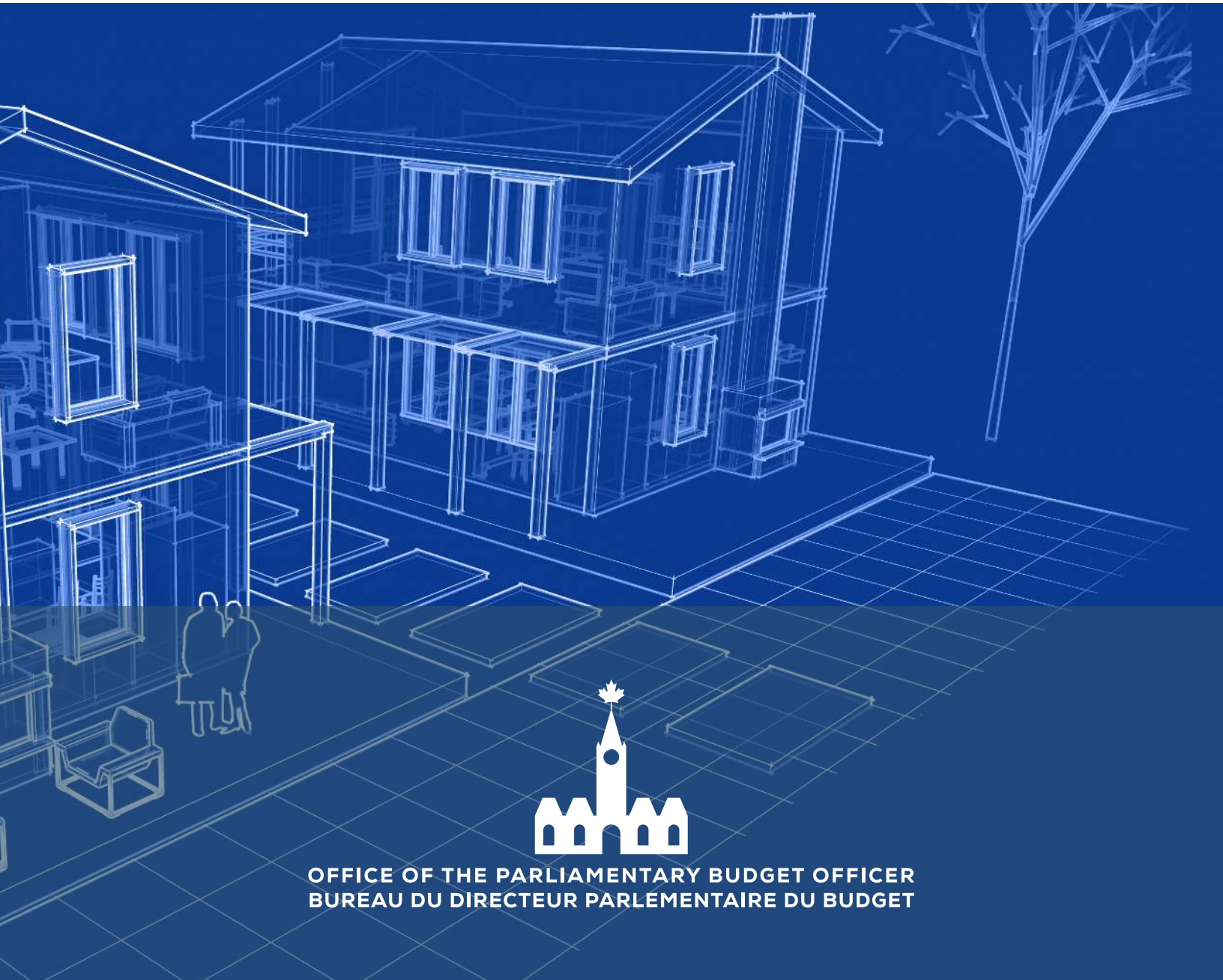


February 17, 2022



HOUSE PRICE ASSESSMENT: A BORROWING CAPACITY PERSPECTIVE



OFFICE OF THE PARLIAMENTARY BUDGET OFFICER
BUREAU DU DIRECTEUR PARLEMENTAIRE DU BUDGET

The Parliamentary Budget Officer (PBO) supports Parliament by providing economic and financial analysis for the purposes of raising the quality of parliamentary debate and promoting greater budget transparency and accountability.

This report provides an assessment of house prices relative to a household's capacity to borrow and pay for the purchase of a house in selected Canadian cities.

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Parliamentary Budget Officer

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Summary

This report provides an assessment of house prices relative to a household's capacity to borrow and pay for the purchase of a house in selected Canadian cities.

We estimate the level of house prices that an average household would be able to afford under normal utilization of its borrowing capacity—the “affordable” house price. House prices that exceed affordable levels imply that a household is stretching its finances and borrowing capacity, increasing its vulnerability to adverse economic shocks.

