time until 2001. Thus, the oil companies in Alberta must have been hesitant to increase any investments when the oil price first started to climb in 2002. However, as the price continued to escalate, more companies expanded their investments in oil exploration, extraction, refining, and transporting, increasing the amount of opportunities within the oil industry as well as other related industries. This led to a forecast for higher household income as well as an increase in incoming workers. Both of these factors would significantly boost the housing demand in Calgary. Additionally,

¹⁰ Source: <http://www.macrotrends.net/1369/crude-oil-price-history-chart>

among all the newcomers in Alberta, many of them were from overseas and were able to spend their savings in other countries to invest in Canadian real estate properties, adding an extra layer of purchasing power on top of the local one. Such trend will be discussed in details in the next section 1.14. Moreover, the positive correlation between the oil price and the housing market in Calgary can be further verified as the the oil price suddenly dropped during the 2008 economic crisis as the housing price in Calgary immediately decreased as well.

1.14 External Purchasing Power

As mentioned previously in section 1.13, the purchasing power for real estate properties should not exceed the actual housing price, but it is shown in Figure 5 & 6 that in both the GTA and the GVA, the residential prices have risen far beyond the local purchasing power. Unlike the housing market in Montreal and Calgary, the market in Toronto and Vancouver is strongly influenced by another crucial force - the external purchasing power. Although the data for foreign investors is unavailable, we have analysed the trends in exchange rates as well as the numbers of immigrants and international students in Montreal, Calgary, Vancouver, and Toronto over the years. Detailed analysis on how these factors contribute to the external purchasing power is explained in the following sections.

1.141 Trends in Exchange Rates

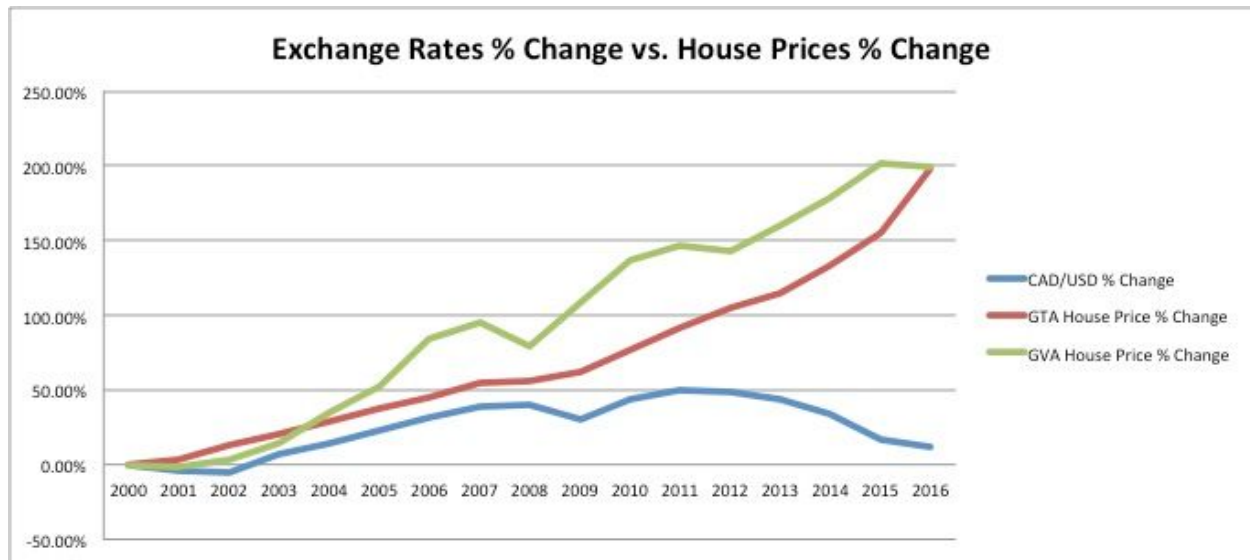


Figure 8¹¹

The changes in the exchange rates can directly affect the external purchasing power on the housing markets, since Canadian dollars are not commonly held by foreign investors. A lower exchange rate between Canadian dollars and other currencies will boost the purchasing power of foreign investors or homebuyers, and vice versa. Figure 8 shows that the yearly average exchange rate between Canadian dollars and US dollars reached its historical highest point in 2011 and since then it has been depreciated more than 25% until 2016. At the same time, the housing price in the GTA increased by 56%, and the GVA shared a similar trend with a 21% increase in the housing price.

¹¹ Primary data source: Tradingeconomics.com, TREB and REBGV

1.142 Trends in Immigration

1.1421 Immigration Overall

To investigate the possible impact of immigration on the rise of housing prices, we began by examining the annual immigration to population ratio based on data published by Statistics Canada.

Annual Immigration vs. Population

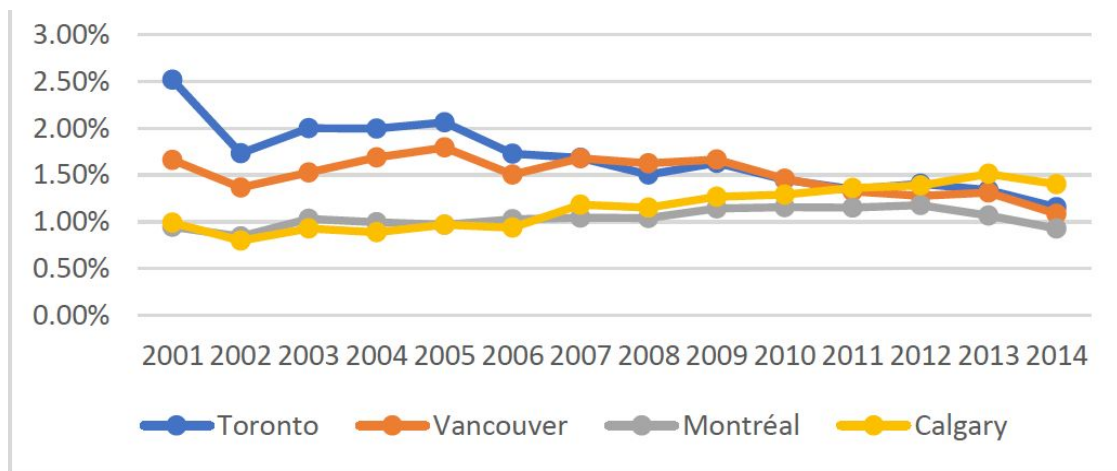


Figure 9¹²

From the data collected, we found that at the year 2001, the annual immigration to population ratio of Toronto topped among the four cities at 2.52%, more than 2.5 times of the Calgary's and Montreal's ratios (0.99% and 0.95%, respectively).

Additionally, as reported by Globe and Mail, new Canadians who initially arrived in Montreal tend to leave Quebec much more often than other cities. This is mainly because Quebec's independent immigration policies made it easier to enter Canada for French

¹² Primary data source for Figure 9-11: Statistics Canada

learners. However, immigrants still tend to settle down in other parts of Canada where there is more opportunities for newcomers.¹³ Thus, the ratio for Montreal should be even lower than the statistics show, which explains why the housing price in Montreal has always been more affordable comparing to other big cities.

Vancouver's corresponding ratio was 1.66%. Though not as high as Toronto's, it was considerably much higher than those of Montreal and Calgary. Such significant difference was presented for at least 7 to 8 years; however, starting from 2009, the trend was altered and the difference between the four cities began converging. During the recent years, few significant differences can be observed, thus leading us to look into the breakdown of immigration components to find out the stories behind.

1.1422 Components of Immigration

By studying the components of population growth table from Statistics Canada, we discovered two important groups of immigrants which could potentially impact our housing markets – skilled workers and business class immigrants. As before, we continue to examine the immigration to population ratio.

