

THE EFFECT OF FOREIGN INVESTMENT ON HOUSING PRICES IN MAJOR CANADIAN
CITIES

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1. INTRODUCTION

The housing market is now regarded as fundamental in assessing the wellbeing of a country's economy. Historically, the analysis of the housing market was simple; it relied heavily on the balance of domestic supply and demand and it was studied predominately in isolation of other markets. This has become increasingly insufficient due to the global nature of markets today. This does not suggest that supply and demand of housing is not fundamental to studying the housing market but rather that the analysis of this market no longer includes only domestic determinants, and even the domestic determinants have grown in number and complexity. In order to understand the housing market, it is important to look at it as a part of a complex economic ecosystem that is impacted by a variety of factors both domestically and globally.

A strong interdependence exists between the housing market and other markets such as the labour and financial markets, which makes it difficult to analyze it in isolation (Arestis & Gonzalez, 2014). The extent of this interdependency became evident in the US financial crisis in 2008 when the American subprime mortgage market collapsed. This collapse had a direct and significant effect on the well being of the entire economy threatening financial depression (Holt, 2009). The effects of this crisis spilled beyond the borders of the US affecting the global economy. This example serves to demonstrate the importance of housing markets such as those of the USA and Canada. Their power to impact economies across the world, should not be taken lightly. It is thus critical to have the ability to analyze these markets thoroughly in order to effectively regulate or adjust them as necessary.

There has been a recent shift in the capacity in which individuals participate in the housing market. Previously for the majority of individuals, housing was a necessity and seen as a long-term asset. In recent years it is more common for real estate to be purchased as an

investment. Rental properties and “fixer uppers” purchased for renovation and resale have become a popular investment strategy, especially in thriving housing markets, that guarantee a return on investments in a relatively short time frame. Domestic and foreign investors are capitalizing on an increase in demand for homes in specific prosperous areas. Countries with growing economies, stable governments, and high living standards are targeted by such investors (Guest and Rohde, 2017). With the housing market taking on characteristics of financial markets, investor expectations begin to play a more important role in housing prices (Case and Shiller, 2003). While foreign and domestic investment usually has a positive economic effect on cities, the level of investment in some global city centers have had a negative impact on affordability and stability of the housing market (Bruneau et al, 2017). The research around housing markets has started to take this new conceptualization of housing into account.

Recently, there is concern over the ever-increasing housing prices in many Canadian metropolitan centers. The OECD (2016) released a report about the Canadian housing market and predicted corrections in the medium term. As the Canadian government seeks to respond to these concerns, it has become increasingly important to thoroughly understand the factors that affect housing prices. One of the outcomes of past research into the housing market was an apprehension about foreign investment in major cities within Canada. The general public sees these investments as a major contributor to the excessive rise of housing prices, rendering local buyers unable to afford a home. The affected provincial governments were quick to react to the public uproar by placing an additional tax on foreign buyers purchasing real estate. British Columbia instituted this tax in the summer of 2016 and Ontario followed in 2017. The federal government has introduced further restrictions on the access to credit through more stringent mortgage approval processes such as stress testing. Data limitations make it difficult to evaluate

these policies so early after their implementation, but further research on the factors that affect housing prices can provide us with a better understanding of whether or not these targeted policies were necessary as well as the level of their expected impact.

In particular, Chinese investment in the Canadian housing market has been the focus of public concern. Chinese investment in Canada has increased in the recent years. Hurun Research and Visas Consulting Group (2014) present the results of a survey of the Chinese High Net Worth Individuals (HNWIs), which state that 64% of these individuals were moving or considering moving to Los Angeles, San Francisco, or Vancouver. Ley (2017) states that once the real estate market within China was moderated, Chinese insurance and development companies had to diversify their portfolio and invest in foreign real estate. Ley (2017) also explains how earlier Canadian policies put in place to incentivize foreign investors and jump start a struggling economy at the time, caused two waves of Chinese investment in Canada from 1986 to 1997 and another wave after 2000. This increasing Chinese investment in real estate is now a source of concern. Whether this concern is warranted is the basis of this paper. This paper investigates how this increase in Chinese demand for Canadian housing has impacted housing prices. Due to data limitations Gross Domestic Product (GDP) of China is used as a proxy for Chinese demand for property in Canada.

This paper examines the effect of a proxy of Chinese investment while controlling for supply and demand factors on housing prices in 6 major Canadian cities (Toronto, Vancouver, Calgary, Edmonton, Montreal, and Ottawa) over a time period of 17 years from 1999 to 2015. Canadian literature on the issue of foreign buyers focuses on capturing the frequency of foreign buyers, which is done under a number of assumptions due to gaps in the data (Sun, 2015). This paper takes a different approach as it examines the effect of Chinese income as a proxy for

Chinese investment on Canadian housing prices. It looks at the effect of foreign investment versus the effect of domestic factors on housing prices. The domestic factors considered include population, income, the average value of building permits, and mortgage rates.

From the analysis it was concluded that Chinese GDP has a positive effect on housing prices in major Canadian cities. Domestic income also proves to have a positive effect on housing prices. Additional analysis was conducted studying total foreign direct investment (FDI) in real estate as a proxy for foreign investment and it concluded that FDI in real estate has a negative effect on housing prices in cities. These two factors seemingly affect separate components of the housing market. While Chinese GDP increases demand for housing, foreign direct investment seems to be increasing the supply of housing, resulting in opposing effects on housing prices. However due to a lack of detailed data on foreign investment in real estate, more research must be conducted as recently collected data becomes available.

Knowing the determinants of the demand for housing and housing prices can allow for informed and targeted policy. This paper can provide an insight on the domestic and foreign factors affecting the demand for real estate in major Canadian cities. Knowing the impact of Chinese investment in Canadian real estate, increasing costs for foreign investors can be one approach to correcting the market. However increasing costs for local buyer by increasing the cost of obtaining credit would also be effective in cooling the market as analysis has proven both factors significantly affect housing prices.