Key findings

- In early 2015, house prices in most of the census metropolitan areas (CMAs) considered were below, or close to, affordable levels based on borrowing capacity. At the national level, at the beginning of 2015, the average house price was \$413,000.
- However, in the years that followed—and prior to the pandemic— house prices “de-linked” from household borrowing capacity in several CMAs: Hamilton, Toronto, Ottawa, Victoria, Halifax and Vancouver.
 - House prices in these markets were 20 per cent, or higher, than affordable prices based on household borrowing capacity.
 - Over this period, population increases sharply outstripped housing completions, suggesting that supply was not keeping pace with demand, putting upward pressure on house prices.
 - Just prior to the pandemic, the average house price in Canada at the end of 2019 was \$565,800—an increase of 37 per cent from January 2015.
- Borrowing capacity increased during the pandemic due to lower interest rates and COVID-19 financial support. However, in several CMAs, further increases in house prices far outpaced gains in borrowing capacity, resulting in wider gaps in house price affordability.
 - At the end of 2021, the average house price nationally was \$811,700—an increase of 43 per cent from December 2019 and a 97 per cent increase compared to January 2015.
 - We estimate that in December 2021, average house prices in Hamilton, Toronto, Halifax and Ottawa were more than 50 per cent above affordable levels.

- Average house prices in Vancouver, Montréal and Victoria were between approximately 30 per cent to 45 per cent above their estimated affordable levels in December 2021.
- Looking ahead, rising mortgage lending rates are projected to offset the increase in average household incomes, resulting in declines in borrowing capacity over the medium term.

To gauge the extent to which a household is stretching its finances to purchase a home, we examine its mortgage debt service ratio, which represents the share of a household's total income that is devoted to servicing total mortgage payments (that is, principal plus interest).

- While approximate in nature, our results suggest that household financial vulnerability is elevated in several CMAs for households that have recently purchased homes.

1. Introduction

Context

Since the onset of the COVID-19 pandemic, the acceleration in Canadian house prices has boosted the average price by 43 per cent, reaching \$811,700 in December 2021.² Bank of Canada analysis points to “[s]trong demand fundamentals, shifting preferences for more space, and limited supply of single-family homes” that together have contributed to the acceleration in house prices across Canadian cities.³

Strong demand fundamentals reflect, in part, fiscal and monetary policy actions implemented in response to the pandemic that have increased the borrowing capacity of households. Interest rates are expected to rise and growth in household income is projected to moderate over the medium term.

Scope of analysis

Based on a methodology developed at the International Monetary Fund (IMF), this report provides an assessment of house prices relative to a household’s capacity to borrow and pay for the purchase of a house in selected Canadian cities.

Specifically, we estimate the level of house prices that an average household would be able to afford under normal utilization of its borrowing capacity—the “affordable” house price. House prices that exceed affordable levels imply that a household is stretching its finances and borrowing capacity, increasing its vulnerability to adverse income and interest rate shocks.

Our analysis examines average house prices and borrowing capacity in selected census metropolitan areas (CMAs): Halifax, Québec, Montréal, Ottawa (that is, Ottawa-Gatineau, Ontario part), Toronto, Hamilton, Winnipeg, Edmonton, Calgary, Vancouver and Victoria.⁴

Structure of report

Section 2 of the report describes the borrowing capacity approach and data sources. Section 3 presents our estimates of affordable house prices compared to actual house prices observed over 2000 to 2019, based on historical data. Section 4 examines developments since the start of the pandemic and provides a medium-term outlook for household borrowing capacity. Section 5 concludes with an assessment of household financial vulnerability.

2. Household borrowing capacity

The methodology used in this report is based on the borrowing capacity approach developed at the IMF that, in 2019, was used to assess house prices in Canadian cities.⁵ This approach is oriented toward the demand side of the housing market.

Indeed, this approach is closely related to the online mortgage payment “calculators” provided by financial institutions. However, rather than calculating the amount of the monthly payment required to service a new mortgage, this approach estimates the house price that a household can afford given its financial situation.

Following standard mortgage payment calculations, the total monthly payment (TMP), including principal (D) plus interest, is given by equation (1), where i represents the mortgage lending rate (per month) and m is the number of months of the amortization period.

$$TMP = \left[\frac{i \cdot D}{1 - (1 + i)^{-m}} \right] \quad (1)$$

A household’s debt service ratio (DSR) is calculated as a household’s total monthly mortgage payment relative to its total monthly gross (pre-tax) income Y . The mortgage principal is equal to the loan-to-value (LTV) ratio (at origination) multiplied by the “affordable” house price, PH .⁶

$$DSR = \left[\frac{i \cdot D}{1 - (1 + i)^{-m}} \right] \cdot \frac{1}{Y} \quad (2)$$

$$D = LTV \cdot PH \quad (3)$$

By substitution and rearranging terms, the affordable house price can be expressed as equation (4).

$$PH = \frac{1}{LTV} \cdot \left[\frac{(1 + i)^m - 1}{i \cdot (1 + i)^m} \right] \cdot DSR \cdot Y \quad (4)$$

For given debt service and LTV ratios, and assuming a fixed amortization period, affordable house prices are determined by mortgage lending rates and household incomes.

From this equation, certain relationships that affect a household’s borrowing capacity can be highlighted. Increases in affordable house prices are driven by increases in household income, decreases in mortgage lending rates, and decreases in the loan-to-value ratio due to a larger down payment.

Data and assumptions

For the CMAs considered in this report, we use average monthly house prices from the Canadian Real Estate Association (CREA), based on their seasonally adjusted MLS Composite HPI Benchmark.⁷ These prices reflect all housing types (that is, single family, townhouse/row house and apartments)

and are based “on a hybrid model that merges Repeat-Sales and Hedonic Price approaches”.⁸

For the amortization period, we assume that an average household contemplating a home purchase would amortize their mortgage over a period of 25 years. The mortgage lending rate in each month is the average of posted 5-year fixed rates calculated by Canada Mortgage and Housing Corporation (CMHC).⁹

We assume that the LTV ratio (at origination) remains constant at its 2019 national average of 67 per cent, which implies that the average household in each CMA will make a down payment of 33 per cent of the purchase price.¹⁰

Average household income over 2000 to 2019 for each CMA is taken from Statistics Canada’s Canadian Income Survey (CIS).¹¹ Average annual household income (excluding zero-income households) is on a gross basis (that is, before taxes) and is converted to a monthly frequency.

