The Effect of Immigration on Housing Prices in Vancouver

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Contents

Abstract

This study examines the behavior of the housing prices in response to immigration activity in Vancouver and Toronto at census tract level based on the population censuses of 1996 to 2006. The results show that in Vancouver, immigration has a positive effect on the housing prices, an 1% point increase of the immigration share in the total population is associated with an increase in average dwelling values of 0.675%. As Toronto and Vancouver are two major English speaking census metropolitan areas (CMAs) with the largest number of immigrants, as a reference, the case of Toronto will be compared with the case of Vancouver. In Toronto a 1% point increase of the immigration composition is coincident with an increase of the housing prices of 1.108%.

1. Introduction

Immigration has always played a significant role in Canada's population growth. This trend will continue, as the census of 2006 from Statistics Canada indicates that the immigration inflows are responsible for two-thirds of the national population growth from 2001 to 2006. These groups of immigrant arrive with different racial and socio-economic backgrounds. However, no matter how different their backgrounds are, they land in Canada with a common requirement, which is the need to be housed. Thus, in addition to the well-known fact that immigration is important for economic growth, immigration also affects the housing demand. Immigrants comprise a substantial number of potential home buyers. Approximately 225,000 immigrants are accepted into Canada each year, which is a considerable factor in stimulating the housing demand. The arrival of new immigrants to a destination city would cause the housing supply shift upward if the market expects a high housing demand (Sarner 2011). Guatieri (2011) points out that Canada's housing market has experienced a substantial boom in prices over the past decade. Average existing house prices have more than doubled in the past ten years. In one of the gateway cities of Canada, Vancouver, housing prices have nearly tripled in the past decade. In the largest Canadian city of Toronto, housing prices have almost doubled in the past ten years[1]. Table 1 shows that until April 2011, the average dwelling value of Vancouver reached $815,000, and the average home price of Toronto was $477,000.

Although Vancouver has the tightest and least affordable housing market, many immigrants still opt to settle there, because Vancouver has the most moderate climate

[1] Montreal's (the second largest city in Canada) housing prices have increased 150% in the past decade. Thus, in the past decade, all the three largest gateway cities experience a housing price boom.

compared with other destination cities for immigrants. Metro Vancouver has a mild climate with cool, wet winters and warm, dry summers. This mild weather attracts immigrants to settle there. However, other cities do not have the advantage of climate, such as Toronto and Montreal. The Figure 1 indicates that the total immigrant population was increasing in Vancouver between the censuses of 1996 and 2006. Relative to the increase in the overall population, the percentage of immigrants was growing over the three censuses (Figure 2). The growing size of immigrant population is coincident with the boom in housing prices in Vancouver, but this does not necessarily imply causality, and there are doubtless other influences at work. Therefore, besides the influences of low interest rates, which allow low income buyers to enter the market with low equity financing, in this paper I am particular interested in the effects of immigration activity on housing prices in Vancouver: does immigration affect the home values substantially, or does it have no effect on the housing prices?

The objective of my empirical analysis is to estimate the relationship between house prices and immigration in the Census Metropolitan Area (CMA) of Vancouver at census tract (CT) levels based on the population censuses of 1996, 2001 and 2006. I will estimate the fixed-effect model, which uses the time-series variation (within given census tracts) to find how the average housing prices change when the immigration to the total population ratio changes holding other factors constant from the 1996 to the 2006 Census. The between model, which collapses the three cross-sections into one, will also be estimated. It uses strictly cross-sectional variation to examine the differences of the average dwelling values due to the variations of immigration share of their total population across census tracts with other determinants constant. Using a panel data model allows one to control for unobserved heterogeneity (provided that it is time invariant) among CTs when the fixed effect model (the within model) and the between model are both used.

As a comparison case, I will also examine the nexus between immigration and housing prices in the CMA of Toronto, compare the estimation results of Vancouver with those of Toronto, and use the Oaxaca decomposition to determine whether the large, observed housing price differential between Vancouver and Toronto is due to differences in coefficients of the exogenous variables, or whether it is due to differences in the average value of the independent variables. It is worth adding Toronto into my empirical analysis, because Toronto is the biggest gateway city for immigrants, and it is also the largest city in Canada. Unlike Vancouver, which has had the strongest links to Asia and draws the majority of immigrants from Asia[2], Toronto has had links to the United States, and it has the largest share (of the total population) of first-generation immigrants of any city in an OECD[3] country and the largest number of immigrants in Canada (CMHC, 2007). Hiebert, Mendez and Wyly (2008) report that in 2001, 16.5% of the population of CMA Vancouver was comprised of immigrants who officially landed in Canada in past decade (Vancouver has the second-most important centre of immigrant settlement in Canada). For Toronto, this value is even higher at 17%. Vancouver and Toronto are therefore suitable for examining the relations between the immigration and house prices as they receive the largest immigrant inflows in Canada.

In this paper, Section 2 reviews several literatures consisting of different country studies of the nexus between the housing prices and immigration (ex. US, Canada, UK etc), and also

[2] Vancouver receives the majority of the immigrants from eastern and southern Asia. The more recent rise of the Asian economies has positive effects to the economic growth in Vancouver.
[3] Organisation for Economic Co-operation and Development.

reviews some Canadian studies about the immigrants' homeownership rates, settlement conditions, and historically how immigration activity affects housing prices in Vancouver and Toronto; Section 3 discusses the econometric model estimated (including the variables used) in my paper; Section 4 presents the data set; Section 5 presents empirical methodology; Section 6 documents the econometric results and analysis; And Section 7 concludes my study.

2. Past studies of immigration and housing prices changing:

There is a growing body of literature focusing on the effects of immigration on housing prices in different countries. Recent evidence of these country studies just suggests that immigration affects housing prices globally. Among these studies, some reveal that immigration activity affects housing price *substantially* (positively or negatively), while others find immigration has a *small* impact on rising housing prices.

For those studies reporting *positive* effects of immigration on housing prices, Saiz (2007) shows a local economic impact of immigration in American MSAs.[4] He finds that immigration stimulates the housing demand in immigration destination cities such that rent increases in the short run, which then drives the housing prices to increase as well. He uses the annual data on legal immigration inflows, and the Census decennial data on the stock of foreign-born individuals, housing rents and dwelling values at the metropolitan area level. He finds that an immigration inflow equalling to 1% of total population leads to an increase in average gross rents and average housing values of approximately 1%. In his study, he uses

[4] Metropolitan Statistical Areas. In the United States, a MSA is a geographical region with a relatively high population density at its core and close economic ties throughout the area. Typically a metropolitan area is centered around a single large city that wields substantial influence over the region. (ex. Los Angeles)

the inflow of recent immigrants as the instrumental variable for immigration based on two approaches, one is based on the characteristics of sending countries, the immigration levels by original countries in 1979 and the initial geographical distributions of immigrants by country. The other one is based on the year-to-year changes in national immigration levels and previous settlement patterns. Then these two approaches of instruments yield the similar results: Cities which draw immigrants experience higher housing rents and housing values. Moreover, his fixed-effect model, which uses within-city variation in the immigration inflows between censuses, also yields the similar results of positive effects of immigration on average rents and housing values.

Degen and Fischer (2009) examine the behavior of Swiss house prices on immigration flows across 85 districts from 2001 to 2006. Conditioning on the immigration variable, the unemployment variable, and the regional control variables which capture region-specific characteristics with year fixed-effects, their estimates find that 1% point increase in immigration inflow is coincident with an increase of housing prices for single family dwellings of approximately 2.7%, and the relations hold even in the environment of low house price inflation and modest immigration inflows. This study emphasizes the distinct characteristics (of the housing markets) of national rent control policies, low levels of home ownership, and low vacancy rates, which tend to cause moderate house price movements. The low vacancy rates and low turnover rates also make the Swiss market sensitive to unexpected immigration inflows. Hence these characteristics which depict the Swiss market affect the nexus between immigration and housing prices such that the impact is stronger than is the case for other countries. The short-run estimates for Switzerland are consistent with other countries' studies that report higher housing prices appreciation, and the distinct features in Switzerland do not abate the effects of immigration inflows on housing prices.

For Spain, Gonzalez and Ortega (2009) estimate empirically the effect of immigration on housing prices and the flow of new residential constructions over the period 1998 to 2008 across 50 Spanish provinces. Spain experienced a spectacular boom in house prices over the last decade- housing prices increased by 175%. In addition to the contributing factors like unprecedented low interested rates, deregulation in the mortgage market and rising incomes which played a role in the housing boom, they hypothesize that immigration may partially explain Spain's stronger housing boom relative to other countries, as the housing boom coincided with a big immigration wave. Their results show that from 1998 to 2008, Spain received an immigration inflow which equaled 17% of working-age group, and this inflow stimulated housing prices to increase by 52%. Overall they estimate that immigration can account for 30% of the total increase in prices. Also the authors mention that compared with the US literature, they do not only focus on house prices, but also on the effect on housing supply, which is represented by new residential constructions, in order to paint a more comprehensive picture of how the housing market responds to immigration shock. Therefore, they find the immigration inflow also can account for 37% of the total new dwellings built. Thus, their study concludes that immigration does affect the housing market and was responsible for 1/3 of the housing market boom both in terms of prices and quantities in Spain.

Sa (2011) claims to have discerned a *negative* effect of immigration on housing prices in UK, which is in contrast with those studies revealing positive effect of immigration on housing prices. He uses data on immigration activity and housing prices which cover periods from the first quarter of 2003 to the last quarter of 2010 across 159 local areas in England and Wales. The coefficient's estimate is an inflow of immigrants equal to 1% of the local population causes the housing price to fall by 1.6%. His model includes year fixed effects to capture national trends of inflation and other macroeconomic factors. Besides the relationship of immigration and housing prices, he also focuses on the nexus between immigration and geographic mobility, native population growth, and the distribution of wages among natives. He points out that in the local areas with a high concentration of immigrants, the distribution of wages is tilted towards the low end, which may be due to the fact that native population earning relatively low wages typically live in areas with a high density of immigrants. Thus this leads to a negative income effect that tends to reduce the housing demand, and therefore housing prices tend to go down in high immigration areas, all other factors held constant. Moreover he explains the negative effect of immigration on housing prices may result from the mobility response by the native population. In his study, the estimates reveal that an immigrant inflow equal to 1% of the local population leads to a native outflow equal to 0.849% of the local population.