The next section provides a literature review of the research on the effects of foreign investment in housing markets around the world. Followed by the data section, which examines the data sources and quality of the data used in the analysis of this paper. The subsequent section explains the econometric model used in this paper. Section 5 summarizes the findings of the

analysis and the robustness checks. The paper is concluded in section 6.

2. LITERATURE REVIEW

There is extensive literature on foreign investment and its effects on housing prices. Rogers et al. (2017) state that the creation of a new middle class in countries such as China, South Korea, Singapore, Russia and Brazil has increased activity in the global housing market. A number of countries have faced increased foreign investment in their real estate markets and are investigating methods of dealing with the consequences of such an increase in investment on the prices of homes. Australia and China (Mainland and Hong Kong) have dealt with a simultaneous increase in housing prices and increase in foreign investment in recent years. Studies on the correlation of these two variables have been done in these countries and have concluded a positive relationship between levels of foreign investment and housing prices.

Concerns with the positive relationship between foreign investment and housing prices around the world have been expressed. One of these concerns is rapidly increasing housing prices to the point where individuals earning a national average income can no longer afford a home. The income of a resident in the host country no longer seems to be the main driver of housing prices in some urban centers (Burda, 2013). Governments around the world are implementing policies to mitigate the risks and impact of increasing foreign investment on their domestic economies.

China

In 1978 the People's Republic of China implemented an open door policy, which allowed for the interaction of local and global markets. This change preceded the new legislation that was enacted in China the following year, which allowed for joint-venture using Chinese and foreign investment (Chan and Hui, 2014). This new legislation permitted foreign investments and led to

the creation of four zones in China; Shenzhen, Zhuhai, Shantou, and Xiamen, where foreign investors received special treatment (Chan and Hui, 2014). Those policy changes were followed by many more, including the entrance of China into the World Trade Organization in 2001, that all contributed to China's growing prosperity and in turn attractiveness to foreign investors.

In the early 2000s, foreign investment in cities such as Shanghai, Beijing, Shenzhen, and Guangzhou grew exponentially. The property prices increased by 50% in some of these cities and doubled in others (Wang, 2007). Among other factors affecting the housing prices in China, Wang (2007) cites foreign investments as one of the factors with the largest effect. An et al. (2017) argue that in the case of China the regular supply and demand factors underlying house prices are insufficient in explaining the large increases in prices of homes. An et al. conduct an analysis using a Vector Autoregression (VAR) model to conclude that capital inflows affect housing prices positively. An et al. also explains the importance of regional analysis in the case of China's housing market. Evidence shows that foreign investment does not affect the housing prices in different parts of China to the same levels. This is an important conclusion because it informs policy makers that a policy addressing the issues caused by increased foreign investment would have to account for the regional differences in the market.

The risks summarized in the literature that arise from increasing foreign capital inflows into China's housing market include: the appreciation of the currency, which weakens monetary policy; the distortion of supply and demand fundamentals in the housing market; and the encouragement of speculation which further drives up housing prices and contributes to economic instability and the potential of a housing bubble (An et al. 2017).

Wang (2007) explains the regulations that were put in place to slowly mitigate the effect of foreign investment on housing prices. Requirements to obtain a Business license and Foreign

Investment Enterprise Approval certificate to invest in China were implemented in 2006. The Chinese government went further to require municipalities to collect better data on foreign investment in the luxury real estate market. Amongst other regulation changes, the Chinese government also did not allow foreign-funded real estate developers to use foreign credit to finance their developments, which was done to insulate China from a shock in credit markets in other countries. Most of these changes were targeted at making it more expensive for foreign investors to continue investing in China. If the capital returns of rent, appreciation of real estate and the additional return from the potential appreciation of the Chinese currency (RMB) were higher than the costs incurred due to these regulations, these regulations would not be very effective (Wang, 2007).

Australia

Wong and Nelson (2017) conducted a public survey that showed that Sydney residents were concerned about the level of foreign investment and more specifically they were concerned about Chinese investors who they felt made up the majority of foreign investors in the housing market. Rogers et al. (2017) explains that this sentiment is rooted in history. They explain that the gold rush era in the early 19th century in Australia, attracted a large number of Chinese immigrants. The use of foreign capital and labour on Australian land during this time created land disputes and an anti-Asian sentiment with which the Australian government is still trying to deal with today. However, that foreign investment in the mining industry had positive effects on the Australian economy. Today, China is still a crucial consumer of Australian iron, ore and other minerals (AptCapital Management, 2015). This public concern over foreign investment and more specifically Chinese investment in Australian real estate has encouraged more research in the correlation between foreign investment and housing prices in urban centers.

In Australia, all foreign investments in domestic real estate have to be reviewed by the Foreign Investment Review Board (FIRB) (Wokker & Swieringa, 2016). This allows the Australian government to have a well document measure of foreign investment in the real estate market. A number of studies examine the number of approvals by the FIRB and factors that affect it. Wokker and Swieringa (2016) use a fixed effects panel regression technique to evaluate the effect of foreign demand on domestic housing prices. The study concludes that there is a positive relationship between foreign investment approvals and housing prices. The increasing foreign demand for housing in Australia is being driven by Chinese nationals who made up about 70% of approvals in early 2015. Guest and Rohde (2017) used panel data to evaluate the effect of foreign investment on housing prices in Sydney and Melbourne. Their results suggest that foreign investment is the factor that explains 20-30% of the change in housing prices from 2004 to 2014. Housing prices in Australia from 2004 to 2014 grew quicker than the average growth in OECD countries over that period (Guest and Rohde, 2017).