For each CMA, given average MLS composite benchmark house prices, an average LTV ratio of 67 per cent, average household income and the average mortgage lending rate, we use equation (4) above to calculate the implied debt service ratio in each month. Next, we use the average DSR over the period 2012 to 2014 to represent the average household’s “normal” mortgage debt-servicing capacity.¹²

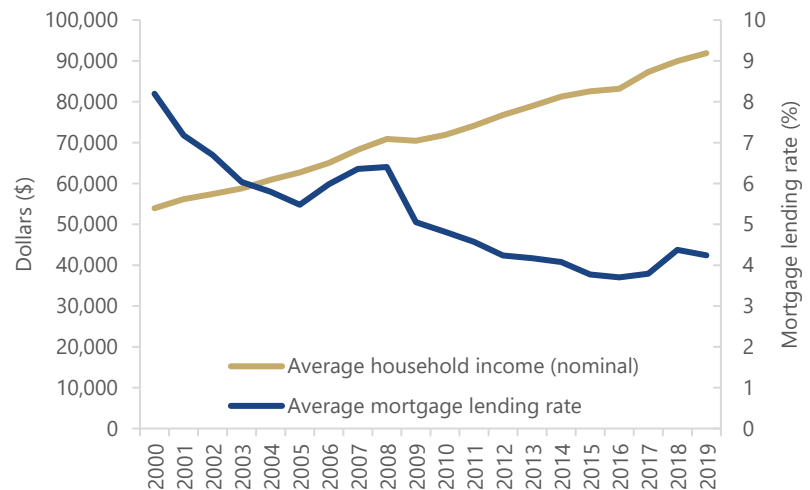
Next, to estimate affordable house prices based on household borrowing capacity, for each CMA, the normalized DSR is then combined with the assumed LTV ratio, household income and mortgage lending rates in equation (4). Implicit in our approach is the assumption that households with average incomes are prospective buyers of average-priced homes.¹³

3. House prices and borrowing capacity

Using the borrowing capacity approach, we compare affordable house prices for the average household in each CMA to average house prices observed over 2000 to 2019.

Figure 3-2 below shows graphically that house prices generally tracked household borrowing capacity up to 2015 in most CMAs considered. The trend increase in affordable house prices reflects trend increases in average household incomes and trend declines in mortgage lending rates (Figure 3-1).

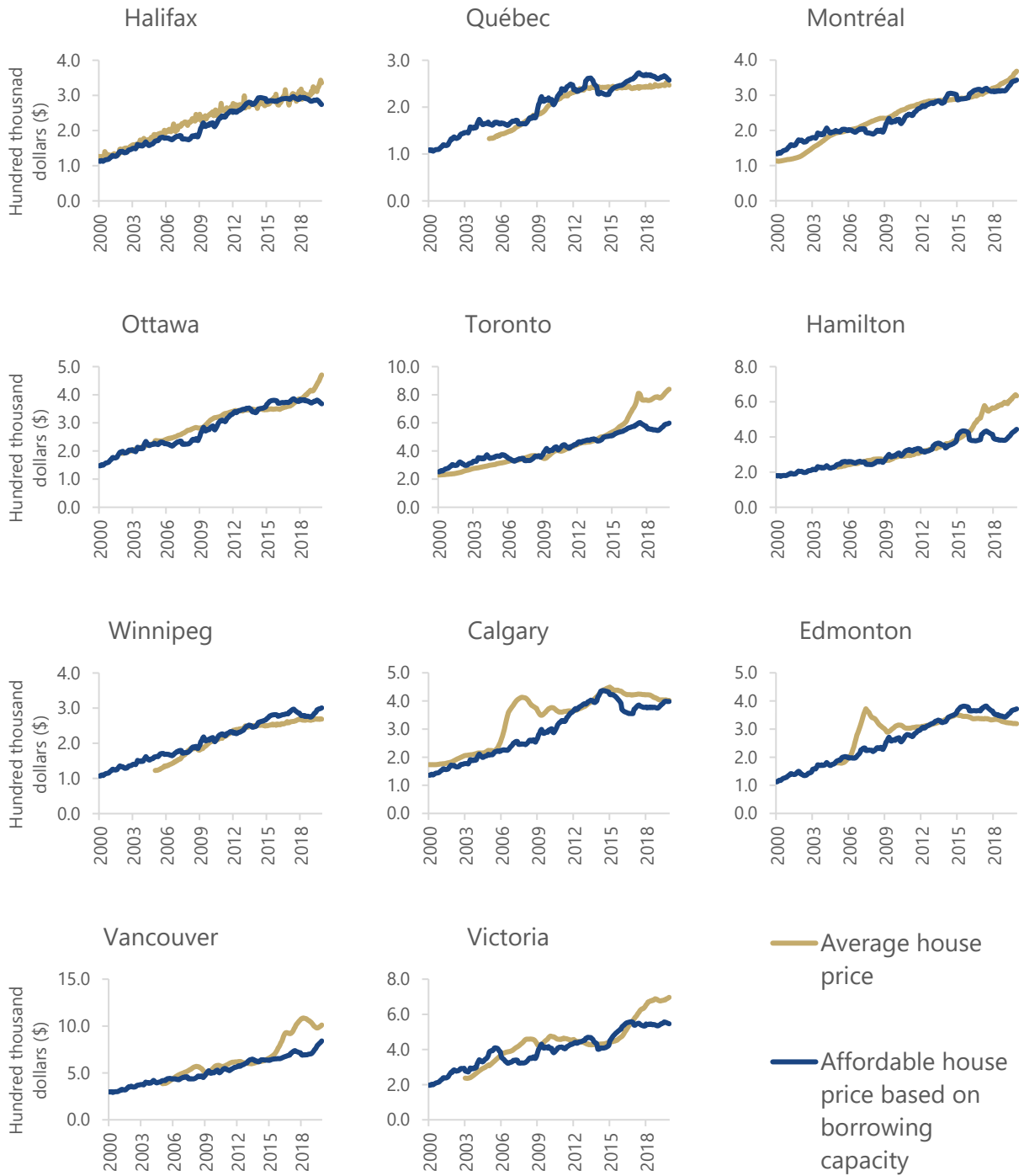
Figure 3-1 Average household incomes and mortgage lending rates, 2000 to 2019



