



OFFICE OF THE
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CANADA

Household Formation and the Housing Stock

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The mandate of the Parliamentary Budget Officer (PBO) is to provide independent analysis to Parliament on the state of the nation's finances, the Government's estimates and trends in the Canadian economy; and, upon request from a committee or parliamentarian, to estimate the financial cost of any proposal for matters over which Parliament has jurisdiction.

This report responds to the 10 May 2017 request by the Honourable Elizabeth Marshall to provide an update of the 13 December 2016 PBO report "Household Formation and the Housing Stock: A Stock-Flow Perspective". The report provides updated estimates of household formation and the housing stock in Canada, as well as an updated medium-term outlook for the housing sector.

This report was prepared by the staff of the Parliamentary Budget Officer. Chris Matier updated the December 2016 report. Mostafa Askari and Tim Scholz provided comments. Nancy Beauchamp and Jocelyne Scrim assisted with the preparation of the report for publication. Please contact pbo-dpb@parl.gc.ca for further information.

Jean-Denis Fréchette
Parliamentary Budget Officer

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Executive Summary

This report responds to the 10 May 2017 request by the Honourable Elizabeth Marshall to provide an update of PBO's 13 December 2016 report "Household Formation and the Housing Stock: A Stock-Flow Perspective".¹ The updated report includes revised population data over 2012 to 2016 and projections to 2021, as well as 2016 housing construction and residential investment data. In addition, the outlook for the housing sector has been updated to incorporate PBO's 28 April 2017 Economic and Fiscal Outlook.²

Key points

This report provides estimates of household formation and the housing stock in Canada, and also attempts to gauge the degree of balance in the housing sector, both for new housing units and for the overall housing stock. Our assessment, however, is based on housing data and indicators at the national level, which can mask important variation across regions. An assessment of the housing sector at the regional, or Census Metropolitan Area (CMA), is beyond the scope of our report.

- Over 2012 to 2016, we estimate that the number of (net) new households formed outpaced the construction of new housing units, reversing the trend observed since 2001.
- The reversal of this trend helped reduce the national vacancy rate from elevated levels, resulting in an apparent balance in the housing market in terms of the overall supply and demand for housing units in 2016.
- PBO's April 2017 Economic and Fiscal Outlook incorporates a significant decline in residential investment—beginning in the second half of 2017 and continuing into 2019—that is driven by rising household borrowing rates and a deceleration in house prices.
- Based on PBO's April 2017 outlook, we project that household formation will continue to outpace housing construction through 2021, pushing the national vacancy rate below its long-term historical average.

Compared to the outlook for the housing sector presented in our December 2016 report, household formation has been revised up due to higher population levels and housing construction has been revised lower, reflecting higher household borrowing costs. Consequently, our outlook for the national vacancy rate has been revised lower and now suggests excess demand in terms of the overall stock of housing units over 2017 to 2021.

Households and household formation

We adopt the Census definition of a household, which is defined as a person or a group of persons (other than foreign residents) who occupy a private dwelling and do not have a usual place of residence elsewhere in Canada. Household formation is the net change in the number of households.

The headship rate

The headship rate is defined as the ratio of the number of household heads or household maintainers to the population 15 years of age and older.

We would again caution that our estimates of household formation over 2012 to 2021 reflect only the demographic demand for new housing units. Including behavioural effects (through changes to age-group specific headship rates) could affect our estimates of household formation and the national vacancy rate.

Context

In its 2016 *Economic Survey*, the Organization for Economic Co-operation and Development (OECD) noted that Canada's share of residential investment in gross domestic product (GDP) was the highest among OECD countries and that "it appears stronger than what can be justified by underlying population increases".

Residential investment

Statistics Canada's measure of residential construction investment includes three components: investment in new housing construction; investment in renovations; and acquisition costs.

Over 2010 to 2016, new housing construction accounted for just over 44 per cent of residential investment.

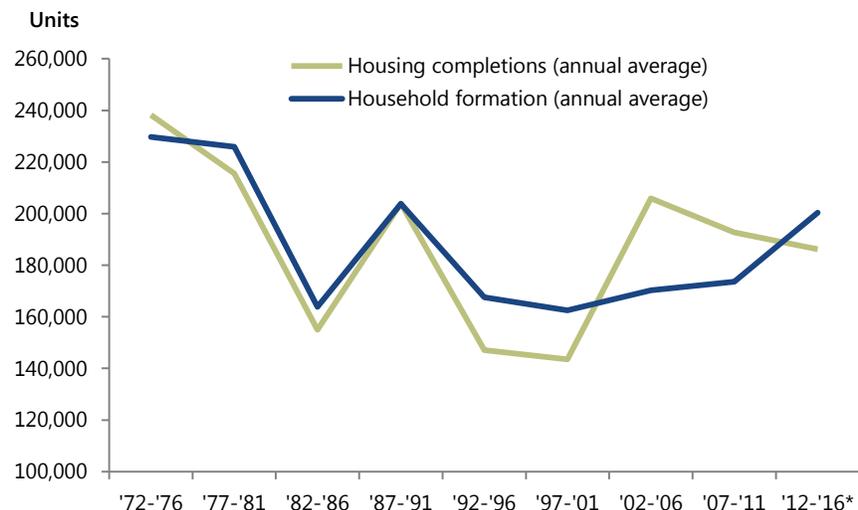
While the share of residential investment in the economy serves as a useful indicator of housing market activity, assessing imbalances—in terms of housing units as opposed to prices—in this sector requires taking a broader perspective. This report examines the "flow" of residential construction relative to its fundamental driver, household formation, as well as in the context of the overall "stock" of occupied and vacant housing units.