In contrast with those articles that find that immigration *substantially* affects house prices, the result of "*muted* immigration effect" is discerned in Akbari and Aydede (2009), which consists of an investigation of the relations between immigration and the housing price in Canada. This study uses cross-sectional information and time-series information to estimate the long-run relationships between average dwelling prices and immigration. They test for a relationship based on 289 Census divisions across Canada for three census years which cover a ten-year span beginning in 1996. Their estimation results, based on a fixed-effect model estimated from a panel data structure indicate that the change in immigration ratio[5] does not affect housing prices over periods between 1996 and 2006. In addition to estimating a within, fixed-effect model, they also estimate a between-model which uses cross-sectional variation. It reveals a positive effect of immigration on average dwelling prices (the magnitude of this effect is 0.11 percent associated with a one percentage point increase in immigration share), which is statistically significant. They conjecture that the small estimated magnitudes of immigration coefficients may result from the displacement effects that the inflows of immigration might be offset somewhat by out-migration. The estimated coefficient of the immigration ratio is the net value after the displacement effect occurs.

The articles cited above just show the impact of immigration on housing prices at national levels. Although the estimated results for aggregated Canada from Akbari and Aydede (2009) indicate a statistically but small effect of immigration, I am interested in the immigration effect in gateway cities in Canada like Vancouver or Toronto. Does immigration activity tend to have a muted effect in immigration destination cities that is consistent with the national results discerned by Akbari and Aydede (2009) or might there be a discernable and statistically significant effect in these instances? There are also some articles that imply the relationship between immigration and housing prices in Vancouver and Toronto.

Laryea (1999) uses 1991 census data to investigate housing tenure among three largest cities- Toronto, Montreal and Vancouver. A logistic regression is estimated between whether

[5] In contrast with other countries' studies which use the immigration inflows as the immigration variable, Akbari and Aydede (2009) use the ratio of total immigrant residents in one census division to that census division's population as the variable of immigration.

one owns a houses or not and socio-economic and demographic variables on home ownership. The result indicates that the home ownership rates of immigrants in Vancouver are higher among immigrants from US, Europe and Asia. He compares the conditions of home ownership between the Asian immigrants in Vancouver and Montreal as well. He reports that Asian immigrants in Vancouver have a higher probability of owning a house, but Asian immigrants in Montreal tend to rent rather than own. He conjectures that the large number of investment immigrants from Asia plays a significant role in the high home ownership rate in Vancouver, which is a linked to their personal wealth when they enter into Canada.

Also, Ley and Tutchener (1999) conclude that high immigration rates are correlated with high dwelling values in Toronto and Vancouver. They study eight metropolitan areas' housing price trajectories from 1971 to 1996. For each area, correlations are run between annual house prices and a series of other variables including regional GDP, unemployment rate, bank rate, immigration etc. Then they find that Vancouver and Toronto have different trajectories than other cities, higher correlation values between housing prices and immigration are found in both regions. In that 25-year period, Vancouver and Toronto exhibited substantial increases in housing prices during the economic boom and strong decreases during economic downturns. The authors attribute these phenomenons to immigration quotas. The distinct housing price appreciation usually coincides with large immigration inflows. Housing prices in Toronto appreciated 27% in 1986, 37% in 1987, 21% in 1988, and 19% in 1989, which coincided with a large influx of immigration inflows into the city under the immigration class. Prices started to decline between 1990 and 1994 during the recession, but meanwhile the Vancouver real estate market remained buoyant, and prices kept increasing until 1995, which resulted from the wealthy Asian immigration groups landing continuously during those periods.

Hiebert, Mendez and Wyly (2008) obtain an important finding from their research about the housing situation and the needs of recent immigrants in Vancouver. They use the information from the first wave of LSIC[6] on a representative sample of immigrants who landed in Canada between October 2000 and September 2001 to explore how recently-arrived immigrants find housing and the extent to which their initial housing situations are affordable, adequate and suitable. They find that the immigrants in Vancouver are able to buy houses early during their settlement period; usually they start to buy houses within six months after landing. And 20% of recent immigrants and refugees in Vancouver already owned a home. From these articles about the major immigration destination cities, one would expect there to be a relationship between immigration and housing prices in the Vancouver real estate market. The Vancouver market has a very distinct feature - steadily attracting wealthy business immigrants and keeping the homeownership rate among immigrants relatively high. Therefore I take as my prior expectation that immigration has substantial effects on housing prices in Vancouver, and then I will test that hypothesis using an empirical model similar to the one set out in Akbari and Aydede (2009).

3. The model and econometric specifications:

The model and empirical specifications that I use to estimate the impacts of immigration on housing prices mainly follow the work of Akbari and Aydede (2009). The theory that

[6] the Longitudinal Survey of Immigrants to Canada (conducted by *Statistics Canada* and *Citizenship and Immigration Canada*).

underlies the model is based on the assumption that the market will clear in the long run such that the existing stock of housing is equal to the housing demand. As the model is estimated based on three censuses of Canada conducted in 1996, 2001 and 2006, I believe that the interval of five years between census years could give the market sufficient time to reach the clearing level. The market clearing conditions derive from the following equations:

$$\begin{cases} P_{it} = f(h_{it}, y_{it}, X_{it}, uc_{it}) \\ S_{it} = I_{it} + (1-\delta)h_{it-1} \\ I_{it} = f(P_{it}, C_{it}) \end{cases}$$

where subscript i and t represent a census tract (CT) and year t respectively. P is the average value of dwelling, h is the number of units of existing housing stock, y is income per capita, X is vector of factors which affect housing demand, uc is user cost, S is market supply, I is number of new units of construction, δ is the depreciation factor applied to the value of existing houses, and C is construction costs. The first equation is the inverse demand function, which specifies that the equilibrium price is determined by the housing stock as well as demand-side variables such as income, user cost etc. The second equation shows the housing supply is equal to the sum of the number of new construction units and the existing stock after accounting for depreciation from the last period. The third equation models the new construction of housing as a function of the price and the construction costs. Hence, when we place these three equations together within this system by making the quantity demanded of housing demand equal to the quantity supplied, the market clearing takes place. Therefore the core reduced-form expression of the average dwelling value can be expressed as:

$$P_{it} = f(h_{it-1}, y_{it}, X_{it}, I_{it}, uc_{it}) \qquad (1)$$

To enrich the model, more factors which may in reality affect housing price will be added. According to Poterba (1991), the cost of owning a house over a given time horizonwill be equal to the costs of renting, which can be presented as:

$$User\ cost = Rent = P(i + \tau + \lambda - \pi)$$

which can be inverted to:

$$P_{it} = \frac{R_{it}}{(i+\tau+\lambda - \pi)_{it}} \qquad (2)$$

where subscript i and t represent a census tract (CT) and period t respectively. P is the housing price, R is the average gross rent, i is the interest rate earned from investment, τ is the property tax rate, λ is the recurring costs of maintenance, depreciation and the risk premium on property, and π is the expected capital gains or loss. Therefore, based on equations (1) and (2) above, another fourteen variables will be included in the estimating model besides the variable of immigration. Details will be presented below.

The equation for the demand for housing in area (i) at year (t) is given by:

$$Q_{i,t}^{D} = D(hprice_{i,t}, immratio_{i,t}, mobility_{i,t}, mobility5_{i,t}, income_{i,t}, un_{i,t}, lfpr_{i,t}, rent_{i,t}, maincost_{i,t}, room_{i,t}, ratio2034_{i,t}, density_{i,t}, abor_{i,t}, u_{i,t}) \qquad (3)$$

Where:

$hprice_{i,t}$ = the housing price

$immratio_{i,t}$ = the ratio of immigration over total population

$mobility_{i,t}$ = the ratio of people living in a different census tract one year ago to non-movers.

$mobility5_{i,t}$ = the ratio of people living in a different census tract five years ago to non-movers.

$income_{i,t}$ = pre-tax income per capita.

$un_{i,t}$ = the unemployment rate

$lfpr_{i,t}$ = the labor force participation rate.

$\boldsymbol{rent_{i,t}}$ = the gross average rent.

$\boldsymbol{maincost_{i,t}}$ = the ratio of the number of houses needing minor renovations to those which need major renovations.

$\boldsymbol{room_{i,t}}$= the average number of rooms per dwelling.

$\boldsymbol{ratio2034_{i,t}}$= the ratio of the population between 20 to 34 years old to the total population.

$\boldsymbol{density_{i,t}}$ = the population living in one square kilometer.

$\boldsymbol{abor_{i,t}}$ = the percentage of aboriginal population in total population.

$\boldsymbol{u_{i,t}}$ = the random error term.

Similarly, the equation for the housing market supply, it is presented as:

$$Q_{i,t}^{S} = S\ (hprice_{i,t},\ cwork_{i,t},\ stock_{i,t},\ Ndwell_{i,t},\ v_{i,t}) \qquad (4)$$

Where:

$\boldsymbol{hprice_{i,t}}$= housing prices

$\boldsymbol{cwork_{i,t}}$ = the percentage of construction workers in the total labor force.

$\boldsymbol{stock_{i,t}}$ = the total number of occupied private dwellings

$\boldsymbol{Ndwell_{i,t}}$ = the number of new units of constructions.

$\boldsymbol{v_{i,t}}$ = the random error term.

The unit of analysis is the census tract. In equilibrium, the following condition holds:

$$Q_{i,t}^{D} = Q_{i,t}^{S} \qquad (5)$$

Then, substituting equation (1) and equation (2) into (3), we obtain the reduced-form equation:

$$hprice_{i,t} = f\ (immratio_{i,t},\ ratio2034_{i,t},\ density_{i,t},\ income_{i,t},\ abor_{i,t},\ mobility_{i,t},\ mobility5_{i,t},\ un_{i,t},\ lfpr_{i,t},\ cwork_{i,t},\ stock_{i,t},\ user\ cost_{i,t},\ Ndwell_{i,t},\ rent_{i,t}) \qquad (6)$$

Therefore, based on the assumptions of market clearing conditions in the long-run, the primary regression model, which assumes the general linear form, can be presented in compact notation as:

$$y_{it} = \alpha + \sum_{k=1}^{k} X_{it}\beta_{it} + \varepsilon_{it}, \quad i = 1,2,3,\ldots n, \quad t = 1996, 2001, 2006 \qquad (7)$$

Here, n represents the maximum number of census tracts measured in period t.