There is an agreement that foreign investment affects the housing market in Australia, whether it is segments of it or the whole market is a concept being debated. Gauder et al. (2014) suggest that first time homebuyers are in the market for an established, smaller and more inexpensive dwelling while foreign investors tend towards luxurious homes and therefore foreign investment is not causing an issue for first time homebuyers. Others argue that there is a spill over effect of increasing prices of luxury homes into the market for other categories of houses (Liao et al., 2015). Guest and Rohde (2017) argue that Gauder et al. underestimate the effect of foreign investment on housing prices and the stability of the housing market.

An International Monetary Fund report cites that the house prices to income ratio in Australia are rising. This is a concern for multiple reasons. Firstly, a high house price to income

ratio is indicative of unaffordable housing, which if combined with loose restrictions to credit can result in high household debt. Secondly, a high ratio indicates that domestic income is not the only driver of housing prices. This inference in combination with evidence of increasing foreign demand can lead to the risk of foreign economic shocks on the domestic economy. In summary, this would all signal the formation of a housing bubble with a threat of sudden market corrections.

The Australian government is struggling to manage its relationship with China as to maintain the positive effects of foreign investment in the mining industry and simultaneously mitigate the risk of a housing bubble. This need for balance is evident in earlier policy changes targeted at cooling the housing market. For example, there are limitations on the type of properties foreigners and temporary residents can purchase that limit their options to newly developed or redeveloped land (Sun, 2015). In 2015, a stricter policy was implemented. This policy imposed a AU\$5,000 fee on foreigners for applying to purchase property in Australia. In addition to that fee, a foreign buyer would have to incur an additional AU \$10,000 for every AU\$1 million in the value of the property they are purchasing (Sun, 2015).

China and Australia attracted foreign investors for very different reasons. China was a newly open and growing economy where the return on an inexpensive investment in the past has grown exponentially as China has become integrated in the global market. In countries like Australia and Canada, which are already developed, foreign investors, see a less risky investment that can appreciate under a stable government. Furthermore these developed countries provide a higher standard of living, especially in terms of education.

Canada

Literature around housing prices in Canada is emerging. However not much empirical work has been done specifically around the effect of foreign investment on housing prices in

Canada because of the lack of reliable and consistent data on foreign investment in real estate at the city level. It is suggested that a lot of foreign investment is targeted in certain major Canadian cities such as Vancouver and Toronto, due to their economic prosperity. Unfortunately there is no extensive data publicly available on foreign investment in housing in these specific areas. Researchers have tried to find proxies for foreign investment or frequency of foreign buyers. However a number of assumptions have to be made about foreign buyers or foreign investment.

Studies on foreign investment in real estate use formal and informal survey data to comprehend the sectors of the market in which foreign investment is prominent. However there are inconsistencies in these data sources. Additionally, assumptions on what characterizes a foreign buyer have to be made. For example, the Landcor Data Corporation examined BC residential sales transactions of luxury homes in Vancouver and categorized new owners' names by whether they were traditional Chinese names or Western names. This study found that in 2008, 46% of luxury homes sold in the Westside Vancouver and Richmond were purchased by homebuyers whose name match a traditional Chinese name. This percentage grew to 74% in 2010 (Sun, 2015). Another example of analysis done on foreign investment is the Rental Market Survey conducted by Canada Mortgage and Housing Corporation (CMHC) in 2014. Owners, managers, and superintendents of rental buildings were asked how many apartments individuals living outside of Canada own. It was concluded that the highest percentages of foreign investment in condominiums were in Toronto, Vancouver, and Montreal (Sun, 2015).

A number of studies also examine the determinants of housing prices more broadly in the Canadian context, however empirical work around foreign investment in the housing market is limited. Allen et al. (2006) study the underlying determinants of the housing market in major Canadian cities from 1981 to 2005 using the Multiple Listing Service (MLS). The analysis is

done on both the national and city level. Allen et al. (2006) conclude that determinants differ among cities. This report exhibits the importance of city level data in understanding the housing market in Canada.

The Parliamentary Budget Office (PBO) (2017) takes a stock flow approach to the housing market and analyzes the underlying supply and demand for housing. A projection of housing stock is created and demand for new housing is based on household formation reported in the Census. Results of the report suggest that from 2001 to 2012, construction of new homes (supply) outpaced the formation of households (demand). This trend is reverse starting in 2012 to 2016 where the demand outpaced the supply. The PBO (2017) projects that there will be excess demand for housing relative to housing stock from 2017 to 2021. This report tries to gauge imbalances in the housing market based on fundamental factors that could be driving house prices. It also presents an important characteristic of the housing market, which is that; supply in the short run is fixed. These are all important factors to consider when studying the determinants of housing prices.

Bruneau, Leboeuf and Nolin from the Bank of Canada (2017) analyze Canada's International Investment Position (IIP) after the 2008 financial crisis shock. They suggest that even though Canada's IIP will continue to stabilize the economy (Bruneau et al, 2017), the increasing external liabilities since the 2008 global financial crisis should be monitored. Canada was praised for its stability during the global financial crisis and shortly after and that attracted a lot of foreign investors, looking for a more stable financial environment.

Bruneau et al. (2017) conduct an in depth analysis of the vulnerabilities of Canada's IIP and the risks of the increasing foreign capital inflows. They suggest that an increase in foreign investment can be linked to an increase in asset prices. The increased foreign investment expands

demand for assets and if the supply is fixed in the short term, as it is in the case of housing, the price of the asset increases. This would then in turn lead to changes in availability of credit as collateral value increases (Bruneau et al, 2017). The inflow of investment itself appreciates the domestic currency and reinforces the availability of credit. The availability of credit combined with increasing asset prices, especially of perceived stable assets such as housing, then encourages both local and foreign investors to borrow more and invest in housing with the expectation of higher returns. This cycle in turn increases another risk tied to credit availability. If the cost of credit increases as a result of an increase in interest rate, entities that have taken out more credit might be unable to pay their debt payments.