Sources: Statistics Canada, Canada Mortgage and Housing Corporation and Office of the Parliamentary Budget Officer.

However, house prices in Calgary and Edmonton did spike above household borrowing capacity in 2007-2008 owing to the commodity price boom attracting people to this region, putting upward pressure on house prices. Beginning around 2015—and prior to the COVID-19 pandemic—house prices “de-linked” from household borrowing capacity in Hamilton, Toronto, Ottawa, Victoria, Halifax and Vancouver.

Figure 3-2 House prices and borrowing capacity, 2000 to 2019



Sources: Canadian Real Estate Association and Office of the Parliamentary Budget Officer.

Note: House prices shown are the MLS Composite Benchmark prices from CREA except for Halifax, which is the average residential sale price.

House price affordability gap

The house price affordability gap is defined as the percentage difference between actual house prices and affordable house prices (for the average household) based on household borrowing capacity.

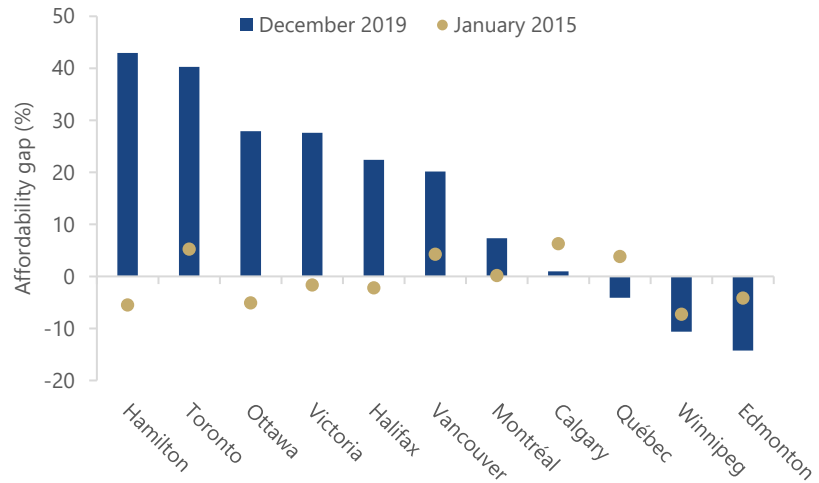
In early 2015, house prices in most CMAs were below, or close to, affordable levels based on normal utilization of its borrowing capacity. In Toronto and Calgary, average house prices were only 5-6 per cent above affordable levels. At the national level, at the beginning of 2015, the average house price was \$413,000.

In the years that followed (and prior to the pandemic), increases in house prices in Toronto continued to outstrip borrowing capacity, while house prices in Calgary declined, converging to affordable levels. Moreover, significant affordability gaps also opened in Vancouver in 2015, in Hamilton in 2016, in Victoria in 2017, in Ottawa in 2018 and in Halifax in 2019. At the end of 2019, the average house price nationally was \$565,800—an increase of 37 per cent from January 2015.

Figure 3-3 shows the size of the affordability gaps observed in January 2015 and December 2019 in selected CMAs. Since early 2015, the affordability gap widened sharply in Hamilton, Toronto, Ottawa, Victoria, Halifax and Vancouver. House prices in these markets were 20 per cent or higher than affordable prices based on household borrowing capacity, while house prices in Montréal were “only” 7 per cent above affordable levels.

In contrast, house prices in Edmonton and Winnipeg fell further below affordable levels based on borrowing capacity, while house prices in Calgary and Québec remained close to affordable levels.

Figure 3-3 House price affordability gaps in selected CMAs, 2015 and 2019



Sources: Canadian Real Estate Association and Office of the Parliamentary Budget Officer.

Note: The house price affordability gap is defined as the percentage difference between actual house prices and affordable house prices (for the average household) based on household borrowing capacity.

A positive gap indicates that house prices exceed affordable house price levels based on borrowing capacity. A negative gap indicates that households could afford higher house prices based on their borrowing capacity.