In this linear representation, y_{it} is the average value of privately owned dwellings, which is the average housing price in the i-th CT at year t. It is the dependent variable in my model, and this value is adjusted to 1996 prices by using the 1996 GDP deflator. I then take the logarithmic form. For the independent variables, the descriptions are given in two parts: variables affecting housing demand and those affecting housing supply.

Demand-side variables:

The independent variable which is primary to my analysis is the ratio of the number of immigrant people living in one Census Tract to the total population in that CT (***immiratio***).[7] When immigrants land in Canada, some may choose to rent houses, but some may choose to buy houses. I assume that an increasing number of immigrants may stimulate the housing demand in the market, and expect that it would affect the housing prices positively, all other factors held constant. This prior expectation is subjected to empirical validation below.

It is possible that an inflow of immigrants moving to one Census Tract may cause a number of original residents to move out, which is called a crowding-out effect. Sa's (2011) empirical study points out that an immigration flow could potentially lead to a reduction in native wages (due to a push in labour supply), but if immigrants' earnings are not high

[7] This immigration variable is the stock and not the flow of immigrants.

enough to compensate for the reduction in natives' earnings occasioned by lower wages, total labour income in the census tract would fall, leading to a reduction in housing demand, and perhaps in housing prices. In order to control for this potential displacement effect to housing prices, ***mobility***, which is the ratio of the number of people who were in a different CT one year ago to non-movers, and ***mobility5*** which is the ratio of the number of people who were in a different CT five years ago to non-movers, are added to the model.

Income (***in***), the labor force participation rate (***lfpr***), and the unemployment rate (***un***), which are indicators of labor market conditions, are included in the model. Income (***in***) is pre-tax income per capita. I assume that housing is a normal good, as people can afford to buy more expensive housing when they receive higher incomes. The labor force participation rate (***lfpr***) is positively associated with income, specifically for the component of permanent income. I therefore expect to obtain a positive estimated coefficient for ***lfpr***. On the other hand, a lower labor force participation rate may not always be associated with decreasing housing demand, as some communities with a high concentration of retirees may have greater resources to buy houses despite a relatively low labour force participation in the CT. In that instance, the variation in the labor force participation rate may only reflect the substitution between active members and retired people, which implies that we do not have a prior expectation for the sign of ***lfpr***. I expect that a lower unemployment rate (***un***) would lead to higher housing demand due to a simple income effect. On the other hand, certain unemployed individuals may have alternative sources of income or assets, and so one might consider the possibility of a weak effect for ***un*** on housing prices.

In addition, to estimate the effect of maintenance costs on housing prices, following

Akbari and Aydede (2009), I use the ratio of the number of houses which need minor renovations to those needing major renovations in order to measure the effects of maintenance costs (***maincost***). Adding average gross rent (***rent***) to the model is necessary, as it is an important proxy of user costs of owning a house. The average number of rooms per dwellings (***room***) is used to control for the size of housing units.

For the demand-side variables, the demographic indicators of ***ratio2034*** and ***abor*** are incorporated into the model. ***Ratio2034*** is the ratio of people between 20 to 34 years old to the total population in the CT. According to Akbari and Aydede (2009), the age group of 20-34 is identified as the prime home buying age group, as the variations in the age composition of population explain the diffentials in housing values across regions (Mankiw and Weil 1989). So I set the variable of ratio2034 as the group of prime age housing buyers. ***abor*** is the percentage of aboriginal people in the total population of each CT. This variable is used to control for the special legal circumstances in some CTs, such as land-ownership considerations.

Supply-side:

There are four independent variables which affect the supply of housing market. The first one is ***Ndwell***, which is the number of new units constructed between censuses. Next is the housing stock in the current census (***stock***), which is the number of total privately occupied dwellings, including privately owned dwellings, rental properties, and band housing. Construction cost is a significant factor to be concerned with according to Abraham and Hendershott (1996); real construction costs are expected to have a positive effect on housing price appreciation, so construction cost is incorporated and represented by ***Cwork***, which is the ratio of number of construction workers to the size of total labor force. The last variable of this category is ***density***, which is the population per square kilometer. This variable is used to control for the housing supply factors based on actual land availability.[8]

4. Description of Data:

My estimations are based on three population censuses (1996, 2001 and 2006), which are collected and compiled by Statistics Canada. My estimating sample includes all of the census tracts for Vancouver and Toronto. The CMA of Vancouver comprises of 410 areas in census 2006, 387 areas in census 2001, and 298 areas in census 1996. The CMA of Toronto comprises of 1,003 areas in the 2006 census, 932 areas in the 2001 census, and 808 areas in the 1996 census.

The definition of a Census Tract according to Statistics Canada indicates that CTs are small, relatively stable geographic areas that usually have a population of 2,500 to 8,000, with a preferred average of 4,000, and are located in census metropolitan areas and larger census agglomerations. Each CT is assigned a seven-character numeric name (ex, 9330001, whose first three digits (933) uniquely represent the CMA of Vancouver, and whose last four digits (0001) represent that CT's particular code). Their boundaries are supposed to follow permanent and easily recognizable physical features, and their shape should be as compact as possible. The CTs should be as homogeneous as possible in terms of their socio-economic characteristics. Moreover, one should note that road construction patterns, suburban growth patterns, or municipal annexations may lead to changes in CT boundaries. Furthermore, a

[8] All dollar values (for housing prices, income and rent) are deflated to 1996 prices by the 1996 GDP deflator. Housing stocks and new construction units are per capita values.

census tract may be split into two or more new census tracts when its population exceeds 8,000 (ex. 9530001 in 1996 census becomes 9330001.01 and 9330001.02 in the 2001 census), which is the main reason why the number of CTs in Vancouver increased significantly from census 1996 to 2006.[9]

One of my objectives is to compare the estimates of the Vancouver sample with those derived from the CMA of Toronto, which is the most popular and largest traditional destination city of immigrants. Similar to the case of Vancouver, the number of CTs for which boundaries changed rose from the Census of 1996 to 2006, mainly due to increasing populations in certain census tracts. For both Vancouver and Toronto, the detailed information (ex, demographic profiles) of a given CT can be found on the website of Statistics Canada.[10] For econometric analysis of dynamic changes in housing prices, this paper is the first one to use the Census Tract as the unit of collected sample of certain CMAs.[11]

5. Methodology:

One obvious problem with using census data over multiple censuses is the boundary changes that occurred from the 1996 census to the 2006 census. There are two ways to address this problem: one is to set up a panel data structure and obtain consistency in the

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[9] Description of Census Tract obtained from: Census, 2006 Census dictionary, *Statistics Canada*, at http://www12.statcan.ca/census-recensement/2006/ref/dict/geo013a-eng.cfm (Accessed June 26, 2012)

[10] Links from Statistics Canada:
http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-597/includes/CTname-nomSR.cfm?Lang=E (Naming Convention)
http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-597/P3.cfm?Lang=E&ctcode=5273&cacode=933 (Vancouver CMA)
http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-597/P3.cfm?CTuid=5350286.00&Lang=E (Toronto CMA)

[11] One thing to mention is that as my paper is based on censuses from 1996 to 2006, I will use data of units of housing stock in the current census year rather than in last census in order to prevent losing all of the observations from 1996.

definition of CTs from census to census by deleting those areas whose boundaries changed. [12]Hence, for Vancouver, my analysis is based on 212 CTs for all three census years. In the case of Toronto, after dropping those CTs whose boundaries changed, 673 areas remained in the panel data model. A second approach is to retain all CTs of CMA (including areas with and without boundary changes), and to estimate OLS regressions for each census separately. This would provide a possible range of estimates that could be compared to the fixed effect model.

To test how housing prices change due to variables changing within each census tract from the census of 1996 to 2006, the within-unit, fixed-effect model will be used. This model uses time-series variation in order to identify the coefficients of the exogenous variables. The within model can be presented based on equation (7), with census-tract-specific parameter u_i added into a one-way model:

$$y_{it} = \beta_k X_{it} + u_i + \varepsilon_{it} \qquad (8)$$

For which β is $k \times 1$ vector of coefficients of vector X, and X is a $1 \times k$ vector of exogenous variables which shows variables changing over each CT (subscript i) and over three censuses (subscript t). u_i is the binary variable capturing region-specific characteristics. ε_{it} is the disturbance term (which is i.i.d and satisfies $\epsilon_{it} \sim (0, \sigma_\epsilon^2)$), which represents the shock to house prices in CT_i at time t. As u_i is treated as an unobserved random variable that is potentially correlated with the observed regressors in X_{it}, if the fixed effects are present and correlated with X_{it}, then the pooled OLS estimators are inconsistent. The advantage of the within estimator is it exploits the longitudinal feature of the panel data,

[12] The disadvantage of using this approach is that one is discarding observations, which could undermine the representativeness of the estimating sample if the omissions are not totally randomized.

nets out the influence of the time-invariant aspects of each unit, and yields consistent estimates of β. Also the equation (8) can be transformed such that it shows the relationship between CT-specific deviations of independent variables from their time-averaged values and the CT-specific deviations of the dependent variable from its time-averaged value. Let $\bar{y}_i = (\frac{1}{T})\sum_{t=1}^{T} y_{it}$, $\bar{X}_i = (\frac{1}{T})\sum_{t=1}^{T} X_{it}$, and $\bar{\varepsilon}_i = (\frac{1}{T})\sum_{t=1}^{T} \varepsilon_{it}$. The within-model can now be expressed as:

$$y_{it} - \bar{y}_i = \beta(X_{it} - \bar{X}_i) + (u_i - u_i) + \tau_t + (\varepsilon_{it} - \bar{\varepsilon}_i) \qquad (9)$$

In this equation a time dummy τ_t is added to the within model. The reason for choosing a one-way within model plus a time-specific effect rather than a two-way within model is that the estimation is based on only three censuses. Thus I will use this within model to test how immigration composition and other regressors affect the housing price based on within variation of each census tract over the periods from 1996 to 2006. Also, I applied the Hausman test and found that the test result indicates I can strongly reject the null hypothesis that the random effect estimators are consistent. Thus it is appropriate to choose the fixed effect model.