¹³ Source:
<http://www.theglobeandmail.com/news/national/new-canadians-love-quebec-but-theyre-leaving-it/article6673482/?page=all>

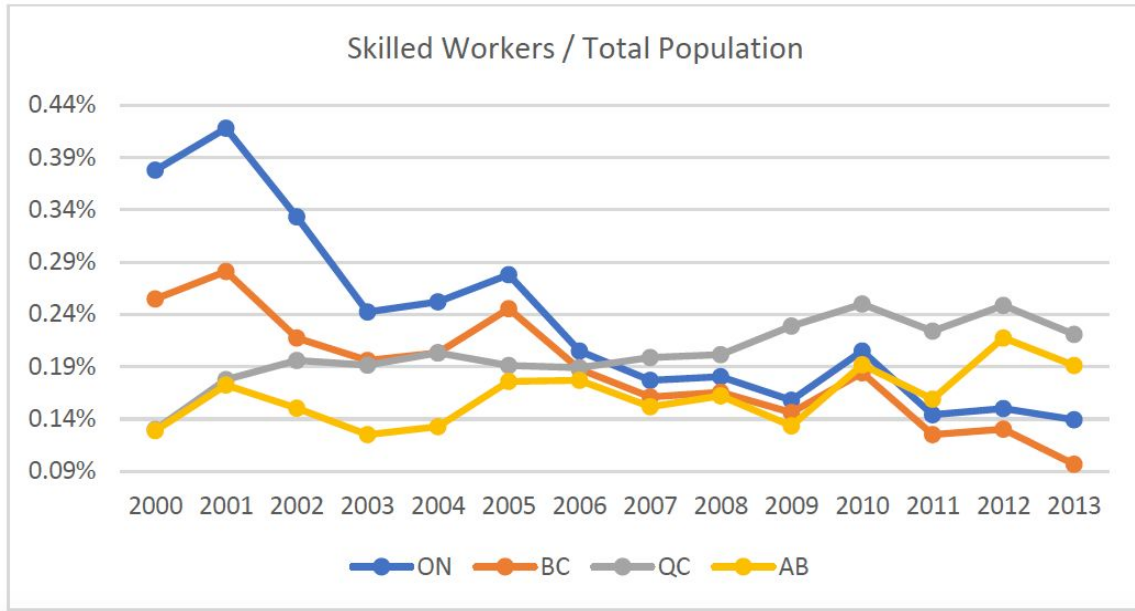


Figure 10

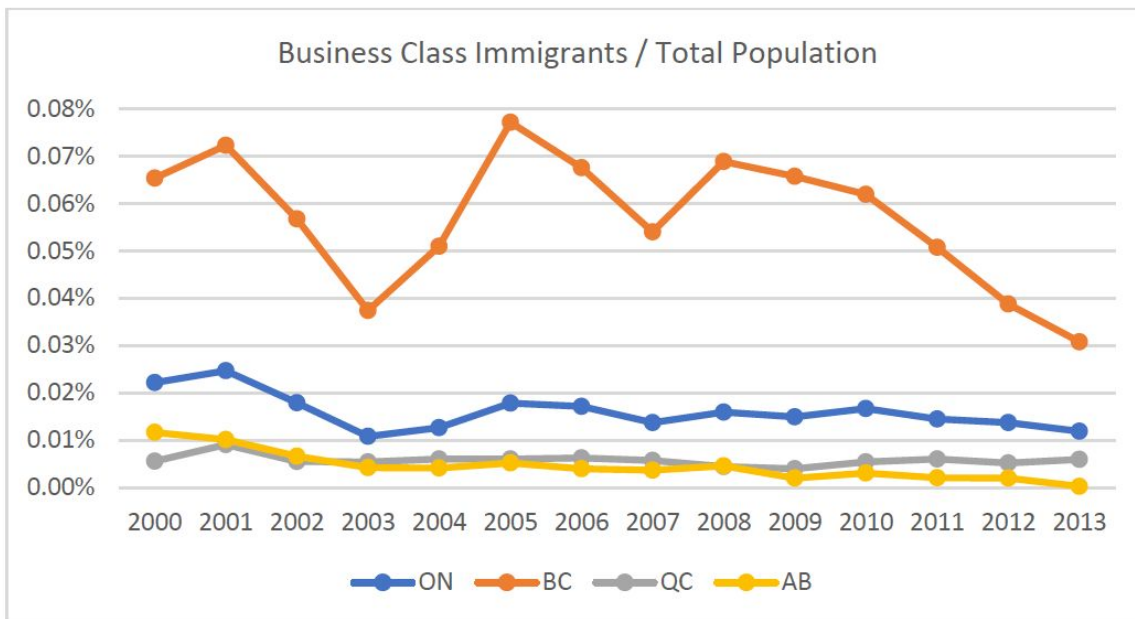


Figure 11

From Figure 11, we immediately observe that the relative amount of business class immigrants¹⁴ in BC exceeds those of other provinces dramatically. Meanwhile, the relative amount of business class immigrants in ON is also at least 1.5 to 2 times as much as Quebec's and Alberta's. We also note that the cities with a widening gap between local purchasing power and housing prices in the previous 1.13 analysis (Toronto and Vancouver) are located in these two provinces respectively, demonstrating a high correlation between business class immigrants and the overall housing demand. Since people falling into the business immigrants category are typically those with high income or high capital¹⁵, and their main focuses are usually on high-value real estates, it would not be surprising if we are able to observe booming high-end real estate markets in BC and ON, especially in Vancouver, BC, where the major Canada's luxury real estate market is located.

Additionally, as previously discussed in section 1.13, the increasing oil price resulted in many new opportunities in Calgary and this trend is also shown in Figure 10. One can observe significant increases in Alberta's number of skilled workers from 2004 to 2005 as well as from 2011 to 2012, when oil price was either escalating or remained high at 100 dollars during this two periods. However, although Alberta and Quebec's amount of

¹⁴ Note: Although we would like our data to be as specific as possible, unfortunately, due to our limited resources, we were not able to find municipal immigration category data for our analysis. Thus, we compromised to use the corresponding provincial data instead. We apologise for any inconvenience, and please let us know as soon as possible if such municipal data is available.

¹⁵ Reference: Statistics Canada Table 054-0004, 054-0006, 054-0012, 054-0014, Income of immigrants

business class immigrants are relatively close to each other, the Quebec's relative amount of skilled workers is always above that of Alberta's. Combined with the performances of the housing markets, this could be an indication that the rise of skilled workers may also contribute to the increase in housing prices, but the impact is relatively limited comparing to the one from business class immigrants.