Furthermore, another risk of increased foreign investment is that foreign investors often have imperfect information and it could lead to quick withdrawals of investment if they perceive any instability in the domestic country. This withdrawal would increase the cost of borrowing by increasing risk premiums. The negative repercussion of a sudden withdrawal of foreign investment increases with the amount of foreign investment in the market (Bruneau et al., 2017).

The Canadian federal government and provincial governments have put in place policies to mitigate the risks described above. In the last two years, British Columbia and Ontario provincial governments have imposed a foreign buyer tax to moderate foreign demand in heated local housing markets of Vancouver and Toronto. Federal and provincial governments are calling for better data collection of foreign investors and their investments in the housing market. More recently the federal government imposed stricter regulation around obtaining a mortgage. Controlling credit availability can mitigate the risk of high debt loads, which in the case of an external economic shock would slow the recovery from a negative shock.

The relationship between foreign investment, housing prices and economic stability has been established throughout the literature. The risks of increasing levels of foreign investment are summarized and some policy options have been presented in the international literature. In China, Australia, and Canada the risks of the increasing levels of foreign investments are similar: increase in unaffordability for local residents, the over dependency of foreign capital, asymmetric information for foreign investors and the consequences of a sudden reversal of the foreign capital inflow, and increasing restrictions and cost of borrowing that may increase debt loads exponentially. A combination of these potential risks can collapse an economy as seen during the global crisis in 2008. It is important to better understand this relationship in the Canadian context.

In comparison to the empirical research conducted in other countries facing similar questions and concerns about their housing markets, Canada is just at the beginning of a steep learning curve when it comes to foreign investment in real estate. This paper aims at contributing to this literature by examining if variation in Chinese income can explain the increase in housing prices in major Canadian cities and how it compares to the effect that domestic income has on housing prices.

3. DATA

Data specifically on foreign investment in real estate by city is not publicly available in Canada like in other countries such as Australia. As a result of the recent interest in foreign investors, the Canadian federal and provincial governments have taken more action to collect information specifically on the foreign investment in real estate. This initiative is recent and the available preliminary data is not publicly available yet. This data is also over too short of a time span to make any concrete conclusions at this time. Therefore, this paper utilizes factors that represent foreign investment and would affect housing prices in a similar way as foreign

investment. However future researchers would be better situated to use the new Canadian data on foreign investment to better understand the connection between foreign investment and housing prices in Canada.

Data on supply and demand of housing is also fundamental to this analysis. Canada has no up to date data on the housing stock in Canada (PBO, 2016). Therefore proxies for both supply and demand of housing are used. Proxies for the supply side are the average value of building permits that are representative of construction costs. Proxies representing the demand for housing include population, domestic income, mortgage rate, and Chinese PPP GDP.

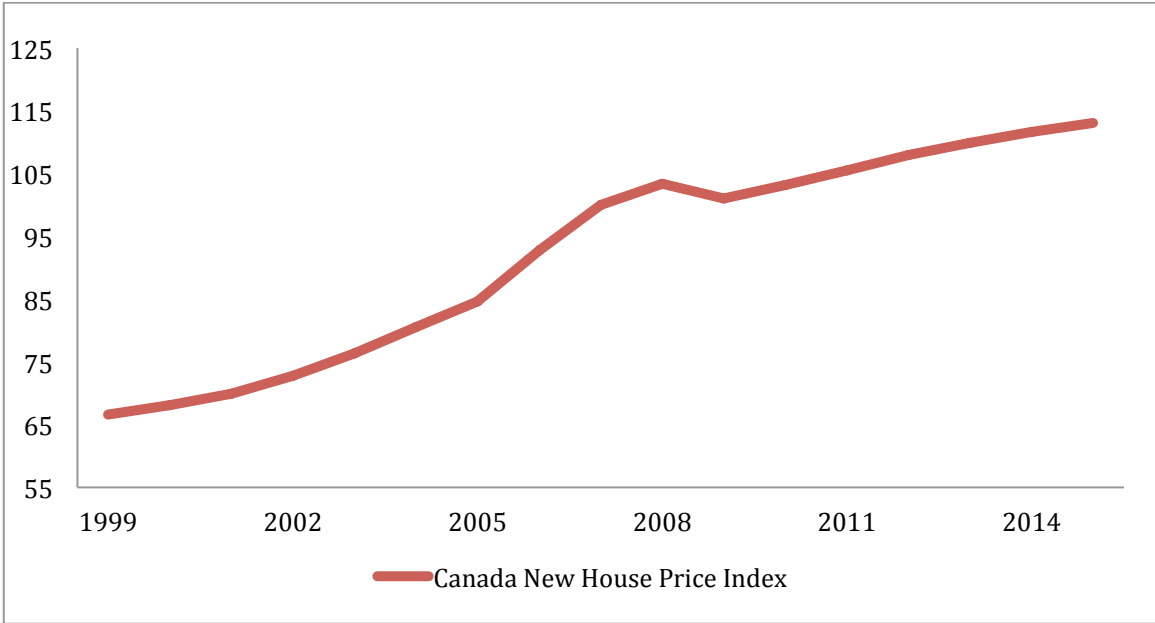
This paper utilizes a balanced panel data. The categories are 6 major Canadian cities and the time frame is 17 years from 1999 to 2015. This section briefly describes the data used in this report: the new housing price index (NHPI), the population estimates from 2016 Census of Population, domestic income from the Income Statistics Division in Statistics Canada, the number and value of building permits from the Building Permit Survey, average annual mortgage rates from the Bank of Canada's Financial Market Statistics, and Chinese PPP GDP from the World Bank national accounts data. The data is from multiple sources and this usually increases the risk of definitional differences amongst data sources. In this case all variables pertaining to the city level are from Statistics Canada and have the same definitions of the census metropolitan areas. All other variables are macroeconomic determinants and therefore while they change over time, are the same for every city.