As an alternative approach, in order to examine the difference in the average dwelling values between two census tracts, the between model will be applied, which uses only the cross-sectional information and depicts the long-run relationships between the dependent variable and the independent variables. In the between model, the group (at the level of the census tract) means of y are regressed on the group means of X in a regression containing of N observations:

$$\bar{y}_i = \alpha_i + \bar{X}_i\beta + u_i + \bar{\varepsilon}_i \qquad (10)$$

The between estimator ignores all of the census-tract-specific (within) variation in y which is exploited in the within model, replacing each observation for an individual with its mean values. This estimator is not widely used due to its inconsistency, but sometimes it is applied when the variation over time for each individual is assumed to contain random deviations from long-run average values. Thus, in my estimation, I use the between model to complement the estimates and results derived from the within model. The econometric results from the both models are presented below.

6. Econometric Results and Interpretations:

6.1. Estimation results from the OLS model, within model and the between model

I now turn to the presentation of the estimations. Throughout this section, I compare the estimation results of the Census Metropolitan Area of Vancouver with those from the CMA of Toronto based on the OLS regressions presented in Table 2 and on the within model and the between model presented in Table 3.

Demand-side variables and their influences on housing prices:

I first turn to the relationship between the housing price and the immigration ratio. In the case of Vancouver, the OLS regressions for the three censuses show that the coefficients for the variable of immigrant ratio lie between 0.681 and 1.104, and all have P-values of 0.000, which show a high level of statistical significance. In fixed effect model, I have 636 observations for 212 CTs across three censuses. The estimated coefficient of ***immiratio*** is 0.675, which means that a one percentage point increase in the ratio of immigration to the local population raises housing prices by 0.67 percent, which is similar to the OLS regression result in 2006. The P-value is 0.024, indicating a high level of significance. And in the between model, the coefficient of ***immiratio*** is 0.828 (that is also statistically significant), which is a higher value than the within model. The coefficient indicates one percentage point increase in ***immiratio*** associates with a 0.83% increase in the housing price.[13]

In the Toronto real estate market, the estimated coefficients of the ***immiratio*** variable from the OLS equation vary from 0.512 to 1.204. This range is larger than the results for the Vancouver market. The P-value of 0.000 in the all three censuses indicates a high level of statistical significance. In the within model, I take 2019 observations for 673 CTs across three censuses. The estimated coefficient of the variable of ***immiratio*** is 1.108 (with a P-value of 0.000), which means that a one percentage point change in ***immiratio*** associates with a statistically significant 1.108% increase in housing prices. This value is obviously higher than the 0.675% value obtained for Vancouver, but it is of a similar order of magnitude. The point estimate for Toronto has a higher level of significance. Thus these results of Toronto suggest that the immigration ratio affects the housing market more strongly in Toronto than in Vancouver. In addition, in the between model, the variable of ***immiratio*** has the estimated coefficient of 0.776, which is still positive but smaller than it is in the within model.

These results for the Vancouver and Toronto markets contrast sharply with those reported in the study by Akbari and Aydede (2009), which reports that a 1% point increase of the ratio of immigrants to the total population results in an increase in average dwelling value of only 0.2%, and high level of insignificance indicated by a P-value of 0.923. The reason for this discrepancy may lie in the geographical distribution of immigrants. Akbari and Aydede

[13] The result is qualitatively (and somewhat quantitatively) robust to the three specifications.

(2009) study the impacts of immigration on housing prices for all of Canada in the aggregate, but the locational choice of immigrants is not random. In most CMAs, the concentrations of immigration are very low, and thus it is hard to identify the estimated coefficient. The statistical insignificance and the small estimated coefficient of immigration ratio reported in of their study probably can be explained by the fact that the immigration patterns and housing prices may be driven by the common influences, such as the climate or local amenities. The fact that immigration populations are driven by unobservable factors across could explain why the coefficients of ***immiratio*** for Vancouver and Toronto seem to make sense and are statistically significant, although some degree of bias in the estimated coefficient is still possible. It appears that that the immigration share is only likely to affect housing prices in sub-samples characterized by high activity levels of immigration rather than all of Canada.

In regards to the relationship between the housing prices and the mobility variables, in the case of Vancouver, the OLS regressions for the three censuses show that the coefficients for ***mobility*** lie between -0.291 and 0.398, and all their P-values are above 5% level, which indicate the insignificance of mobility for explaining fluctuations in the housing price. In the within model, the estimated coefficient of ***mobility*** is 0.579, whose magnitude is greater than the magnitude of the estimated coefficient in the OLS regression and has a more positive effect on the housing price. The P-value of 0.004 shows its statistical significance, which is contrary to the result in the cross sectional equations. In the between model, the estimated coefficient of ***mobility*** is 1.579, which is larger than it is for the within model. The P-value of 0.002 reveals its statistical significance. In addition, for the variable ***mobility5***, the estimated coefficients in the OLS regression range from -0.202 to -0.134, which indicates ***moblity5*** in all 3 censuses negatively affects the housing price, and all estimates are statistically significant. In the within model, however, the coefficient of ***mobility5*** is 0.071, which contrasts with the sign of the estimated coefficient in the cross-sectional equations. The P-value is 0.052 which is statistically significant at the 6% level. This positive sign suggests that high mobility inflows are associated with higher dwelling values. However, in the between model, ***mobility5*** has a negative effect (-0.325), which is in contrast with the result of the within model. The results for the within model are more in line with prior expectations.

In the case of Toronto, of the OLS equation, the estimated coefficients of ***mobility*** range from -0.124 to 0.087, and all of their P-values are above the 5% level, which indicates statistical insignificance. In the within model, the variable of ***mobility*** has positive effect (the estimated coefficient is 0.454, which is smaller than it is in the case of Vancouver) on the housing prices. The P-value is 0.000, which indicates that it is statistically significant. In the between model, the coefficient of ***mobility*** is 0.390, which is smaller than the estimate for the within model. Also the P-value is 0.117, which leads one to not reject the hull hypothesis. For the variable of ***mobility5***, its estimated coefficients lie between -0.088 and 0.007 from the results of the OLS equations. In the within model, its estimated coefficient is -0.057, which is in contrast with the point estimate for Vancouver (0.071). This negative sign of ***mobility5*** suggests that lower mobility flows are associated with higher housing prices. Furthermore, in the between model, ***mobility5*** has more negative effect (-0.207) on the housing prices than the within model.

Akbari and Aydede (2009) point out that their results of insignificance for the immigration ratio may result from the crowding-out (or displacement) effect of immigration, as some non-immigrants move out of census tracts such that the immigration activity has a weaker net effect on the size of the total population, which in turn reduces the housing market demand. Comparing their results with mine, my finding of significance and a more positive effect of immigration may suggest that in CTs of the CMA of Vancouver and Toronto, the displacement effects are much weaker than they are at the aggregate national level. The numbers of movers (including new immigrants and non-immigrants) are increasing over the three census years, which could offset the effects from non-immigrants moving out. In contrast with the rest of Canada, non-immigrants in Vancouver or Toronto may tend to remain in their original CT rather than moving to areas with fewer immigrants when the average immigration ratio increases. Based on the results obtained from the within model, I find for both cases of Vancouver (0.579) and Toronto (0.454), the values of ***mobility*** are much higher than the value from the national level (0.029) obtained from Akbari and Aydede (2009). But the magnitude of coefficients of ***mobility5*** for Vancouver (0.071) and Toronto (-0.057) are close to the value for the whole Canada (-0.052). These results indicate that in one-year level, one region receives much more new residents (including immigrants and non-immigrants) in Vancouver or Toronto than the level of the whole Canada. However, based on five-year level, one region receives relatively fewer new residents, which implies the displacement effect becomes stronger than one-year level. In the absence of out migration, the housing prices go up due to the shift of market demand as the population increases. In other words, the magnitudes of the displacement effects of Vancouver and Toronto are smaller than they are at the national level, perhaps because their local populations are less mobile. This suggests that the housing markets in those two CMAs work differently than they do in many other parts of Canada. Therefore, in contrast to the results in Akbari and Aydede (2009), who attribute a weak value for the immigration inflow to a displacement effect, in my analysis the immigration ratio plays the primary role after the mobility measures control for the crowding effects.

Next I turn to the relationship between the housing prices and the labour market variables. In the case of Vancouver, the coefficients of the ***income*** variable in all three censuses are positive and statistically significant. In the within model, the coefficient of income is 0.913, with a P-value of 0.000. The interpretation is that a 1% increase in what people earn (on average) in the census tract will bring about a housing price increase of 0.913%. This positive impact is as expected, and the price elasticity is almost unitary. In the between model, the income variable has more positive effect (1.025) on the housing prices, but this difference is not large. For the variable ***un***, its estimated coefficients from the OLS equation vary from 0.0027 to 0.0186 accross the three censuses. In the within model, its estimated coefficient is -0.021, which is of the opposite sign from the case of the OLS regressions. This estimate is statistically significant. The negative sign makes sense: one would not expect strong housing prices to exist in a high-unemployment area. In the between model, the ***un*** variable has a weaker negative effect (-0.001) on the housing prices and is highly statistically insignificant. For the variable ***lfpr***, the coefficients obtained from the three cross-sectional regressions are between -0.027 and -0.015, and all are statistically significant. In the within model, ***lfpr*** has a positive coefficient (0.003) and an insignificant p-value (0.434), which is in total contrast with the results (0.000) from the OLS equations. My interpretation is that as when more people participate in the labor market, the level of labour income rises, which places upward pressure on housing prices. However, in the between model, its estimated coefficient has opposite sign (-0.021) from the within model. Comparing the results from the within model with those from Akbari and Aydede (2009), ***income*** plays a more significant role in the Vancouver housing prices (0.913) than at aggregate national level (0.397). But the effects of unemployment rates and labour force participation rate on Vancouver housing market are quite similar with the effects on the national housing prices.