1.143 Trends in International Students

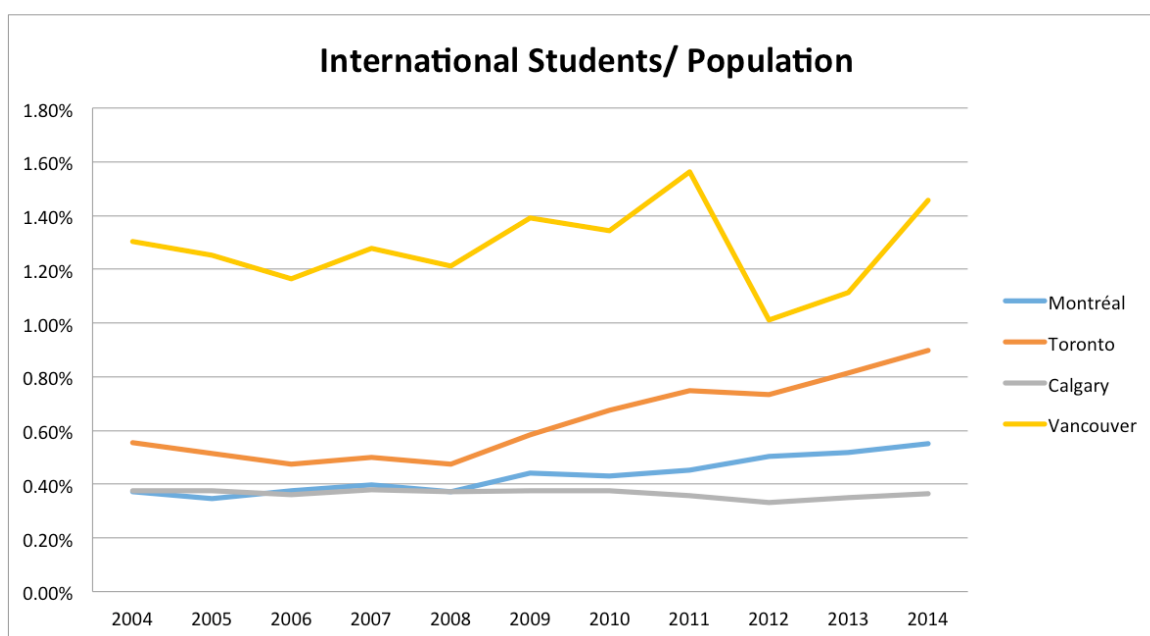


Figure 12¹⁶

In Figure 12, the ratio between total number of study permit holders and total population within each city was calculated. Not surprisingly, Vancouver and Toronto also remained at the top two. According to our previous findings in section 1.13, these two

¹⁶ Primary data source: Canada Immigration and Citizenship and Statistics Canada

cities are also the only one whose housing prices exceed their local purchasing power, contrasting with the housing market in Calgary and Montreal. Thus, we propose that the number of immigrants can have a direct effect on the house price.

Vancouver International Students vs. Business Immigration vs. House Price

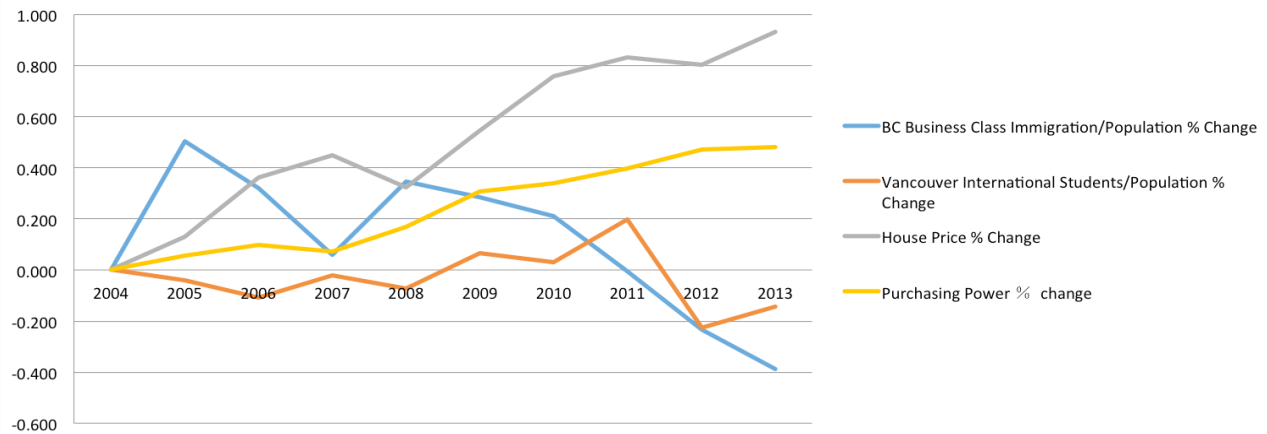


Figure 13¹⁷

Toronto International Students vs. Business Immigration vs. House Price

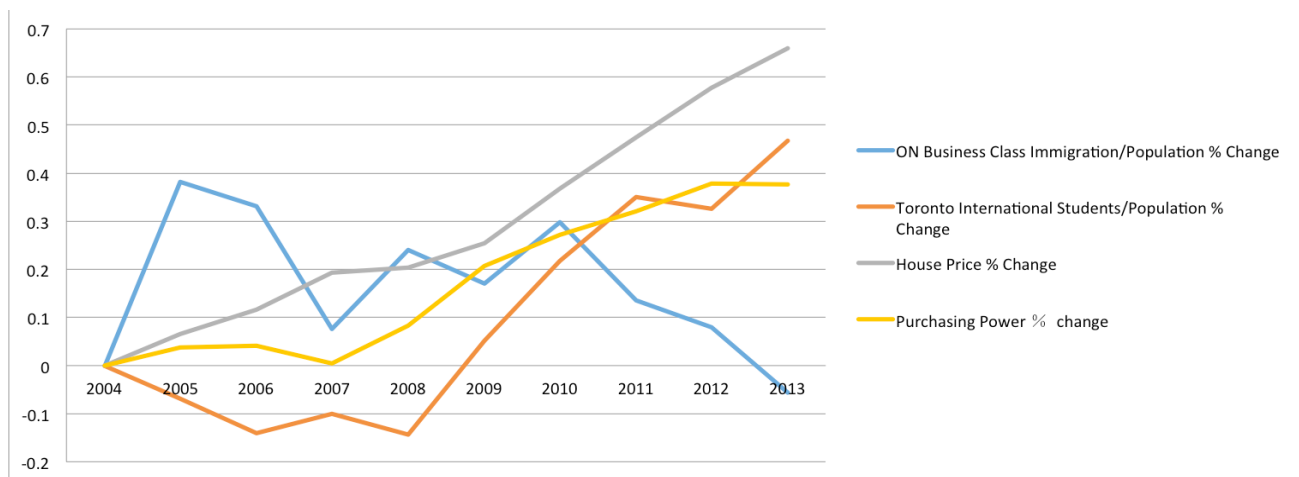


Figure 14

¹⁷ Primary data source for Figure 13 and 14: Statistics Canada, Canada Immigration and Citizenship TREB and REBGV

To further examine our hypothesis, we compared the trends in house price, international students, business immigrants and purchasing power within both Vancouver and Toronto in Figure 13 and 14. Despite the fact that both cities have growing local purchasing power as well as decreasing business immigrants and international students over 2011 and 2012, while the housing price in the GTA continued to climb, there was a significant drop in the price within the GVA. As we further compare the differences between the two graphs, we note that during 2011 and 2012, the number of international students in the GVA decreased much faster than the one in the GTA, with decreasing rates of -34% and -0.01%, respectively, and British Columbia's business immigrants also decreased more than the one in Ontario did, but with a smaller difference in terms of the decreasing rate - Ontario decreased by 3.9% and British Columbia decreased by 22%.¹⁸ Based on these observations, we realize that the decrease in both the number of business immigrants and international students might have caused the GVA's housing price to drop during 2011 and 2012. However, since the change in the international students in the GVA is more significant than the one in business immigrants, as comparing to those numbers in the GTA, the decreasing number of international students might be a crucial factor that contributed to the drop of the housing price in the GVA between 2011 and 2012.

¹⁸ Data source: Statistics Canada and Canada Immigration and Citizenship

1.15 Demand Variables Conclusions

After analyzing the housing market trends in the four cities, we conclude that the housing demand in those cities is affected both locally and externally. While mortgage rates and household income make up the local purchasing power, external factors such as immigration, international students, foreign investments and exchange rates impact the Canadian housing market from outside of Canada. All four cities have distinct features in their composition of the housing demand, but generally speaking, the external impact on the GTA and the GVA markets is much stronger than the one in Calgary and Montreal's markets. Among Calgary and Montreal, while the housing demand in Montreal is contributed mainly from local residents, the change in the oil price can have a significant influence on Calgary's housing markets by affecting both of its local and external purchasing power.