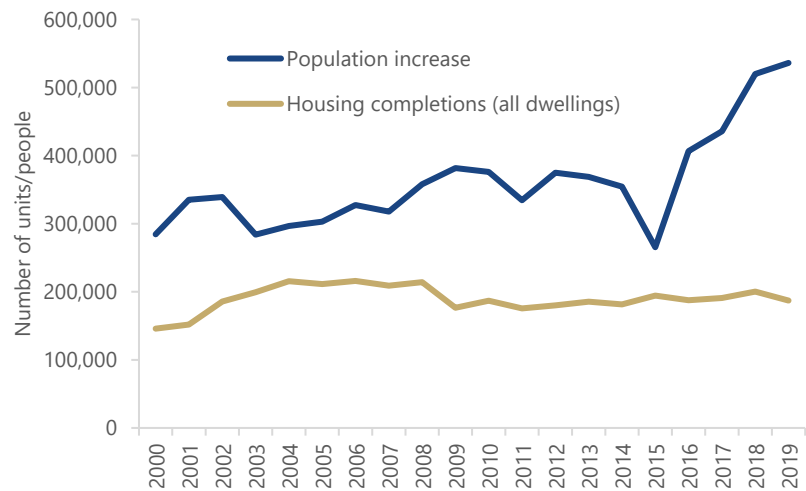
Housing demand and supply

While house prices broadly tracked borrowing capacity until around 2015, their rise above affordable price levels in most CMAs after 2015 suggests that other factors were at play.

Recall that the household borrowing capacity approach is oriented toward assessing the demand side of the housing market from the perspective of an individual household's financial position. However, overall demand for housing is also influenced by changes in the overall size of the population. To approximate the underlying demographic demand for housing, we use the change in the size of the population and compare it to housing completions.

Figure 3-4 shows that, at the national level, housing completions broadly tracked population change over 2000 to 2014, which suggests that new housing supply roughly matched demographic demand. However, after 2015, population increases sharply outstripped housing completions, suggesting that supply was not keeping pace with demand, contributing to the upward pressure on house prices over this period.¹⁴

Figure 3-4 Population growth and housing completions, 2000 to 2019



Sources: Statistics Canada, Canada Mortgage and Housing Corporation and Office of the Parliamentary Budget Officer.

A March 2021 report by CMHC identified the combination of high international migration and unresponsive housing supply as factors contributing to the surge in house prices in Toronto and Vancouver between 2015 and 2019. Moreover, the CMHC report assessed that “[g]reater out-migration from Toronto and Vancouver put considerable upward pressure on house prices in many other regions of their respective provinces, particularly their neighbouring CMAs.”

4. Medium-term outlook

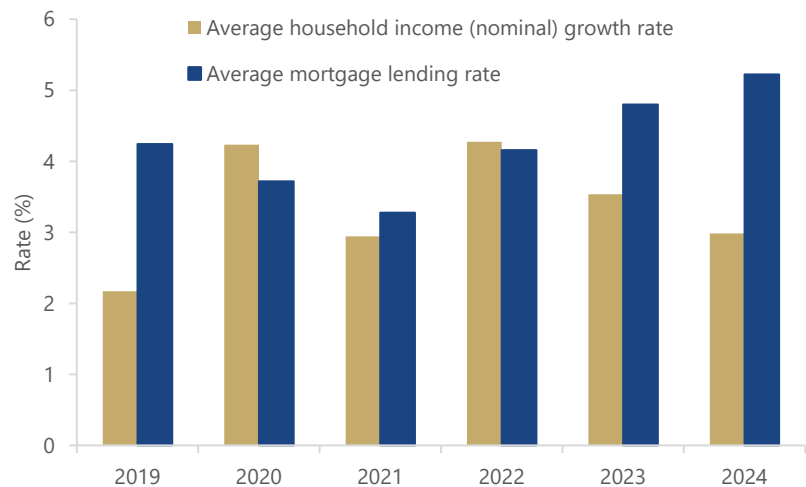
The estimates of household borrowing capacity in the previous section are based on historical data up to, and including, 2019. To estimate affordable house prices in 2020 and 2021, as well as projecting them over the medium term, requires additional data and assumptions. Note 15 details the data and assumptions used to estimate household borrowing capacity over 2020 to 2024.¹⁵

Figure 4-1 highlights the profile of the average mortgage lending rate and growth in average household income (at the national level) underlying our estimates and projection over 2019 to 2024. For each CMA, average household income is assumed to grow at same rate as projected at the national level from PBO's updated outlook.¹⁶

Beginning in 2022, rising mortgage lending rates are projected to offset the increase in average household incomes, resulting in declines in borrowing capacity over the medium term (Figure 4-3). If house prices remain close to their current levels, this suggests that they will become even more unaffordable in most of the CMAs considered.

Figure 4-1

Mortgage lending rate and growth in average household income, 2019 to 2024



Sources: Statistics Canada, Canada Mortgage and Housing Corporation and Office of the Parliamentary Budget Officer.