New Housing Price Index (NHPI)

Statistics Canada's New Housing Price Index (NHPI) is a monthly series that represents the change in prices of new residential housing. Builders from 21 census metropolitan areas (CMA) across Canada are asked to provide information on prices of residential properties. The

price of the land is also surveyed and subtracted from the selling price to obtain the price of the structure, which is indexed to get the NHPI. The prices surveyed in each metropolitan area are equally weighted and each metropolitan area is assigned a weight based on the number of houses completed in the area. These prices are then indexed using the Chained-Laspeyres index formula (Statistics Canada, 2016). The base year used is 2007. Figure 1 displays the NHPI for Canada over the years being studied in this report (1999 to 2015). The increase in housing prices leading up to the 2008 financial crises is clearly indicated in figure 1.

Figure 1: New House Price Index (2007) in Canada



Source: Statistics Canada. Table 327-0046 - New housing price index, annual (index, 2007=100)

Using the NHPI as a dependent variable, allowed for annual analysis of the housing prices in the Census Metropolitan Areas. Given the localized nature of the housing market, it is helpful to have this data on a lower geographical level. Furthermore having the base year as 2007 allows for the inclusion of a recessionary period in the economy, which plays a role in the analysis of the housing markets. The composition of the index allows for a unit change in the NHPI to be

interpreted as a percentage point change in the housing prices.

It is important to note that this index accounts for newly built home prices but does not consider the price of homes that are re-sold. The data on resale prices of homes is not publicly available. Future research should be done on the comparison of the factors that affect new build house prices and those of resale prices.

Population

The 2016 Census of Population provides estimates of population by census metropolitan area. Estimates for years 2001 to 2015 are based on the Standard Geographical Classification (SGC) 2011 and estimates for years 1999 to 2000 are based on Standard Geographical Classification (SGC) 2006 (Statistics Canada, 2016). These estimates have been adjusted for the under coverage of the Census. Population growth is an indicator of growth in the demand for homes, which directly affects housing prices.

Income

The income used in this report is obtained from the Income Statistics Division in Statistics Canada. These estimates of the median after-tax income of individuals in each city are based on data from Survey of Labour and Income Dynamics (SLID) and the Canadian Income Survey (CIS). The median after-tax income is used to account for outliers such as the smaller number of very wealthy individuals. Having the income after-tax allows for a more accurate representation of disposable income, which is available for the purchase of a home. An alternative measure of income would be GDP but since the analysis is on the city level and the data on GDP at that level is limited, the median income was used. Statistics Canada has a short series of GDP at the city level in Canada but it only spans from 2009 to 2013. Income change also indicates changes in demand for housing.

Building Permits

The Building Permits Survey is a mandatory survey, which collects data on the value and number of the building permits granted by approximately 2,400 municipalities, representing about 95 per cent of the Canadian population. The building permits are categorized by residential and non-residential property and data on both is collected monthly (Statistics Canada, 2016). I use the seasonally adjusted annual value and the annual number of residential building permits for each CMA. The value of the building permits is commonly used as a proxy for construction costs, which affect the supply of housing and therefore indirectly affect the housing prices (Ghilipor, 2012).

Mortgage Rates

The Chartered Bank's interest rates for the conventional 5-year mortgage were retrieved from Financial Market Statistics, which consists of data on key indicators within the national financial markets for every month of the year. Chartered banks and other financial institutions that adopted the International Financial Reporting Standards provide data from their balance sheets to compose the Financial Market Statistics data. The interest rates are a national average and therefore I apply the same average interest rates to all CMAs. Interest rates are representative of the cost of credit for homebuyers. If interest rates are high it is more expensive for buyers to take credit out to purchase a home and therefore this affects the demand side of the equation of housing prices.

GDP of China

World Bank national accounts data were used to obtain the Gross Domestic Product (GDP) per capita of China based on purchasing power parity (PPP GDP). PPP GDP is the GDP

converted into international dollars using PPP rates¹ and is equivalent to the purchasing power of the US dollar in the United States. GDP is calculated by summing the gross value of all production by domestic producers in the economy (World Bank, 2017). The positive relationship between foreign investment and housing prices has been confirmed in the international literature (Liao et al., 2014; Wokker and Swieringa, 2016). This paper tries to extend the literature by using the PPP GDP of China as a proxy for foreign investment from China. It is believed that the two variables are positively related and therefore the higher GDP China has, the more Chinese investors have to invest abroad. From a review of the literature, this relationship between this specific proxy of foreign investment (foreign income) and housing prices has not been studied. It is important to note that the GDP per capita of a country interacts with a number of other variables internationally that can in turn affect underlying factors of domestic housing prices. For this reason and the complexity of the derivation of this variable, care should be taken with interpreting its effect on housing prices.

I focus on how variations in the explanatory variables mentioned above affect the NHPI in the 6 CMAs from 1999 to 2015. My sample has 102 observations. These observations represent the annual housing prices and the underlying explanatory variables for that year over the 17 years of study (1999- 2015) in each of the 6 cities. When interpreting the results of this analysis, it is important to note that this is a relatively small sample and should proceed with caution. The included controls are meant to capture the localized nature of the housing market and the cyclical nature of influential factors.

Table 1 presents the means and standard deviations for the variables used in this analysis.

¹ International dollars utilized are based on 2011 International Comparison Program (ICP) round.

4. ECONOMETRIC MODEL

The particular controls used in my regression model are common in the literature on housing price determinants (Swieringa and Wokker, 2016; Lu, 2016; Glindro et al. 2011; Allen et al, 2006; Gholipour, 2013). The model used in this paper is based on the empirical work observed in the international literature on the topic of foreign investment in real estate such as Swieringa and Wokker (2016) who use a fixed effects model in their analysis of foreign demand in the Australian housing market.