1.2 Housing Supply Variables

Similar to demand, factors related with the housing supply are also expected to contribute to the booming real estate markets in both the GTA and the GVA. As the new supply of residential properties is mainly determined by the builders' profitability from land acquisitions, building, and selling, this chapter will analyze the trends within the two main expenditures for land developers - building cost and land acquisition cost, while assuming builder's profit remains at 20% of the overall sales price.

1.21 Trends in Construction Cost

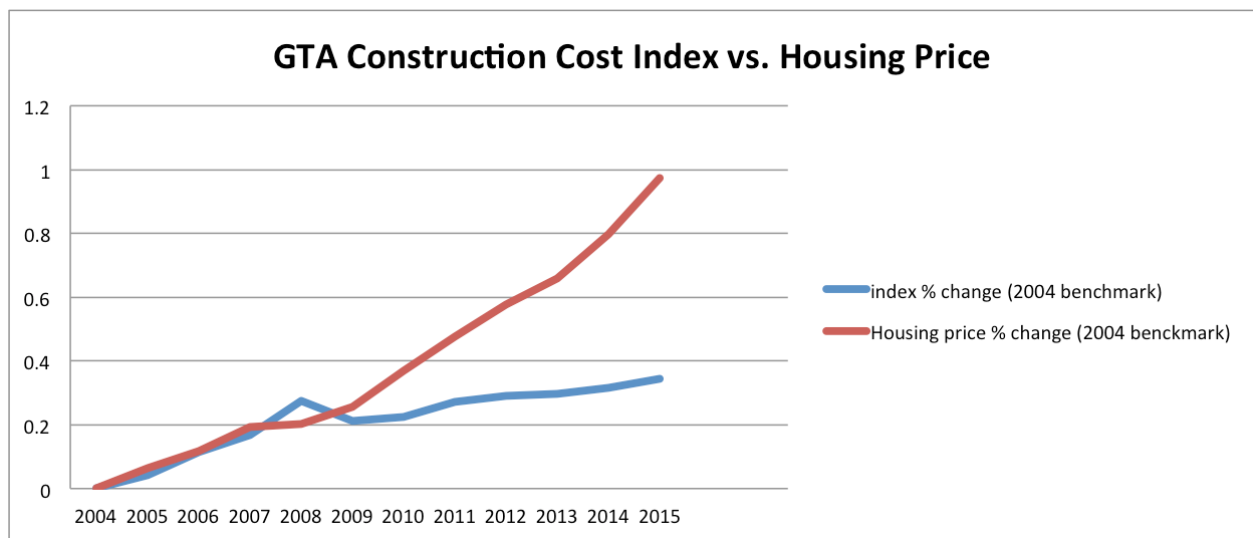


Figure 15¹⁹

¹⁹ Primary data source for Figure 11-12: TREB, REBGV and Statistics Canada

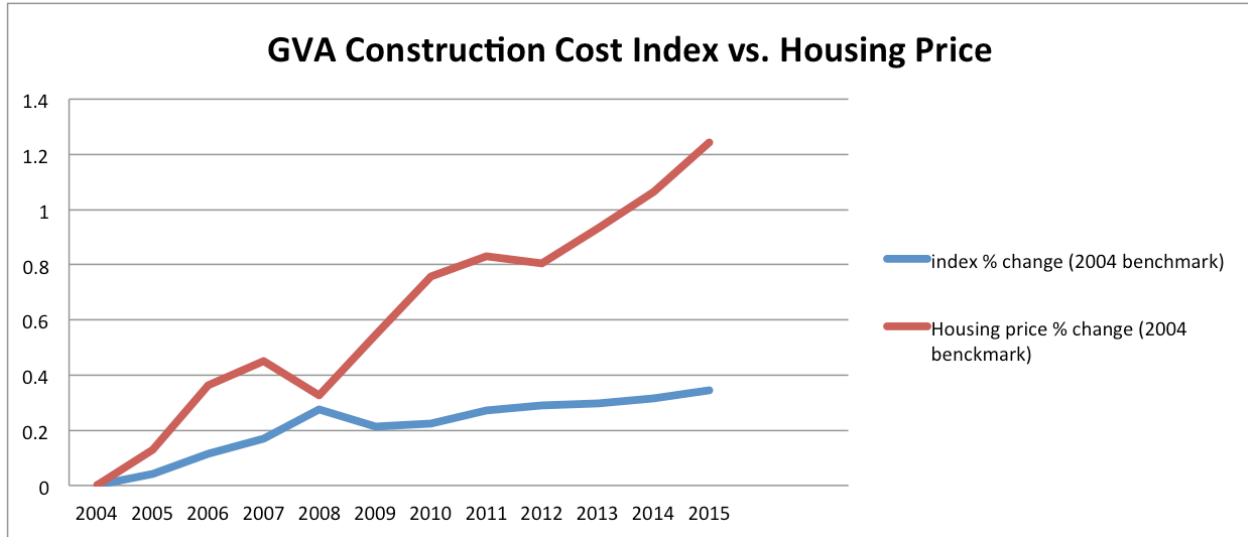


Figure 16

We begin by analyzing the effect of construction costs on the price of housing. Figures 15 and 16 show the percent change of housing prices and the construction cost index in the GTA and the GVA, comparing to their initial numbers in 2004. Using the apartment construction index published by Statistics Canada, we assume the overall construction prices fluctuated with a similar pattern over the years. Though construction costs and house prices appear to have risen in tandem, the increase of housing prices clearly exceeded the rise in construction costs over the last 10 years. Between the years 2004 – 2015, the cost of real estate construction in the GTA rose by approximately 34%. This contrasts sharply with the 97% increase in the GTA housing prices over the same period. At the same time, the construction cost in the GVA shares the same pattern, with a 124% increase in house price but only a 36% increase in the building cost.²⁰

²⁰ Source: TREB, REBGV and Statistics Canada

1.22 Trends in Land Acquisition Cost

As the construction costs in the GTA and the GVA remained stable compared to the roaring housing prices, we continue to examine the trends in builder's ability to acquire land for residential purposes. The costs of property development can be categorized into two main divisions: construction costs (discussed in 1.21), and land costs. Assuming a profit margin of 20%, we estimate the cost of land by subtracting the building cost/m² by the total indoor area of the properties. The results are shown in Figures 17-20.

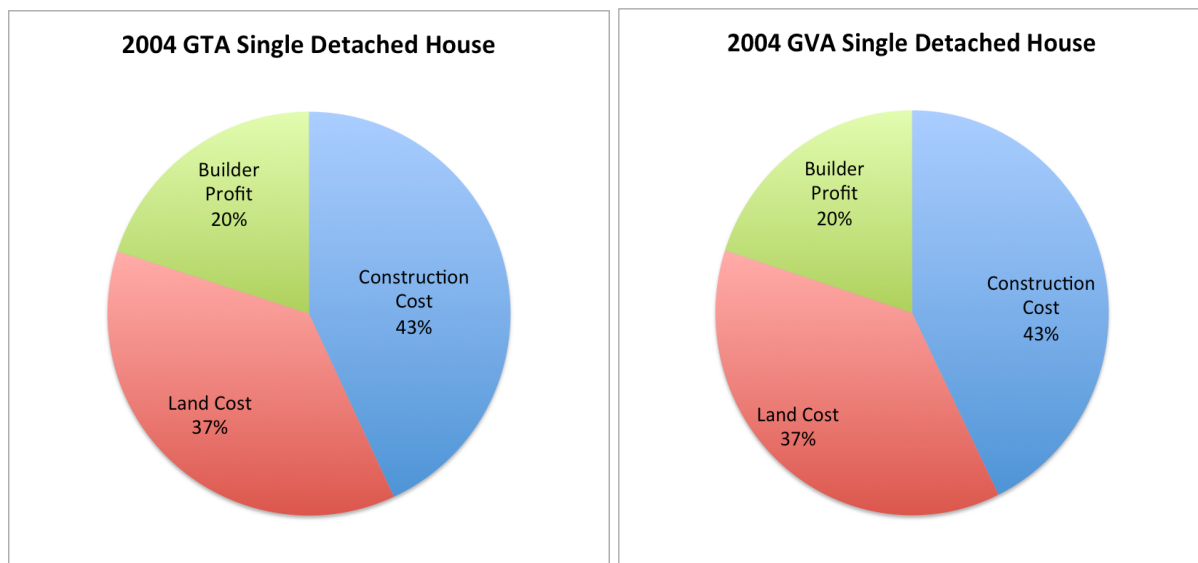


Figure 17-18²¹

²¹ Primary data source for Figure 17-20: ontariocontractors.com, misonet.com, Statistics Canada, callmepower.ca, toronto.ca