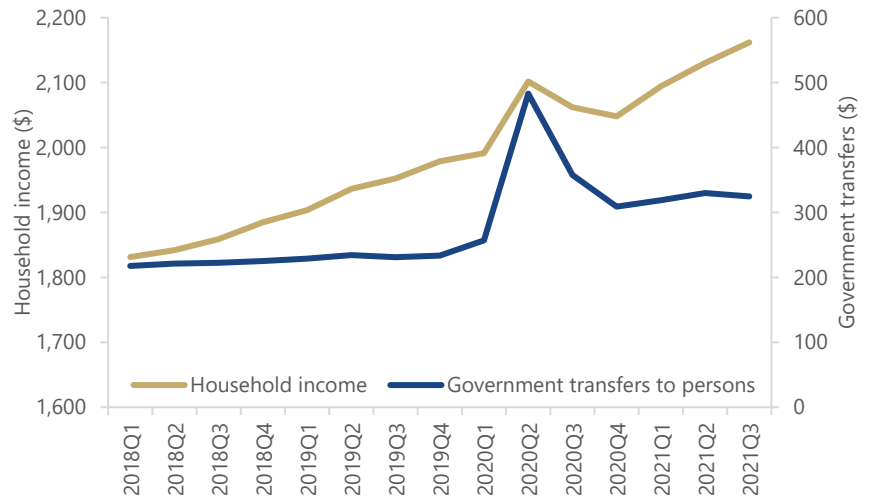
Note: Historical data covers the period 2019 to 2021. PBO projections are used for the period 2022 to 2024. The mortgage lending rate is the average of 5-year posted (fixed) rates.

Figure 4-3 presents estimated and projected affordable prices based on borrowing capacity over 2015 to 2024, compared with average house prices observed over 2015 to 2021. Despite the pandemic-induced economic

contraction, borrowing capacity increased over 2020 and 2021 pandemic due to lower interest rates and COVID-19 financial support (Figure 4-2). However, in several CMAs, further increases in house prices far outpaced the gains in borrowing capacity, resulting in wider gaps in house price affordability.

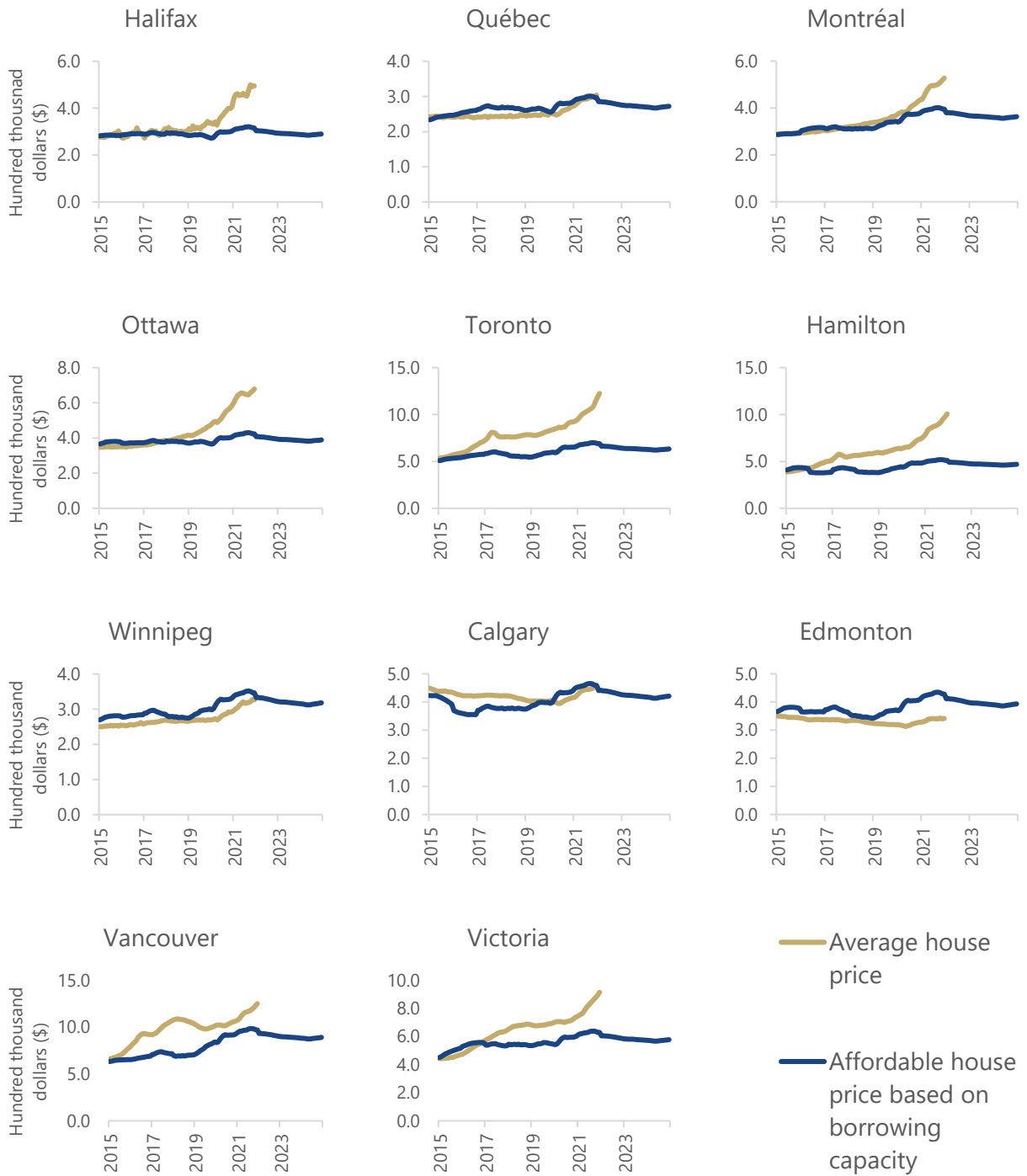
At the end of 2021, the average house price nationally was \$811,700—an increase of 43 per cent from December 2019 (\$565,800) and a 97 per cent increase compared to the average price in January 2015 (\$413,000).