The results from the Toronto equation for the ***income*** variable are similar to the case of Vancouver. The coefficient has a positive effect on the housing prices in all the three censuses and is statistically significant. In the within model, its estimated coefficient (0.777) is smaller than 0.913 (the value in the Vancouver equation), which indicates that a 1% change in ***income*** is found to produce a 0.777% change in housing values. The P-value is 0.000 indicating a high level of statistical significance. In the between model, the variable of ***income*** affects the housing prices more strongly (1.049) than in the case of the within model. For the variable of ***un***, the estimated coefficient from the results of the OLS regressions lie between -0.0001 and 0.011. In the within model, the estimated coefficient has a positive sign (0.013) compared with the result for Vancouver (-0.021). A possible interpretation for the positive sign of ***un*** may be that in spite of rising unemployment, there is still wealth pouring in to the housing market. Note that we cannot observe the latter variable. In the between model, the estimated coefficient has a positive sign (0.016), which is more consistent with my prior expectation. For the variable of ***lfpr***, its coefficients range from -0.009 to -0.007, and the P-values in the three censuses are all 0.000. In the within model, the estimated coefficient is negative (-0.0007), which is not consistent with the result of Vancouver. The negative sign for ***lfpr*** in Toronto may not be meaningful, as the magnitude of the coefficient is very small, and the P-value is 0.597, which is very insignificant. In the between model, the variable ***lfpr*** has a more strongly negative effect (-0.007) on the housing prices.

Therefore, the variable ***income*** is a very important indicator to the movement of housing prices. The unemployment rate (***un***) has non-ignorable effects on housing values as well, and it is supposed to affect housing prices negatively, but the empirical results from the case of Toronto shows the opposite effect. And the labour force participation rate (***lfpr***) has a negligible and statistical insignificant effect on both cities' housing values.

I now turn to a discussion of the results for the user cost variables. The estimated coefficients of the ***rent*** variable range from -0.016 to -0.0006, which indicates that this variable negatively affects housing prices. This sign does not make sense at all. But in the within model, the variable of ***rent*** has an opposite effect, with a positive coefficient of 0.0071, but the P-value indicates statistical insignificance. The lack of precision could be due to collinearity. In the between model, the ***rent*** variable has the opposite sign (-0.017) of point estimate obtained from the within model, and it is statistically significant. For the variable of ***maincost***, the coefficients vary from -0.009 to 0.008 and all are insignificant over the three censuses in OLS regression, however the within model indicates that the coefficient of ***maincost*** is statistically significant with a positive sign (0.019). In the between model, the variable of ***maincost*** affects the housing prices negatively (-0.006), which is the same sign as the results from the OLS equations. And its P-value is 0.546, which indicates that we cannot reject the null hypothesis. For the regressor ***room***, the OLS model shows it positively affects of housing prices for all three censuses, and the estimated coefficients from the within model

(0.201) and the between model (0.090) have the same sign.

I now discuss the results for the coefficients of these variables in the case of Toronto. In the OLS equations, from the 1996 to the 2006 census, the variable of ***rent*** affects the housing prices negatively in Toronto, and the P-values are all within the 5% level. In the within model, the estimated coefficient is 0.011, which is higher than the value of 0.007 that way discerned for Vancouver. The P-value is 0.000, which indicates that we can reject the null hypothesis of no effects. This result suggests that in Toronto the variable of rent has a stronger effect to the housing prices than in Vancouver. But in the between model, the rent has opposite sign (-0.017). For the variable of ***maincost***, its estimated coefficients vary from -0.004 to 0.001. In the within model, it has a positive but weaker effect (0.004) on the housing prices compared to Vancouver (0.020), which implies that the maintenance cost affects the housing prices more strongly in the Vancouver market than in the Toronto market. The P-value of 0.010 indicates statistical significance. In contrast, in the between model, the variable of ***maincost*** has a negative sign (-0.003), which has same sign as the results from the between model for Vancouver (-0.006). Furthermore, for the variable of ***room***, the results are similar to those discerned for Vancouver: it affects the housing prices positively in all the three censuses. And in the within model, the value of the coefficient (0.215) is close to the value of Vancouver (0.201). The P-value of 0.000 indicates that it is statistically significant. In the between model, the estimated coefficient is consistent with the positive sign but has a smaller magnitude (0.075) compared to the results obtained from the within model.

Hence, for the variables of user costs, the variable room is found to be most responsive to the housing value appreciations for both cities. In my opinion, this result is not reliable as room is just used to control for the size of housing in the model. The variable maincost has a modest effects on housing prices in Vancouver , but a muted effects in the Toronto market. Also average rent (rent) affects housing prices very gently in both cases, which does not make significant contribution to the housing price appreciations.

The next set of estimates pertains to the demographic variables. For the Vancouver sample, the variable ***ratio2034***, in the OLS equations has a positive sign for its estimated coefficients in all three censuses (with statistical significance), but for the within model, ***ratio2034*** has negative effect (-2.654) on housing prices, which might imply that people from 20 to 34 years old are not prime home-buyers in Vancouver and may actually invest less in the real estate market than do other age groups. This unexpected result may derive from the fact that Vancouver has the highest housing prices in Canada. The age group of 20-34 years old is either starting their careers or is still in the early stages of career development, so in the Vancouver market they have not yet attained sufficient wealth formation in order to buy a home. In the between model, the estimated coefficient has a similar magnitude but the opposite sign (2.043) from the result from the within model. This result indicates in the between model, the age group of 20-34 years has a strongly positive effect on the housing prices. The variable of ***abor*** positively affects the housing prices no matter in the OLS regression, the within model or the between model.

Similar to the results from the OLS model in Vancouver, in Toronto the variable ***ratio2034*** positively affects the housing prices in the OLS model in all the three censuses, and the estimates are statistically significant. In contrast, in the within model, the estimated coefficient is -2.549 which is close to the value discerned for Vancouver (-2.654).I conjecture a similar interpretation that I mention above for Vancouver. The age group of 20 to 34 years old is not a prime home-buyer in Toronto, and this age group invests less in the real estate market than other age groups. As Toronto has the second highest dwelling values in Canada, people between 20 to 34 years old are not wealthy enough to buy a home, so the negative coefficient indicates a one percentage point increase in ***ratio2034*** will cause the housing prices to decrease by 2.55% in Toronto. However, in the between model, the variable of ***ratio2034*** has a positive effect on the housing prices (2.018) which contrasts with the result for the the within model. For the variable of ***abor***, its estimated coefficients vary from -2.516 to 0.695. In the within model, the estimated coefficient is 3.058 which is much higher than 0.398 of Vancouver. The P-value of 0.002 indicates that we have enough evidence to reject the null hypothesis. This result suggests that the aboriginal population has a more distinct effect on the dwelling values in Toronto rather than Vancouver. Whereas in the between model, the variable of ***abor*** shows a negative sign of the coefficient (-2.515) with statistical significance. However, I do not find any of the results for the variable ***abor*** reliable. In my opinion, it is capturing the effect of an unobservable influence.

Therefore, comparing with the modest, negative effect of ratio2034 (-0.094) obtained from Akbari and Aydede (2009), in the Vancouver or Toronto market which have most expensive housing values, the age group of 20 to 34 years (***ratio2034***) cannot used as an indicator of the movement of housing prices. The age group of 35 to 60 may be a better option, as the population of this group has already been on the mature stage in the career and has sufficient wealth to buy houses. And the population of Aboriginal people (***abor***) makes a greater contribution to housing value appreciation in Toronto than in Vancouver.

Supply-side variables and their influences on the housing prices:

For the Vancouver equation, the coefficient of the ***stock*** variable varies from -0.702 to 0.384 in OLS equations, however in the within model, it has a stronger positive effect with a statistically significant coefficient of 3.171. It indicates that an increasing stock would tend to be consumed by rising housing demand and would be associated with rising housing price in Vancouver, however, we would expect a negative effect of the housing stock on the housing prices with all other factors held constant. It is difficult empirically to identify this effect. In the between model, the coefficient is negative (-0.511), which is the sign that I expect. But the P-value is 0.227, so we cannot reject the hull hypothesis. For the variable of ***Ndwell***, in the OLS equations its coefficient ranges from -0.06 to 0.959 depending on the census year. In the within model, ***Ndwell*** has a negative coefficient of -0.706 that is insignificant. However, in the between model, the variable of ***Ndwell*** affects the housing prices positively (0.805), but the P-value is 0.184, which indicates statistical insignificance. For the variable of ***Cwork***, its coefficient varies from –0.407 to 1.17 from 1996 to 2006. In the within model, ***Cwork*** has such a strong positive effect (6.309) on housing prices: a 1% point change in ***Cwork*** raises housing values by 6.309%. This result probably reflects reverse causality – as the housing prices increase, eventually more workers would enter the construction industry. However, this result does not seem reliable, the value of coefficient is too high. In contrast, in the between model, the estimated coefficient reveals the variable of ***Cwork*** affects the housing prices negatively (-2.561) and it is very statistically significant.

In the Toronto market, the estimated coefficient of the variable of ***stock*** is positive for all the three censuses based on the results of the OLS regressions. In the within model, its estimated coefficient is 3.969 a value which is close to the one estimated for Vancouver. This indicates that the greater the stock of houses in the real estate market, the higher the housing prices. Similar to the case of Vancouver, this positive sign is not what we would expect. In the between model, the coefficient is much smaller than the within model (0.674), which is in contrast to the negative sign of the result from the between model for Vancouver (-0.511). This estimate is statistically significant. For the variable of ***Ndwell***, its estimated coefficients lie between -0.577 to 0.618 in Toronto in the cross-sectional equations. In the within model, the coefficient has the opposite sign (0.394) of the result for Vancouver (-0.706), which means that in Toronto the increasing units of new construction will result in higher housing prices, but in Vancouver when more and more new houses are listed in the Multiple Listing Service system (MLS), there is a negative impact on housing prices. The P-value is 0.081, which means we cannot reject the null hypothesis at the 5% level of significance. In the between model, the variable of ***Ndwell*** has a smaller effect on the housing prices (0.016) than is the case with the within model. Lastly, for the variable of ***Cwork***, it affects the housing prices positively based on the results of the cross-sectional equations. In the within model, the estimated coefficient of ***Cwork*** in Toronto has such a smaller magnitude (1.177) than is the case with Vancouver (6.309). This suggests that the number of construction workers has a much weaker effect on the housing prices in Toronto rather than Vancouver. The P-value of 0.000 indicates its high level of statistical significance. In the between model, the magnitude of the coefficient is smaller (0.736). Its P-value is significant, so one can reject the null hypothesis of no effect.