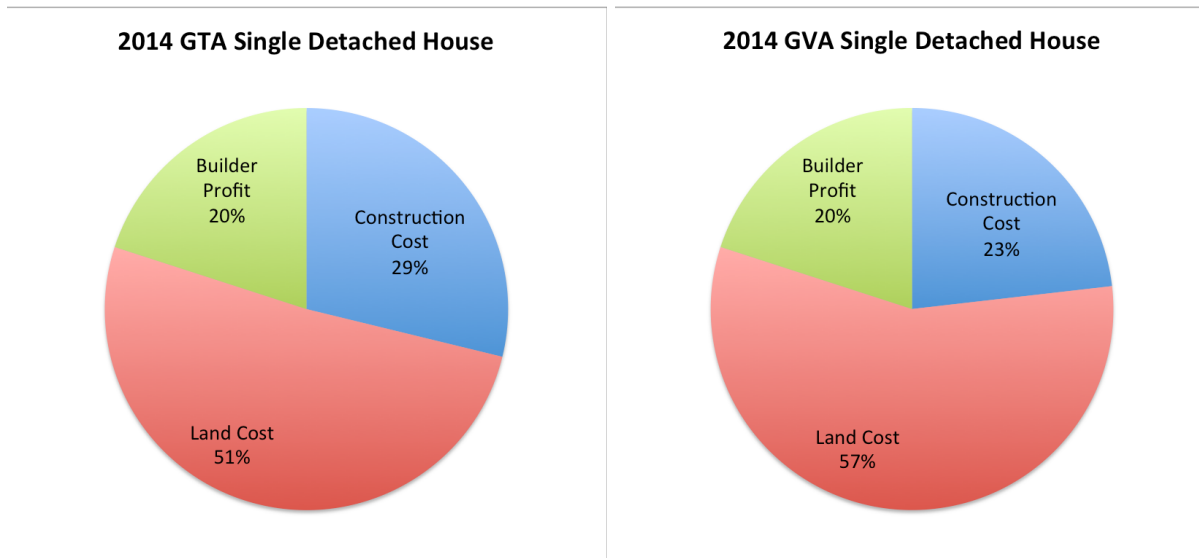


Figure 19-20

In both the GTA and the GVA, the effect of the cost of land rose dramatically between the years of 2004 to 2014. The surge in land costs as part of the total cost suggests that the cost of acquiring land may play a significant role in the growth of housing prices. Such conclusion also lead to a further investigation on the potential causes of the significantly increasing land costs. Details will be explained in the following sections.

1.23 Trends in New Housing Starts

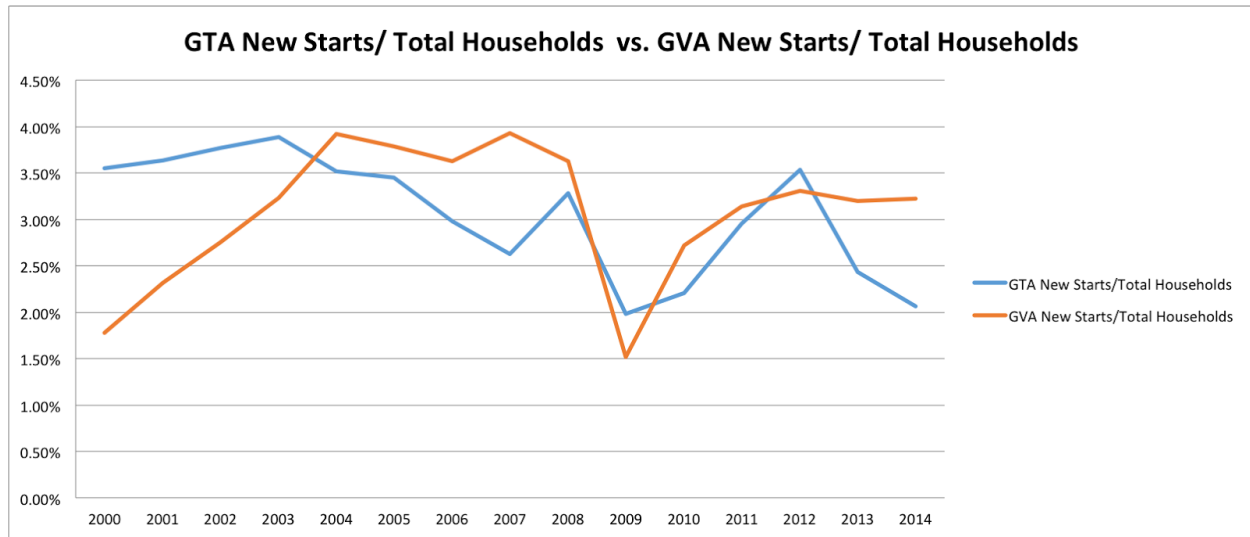


Figure 21²²

New starts indicates the amount of new housing supplies in the future. Thus, the trends in housing starts over the total number of households in both the GTA and the GVA is compared. Based on Figure 21, we note that the GTA began with a much higher number of supplies than the GVA did back in early 2000s. However, the number of new starts in the GVA soon caught up quickly and has been higher than the one in the GTA after 2004 for most of the time. By the end of 2014, while the number of new starts over households ratio was about 3.2% in the GVA, new starts in the GTA was only 2% of the total number of households, showing that the GTA was more likely experiencing a shortage of housing supplies.