Household formation and housing construction

Summary Figure 1 shows that average annual housing completions closely tracked household formation over 1972 to 1991. However, over 1992 to 2001, household formation exceeded housing completions. This dynamic then reversed over 2002 to 2011 as housing construction surged.

Summary Figure 1

Household formation and housing completions



Sources: Canada Mortgage and Housing Corporation; Statistics Canada; and Parliamentary Budget Officer.

Note: * Household formation over 2012 to 2016 is estimated assuming that age-group specific headship rates are unchanged from 2011 levels.

Based on our estimate of the number of households in 2016, household formation outpaced the construction of new housing units over 2012 to 2016, reversing the trend observed since 2001.

The housing stock and vacancy rate

Assessing housing completions relative to household formation helps to gauge flow imbalances, whereas taking into account the total vacancy rate (that is, the number of vacant units for sale and rent relative to the overall housing stock) provides a stock perspective.

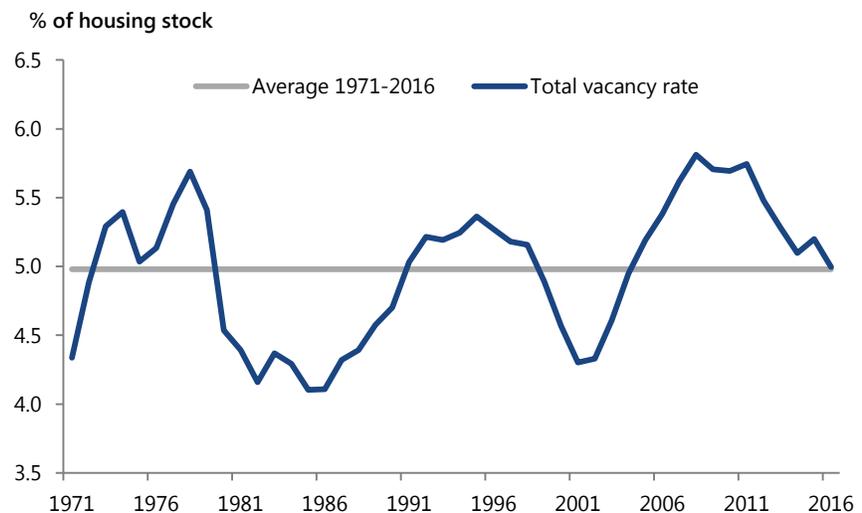
Summary Figure 2 shows that, nationally, the total vacancy rate remained elevated in the aftermath of the global financial crisis as housing construction moderated and moved into line with household formation over 2009 to 2011. In 2012, the vacancy rate began to decline sharply, returning to its long-term historical average of 5.0 per cent in 2016, as housing construction remained subdued while the pace of household formation picked up.

The total vacancy rate

The total vacancy rate represents the number of vacant units, for sale or rent, relative to the total stock of housing units, which includes both occupied and vacant dwelling units.

Summary Figure 2

The total vacancy rate, 1971-2016



Sources: Statistics Canada and Parliamentary Budget Officer.

Note: The total vacancy rate includes dwelling units for sale and for rent.

Relative to its long-term historical average, our estimate of the vacancy rate in 2016 suggests that there was an apparent balance in the housing market in terms of the overall supply and demand for housing units. Thus the imbalance between the flows of household formation and housing completions over 2012 to 2016 helped to eliminate the excess supply in the overall stock of housing units.

Medium-term prospects

Based on PBO's April 2017 Economic and Fiscal Outlook, the share of residential investment in the Canadian economy is projected to reach a record level of 7.7 per cent of GDP in 2017 before falling to 6.7 per cent of GDP in 2019 (Summary Figure 3). The projected decline primarily reflects weaker residential investment volumes, owing to rising household borrowing rates and a deceleration in house prices.

Summary Figure 3

Residential investment in the Canadian economy



Sources: Statistics Canada and Parliamentary Budget Officer.

Note: The projection period covers 2017 to 2021.

Based on PBO's April 2017 outlook for residential investment, we project that housing completions will increase to 199,300 units in 2017 before moderating to around 172,000 units, on average, over 2019 to 2021. Household formation is estimated to have increased from 171,700 (net) new households in 2015 to 209,100 in 2016 but is then projected to trend lower to 176,700 by 2021.

We project that, through 2021, the total vacancy rate will fall below its long-term historical average as household formation continues to outpace net additions to the housing stock. This would suggest excess demand in the housing market, both for new housing units and for the overall housing stock.

1. Introduction

Residential investment

Statistics Canada's measure of residential construction investment includes three components: investment in new housing construction; investment in renovations; and acquisition costs.

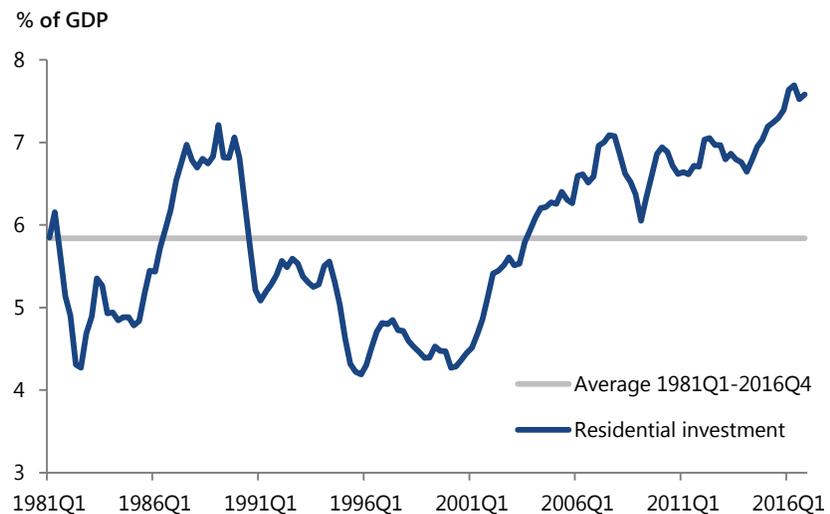
Over 2010 to 2016, new housing construction accounted for just over 44 per cent of residential investment.