Therefore, the housing stock (***stock***) makes a very important contribution to the increase of housing prices in both Vancouver and Toronto. This variable should be treated as a significant indicator to the movement of housing values. The new construction (***Ndwell***) has a modest effect on the housing prices in both markets, which is also a non-ignorable for studying the dynamic change of housing values. The result from the estimate of ***Cwork*** is not reliable in the case of Vancouver, the construction worker should play a role on housing prices as a supply-side variable, but such a substantial effect in the case of Vancouver is implausible.

Overall, the estimated results from the within model should be more reliable than the results from the between model, because the between estimator is affect by the presence of unobserved heterogeneity, which after make the estimates in the between model inconsistent. The results obtained from the within model suggests a significant and positive effect of immigration on the housing prices in Vancouver and Toronto, which is consistent with my prior expectation that the immigration share is positively associated with house values in cities with high concentration of immigrants.

6.2. The estimation results from the fixed effects model with 2SLS.

In table 4, I treat the variable ***Ndwell***, which is the number of units of new construction as endogenous, and use the variable of ***Cwork***, which is the percentage of construction workers in the total labour force as the instrumental variable in the fixed effect model. However, the results contrast sharply with the estimates generated by fixed effects model without 2SLS. First, for Vancouver the estimated coefficient for new constructions estimated using IV is -96.965, of which the magnitude blow up to 96.965 from 6.309, and in addition the sign turns negative. This suggests that when ***Ndwell*** (instrumented by ***Cwork***) increases one unit per capita, the housing prices will decrease by 96.97%, which is quite implausible. The P-value of 0.262 indicates that it is very statistically insignificant. Similar to the case of Vancouver, the coefficient of ***Ndwell*** for Toronto is 136.730 estimated using IV which is much higher but positive compared to the estimates for Vancouver. It reveals that a one unit increase in the variable ***Ndwell*** raises housing values by about 136.73%, which is even less plausible. The P-value is 0.778, which indicates that one cannot reject the null hypothesis of no effect. The reason for such high values of IV coefficients is that the instrumental variable itself is probably endogenous, a conjecture which cannot be tested. Second, for both Vancouver and Toronto, the P-values for all variables are very statistically insignificant, which means we cannot reject the null hypothesis of no effects. These results imply that perhaps the Instrumental variable approach in the fixed effect model is unsuitable.

I applied the Hausman test to see whether the fixed-effects model is appropriate to use. The result cannot reject the null hypothesis that the random effect estimators are consistent, which implies there is no correlation between X and u. Table 3 also shows the results of the random effects model with 2SLS for Vancouver and Toronto. In the random effects model, the estimated coefficients from the IV specification become much more plausible. For Vancouver, the coefficient is -29.821 which is still negative, but the magnitude decreases sharply. This means that a one unit per capita change in the instrumental variable (for new construction) is found to produce a 29.82% change in housing values, rather than 0.706% from the within model without 2SLS. The P-value is 0.262 which is still statistically insignificant. For Toronto, the estimated coefficient using the IV approach is reduced from

136.730 to 19.119, which still implies a much stronger effect compared with the result from the within model without 2SLS (0.394%). The P-value is 0.000, which indicates its statistical significance. Furthermore, in the case of Vancouver, the ***immiratio*** is statistically significant with the estimate coefficient of 1.281, which means that a 1% point increase in the immigration share is associated with a 1.281% increase in housing prices. In the case of Toronto, the estimated coefficient of immiratio is 0.822, which is consistent with the positive sign from the results in Table 2. And its P-value is 0.000 indicating its statistical significance. In addition, for other variables, comparing to the results of within model in Table 2, for Vancouver the variables of ***lfpr***, ***stock***, ***rent***, ***room***, ***density*** and ***mobility*** have opposite signs. For Toronto, the variables of ***lfpr***, ***maincost***, ***room*** and ***ratio2034*** affect the housing price with the opposite sign.

Overall, I attribute the implausible results from the fixed-effects model estimated using 2SLS to the fact that the ***Cwork*** variable should not be used as an instrumental variable, because it is already being included as an exogenous variable. As my model mainly follows the work of Akbari and Aydede (2009), in their study they use the ***Cwork*** variable as IV. Their results from the within model with 2SLS indicates that the immigration share has no effect on the housing prices in Canada, which is consistent with the result from the within model without 2SLS. However, their strategy does not work well for the sub-samples (ex. Vancouver or Toronto). Even though the results from the random effects model with 2SLS indicate a statistically significant coefficient of immigration ratio which presents a positive effect of immigration on the housing prices in both Vancouver and Toronto, in my opinion, a better choice for IV is needed in order to obtain more reliable results from the within model with 2SLS.

6.3. Oaxaca Decomposition

I use Oaxaca decomposition to determine, (using the fixed-effect models) whether the housing price differential between Vancouver and Toronto is primarily due to differences in coefficients of independent variables or whether they are due to differences in the mean values of the exogenous variables. The "explained" gap shows the difference in housing prices due to differences in average values of the exogenous variables, and the "unexplained" portion shows the differences due to the magnitudes of the various coefficients.

The housing price equation for Vancouver is:

$$\ln y_V = \alpha + \sum_{k=1}^{k} X_{kV}\beta_{kV} + \varepsilon_V$$

The housing price equation for Toronto is:

$$\ln y_T = \alpha + \sum_{k=1}^{k} X_{kT}\beta_{kT} + \varepsilon_T$$

where:

X_{kV} consists of the immigration variable, the demand-side variables, and the supply-side variables measured in fixed effect model for Vancouver.

β_{kV} is a vector of coefficients measuring the effects of X_{kV} on the housing prices in Vancouver.

(Subscript T: version for Toronto)

When I input the sample means of independent variable and all dependent variables into the previous equations of Vancouver and Toronto, I obtain:

$$\overline{\ln y_V} = \hat{\alpha}_V + \sum_{k=1}^{k} \overline{X_{kV}}\hat{\beta}_{kV}$$

$$\overline{\ln y_T} = \hat{\alpha}_T + \sum_{k=1}^{k} \overline{X_{kT}}\hat{\beta}_{kT}$$

The gap in average dwelling values is expressed as:

$$\overline{\ln y_V} - \overline{\ln y_T} = \hat{\alpha}_V + \textstyle\sum_{k=1}^{k}\overline{X_{kV}}\hat{\beta}_{kV} - (\hat{\alpha}_T + \sum_{k=1}^{k}\overline{X_{kT}}\hat{\beta}_{kV})$$

$$= \hat{\alpha}_V + \overline{X_{1V}}\hat{\beta}_{1V} - \ldots - (\hat{\alpha}_T + \overline{X_{1T}}\hat{\beta}_{1T} + \ldots)$$

$$= (\hat{\alpha}_V - \hat{\alpha}_T) + (\overline{X_{1V}}\hat{\beta}_{1V} - \overline{X_{1T}}\hat{\beta}_{1T}) + \ldots$$

After adding and subtracting $\overline{X_{kT}}\hat{\beta}_{kV}$, the decomposition equation becomes:

$$\overline{\ln y_V} - \overline{\ln y_T} = (\hat{\alpha}_V - \hat{\alpha}_T) + \textstyle\sum_{k=1}^{k}\hat{\beta}_{kV}(\overline{X_{kV}} - \overline{X_{kT}}) + \sum_{k=1}^{k}\overline{X_{kT}}(\hat{\beta}_{kV} - \hat{\beta}_{kT})$$

The second term is the component of the housing prices gap due to differences in average characteristics between Vancouver and Toronto. This is the component that is explained. If Vancouver and Toronto both have same average levels on immigration ratio, income, mobility etc, then this term would be zero. The first and third terms are the components of housing prices which result from variation in the value of the estimated parameters between Vancouver and Toronto. If $\hat{\beta}_{kV}$ and $\hat{\beta}_{kT}$ are same and $\hat{\alpha}_V = \hat{\alpha}_T$, then the gap is entirely due to differences in the estimated parameters.

From the results presented in table 4, the estimated housing price equations are:

Vancouver:

$$\widehat{\ln\ y}_V = -0.74 + 0.67\ \text{immiratio}_V + 0.91\ \text{income}_V - 0.02\ \text{un}_V + 0.003\ \text{lfpr}_V$$
$$+ 3.17\ \text{stock}_V + 0.007\ \text{rent}_V + 0.020\ \text{maincost}_V + 0.20\ \text{room}_V$$
$$- 0.71\ \text{Ndwell}_V + 0.10\ \text{density}_V - 2.65\ \text{ratio2034}_V + 0.40\ \text{abor}_V$$
$$+ 0.58\ \text{mobility}_V + 0.07\ \text{moblity5}_V + 6.31\ \text{cwork}_V$$

Toronto:

$$\widehat{\ln\ y_T} = 0.35 + 1.11\ \text{immiratio}_T + 0.78\ \text{income}_T + 0.013\ \text{un}_T - 0.00076\ \text{lfpr}_T$$
$$+ 3.97\ \text{stock}_T + 0.011\ \text{rent}_T + 0.004\ \text{maincost}_T + 0.22\ \text{room}_T$$
$$+ 0.39\ \text{Ndwell}_T + 0.015\ \text{density}_T - 2.55\text{ratio 2034}_T + 3.05\ \text{abor}_T$$
$$+ 0.45\ \text{mobility}_T - 0.06\ \text{moblity5}_T + 1.18\ \text{cwork}_T$$