²² Primary data source: Statistics Canada

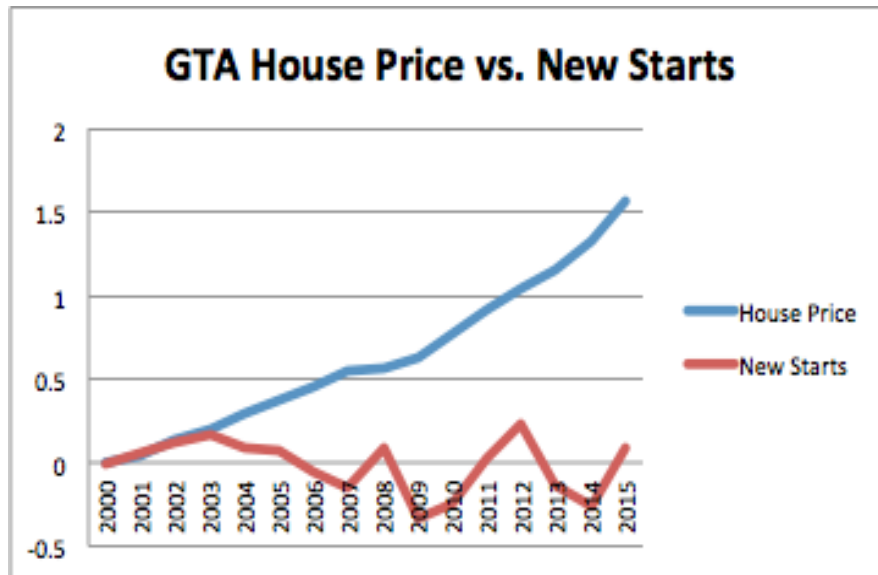


Figure 22²³

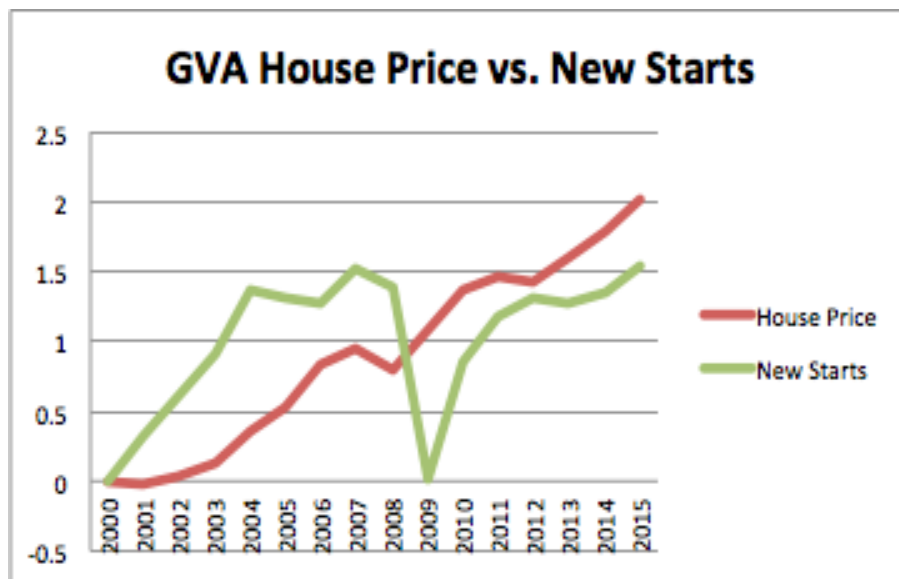


Figure 23²⁴

Theoretically, if house prices rise faster than the cost to produce them, real estate developers should profit more from the rising profit margins. Rising profit margins

²³ Primary data source: TREB and Statistics Canada

²⁴ Primary data source: REBGV and Statistics Canada

incentivize developers to build more houses, pushing the housing supply upwards. Thus, we cannot only draw conclusions by comparing new housing starts alone. As shown in Figure 22 and 23, where the number of new starts in the GTA and the GVA are compared to their corresponding housing prices, distinct features can be found in both of the graphs. In particular, while the new housing starts in the GVA fluctuated similar to the trends in the GVA's average housing price and almost reached its historical highest point, the new starts in the GTA was increasing at the same rate at the housing price at the beginning but has shown little to no correlation with the housing price since 2003 and lagged far behind it. Given the fact that the housing price was escalating but the building cost remained low, there must be great incentives for builders to acquire more land. However, the lagging new starts in the GTA only shows that there must be other factors that were restricting the number of new houses being built.

1.24 Trends in New Housing Permits

Due the highly regulated nature of residential lands in Canada, it is also believed that government plays an important role in regulating the usage of available land. Since the number of new permits is an ideal indicator of builder's ability to acquire new land for residential purposes, we consulted Statistics Canada's database on the number of building permits issued annually since 2000 and compared those numbers with the number of

households in each year.

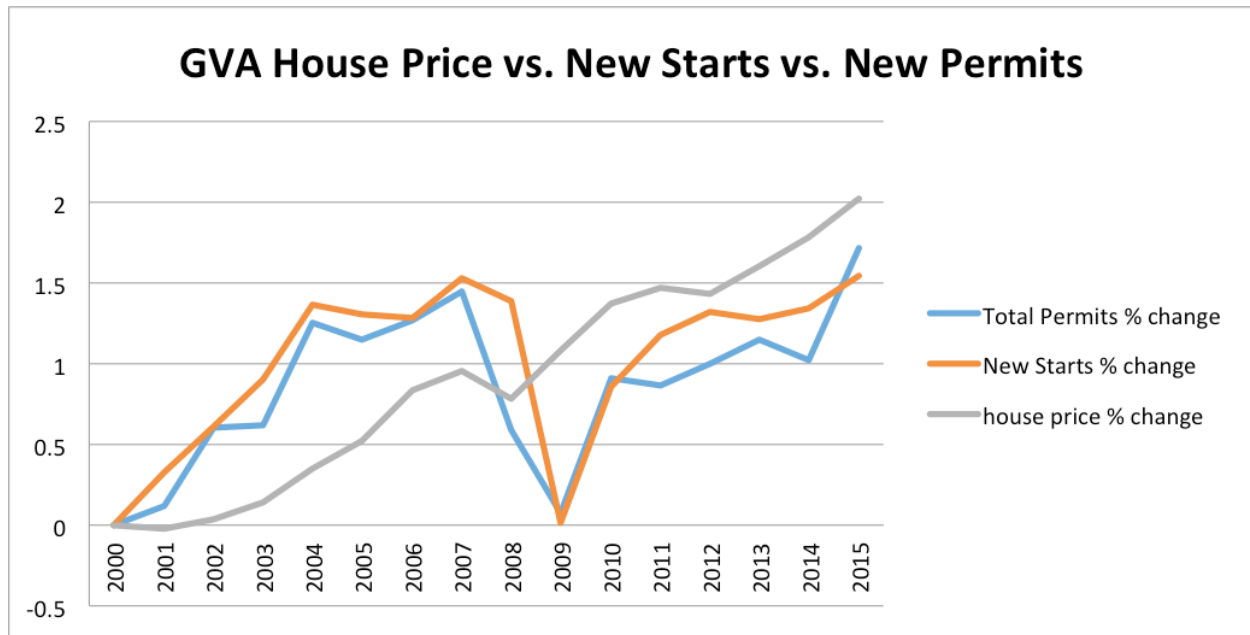


Figure 24²⁵

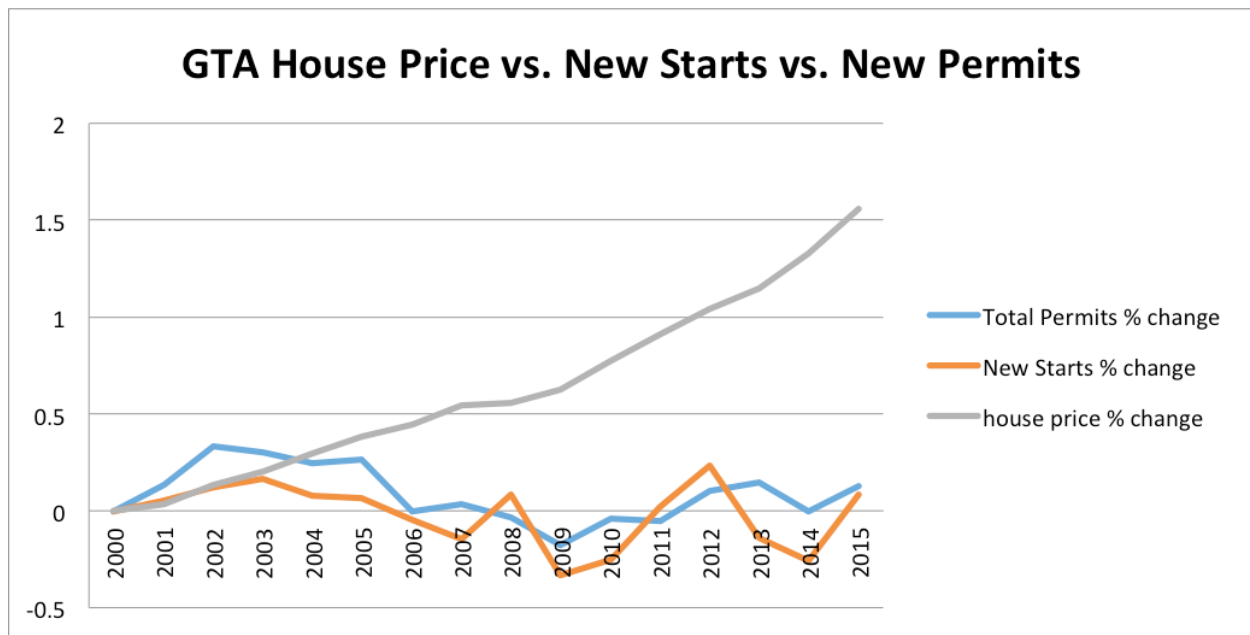


Figure 25

²⁵ Primary data source for Figure 24-25: Statistics Canada, TREB and REBGV

From Figure 24-25, we find that there is a strong correlation between house price and new permits can be found in the GVA market - the number of new permits immediately slumped after the house price dropped in 2008. Additionally, both the issue of new permits and new starts in the GVA almost reached their historical highest points in 2015.