The share of residential investment in the Canadian economy reached a record high of 7.7 per cent of gross domestic product (GDP) in the second quarter of 2016 (Figure 1-1).³ In its 2016 *Economic Survey*, the Organisation for Economic Co-operation and Development (OECD) noted that the share of residential investment in Canada's GDP was the highest among OECD countries and that "it appears stronger than what can be justified by underlying population increases".⁴ Moreover, in 2013, International Monetary Fund (IMF) staff analysis⁵ concluded that

The last time residential investment-to-GDP ratio reached 7 percent, the Canadian housing sector went through a long period of stagnation. With current house prices and construction activity at historical highs, an adjustment is likely to take place in the coming years.

Figure 1-1

The share of residential investment in the economy



Sources: Statistics Canada and Parliamentary Budget Officer.

Since early 2000, the share of residential investment in the economy has increased by over 3 percentage points of GDP due to rising investment prices as well as increases in the "volume" (that is, the inflation-adjusted level) of investment.⁶ The share of residential investment in the economy has remained above its long-term historical average of 5.8 per cent of GDP since late 2003.

Elevated and rising levels of residential activity have prompted concerns about potential overbuilding and an excess supply of housing units. IMF staff analysis conducted in 2015, estimated that by the end of 2013, the Canadian housing market was in excess supply by about 0.5 per cent of the total housing stock.⁷ Since early 2014, increases in the volume of residential investment have outpaced real GDP gains, which would seem to suggest a further buildup of imbalances in the housing sector.

While the share of residential investment in the economy serves as a useful indicator of housing market activity, assessing imbalances—in terms of volumes as opposed to prices—in this sector requires taking a broader perspective. This report attempts to examine the housing sector from a stock-flow perspective. That is, this report examines the flow of residential construction relative to its fundamental driver, household formation, as well as in the context of the overall stock of occupied and vacant housing units.

Our assessment, however, is based on housing data and indicators at the national level, which can mask important variation across regions. An assessment of the housing sector at the regional, or Census Metropolitan Area (CMA), is beyond the scope of our report. That said, we provide a prospective view over 2017 to 2021 based on PBO's April 2017 Economic and Fiscal Outlook.

Structure of report

Section 2 of the report presents our estimates of household formation, highlighting the link with new housing construction. Section 3 provides estimates of the housing stock and the total vacancy rate for housing units. In Section 4, we assess medium-term prospects for household formation and the vacancy rate based on PBO's April 2017 Economic and Fiscal Outlook.

2. Household Formation and Housing Construction

Households and household formation

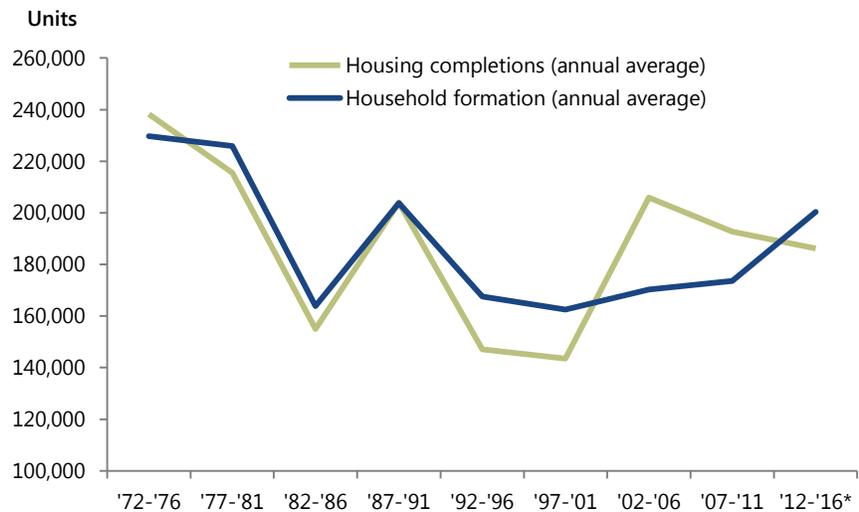
We adopt the Census definition of a household, which is defined as a person or a group of persons (other than foreign residents) who occupy a private dwelling and do not have a usual place of residence elsewhere in Canada. Household formation is the net change in the number of households.

As Lin (2016) and others have noted, the trend in household formation is linked to that for new housing construction given that the “housing stock must grow in order to accommodate increasing numbers of households”. Thus, household formation serves as a useful benchmark to gauge housing construction activity.

Figure 2-1 shows that average annual housing completions closely tracked household formation over 1972 to 1991. However, over 1992 to 2001, household formation exceeded housing construction and then this dynamic reversed over 2002 to 2011 as housing construction surged. Lewis (2013) notes that definitive explanations for the imbalance between housing construction and household formation over 2002 to 2011 are elusive. That said, he does indicate that from 2002 to 2011, the number of dwelling units in Canada not occupied by usual residents (that is, vacant and secondary homes) increased by roughly the amount of the excess of housing completions over household formation.

Figure 2-1

Household formation and housing completions



Sources: Canada Mortgage and Housing Corporation; Statistics Canada; and Parliamentary Budget Officer.