Using the Panel data Fixed Effects model, this paper estimates the following equation:

$$NHPI_{cma,t} = \beta_0 + \beta_1 China\ GDP_t + \beta_2 Trend + \beta_3 Population_{cma,t} + \beta_3 Income_{cma,t} + \beta_4 Building\ Permit\ Value_{cma,t} + \beta_5 Mortgage\ Rate_t + \emptyset CMA + \varepsilon_{cma,t} \quad (1)$$

Where $NHPI_{cma,t}$ is the New Housing Price Index of a given Census Metropolitan Area (CMA). $China\ GDP_t$ represents the Gross Domestic Product (GDP) per capita of China based on purchasing power parity (PPP). $Trend$ is a created variable used to control for a general time trend. Regressions with city-specific trends have also been analyzed. $Population_{cma,t}$ is the estimates of population by CMA. $Income_{cma,t}$ is the median after-tax income in every CMA. $Building\ Permit\ Value_{cma,t}$ is the average value of building permits granted in a specific CMA. $Mortgage\ Rate_t$ represents the average interest rate for a conventional 5-year mortgage offered by chartered banks in a given year in Canada. $\emptyset CMA$ represents fixed geographic effects. All of the explanatory variables are log transformed except for the mortgage rate. The error term, ε_{cma} , represents the residual effects on the housing prices in a given CMA. I assume the errors are normally distributed with a mean of zero and a variance of θ^2 . I sequentially add the controls in equation (1) to see how controlling for other effects on housing prices changes the

effect of China's GDP.

Using the Hausman test, I concluded that fixed effects model was appropriate to use instead of the random effects model. The fixed effect model controls for city specific variables that do not change over time. This concept is important to the analysis because cities have different time invariant characteristics that affect individuals' choices to live in them. For example the distance from urban centers, which is a characteristic that is factored in when an individual chooses a city to live in. Certain Canadian cities can provide individuals with the proximity to high paying jobs in specific industries that other cities cannot. This indirectly affects the demand for housing in these cities and in turn affects the housing prices. Controlling for these factors using the fixed effect model eliminates some omitted variable bias. I also use robust standard errors to account for some heteroskedasticity and serial correlation.

The alternative to this model is the random effects model, which assumes that characteristics of cities are random and uncorrelated with the independent variables. An advantage to random effects model is that you can study the time invariant factors of housing prices within cities. The variable of interest in this report, PPP GDP of China, as well as all other variables used change over time and therefore random effects is unnecessary in this report. Furthermore in the case of the housing market, there is no data on a lot of time invariant variables which if not controlled for in a random effect model would introduce bias to the estimates. The other advantage to random effects models is that results can be generalized for other samples, however this is not the focus of this paper and therefore not necessary.

Fixed effect models are used to analyze a change within a category such as cities. Therefore this model allows me to study how much of the change in housing prices within cities is caused by PPP GDP of China, while controlling for city specific time invariant determinants.

This conceptualization is important for studying the housing market because of its localized nature, especially in a vast country such as Canada where the regional economies differ.

This paper uses a one-way fixed effect model. A two-way fixed effect including time dummies would allow for analyzing time fixed effects. However since a number of the explanatory variables, including that of interest, PPP GDP of China, does not change from one city to another, a two-way fixed effect model cannot be used and instead a one-way fixed effect model, accounting for fixed geographic effects is used. If data on foreign investment in specific cities were available, fixed time effects would be useful to capture the effect of shocks that affected all cities such as the financial crisis in 2008. Taking into account that this effect cannot be fully capture in the analysis of this paper due to data limitations is important.

Another popular model used in the literature to examine foreign investment and its interaction with housing prices is a Vector Autoregression model (VAR). Future research should examine and compare the results of a VAR model to the results of the fixed effect model presented in this paper.

5. RESULTS

Table 2 displays the regression results for equation (1). I sequentially add a control to equation (1) and the results of each specification is displayed in a separate column. In column (1) I regress the NHPI on the PPP GDP of China. In column (2) I control for the population in every city. In column (3) I additionally control for the median after-tax income in each city. In column (4) I add controls for the average value of building permits. In column (5) I control for the average interest rate offered for a conventional 5-year mortgage. In all specifications I control for the time trend.

The PPP GDP of China coefficient remained significant and positive at the 10% significance level as controls were added. This means that, holding all else constant, when PPP GDP of China increases by one percent the housing price index within cities increases by 1.22 percent. Domestic median after tax income is statistically significant at the 5% level and also positively related to housing prices. This means that when median income increases by one percent, housing prices increase by 0.56 percent. Chinese income seems to have an economically larger effect on housing prices compared to domestic income. The relatively larger effect of Chinese income could be a reflection of Chinese buyers' preferences towards over-heated housing markets.

The growth of a city's population is statistically significant and positively related to housing prices, which aligns with the findings in the literature. The average value of building permits has a significantly positive relationship to housing prices. This means that as the cost of building new homes increases the price of these homes increases which is confirmed in the literature. The mortgage rate was insignificant. Allen et al., also encounter an insignificant mortgage rate in their study of city-level determinants of housing prices in major Canadian cities. The trend variable coefficient was negative meaning that the rate of change in the housing price index is decreasing. I also examined the same equation with city specific time trends in the place of a general trend and the results are displayed in Table 3. The city-specific trends prove to have a positive effect in housing prices in all cities except for Vancouver. In this alternative specification, the coefficient for the PPP GDP of China remains positively related to housing prices. However in this specification, the quantitative effect of Chinese income is relatively smaller than the effect of domestic income on the NHPI. A one percent increase in Chinese GDP

increase the NHPI by 0.52 percent, while a one percent increase in domestic income increase NHPI by 0.60 percent.

To look further into the effect of Chinese GDP on housing prices within cities, I used interaction terms of city dummies and the GDP of China as explanatory variables. The results of this analysis are displayed in Table 4. The interaction term is positively related to housing prices in every city in relation to the reference city of Montreal. Surprisingly, Vancouver was the only city in which the relationship between GDP of China and housing prices was insignificant.