Inserting the values of means in table 5, decomposition equation is expressed as:

$$\overline{\text{lny}}_V - \overline{\text{lny}}_T =$$

$$\{\beta_{1V}(\overline{\text{immiratio}}_V - \overline{\text{immiratio}}_T) + \beta_{2V}(\overline{\text{income}}_V - \overline{\text{income}}_T) + \beta_{3V}(\overline{\text{un}}_V - \overline{\text{un}}_T)$$
$$+ \beta_{4V}(\overline{\text{lfpr}}_V - \overline{\text{lfpr}}_T) + \beta_{5V}(\overline{\text{stock}}_V - \overline{\text{stock}}_T) + \beta_{6V}(\overline{\text{rent}}_V - \overline{\text{rent}}_T)$$
$$+ \beta_{7V}(\overline{\text{maincost}}_V - \overline{\text{maincost}}_T) + \beta_{8V}(\overline{\text{room}}_V - \overline{\text{room}}_T)$$
$$+ \beta_{9V}(\overline{\text{Ndwell}}_V - \overline{\text{Ndwell}}_T) + \beta_{10V}(\overline{\text{density}}_V - \overline{\text{density}}_T)$$
$$+ \beta_{11V}(\overline{\text{ratio2034}}_V - \overline{\text{ratio2034}}_T) + \beta_{12V}(\overline{\text{abor}}_V - \overline{\text{abor}}_T)$$
$$+ \beta_{13V}(\overline{\text{mobility}}_V - \overline{\text{mobility}}_T) + \beta_{14V}(\overline{\text{moblity5}}_V - \overline{\text{moblity5}}_T)$$
$$+ \beta_{15V}(\overline{\text{cwork}}_V - \overline{\text{cwork}}_T)\}$$
$$+ \{(\alpha_V - \alpha_T) + (\beta_{1V} - \beta_{1V})\overline{\text{immiratio}}_T + (\beta_{2V} - \beta_{2T})\overline{\text{income}}_T$$
$$+ (\beta_{3V} - \beta_{3T})\overline{\text{un}}_T + (\beta_{4V} - \beta_{4T})\overline{\text{lfpr}}_T + (\beta_{5V} - \beta_{5T})\overline{\text{stock}}_T$$
$$+ (\beta_{6V} - \beta_{6T})\overline{\text{rent}}_T + (\beta_{7V} - \beta_{7T})\overline{\text{maincost}}_T + (\beta_{8V} - \beta_{8T})\overline{\text{room}}_T$$
$$+ (\beta_{9V} - \beta_{9T})\overline{\text{Ndwell}}_T + (\beta_{10V} - \beta_{10T})\overline{\text{density}}_T$$
$$+ (\beta_{11V} - \beta_{11T})\overline{\text{ratio2034}}_T + (\beta_{12V} - \beta_{12T})\overline{\text{abor}}_T$$
$$+ (\beta_{13V} - \beta_{13T})\overline{\text{mobility}}_T + (\beta_{14V} - \beta_{14T})\overline{\text{moblity5}}_T$$
$$+ (\beta_{15V} - \beta_{15T})\overline{\text{cwork}}_T\}$$

Substituting coefficients and means of each variable from table 5 into the decomposition equation respectively, I obtain the following results:

0.246	=	0.055	+	0.192
Total gap		Explained		Unexplained
		(22.4%)		*(77.6%)*

This result reveals that 22.4% of the housing price gap between Vancouver and Toronto is explained by differences in mean values in independent variables between Vancouver and Toronto, and 77.6% of the gap is due to differences in the estimated coefficients of independent variables between Vancouver and Toronto. From the Oaxaca decomposition results, I can conclude that not only do these two markets have very different prices, but these respective prices are generated according to very different processes.

7. Conclusion

This empirical study has examined the nexus between the immigration share and the housing prices in Vancouver and Toronto. The estimation results based on the fixed effect model (the within model), which uses the time-series variation (in order to identify key coefficients), indicates an increase in the number of immigrants equal to 1% of the total population is coincident with an increase in the housing prices of 0.675% across 212 census tracts in the CMA of Vancouver based on the censuses of 1996 to 2006. I also estimate econometric results based on the between model, which uses strictly cross-sectional variation. These results suggest that a 1% point increase of the immigration composition in the total population will bring an increase in average dwelling values of about 0.828% across the three censuses. These results support the hypothesis that the immigration is positively associated with the housing prices in Vancouver, and perhaps contributed to the observed boom. However, the results from the within model should be more reliable than those obtained from the between model, as the between model fails to account for unobserved heterogeneity, so that estimations that use the between model tend to be inconsistent to the extent that the error term is correlated with regressors. It is still interesting to use the between estimator in order to complement the results from the fixed effect model.

The CMA of Toronto is compared with Vancouver in order to further investigate the relationship between the share of immigrants and housing prices. Toronto has the second highest housing values and receives the largest and most diverse immigrant flows in Canada. I find that in the fixed-effects model, when the proportion of immigrants increases by 1% point, the housing prices will increase by 1.108% across the 673 CTs in the CMA of Toronto based on the censuses of 1996 to 2006, which indicates that in Toronto the immigration activity has a stronger effect on the house values than is the case in Vancouver. The result from the between model is consistent with the positive effect obtained from the within model, but the effect of immigration becomes weaker (0.776%).

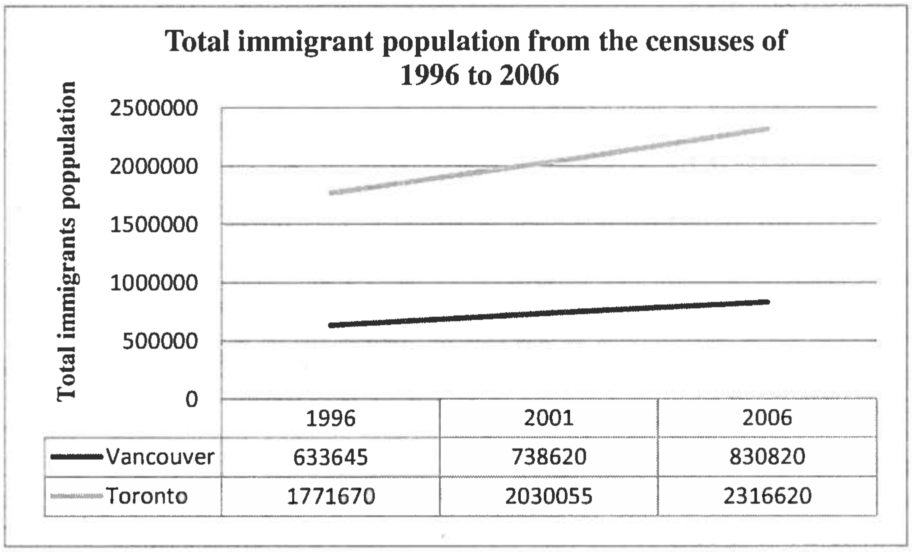
I next go a step further to determine whether the differences of the housing prices between Vancouver and Toronto are due to differences in coefficients of the independent variables or whether they are due to discrepancies in mean values of the exogenous variables, I employ the Oaxaca decomposition and find that 22.4% of the housing price gap between Vancouver and Toronto is explained by differences in mean values in the independent variables between the two cities, and 77.6% of the gap is due to the discrepancies in the estimated coefficients of the exogenous variables between Vancouver and Toronto.

I attempt to address the potential problem of endogeneity with the supply-side variables by estimating the fixed effects model using 2SLS. After treating the variable of new construction as the endogenous variable and using the variable of construction workers as the instrumental variable, I obtained very high and abnormal estimation coefficients of the instrumented variable, and statistical insignificance for all variables for both the Vancouver and the Toronto equations. The Hausman test seems to militate towards the random effects model, for both cities the values of coefficients of the IV specification become smaller but are still implausible. The P-values from the random effects model with 2SLS seem relatively logical compared with the results from fixed-effects model with 2SLS , however, some of the estimated coefficients of the variables switch in sign and the P-values of some variables differ from the results from the within model without 2SLS. The reason may be the instrumental variables chosen were not suitable for this purpose. A better selection of instrumental variables is needed in order to obtain a better specification with more reliable results.

As far as future research is concerned, as Vancouver is the Canadian city having the strongest link to Asia, which in turn is a region of rapid economic development, sending a large number of skilled workers and investor immigrants to Canada, I am interested in doing future research about how immigrants from Asia affect the housing prices in Vancouver. In order to achieve this objective, more recent and precise data would be useful.

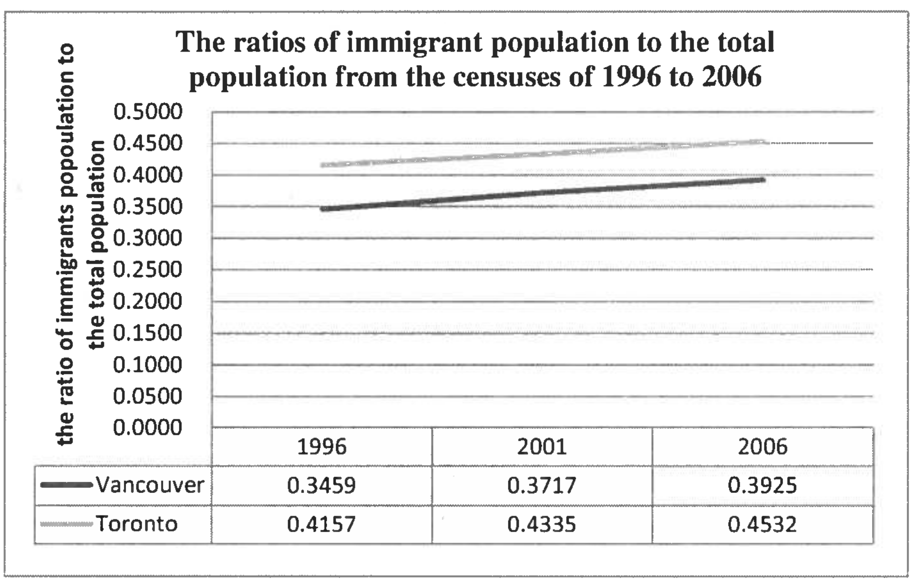
Figures

Figure 1:



(Sources: My calculations are based on the census of 1996, 2001 and 2006 from Statistics Canada.)

Figure 2:



(Sources: My calculations are based on the census of 1996, 2001 and 2006 from Statistics Canada.)

Tables

Table 1.

AVERAGE HOME PRICES, APRIL 2011, NSA

	C$ (in thousands)	Y/Y % Change	10-Year % Change
Canada	373	8.0	122
ex-Vancouver	337	5.1	111
Vancouver	815	21.0	188
Calgary	412	4.0	127
Toronto	477	9.1	91

(Source: Guatieri, Sal (2011). A tale of three Canadian housing markets. Bank of Montreal. Focus. June 10, 2011.)

Table 2.