Note: * Household formation over 2012 to 2016 is estimated assuming that age-group specific headship rates are unchanged from 2011 levels.

The headship rate

The headship rate is defined as the ratio of the number of household heads or household maintainers to the population 15 years of age and older.

To examine potential developments since 2011, and in the absence of 2016 Census data⁸, we construct an estimate of household formation based on the assumption that age-group specific headship rates in 2016 remain fixed at their 2011 levels.⁹ Consequently, over the period 2012 to 2016, household formation reflects only demographic factors (that is, population growth and population ageing).

Based on our demographic estimate, household formation accelerated over 2012 to 2016, averaging 200,400 (net) new households annually. Over the same period, housing completions moderated, averaging 186,100 units annually. While there still remains an imbalance between household formation and housing construction over 2012 to 2016, the gap over this period is smaller (in absolute terms) compared to the periods since 1991.

Just as (net) household formation represents the “flow” into the “stock” of households, housing completions are the main flow into the housing stock. In the section that follows, we turn to the housing stock. Using our estimates of households and the housing stock, we assess imbalances in the housing sector from a stock perspective.

3. Housing Stock and Vacancy Rate

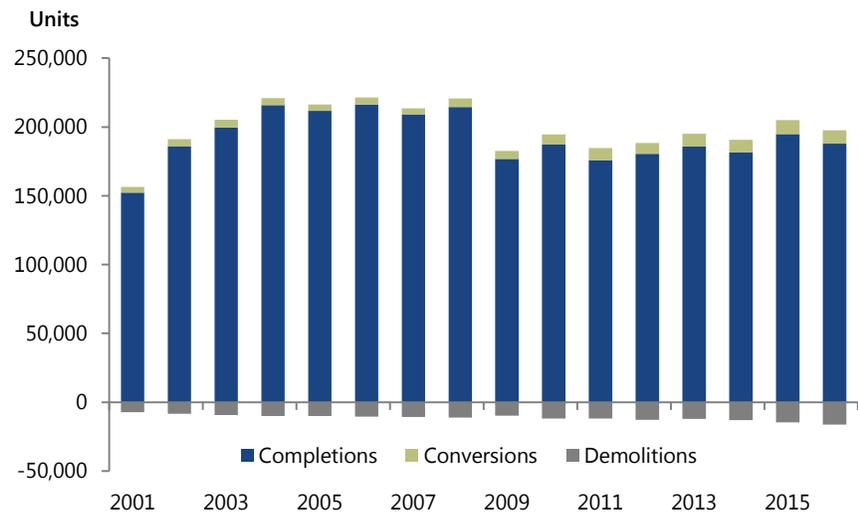
As Reynaud (2015) notes, one of the shortcomings of publicly-available housing indicators is the lack of housing stock data—in terms of the number of units—beyond 2000. This stems from the termination of Statistics Canada’s data in Table 030-0001.¹⁰

Following the approach used by Reynaud (2015), we construct annual estimates of the housing stock beyond 2000 by extrapolating the stock of units using the annual flows of housing completions, conversions¹¹ (that is, “additional housing units created from non-residential buildings or other types of residential units”¹²) and demolitions.¹³ The following equation describes the evolution of the housing stock:

$$\text{Housing stock}_t = \text{Housing stock}_{t-1} + \text{Completions}_t + \text{Conversions}_t - \text{Demolitions}_t$$

Based on our extrapolation, we estimate that the housing stock increased by 3.0 million units from 11.9 million in 2000 to 14.9 million units in 2016.¹⁴ Figure 3-1 shows the contributions to the housing stock from the annual flows of completions, conversions and demolitions. Not surprisingly, completions are the ultimate source of additions to the housing stock, with demolitions more than offsetting the contribution from conversions.

Figure 3-1 Contributions to the housing stock



Sources: Canada Mortgage and Housing Corporation; Statistics Canada; and Parliamentary Budget Officer.

The total vacancy rate

The total vacancy rate represents the number of vacant units, for sale or rent, relative to the total stock of housing units, which includes both occupied and vacant dwelling units.

Statistics Canada's terminated series for the housing stock also included the breakdown by tenure, that is, by occupied and vacant dwelling units. Vacant units include units available for sale or rent. Expressing the number of vacant units relative to the housing stock provides a measure of the total vacancy rate. As CBO (2008) notes, the vacancy rate

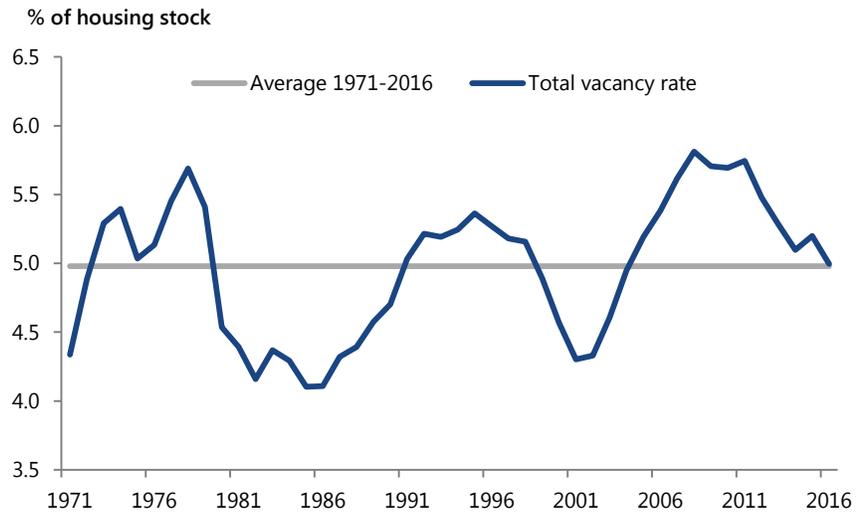
"is a key measure of the balance between supply and demand in the housing market. A low vacancy rate indicates excess demand, which stimulates construction. A high vacancy rate reflects excess supply, which dampens construction."