On the other hand, the ones in the GTA were lagging far behind the housing price after 2005. In 2015, the house price in the GTA had increased 140% more than the new permits had, showing that the speed of increasing new permits is definitely not catching up with the house price in the GTA. Moreover, it is found that such weakening correlation is likely to be a result from the Greenbelt Act, which claims to protect “environmentally sensitive and agricultural land in the Golden Horseshoe from urban development and sprawl” in Ontario, and also officially became law in 2005. Such matching between the release time of the Greenbelt Act and the time when the number of new permits stopped increasing as fast as the housing price did suggests that the act might be a crucial factor that caused the shortage of housing supplies in the GTA. Similarly, it is likely that the significant decrease in new starts after 2003 was due to the expectation of the Greenbelt Act implementation, since the builders might have believed it would be even harder to obtain permits in the future.

1.25 Trends in Unused Land Inventories

Other than government restrictions, another cause for lagging new housing starts (especially in the GTA) might be builders accumulating their land inventories. In other words, not developing all the lands they acquired. Thus, we estimate this number in both the GTA and the GVA by subtracting the cumulative sum of new starts from the cumulative sum of new permits each year.

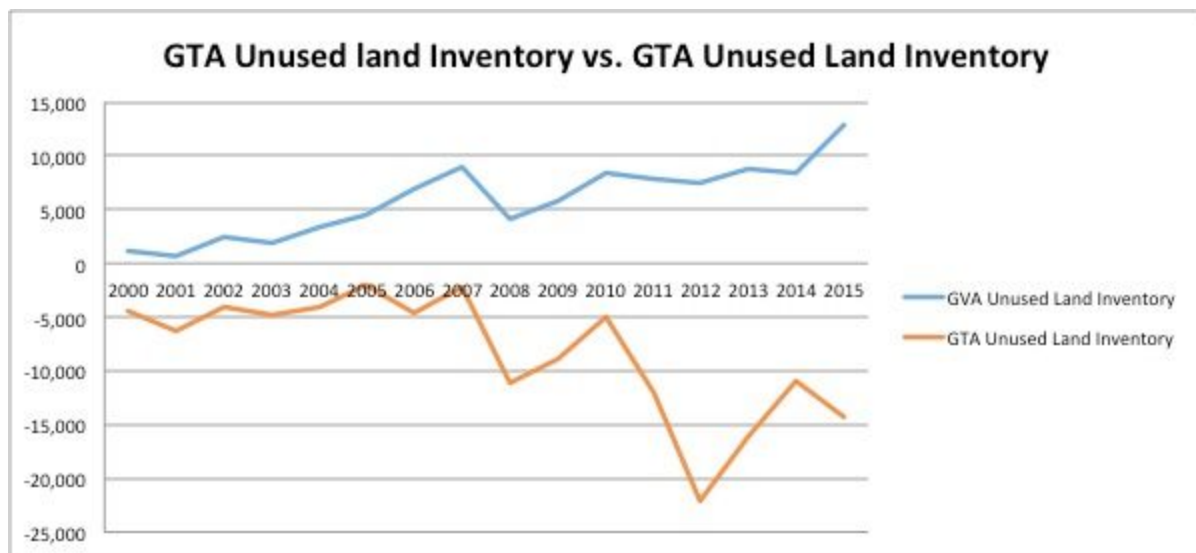


Figure 26²⁶

It is shown in the Figure 26 that the remaining land inventories for developers in the GVA remains at a steady level, and it is calculated that for each year the number of unused permits accounts for 0.2% to 1.4% of the GVA's total number of households. Note that the unused inventories is calculated from cumulative numbers, disregarding the permits that are canceled or discarded. Therefore, as the time gets later in the graph, the

²⁶ Primary data source: Statistics Canada

actual unused inventories should be lower than it appears. On the other hand, one can also observe that the unused inventories in the GTA has been negative and decreasing from the beginning, showing that the developers in the GTA are not accumulating the acquired land at all. Instead, they are constantly using the older permits develop new homes in order to meet the increasing housing demand. Such trend shows that the shortage of residential land does exist in the GTA, and it is mainly resulted from the government restrictions that limits the development of new land.

1.26 Supply Variables Conclusions

From 2004 to 2014, while the cost of building materials and labour has only increased about 35%²⁷, the land value for residences experienced a tremendous growth in both the GTA and the GVA. Other than condominium units, both the land value for townhouses and single detached homes in the GTA and the GVA increased about 200% over the past decade.²⁸ Thus, we conclude that land cost does have a strong impact on the roaring home prices. Since on the supply side, the land acquisition cost is strongly tied to the amount of land available, the deficiency of residential land in the GTA clearly has a strong impact on the escalating housing prices.

²⁷ Observed from Figure 8-9

²⁸ Based on own calculations. Primary data source: ontariocontractors.com, misronet.com, Statistics Canada, callmepower.ca, toronto.ca

1.3 Conclusions on the Key-Drivers

From the previous analysis, we concluded that the overall housing prices is affected by both demand and supply factors, and different cities in Canada show distinct features in terms of the key-drivers that contributed to their own housing markets. In particular, on the demand side, the external impacts from outside of Canada such as foreign investments made up almost 50% of the GVA's purchasing power in 2015, making it the most crucial factor that affects its housing price. Meanwhile in Montreal, the purchasing power for real estate properties mainly come from its local residents. Therefore, unlike Calgary, whose housing prices are greatly affected by the oil price, Montreal might be the most vulnerable city to changes in interest rates and household income. On the supply side, take Toronto as an example, the shortage of supply, which might be a result from government's restrictions on residential land, accounted for the top reason behind its escalating housing prices. Thus, in order to make the housing prices more affordable for Canadian families, different actions should be taken in different cities depending on the key-drivers in each city respectively.

2.1 Introduction to the Housing Price Model and its Variables²⁹

After a long process of data collection and analyzing, we have finally obtained a general idea concerning the key-drivers behind the booming housing markets in the GTA and GVA. In order to further quantify their impacts, we constructed a housing price model for the GTA, through which we are able to predict future trends by accounting for changes in the key-drivers. Variables used in the model are described in the Table 1.