Table 2.1 The OLS estimated results of Vancouver (1996 to 2006)

	Vancouver								
	1996			2001			2006		
Variables	*Coef.*	*SE*	*P>| t |*	*Coef.*	*SE*	*P>| t |*	*Coef.*	*SE*	*P>| t |*
immiratio	1.104	0.164	0.000	1.051	0.143	0.000	0.681	0.156	0.000
income	1.175	0.095	0.000	1.120	0.081	0.000	0.968	0.074	0.000
un	0.003	0.005	0.587	0.019	0.005	0.001	0.006	0.007	0.386
lfpr	-0.027	0.003	0.000	-0.015	0.002	0.000	-0.017	0.003	0.000
stock	-0.467	0.363	0.200	0.211	0.279	0.450	-0.702	0.338	0.038
rent	-0.016	0.008	0.048	-0.009	0.006	0.131	-0.001	0.006	0.918
maincost	-0.009	0.005	0.078	0.008	0.006	0.177	0.000	0.005	0.966
room	0.127	0.031	0.000	0.124	0.023	0.000	0.042	0.023	0.067
ndwell	-0.060	0.355	0.865	0.720	0.391	0.066	0.959	0.423	0.024
density	-0.059	0.012	0.000	-0.047	0.012	0.000	-0.043	0.013	0.001
ratio2034	2.807	0.381	0.000	2.176	0.330	0.000	2.483	0.353	0.000
abor	1.363	0.735	0.065	0.654	0.637	0.305	1.452	0.676	0.032
mobility5	-0.134	0.030	0.000	-0.202	0.035	0.000	-0.152	0.038	0.000
mobility	0.398	0.213	0.064	0.179	0.243	0.462	-0.291	0.238	0.222
cwork	-1.644	0.611	0.008	0.088	0.508	0.862	-0.407	0.528	0.442
Number of oberservations	297			382			404		
F(df,N)	(15, 281) 73.74			(15, 366) 71.05			(15, 388) 56.41		
R^2	0.797			0.744			0.686		
Adjusted R^2	0.787			0.734			0.674		
Prob > F	0.000			0.000			0.000		

Table 2.2 The OLS estimated results of Toronto (1996 to 2006)

	Toronto								
	1996			2001			2006		
Variables	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*
immiratio	1.204	0.085	0.000	0.576	0.072	0.000	0.512	0.075	0.000
income	1.089	0.048	0.000	0.880	0.033	0.000	0.809	0.030	0.000
un	0.011	0.003	0.000	0.006	0.004	0.081	0.000	0.004	0.972
lfpr	-0.009	0.001	0.000	-0.009	0.001	0.000	-0.007	0.001	0.000
stock	1.571	0.223	0.000	0.555	0.199	0.005	0.217	0.202	0.283
rent	-0.019	0.004	0.000	-0.006	0.002	0.019	-0.008	0.003	0.004
maincost	0.001	0.003	0.840	-0.002	0.002	0.180	-0.004	0.002	0.029
room	0.155	0.017	0.000	0.082	0.014	0.000	0.073	0.013	0.000
ndwell	0.618	0.266	0.020	-0.388	0.171	0.023	-0.577	0.157	0.000
density	-0.026	0.007	0.000	-0.017	0.007	0.010	-0.014	0.007	0.067
ratio2034	1.544	0.223	0.000	1.179	0.180	0.000	1.134	0.191	0.000
abor	0.695	1.144	0.544	-1.134	0.934	0.225	-2.516	0.998	0.012
mobility5	-0.088	0.019	0.000	0.002	0.002	0.396	0.007	0.005	0.172
mobility	0.087	0.150	0.564	-0.124	0.071	0.081	-0.048	0.111	0.665
cwork	0.485	0.265	0.068	0.944	0.228	0.000	0.874	0.230	0.000
Number of oberservations	794			901			968		
F(df,N)	(15, 778) 139.13			(15, 885) 170.96			(15, 952) 157.48		
R^2	0.728			0.743			0.713		
Adjusted R^2	0.723			0.739			0.708		
Prob > F	0.000			0.000			0.000		

Table 3. Within and Between estimators (1996 - 2006) of Vancouver and Toronto

	Vancouver						Toronto					
	Within			Between			Within			Between		
Variables	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*
immiratio	0.675	0.298	0.024	0.828	0.203	0.000	1.108	0.113	0.000	0.776	0.089	0.000
income	0.913	0.105	0.000	1.025	0.098	0.000	0.777	0.032	0.000	1.050	0.038	0.000
un	-0.021	0.005	0.000	-0.001	0.009	0.884	0.013	0.002	0.000	0.016	0.005	0.001
lfpr	0.003	0.004	0.434	-0.021	0.003	0.000	-0.001	0.001	0.597	-0.007	0.002	0.000
stock	3.171	0.783	0.000	-0.511	0.421	0.227	3.969	0.302	0.000	0.674	0.240	0.005
rent	0.007	0.010	0.490	-0.017	0.008	0.042	0.011	0.003	0.000	-0.017	0.004	0.000
maincost	0.020	0.005	0.000	-0.006	0.009	0.546	0.004	0.002	0.010	-0.003	0.004	0.347
room	0.201	0.053	0.000	0.090	0.035	0.010	0.215	0.023	0.000	0.075	0.018	0.000
ndwell	-0.706	0.467	0.131	0.805	0.604	0.184	0.394	0.226	0.081	0.016	0.369	0.965
density	0.098	0.079	0.217	-0.044	0.014	0.002	0.015	0.031	0.615	-0.030	0.008	0.000
ratio2034	-2.654	0.637	0.000	2.043	0.485	0.000	-2.549	0.236	0.000	2.018	0.233	0.000
abor	0.398	1.028	0.699	0.704	1.006	0.485	3.058	0.865	0.000	-2.515	1.123	0.025
mobility5	0.071	0.036	0.052	-0.325	0.060	0.000	-0.057	0.019	0.002	-0.207	0.039	0.000
mobility	0.579	0.199	0.004	1.580	0.504	0.002	0.454	0.098	0.000	0.390	0.248	0.117
cwork	6.309	0.555	0.000	-2.561	0.838	0.003	1.177	0.253	0.000	0.736	0.280	0.009
Fixed effects-year	Yes			No			Yes				No	
Fixed effects-CT	Yes			No			Yes				No	
Number of oberservations	636			636			2019				2019	
F(df,N)	(15, 409) 61.69			(15, 196) 63.46			(15, 1331) 340.76			(15, 657) 169.43		
R^2 within, between and overall	0.694	0.185	0.299	0.202	0.829	0.596	0.793	0.637	0.661	0.536	0.795	0.704
corr(u_i,X)	-0.509						-0.535					
ρ=var[u_i]/(var[u_i]+var[e_{it}]) (fraction of variance due to u_i)	0.825						0.785					

Table 4. The fixed effect model and random effect model with 2SLS of Vancouver and Toronto (1996 to 2006)

	Vancouver						Toronto					
	the fixed effect			the random effect			the fixed effect			the random effect		
Variables	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*	*Coef.*	*SE*	*P>|t|*
IV for new constructions (Ndwell)=(Cwork)	-96.965	-96.965	0.262	-29.821	17.281	0.084	136.730	484.813	0.778	19.119	19.119	0.000
immiratio	2.366	2.366	0.502	1.281	0.418	0.002	-1.458	9.355	0.876	0.822	0.822	0.000
income	2.685	2.685	0.181	1.554	0.327	0.000	-3.073	13.691	0.822	0.848	0.848	0.000
un	-0.126	-0.126	0.240	-0.038	0.021	0.070	0.010	0.032	0.760	0.016	0.016	0.005
lfpr	0.030	0.030	0.525	-0.036	0.015	0.016	-0.064	0.226	0.778	0.002	0.002	0.580
stock	-0.136	-0.136	0.987	-5.339	3.214	0.097	-37.675	148.445	0.800	0.613	0.613	0.123
rent	0.039	0.039	0.722	-0.056	0.032	0.077	-0.088	0.357	0.806	0.002	0.002	0.735
maincost	0.042	0.042	0.466	0.002	0.018	0.926	0.055	0.184	0.764	-0.016	-0.016	0.004
room	-0.534	-0.534	0.537	-0.085	0.126	0.499	0.748	1.910	0.695	-0.041	-0.041	0.302
density	1.807	1.807	0.299	-0.177	0.097	0.069	-5.934	21.128	0.779	0.081	0.081	0.007
ratio2034	17.657	17.657	0.373	-0.720	1.451	0.620	-29.572	95.707	0.757	0.595	0.595	0.082
abor	5.087	5.087	0.646	0.370	2.344	0.875	-4.169	30.133	0.890	3.502	3.502	0.032
mobility5	4.175	4.175	0.252	1.431	0.906	0.114	-6.165	21.719	0.777	-1.184	-1.184	0.000
mobility	-0.804	-0.804	0.737	-0.625	1.069	0.559	-0.455	3.667	0.901	1.639	1.639	0.000
Fixed effects-year	Yes			No			Yes			No		
Fixed effects-CT	Yes			No			Yes			No		
Number of oberservations	636			636			2019			2019		
R^2 within, between and overall	.	0.046	0.018	0.083	0.177	0.136	.	0.013	0.011	0.201	0.364	0.297
corr(u_i,X)	-0.949			0.000 (assumed)			-0.9881			0.000 (assumed)		
ρ=var[u_i]/(var[u_i]+var[e_{it}]) (fraction of variance due to u_i)	0.868			0.000			0.966			0.000		

Table 5. Oaxaca Decomposition (the within model)

	Vancouver		Toronto	
Variable	*Coef.*	*Mean value*	*Coef.*	*Mean value*
immiratio	0.675	0.355	1.108	0.412
income	0.913	5.841	0.777	5.896
un	-0.021	6.839	0.013	7.278
lfpr	0.003	66.851	-0.001	67.253
stock	3.171	0.382	3.969	0.365
rent	0.007	10.004	0.011	9.932
maincost	0.020	4.049	0.004	4.625
room	0.201	6.401	0.215	6.248
ndwell	-0.706	0.033	0.394	0.015
density	0.098	7.737	0.015	8.066
ratio2034	-2.654	0.217	-2.549	0.219
abor	0.398	0.018	3.058	0.005
mobility5	0.071	1.054	-0.057	0.804
mobility	0.579	0.208	0.454	0.161
cwork	6.309	0.059	1.177	0.051
Total Gap	0. 246			
Total Explained	0. 055			
Total Unexplained	0. 192			

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