Thus, while assessing housing construction relative to household formation helps to gauge flow imbalances, taking into account the overall vacancy rate provides a stock perspective. For example, housing construction could be outpacing household formation, which all else equal, would suggest potential overbuilding. However, if this occurs in the context of a relatively low vacancy rate, then the potential for overbuilding would be diminished.

To assess the possibility of overbuilding conditions in the housing market, the Canada Mortgage and Housing Corporation (CMHC) uses the rental vacancy rate and the inventory of completed and unsold ownership and condominium housing units per 10,000 population.¹⁵ While these indicators can also reflect imbalances in the housing market, they are not as encompassing as the total vacancy rate. For instance, the rental vacancy rate excludes units for sale and the inventory of completed-unsold units represents only recently constructed units and therefore is largely a flow-based measure.

Using our estimates of the housing stock and occupied dwelling units, we are able to extend Statistics Canada's total vacancy rate beyond 2000.¹⁶ Figure 3-2 shows that the total vacancy rate fell from 4.6 per cent in 2000 to a near-record low of 4.3 per cent in 2001 before rising to a record high of 5.8 per cent in 2008 as housing construction outpaced household formation over this period. The vacancy rate remain elevated in the aftermath of the global financial crisis as housing construction moderated and moved into line with household formation over 2009 to 2011. In 2012, the vacancy rate began to decline sharply, returning to its long-term (1971-2016) historical average of 5.0 per cent in 2016, as housing construction remained subdued while the pace of household formation picked up.

Figure 3-2 Total vacancy rate, 1971-2016



Sources: Statistics Canada and Parliamentary Budget Officer.

As Reynaud (2015) notes, “the difference between the vacancy ratio and its historical average is a measure of the disequilibrium in the housing stock”.¹⁷ Relative to its long-term historical average, our estimate of the vacancy rate in 2016 suggests that there was an apparent balance in the housing market in terms of the overall supply and demand for housing units. Thus the imbalance between the flows of household formation and housing completions over 2012 to 2016 helped to eliminate the excess supply in the overall stock of housing units.

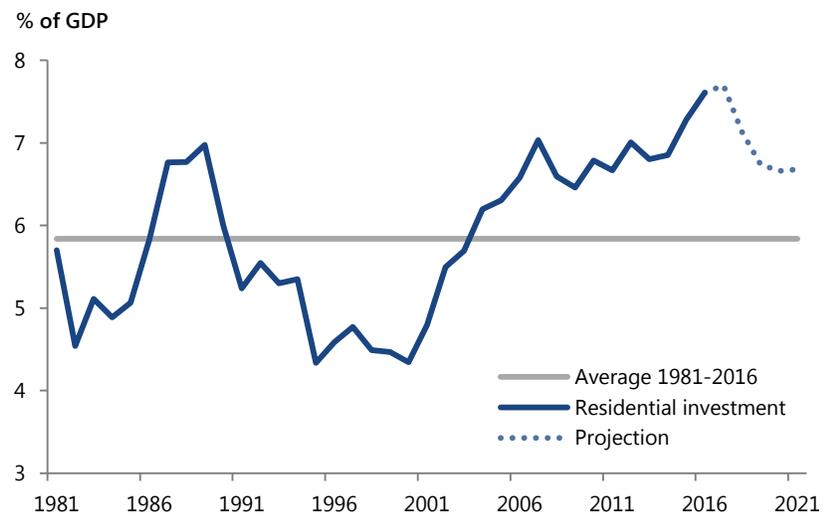
However, we would caution that our estimates of household formation over 2012 to 2016 reflect only the demographic demand for new housing. Including behavioural effects (that is, changes to age-group specific headship rates) could influence our estimates of household formation and the total vacancy rate over this period.

4. Medium-Term Prospects

The most recent data and our estimates suggest there was an apparent balance between the overall supply and demand for housing units in 2016. However, given the recent concerns expressed about the elevated level of residential investment in the Canadian economy, it is useful to assess medium-term prospects for residential investment and the housing stock.

Based on PBO's April 2017 Economic and Fiscal Outlook, the share of residential investment in the Canadian economy is projected to reach a record level of 7.7 per cent of GDP in 2017 before falling to 6.7 per cent of GDP in 2019 (Figure 4-1). The projected decline reflects weaker residential investment volumes relative to real GDP, as opposed to weaker residential investment prices.

Figure 4-1 Medium-term outlook for residential investment

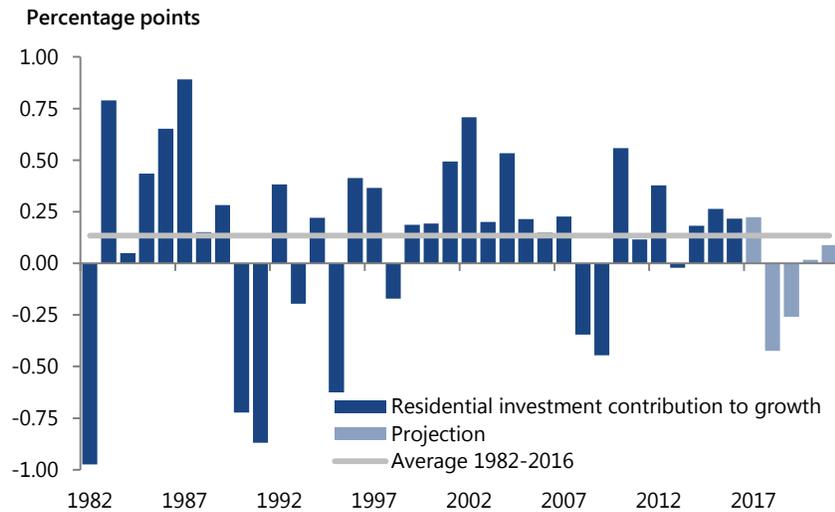


Sources: Statistics Canada and Parliamentary Budget Officer.