Figure 4-2 Household income and government transfers, 2018 to 2021



Sources: Statistics Canada, and Office of the Parliamentary Budget Officer.

Figure 4-3 House prices and household borrowing capacity, 2015 to 2024



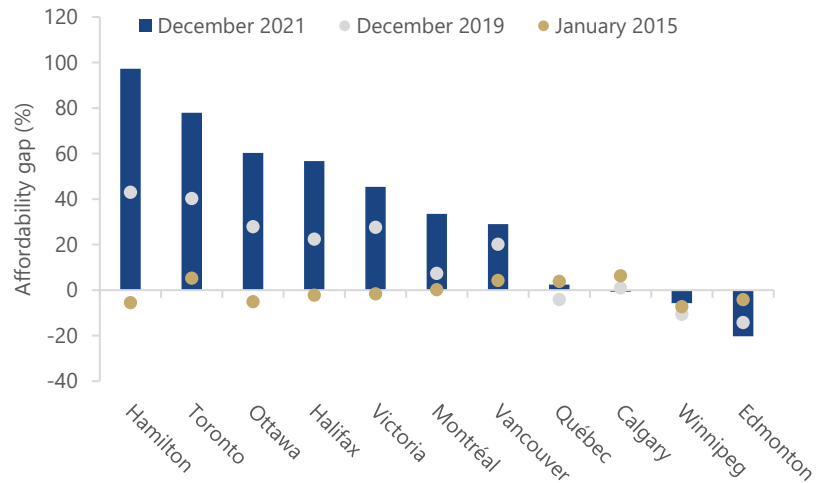
Sources: Statistics Canada, Canadian Real Estate Association and Office of the Parliamentary Budget Officer.

Note: House prices shown are the MLS Composite Benchmark prices from CREA over 2015 to 2021 except for Halifax, which is the average residential sale price. Affordable prices based on household borrowing capacity over 2015 to 2019 are based on historical data; affordable prices estimated over 2020 to 2024 are based on PBO assumptions and projections.

Figure 4-4 shows that since the start of the pandemic, gaps in house price affordability continued to widen in 2021 in most CMAs considered. Of note, we estimate that in December 2021, average house prices in Hamilton, Toronto, Halifax and Ottawa were more than 50 per cent above their affordable levels. Average house prices in Vancouver, Montréal and Victoria were between approximately 30 per cent to 45 per cent above their estimated affordable levels in December 2021.

In contrast, based on household borrowing capacity, we estimate that average house prices were at, or below, affordable levels in Edmonton, Winnipeg and Calgary at the end of 2021.

Figure 4-4 House price affordability gaps in selected CMAs



Sources: Canadian Real Estate Association and Office of the Parliamentary Budget Officer.

Note: The house price affordability gap is defined as the percentage difference between actual house prices and affordable house prices (for the average household) based on household borrowing capacity.

A positive gap indicates that house prices exceed affordable house price levels based on borrowing capacity. A negative gap indicates that households could afford higher house prices based on their borrowing capacity.

5. Household financial vulnerability

Household financial vulnerability

In the context of mortgage debt, a financially vulnerable household is one that is required to devote a substantial portion of its income to service its debt. It faces greater exposure to shocks and is more likely to be delinquent in its mortgage payments.

This report considers household financial vulnerability pertaining to mortgage debt only. However, a broader perspective, taking into consideration non-mortgage debt, would provide a more fulsome perspective of financial vulnerability.

Just prior to the onset of the pandemic, average house prices in several CMAs considered were well above affordable levels based on household borrowing capacity. This implies that households with average incomes were already stretching their finances to purchase and pay for a home. With further increases in house prices over 2020 and 2021, affordability continued to deteriorate in these CMAs, with the average household stretching its finances even further.

To gauge the extent to which a household is stretching its finances, it is informative to examine its debt service ratio (DSR), which represents the share of a household's total income that is devoted to total mortgage payments (that is, principal plus interest).

Recall that our estimates of affordable house prices are based on a household's "normal" utilization of its borrowing capacity, which we assumed was equal to the average DSR observed over 2012 to 2014. Thus, the extent to which the DSR exceeds its "normal" level indicates how far the average household must stretch its finances to afford the average house price.

Moreover, the gross debt service (GDS) ratio, used by financial institutions to assess a prospective borrower's financial capacity, provides a natural upper bound for evaluating a household's financial vulnerability.¹⁷ The GDS ratio is defined as the mortgage principal plus interest, as well as property taxes, condominium fees and heating costs, relative to gross income. Most mortgage lenders limit the maximum GDS ratio to 39 per cent, with 32 per cent being the industry standard.¹⁸ CMHC sets the maximum GDS ratio at 39 per cent for its insured mortgages.

To put the GDS ratio on a comparable basis within the borrowing capacity framework, we use provincial data on property taxes, condominium fees and heating costs from Statistics Canada to adjust the 39 per cent GDS threshold such that it only includes principal and interest payments and therefore can be directly compared to our estimates of implied household DSRs.