As a robustness check, I used an ordinary least square model (OLS) on data for Vancouver, Toronto, and Montreal over the same time period. These regression results have to be interpreted with caution due to the small number of observations and high probability of omitted variable bias. Controlling for the same explanatory variables as the panel fixed effect model, the separate sets of results for Vancouver, Toronto, and Montreal are displayed in Table 5, 6, and 7 respectively. Controls are added sequentially to observe if the coefficient of the variable of interest would change. The results show that PPP GDP of China has a statistically significant positive relationship with housing price growth in Vancouver but not statistically significant relationship in Toronto. In Vancouver, an increase of one percent in the GDP of China increases the housing price index by 1.20 percent. That is an economically significant effect. Median after tax income also has a significant positive affect on housing prices in Vancouver but not to the same magnitude as the GDP of China. A one percent increase in the median income results in a 0.28 percent increase in the housing price index.

On the other hand GDP of China and median income do not seem to have a significant effect on housing prices in Toronto relative to that in Montreal. These results are affected by omitted variable bias, as a number of factors that theoretically effect housing prices are not

controlled for in this regression. In Montreal a percentage increase in the GDP of China results in 0.86 percent increase in the housing price index. Comparatively, a one percent increase in the median income in Montreal would result in an increase of 0.55 percent in the housing price index. The gap in the effect of foreign income and domestic income on housing prices is smaller in Montreal compared to that in Vancouver. These results are indicative of an increasingly larger role for foreign income in explaining housing price variation compared to domestic income.

Other Specifications

Using foreign direct investment in real estate instead of PPP GDP of China as an instrument of foreign investment in real estate, resulted in a negative relationship to housing prices using the fixed effect model. The results of the regression using foreign direct investment in real estate are displayed in Table 8. One reason for these results can be that PPP GDP of China, which may reflect foreign buyer demand for existing properties, has a relatively bigger effect on the demand for housing, while foreign direct investment is a supply related factor. Chinese buyers in real estate in Canada are focused on the purchasing of existing properties, driving up the demand for housing while foreign direct investment is more likely to increase the supply of housing through the construction of new homes. Results show that a one percent increase in foreign direct investment in real estate decreases the housing price index by 0.05%. It is important to note that these two variables used to represent foreign investment were on the national level versus all other variables (except mortgage rate) that were on the city level.

Through this analysis it is clear that there is a need for more specific data on foreign investment in housing markets on a city level in Canada. Without this data it is difficult to conclude the real effect of foreign investment on housing prices. Further more in depth analysis of the types of foreign investment is necessary.

6. CONCLUSIONS

This paper studies the effect of Chinese GDP on housing prices in six major Canadian cities while controlling for domestic factors including population, income, average cost of construction, and mortgage rate. A fixed effects model is used to further control for unobserved time invariant factors across cities. Through this analysis it is concluded that Chinese GDP has a statistically and economically significant effect on housing prices in the Canadian cities included in this paper. Another important finding is that foreign income plays an increasingly important role in explaining changes in the NHPI that complement the effect that changes in domestic income have on housing prices. This is indicative of the importance of studying international factors and their effects on housing markets in complement to domestic supply and demand indicators.

Increasing foreign investment and its positive relationship to housing prices is concerning not only in Canada but in other countries around the world. The risks of unaffordability, increasing household debt, foreign shocks and the disturbances they may cause in the domestic economy are all reasons why Canada's government, as others, has implemented targeted policies to moderate foreign investment in local housing markets. It is too early to conclude whether these policies are effective but it is encouraged that future research uses the data on foreign investment being currently collected to better evaluate these policy changes in the future and more broadly further analyze the effect of foreign investment on housing prices.

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Table 1: Summary Statistics: Overall Mean (6 Cities)

	Mean
New Housing Price Index (2007) (CAD)	89.513 (20.445)
PPP GDP of China (International Dollars)	7409.839 (3800.25)
Population	2430607 (1674693)
Median After-tax Income (CAD)	57508.82 (7935.109)
Average Value of Building Permits (CAD)	310.561 (95.746)
Mortgage Rate (%)	6.259412 (1.015)
Observations	102

Note: Standard deviations are in brackets

Table 2: Effect of PPP GDP of China on New Housing Price Index

Panel One-Way Fixed Effects					
	(1)	(2)	(3)	(4)	(5)
PPP GDP of China	1.465*	1.554*	1.487*	1.156*	1.216 *
	(0.491)	(0.513)	(0.501)	(0.351)	(0.321)
Trend	-0.122*	-0.165*	-0.156*	-0.119*	-0.128*
	(0.050)	(0.062)	(0.060)	(0.039)	(0.035)
Population		1.868*	1.422*	0.889*	0.866*
		(0.553)	(0.603)	(0.402)	(0.405)
Median After-tax Income			0.527*	0.554**	0.559**
			(0.148)	(0.116)	(0.113)
Average Value of Building Permits				0.180**	0.188**
				(0.042)	(0.041)
Mortgage Rate					-0.013
					(0.0162)
Constant	-2.087	-27.717*	-26.890*	-19.493**	-19.252 **
	(1.753)	(8.178)	(7.288)	(4.541)	(4.638)
R^2 (Within)	0.829	0.891	0.902	0.916	0.917
Observations	102	102	102	102	102

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. The reference group used in this model is Montreal. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Effect of PPP GDP of China on New Housing Price Index (With Trend Interaction Terms)

Panel One-Way Fixed Effects	
(5)	
	0.520**
PPP GDP of China	(0.125)
Population	-2.771*
	(1.158)
Median After-tax Income	0.601*
	(0.207)
Average Value of Building Permits	0.172*
	(0.071)
Mortgage Rate	0.023
	(0.021)
Trend* Montreal	Reference
Trend *Ottawa	0.005
	(0.005)
Trend* Toronto	0.018*
	(0.009)
Trend *Calgary	0.058*
	(0.023)
Trend* Edmonton	0.041*
	(0.019)
Trend * Vancouver	-0.006
	(0.005)
Constant	31.143
	(15.817)
R^2 (Within)	0.928
Observations	102