Note: The projection period covers 2017 to 2021.

In PBO's April 2017 outlook, the level of residential investment (in volume terms) is projected to decline by 10 per cent from its peak in the second quarter of 2017 to the first quarter of 2019. To put this adjustment into context, it is helpful to examine the contribution of residential investment to real GDP growth over history and projection (Figure 4-2). The projected weakness in residential investment over 2018 to 2019 in PBO's April outlook is broadly comparable to the collapse in residential investment observed in 2008 and 2009, which occurred during the global financial crisis. In contrast to the rebound in residential investment observed in 2010, we are not projecting a similar bounce-back in 2020.

Figure 4-2 Contribution of residential investment to real GDP growth

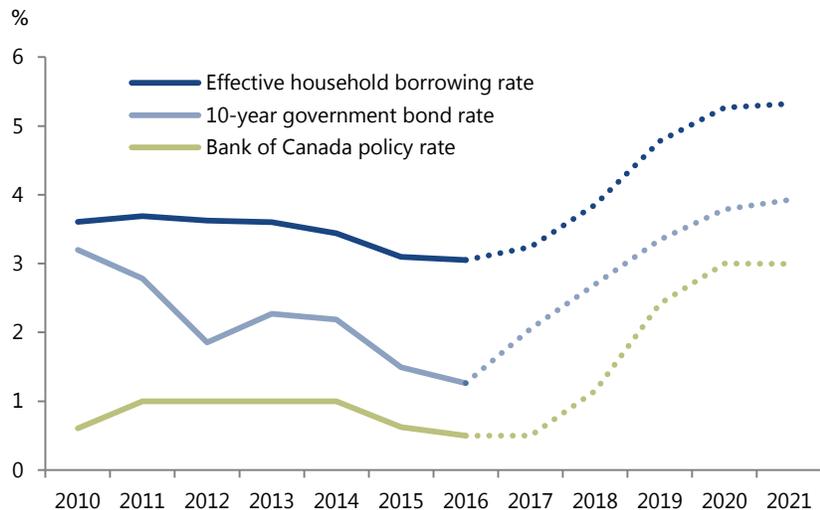


Sources: Statistics Canada and Parliamentary Budget Officer.

Note: The projection period covers 2017 to 2021.

The projected weakness in our outlook for residential investment largely reflects rising household borrowing rates and a deceleration in house prices. Based on PBO's April 2017 outlook, the effective household borrowing rate is projected to rise from a record low of 3.0 per cent in 2016 to reach 5.0 per cent by the end of 2019, and then average 5.3 per cent through 2021 (Figure 4-3).¹⁸

Figure 4-3 PBO interest rate outlook

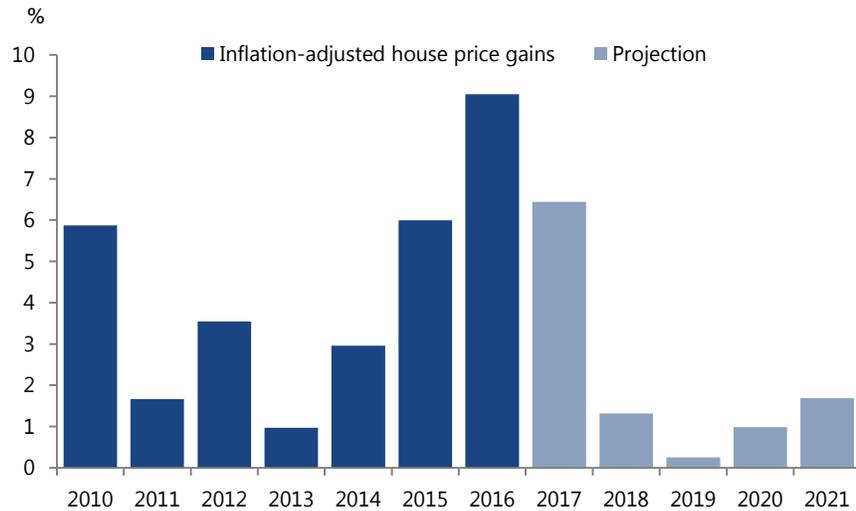


Sources: Statistics Canada; Bank of Canada and Parliamentary Budget Officer.

Note: Over the historical period, the effective household borrowing rate is from the Bank of Canada and represents a weighted average of mortgage and consumer credit rates. The projection period covers 2017 to 2021.

In the April 2017 Economic and Fiscal Outlook, we projected that inflation-adjusted house price gains would decrease from 9 per cent in 2016 to 0.2 per cent in 2019 (Figure 4-4). Thereafter, we projected that inflation-adjusted house price gains would increase to 1.0 per cent and 1.7 per cent, respectively, in 2020 and 2021.

Figure 4-4 Inflation-adjusted increases in house prices



Sources: Teranet/National Bank of Canada; Statistics Canada; and Parliamentary Budget Officer.

Note: PBO’s measure of house prices is based on the Teranet/National Bank of Canada Composite 11 index. The GDP implicit price index is used for the inflation adjustment. The projection period covers 2017 to 2021.