Variables	Descriptions	Symbol
Mortgage rate	Rates for 5-year fixed mortgage published by Bank of Canada	r
Down payment percentage	A typical amount of down payment % out of total home price; Assumed to be 10% in the model	d
Number of low-income families	Families with an annual household income below 40,000	n-low
Number of mid-income families	Families with an annual household income between 40,000 and 100,000	n-mid
Number of high-income families	Families with an annual household income higher than 100,000	n-high
Foreign impact	The amount of purchasing power contributed by foreign home buyers in USD	f
Exchange Rate	CAD/USD	e
Monthly Payment	The amount of monthly payment/annual income a typical family pays; Assumed to be 0.0267 in the model	m
Sales	Yearly sales of the given type of dwelling	V
Remaining inventory	Number of active listings for the given type of dwelling	S
Construction cost	Cost of construction per unit	C
Land cost	Cost of land acquisition per unit	L

²⁹Data source in this part of the report: all sources stated previously and calculations done by ETIC Research Team

Developers' profit	The amount of gross profit a typical developer takes out of the total sales price (housing price); Assumed to be 20% in the model	D
House Price	Median sales price of the certain dwelling type	P

Table 1

2.2 Model Formulas

The basic formula of the model came from the simple definition of price - an equilibrium of supply and demand. Thus, substituting the variables to the equation supply = demand, we get: sales * price + remaining inventory* price = local purchasing power³⁰ + foreign impact. To improve the accuracy of the model, the data is collected separately based on dwelling types (single-detached homes, townhouses, and condos), forming three categories as listed in Table 2.

Dwelling Type	Model Name
Single-detached home	SD
Townhouse	TH
Condo	CD

Table 2

p_low, p_mid and p_high stand for the purchasing power for each class of families, where each of them simply equals to the number of families in that class times their average household income, in other words, $p_{low} = n_{low} * 33000$, $p_{mid} = n_{mid} * 75000$, $p_{high} = n_{high} * 140000$, respectively. Based on the number of yearly

³⁰ For detailed methodology of calculating purchasing power, please refer to section 1.11

sales of each dwelling type with comparison to the total number of households in each income group, the weightings for these variables in each model are assumed and listed in Table 3.

Model	p_low	p_mid	p_high
SD	0.002	0.011	0.027
TH	0.003	0.009	0.008
CD	0.012	0.009	0.008

Table 3

Detailed formulas for each category are listed in Table 4, where effective monthly rate $i = (1+r/2)^{(1/6)} - 1$.

Model	Formula
SD	$P = ((0.002 * p_{low} + 0.011 * p_{mid} + 0.027 * p_{high}) * m * (1 - (1/(1+i))^300) / (i * (1-d) + f/e) / (S+V) = (C+L) / (1-D)$
TH	$P = ((0.003 * p_{low} + 0.009 * p_{mid} + 0.008 * p_{high}) * m * (1 - (1/(1+i))^300) / (i * (1-d) + f/e) / (S+V) = (C+L) / (1-D)$
CD	$P = ((0.012 * p_{low} + 0.009 * p_{mid} + 0.008 * p_{high}) * m * (1 - (1/(1+i))^300) / (i * (1-d) + f/e) / (S+V) = (C+L) / (1-D)$

Table 4

2.3 2017 Projections

We first utilize the housing price model to predict the medium prices for each of the dwelling types in 2017. For most of the variables, their values are assumed to remain

constant from 2016. However, the latest information about households in each income group we can obtain is from 2014. Thus, it is assumed that since 2011 the number of households in each income level is changing at a constant speed. The slopes are listed as below in Table 5.

Variable	Yearly Increase/Decrease
GTA # low-income families	-63
GTA # mid-income families	11,020
GTA # high-income families	29,163

Table 5

Another variable that is constantly growing is the amount of foreign impact within the GTA housing market. Since the amount of foreign impact escalated much faster in the recent two years than anytime before, the yearly increasing rates from 2014 to 2016 are used to predict its values in 2017. For each model, the annual increasing rate of the foreign impact amount is listed below in Table 6.

Model	Amount of Foreign Impact Annual Increase (in US dollars)
SD	3,960,528,706
TH	1,047,195,409
CD	884,607,964

Table 6

In addition to the number of households and the amount of foreign impact, the mortgage rate is also assumed to be 1% higher than 2016, since it is widely expected that the US Federal Reserve will continue to hike US interest rates following by the 25 basis points increase earlier in March, and it is very likely that the Canadian Federal Reserve will also increase the interest rates in Canada by a similar amount.

After making the adjustments, the predicted housing prices for single-detached, townhouses, and condos in the GTA are listed below.

	SD	TH	CD
2016 prices	810,000	517,060	365,000
Projected 2017 prices	881,809	542,729	372,700
% change	8.9%	5.0%	2.1%

Table 7

As shown in Table 7, one can notice that, despite the interest rate hike in 2017, the housing prices in the GTA will still likely escalate due to the increasing household income and the amount of foreign impact. Among the three dwelling types, the prices for single-detached homes might increase the fastest, with a growth rate of 8% comparing to 2016.

2.4 What-if Analysis

In this chapter, the housing price model is also utilized to predict the outcomes of changes in certain variables, therefore examining the effectiveness of possible actions in order to stabilize the overheated housing prices in the GTA.

2.41 What-if Analysis: Exchange Rate Decreases by 20%

As the US dollar continues to appreciate, it is expected that the Canadian dollar will likely to depreciate in 2017. When the exchange rate between Canadian dollars and US dollar decreases, the same amount of foreign impact can be converted to more Canadian dollars, therefore increasing the housing prices by boosting the demand from outside of Canada. The following table shows the detailed possible outcomes if the exchange rate between Canadian dollars and US dollars decreases from 0.76 to 0.60.

	SD	TH	CD
Before	881,809	542,729	372,700
After	1,014,177	609,274	415,237
% change	15.0%	12.3%	11.4%

Table 8

From Table 8, we note that a 20% decrease in the exchange rate can result in significant changes in the prices of single-detached homes, townhouses, and condos in the GTA, with growth rates of 15%, 12%, and 11.4% respectively. Thus, effective actions must be taken in order to prevent the housing prices from such an increase.

2.42 What-if Analysis: New Housing Starts Increase to Vancouver Level

As mentioned in the conclusions for Part 1, one of the most significant key-drivers behind the booming real estate market in the GTA is the shortage of supply. Therefore, we suppose that increasing the GTA's new housing starts to the same level as in Vancouver can effectively help stabilize the housing prices. In order to do so, the percentage of new housing starts over total number of households in the GVA is calculated and used to predict the amount of new supplies needed in the GTA. The number is further divided into different dwelling types using their annual sales in the GTA. As a result, 11,834 more single-detached homes, 6,315 more townhouses, and 7,111 more condos are added to the total housing supplies. The outcomes of the increasing supply, on the basis of the previous what-if analysis, are shown in the following table.

	SD	TH	CD
Before	1,014,177	609,274	415,237
After	832,370	501,172	361,398
% change	-17.9%	-17.7%	-13.0%
2016 prices	810,000	517,060	365,000

Table 9

The results in Table 9 shows that increasing the GTA's new housing supplies to the same level as in Vancouver can be one of the most effective ways to stabilize the housing

prices. Both of the prices for single-detached homes and townhouses can decrease about 17%, and condos about 13%. Note that even after the exchange rate decrease by 20%, the housing prices after the boost in new supplies are all back to the 2016 level, with prices for single-detached homes and townhouses only slightly higher than the ones in 2016.

For the government, many factors such as exchange rates and household income are extremely hard to control, but luckily, many actions can be taken to raise the amount of housing supplies in the GTA. These include shortening the processing time for land developers to obtain their building permits and making possible amendments to the Greenbelt Act so that more residential land is available.

2.5 Conclusions on the Housing Price Model

As shown in the previous what-if analysis, the housing price model can be very powerful in predicting possible changes in different variables may impact the housing prices. Moreover, it can be further applied to demonstrate the future influence of any other variable included in model, as listed in the table of variables in section 2.1. Other than the GTA, the model can also be used for other cities or areas in Canada, under the condition where appropriate weightings are applied.³¹

³¹ We would like to thank you for your patience to read through our report. If you have further questions or comments, we welcome you to get in touch with us by emailing uwetic@gmail.com. Contents in this report should not be distributed unless specifically indicating UW ETIC Club Research Team from the University of Waterloo as the owner.