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. The reference group used in this model is Montreal. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Effect of PPP GDP of China on New Housing Price Index (With City Interaction Terms)

Panel One-Way Fixed Effects					
	(1)	(2)	(3)	(4)	(5)
Trend	0.034** (0.005)	0.083** (0.012)	0.079** (0.012)	0.063* (0.016)	0.069* (0.017)
Population		-4.817* (1.152)	-4.977** (1.015)	-4.142* (1.198)	-3.911* (1.185)
Median After-tax Income			0.596* (0.188)	0.627* (0.256)	0.580* (0.279)
Average Value of Building Permits				0.192* (0.091)	0.157* (0.076)
Mortgage Rate					0.031 (0.022)
Montreal*PPP GDP of China	Reference	Reference	Reference	Reference	Reference
Ottawa*PPP GDP of China	0.016 (0.049)	0.147* (0.012)	0.139* (0.041)	0.115* (0.032)	0.104* (0.032)
Toronto*PPP GDP of China	-0.001 (0.049)	0.282* (0.074)	0.343** (0.062)	0.273** (0.065)	0.255* (0.065)
Calgary*PPP GDP of China	0.278** (0.049)	1.009** (0.178)	0.959** (0.169)	0.755* (0.200)	0.736* (0.202)
Edmonton*PPP GDP of China	0.200** (0.049)	0.785** (0.143)	0.746** (0.136)	0.564* (0.162)	0.551* (0.164)
Vancouver*PPP GDP of China	-0.118* (0.049)	0.047 (0.050)	0.040 (0.046)	0.025 (0.040)	0.010 (0.039)
Constant	2.178*** (0.076)	66.618** (15.410)	62.670* (14.563)	50.411* (17.205)	47.673** (16.966)
R^2 (Within)	0.869	0.896	0.905	0.922	0.925
Observations	102	102	102	102	102

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. The reference group used in this model is Montreal. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Effect of PPP GDP of China on New Housing Price Index in Vancouver

OLS					
	(1)	(2)	(3)	(4)	(5)
PPP GDP of China	1.269 *** (0.173)	1.045 *** (0.083)	1.121 *** (0.067)	1.219 *** (0.104)	1.204 *** (0.109)
Trend	-0.121*** (0.019)	-0.035* (0.013)	-0.059*** (0.012)	-0.076** (0.017)	-0.073** (0.017)
Population		-4.353*** (0.439)	-3.469*** (0.430)	-3.028 *** (0.490)	-3.075*** (0.487)
Median After-tax Income			0.257** (0.082)	0.302** (0.074)	0.284** (0.057)
Average Value of Building Permits				-0.046 (0.030)	-0.051 (0.034)
Mortgage Rate					0.003 (0.005)
Constant	-5.544** (1.340)	59.298*** (6.613)	43.134 *** (6.933)	35.742** (7.859)	36.738** (7.683)
R^2	0.950	0.992	0.995	0.996	0.996
Observations	17	17	17	17	17

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Effect of PPP GDP of China on New Housing Price Index in Toronto

OLS					
	(1)	(2)	(3)	(4)	(5)
PPP GDP of China	0.182*	0.167	0.165	0.156	0.135
	(0.088)	(0.095)	(0.096)	(0.151)	(0.174)
Trend	0.013	-0.001	0.002	0.002	0.005
	(0.009)	(0.012)	(0.014)	(0.014)	(0.017)
Population		0.940	0.795	0.842	0.883
		(0.612)	(0.685)	(0.931)	(1.061)
Median After-tax Income			0.160	0.155	0.172
			(0.259)	(0.298)	(0.321)
Average Value of Building Permits				0.007	- 0.004
				(0.102)	(0.107)
Mortgage Rate					0.005
					(0.011)
Constant	2.864	-11.448	-10.962	-11.603	-12.235
	(0.687)	(9.162)	(9.447)	(12.278)	(14.202)
R^2	0.991	0.992	0.992	0.992	0.993
Observations	17	17	17	17	17

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Effect of PPP GDP of China on New Housing Price Index in Montreal

OLS					
	(1)	(2)	(3)	(4)	(5)
PPP GDP of China	0.863*** (0.157)	0.334 (0.361)	0.633* (0.292)	0.832** (0.221)	0.859** (0.203)
Trend	-0.058** (0.017)	0.083 (0.068)	0.037 (0.051)	-0.030 (0.039)	-0.026 (0.036)
Population		-8.363 * (3.012)	-7.756** (2.232)	-2.491 (1.892)	-3.514* (1.680)
Median After-tax Income			0.712* (0.289)	0.590* (0.197)	0.546* (0.213)
Average Value of Building Permits				-0.154*** (0.026)	-0.122*** (0.021)
Mortgage Rate					-0.015 (0.011)
Constant	-2.495 * (1.222)	127.450* (47.775)	108.407* (35.800)	29.775 (29.732)	45.784 (26.542)
R^2	0.973	0.984	0.990	0.996	0.997
Observations	17	17	17	17	17

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: The Effect of Foreign Direct Investment in Real Estate on New Housing Price Index

Panel One-Way Fixed Effects	
	(1)
Foreign Direct Investment in Real Estate	-0.052* (0.025)
Trend	0.017 (0.010)
Population	0.547 (0.339)
Median After-tax Income	0.603* (0.155)
Average Value of Building Permits	0.261* (0.074)
Mortgage Rate	0.030 (0.015)
Constant	-12.185 (3.940)
R^2 (Within)	0.889
Observations	102

Notes: The dependent variable is the New Housing Price Index. All regressors are expressed in logs except for mortgage rate. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.