PBO’s April 2017 outlook for residential investment incorporated Budget 2016 housing investment measures.¹⁹ However, this outlook did not explicitly incorporate the impact of the Government’s changes to housing insurance rules and income tax proposals that were announced on 3 October 2016.²⁰

Although we have not undertaken an in-depth analysis of these measures, our judgement is that they are unlikely to meaningfully alter our medium-term outlook. That said, the Bank of Canada indicated that the effect of the new measures was “very uncertain” and in its October 2016 outlook incorporated a shock of -0.3 per cent on real GDP by the end of 2018.²¹

Table 4-1 provides a comparison of PBO’s April 2017 outlook for residential investment to the Bank of Canada’s outlook presented in its April 2017 Monetary Policy Report. In terms of the contribution of residential investment to economic growth over 2017 to 2019, PBO’s outlook is weaker than the Bank of Canada’s. Indeed, PBO projects a much larger adjustment in 2018 with residential investment subtracting 0.4 percentage points off of real GDP growth in 2018, compared to 0.0 percentage points projected by the Bank of Canada.

Table 4-1 PBO and Bank of Canada outlooks for residential investment (contributions to real GDP growth)

	Percentage points		Projection			
	2016	2017	2018	2019	2020	2021
PBO April 2017	0.2	0.2	-0.4	-0.3	0.0	0.1
Bank of Canada April 2017	0.2	0.3	0.0	-0.2	N/A	N/A

Sources: Bank of Canada and Parliamentary Budget Officer.

In preparing its Economic and Fiscal Outlook, PBO does not produce a detailed projection of the housing sector (that is, the outlook for housing completions, conversions, demolitions and housing stock). However, to assess the evolution of the housing sector over the medium term, we use our outlook for residential investment to construct a projection of housing completions and conversions.²² As well, we assume that demolitions will remain at their recent levels.

Our medium-term outlook for household formation is based on the same approach we used to extend estimates of the number of households beyond 2011. That is, using population estimates combined with the assumption that age-group specific headship rates remained unchanged at 2011 levels.²³

Table 4-2 summarizes our projection of the housing sector based on PBO's April 2017 outlook.

Table 4-2 Detailed housing sector outlook

	Units, thousands		Projection			
	2016	2017	2018	2019	2020	2021
Housing completions	187.9	199.3	182.9	171.7	171.1	173.3
Conversions	9.6	10.2	9.3	8.8	8.7	8.9
Demolitions	16.2	16.2	16.2	16.2	16.2	16.2
Household formation	209.1	195.0	190.6	186.9	183.2	176.7

Sources: Canada Mortgage and Housing Corporation; Statistics Canada; and Parliamentary Budget Officer.

Based on PBO's April 2017 outlook for residential investment, we project that housing completions will increase to 199,300 units in 2017 before moderating to around 172,000 units, on average, over 2019 to 2021.

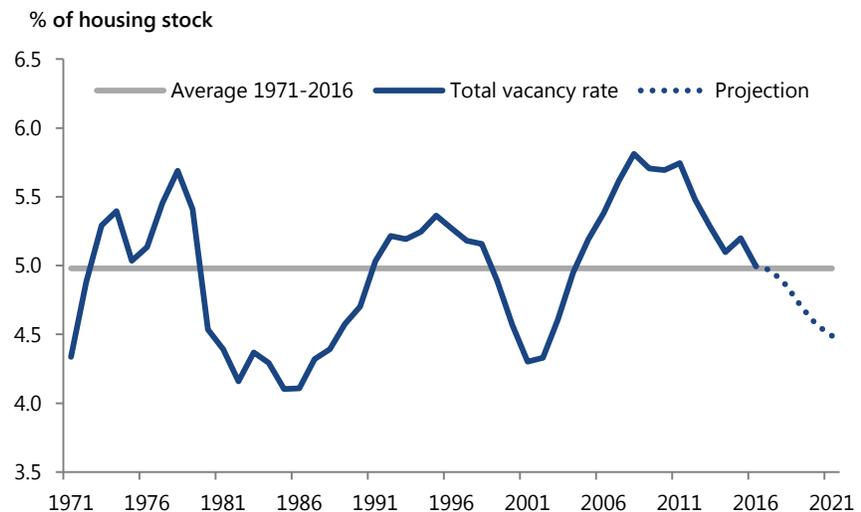
Household formation is estimated to have increased from 171,700 (net) new households in 2015 to 209,100 in 2016 but is then projected to trend lower to 176,700 by 2021.

The evolution of the housing stock is determined by the flows of housing completions, conversions and demolitions (see Section 3). Assuming that occupied dwellings grow in line with household formation, we can calculate residually the number of vacant units and the total vacancy rate over the projection period.

Figure 4-5 presents our projection of the total vacancy rate based on PBO's April 2017 EFO. We project that, through 2021, the total vacancy rate will fall below its long-term historical average as household formation continues to outpace net additions to the housing stock. This would suggest excess demand both for new housing units and for the overall housing stock.

However, we would caution that our estimates of household formation over 2012 to 2021 reflect only the demographic demand for new housing units. Including behavioural effects (through changes to age-group specific headship rates) could affect our estimates of household formation and the national vacancy rate.

Figure 4-5 Outlook for the total vacancy rate



Sources: Statistics Canada and Parliamentary Budget Officer.

Note: The projection period covers 2017 to 2021.

Compared to the outlook for the housing sector presented in our December 2016 report (which was based on PBO's October 2016 Economic and Fiscal Outlook), household formation has been revised up due to higher population levels and housing construction has been revised lower, reflecting higher household borrowing costs. Consequently, the medium-term outlook for the national vacancy rate has been revised lower and now suggests excess demand in terms of the overall stock of housing units over 2017 to 2021.

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Notes

1. Available at: <http://www.pbo-dpb.gc.ca/web/default/files/Documents/Reports/2016/Household%20Formation/Household%20Formation%20EN.pdf>.
2. Available at: http://www.pbo-dpb.gc.ca/web/default/files/Documents/Reports/2017/EFO%20April%202017/EFO_MAY2017_EN.pdf.
3. Statistics Canada's measure of residential construction investment includes three components: investment in new housing construction; investment in renovations; and acquisition costs, which include "sales tax, land development and service charges, as well as record-processing fees for mortgage insurance and the associated premiums." See: <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5016&lang=en&db=imdb&adm=8&dis=2>.
4. An overview of the 2016 OECD Economic Survey of Canada is available at: <http://www.oecd.org/eco/surveys/Canada-overview-OECD-economic-survey-2016.pdf>.
5. See the February 2013 Selected Issues Paper prepared for Canada's 2012 Article IV Consultation available at: <http://www.imf.org/external/pubs/ft/scr/2013/cr1341.pdf>.
6. A logarithmic decomposition of the increase in the nominal share of residential investment in the economy from 2000Q1 to 2016Q4 shows similar-sized contributions from the relative price of residential investment (that is, the price of residential investment relative to the GDP price index) and the volume of residential investment relative to real GDP.
7. See IMF Working Paper WP/15/128, *Gauging Housing Supply in Canada: A Stock Approach*, by Julien Reynaud. Available at: <https://www.imf.org/external/pubs/ft/wp/2015/wp15128.pdf>.
8. 2016 Census data on households is scheduled for release on 2 August 2017.
9. Our December 2016 report presents estimates of the number of households in Canada over 1971 to 2011 as well as a decomposition of growth in the number of households and changes in the aggregate headship rate. These estimates are not affected by the revised data.
10. As Gabay (2015) notes, Statistics Canada does publish the census count of all private dwellings, which provides an estimate of the private housing stock. However, this data provides only a snapshot of the housing stock every 5 years. Further, Gabay (2015) cites concerns made by Statistics Canada about the quality of the data on "unoccupied dwellings and those occupied exclusively by foreign residents or temporarily present persons".

11. Following Reynaud (2015), we assume that all conversions occur within one year.
12. This definition is taken from Statistics Canada's description of residential investment. Available at:
<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5016&lang=en&db=imdb&adm=8&dis=2>.
13. As a check on our approach to extrapolating the housing stock data, our December 2016 report provides a dynamic simulation of the housing stock over 1971 to 2000, comparing the simulated series to the observed data over this period.
14. Although we appear to be using the same data and methodology as Reynaud (2015) to construct estimates of the housing stock and vacancy rate beyond 2000, we obtain different results. Unfortunately, we are unable to reconcile the differences given that the author is unable to provide us with his underlying data and calculations.
15. CMHC publishes a quarterly *Housing Market Assessment* that evaluates "the evidence of problematic housing market conditions at the national level, and in 15 Census Metropolitan Areas (CMAs)". The most recent assessment (Second Quarter 2017) is available at: https://www.cmhc-schl.gc.ca/odpub/esub/68456/68456_2017_Q02.pdf?fr=1494878249927.
16. Our December 2016 report details the construction of occupied and vacant dwelling units beyond 2000.
17. While Reynaud (2015) constructs an estimate of excess supply of housing based on the historical average of the vacancy rate, he also undertakes a model-based analysis to incorporate other determinants of construction activity and construct an econometric estimate of housing stock disequilibrium. Reynaud (2015) argues that the measure of housing stock disequilibrium based on the long-term historical average of the vacancy rate reflects only demographic drivers and does not capture the influence of other determinants of construction activity.
18. PBO uses the Bank of Canada's effective interest rate series for households and businesses in its macroeconomic model. In PBO's April 2017 Economic and Fiscal Outlook, historical data for these effective interest rates, up to and including the first quarter of 2017, were taken from the Bank of Canada's publicly available financial indicator statistics.

The Bank of Canada's effective interest rate for households is a weighted average of mortgage and consumer credit interest rates, where the weights are derived from residential mortgage and consumer credit data. See <http://credit.bankofcanada.ca/financialindicators/eir> for additional detail.
19. These measures amounted to \$1.359 billion in 2016-17 and \$0.966 billion in 2017-18. See Table A2.2 in Budget 2016:
<http://www.budget.gc.ca/2016/docs/plan/budget2016-en.pdf>.
20. Finance Canada's Technical Backgrounder is available at:
http://www.fin.gc.ca/n16/data/16-117_2-eng.asp.
21. See the Governor of the Bank of Canada's opening statement following the release of the October 2016 *Monetary Policy Report*.

<http://www.bankofcanada.ca/wp-content/uploads/2016/10/opening-statement-191016.pdf>.

22. This is done using a regression model that relates growth in completions and conversions (combined) to growth in residential investment volumes (excluding ownership transfer costs). Given our April 2017 outlook for residential investment volumes (excluding ownership transfer costs), we then project the growth in completions and conversions over 2017 to 2021 using this model. For illustrative purposes, to distinguish between completions and conversions, we assume that the share of conversions in the combined total remains at its 2016 level of 4.9 per cent. In our stock-flow framework, in terms of additions to the housing stock, the distinction between completions and conversions is irrelevant.
23. The population projection is based on Statistics Canada's *Population Projections for Canada (2013 to 2063), Provinces and Territories (2013 to 2038)*: <http://www.statcan.gc.ca/pub/91-520-x/91-520-x2014001-eng.pdf>. PBO's population projection was updated in February 2017 by Statistics Canada to include the current population estimates over 2012 to 2016.