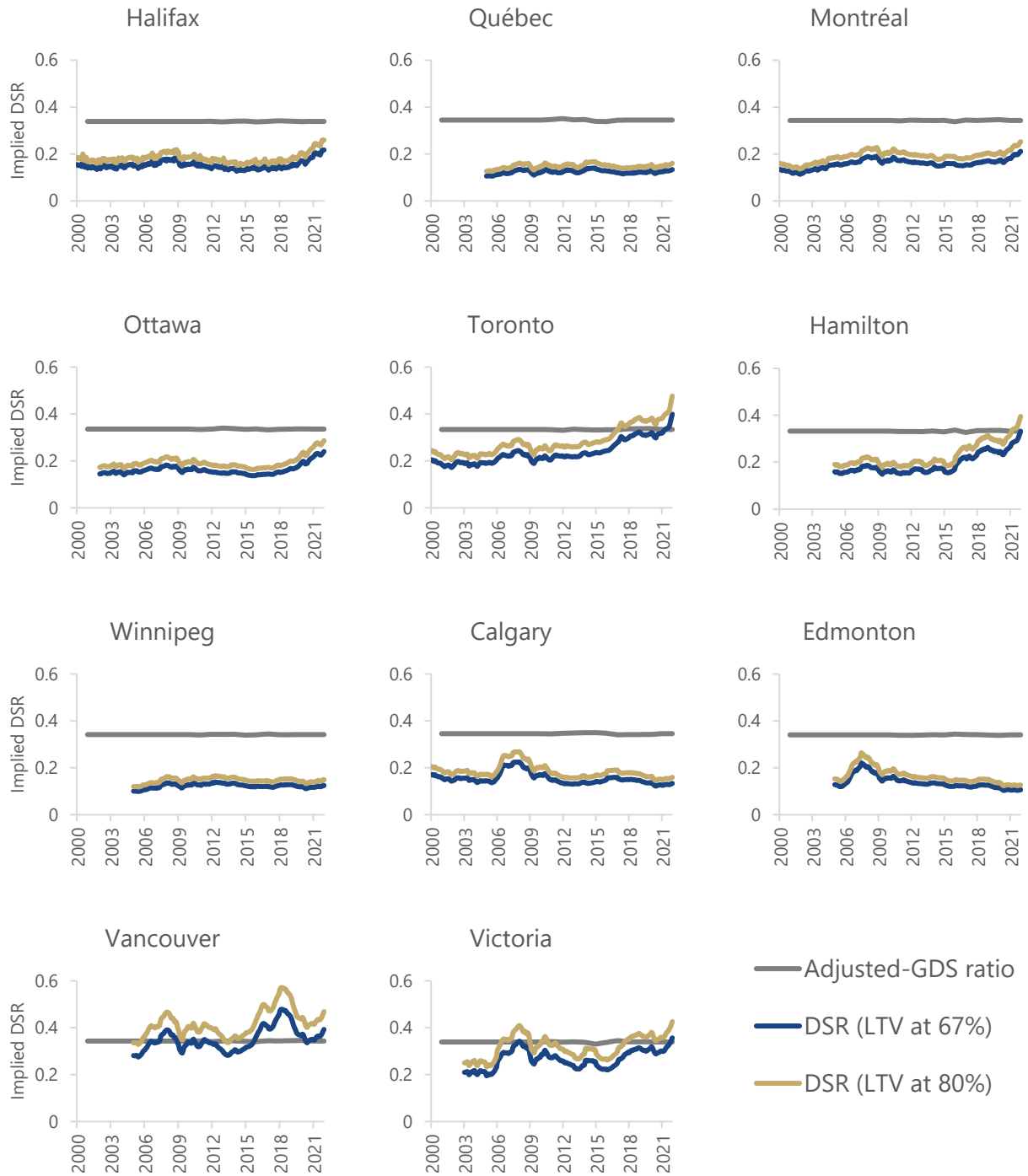
Figure 5-1 shows DSRs for the average household purchasing a home in the CMAs considered. Recall that household DSRs estimated over 2000 to 2021 are based on an average loan-to-value ratio of 67 per cent (at origination) that was observed in 2019. For comparison, we also include household DSRs estimates based on an assumed loan-to-value ratio of 80 per cent, which is the maximum possible LTV ratio for non-insured mortgages, requiring a minimum down payment of 20 per cent of the house purchase price.

Based on our estimated DSRs with an LTV ratio of 67 per cent, the average household purchasing a home in most of the CMAs considered has mortgage debt-servicing capacity that in December 2021 was below the

(adjusted) GDS threshold. That said, DSRs in Toronto, Vancouver, Victoria and Hamilton were at, or above, the (adjusted) GDS threshold.

While approximate in nature, these results suggest that household financial vulnerability is elevated in several CMAs for households that have recently purchased homes.

Figure 5-1 Household mortgage debt service ratios, 2000 to 2021



Sources: Statistics Canada, Canadian Real Estate Association, Canada Mortgage and Housing Corporation and Office of the Parliamentary Budget Officer.

Note: The mortgage debt service (DSR) ratio is defined as total mortgage payments (principal plus interest) relative to total household income.

For each CMA, the gross debt service (GDS) ratio of 39 per cent has been adjusted to remove property taxes, condominium fees and heating costs (as a share of income) to ensure comparability with our estimated mortgage DSRs.

Notes

1. We acknowledge the contributions of our former colleague, Raphaël Liberge-Simard, to this report. Prior to his departure from OPBO, Raphaël conducted the initial analysis on borrowing capacity and completed preliminary estimates of borrowing capacity for the selected CMAs.
2. Based on the increase in the seasonally-adjusted MLS HPI Benchmark Price for Canada in December 2021 compared to December 2019.
3. See Bank of Canada Staff Analytical Note 2021-9, Detecting exuberance in house prices across Canadian cities. Available at: <https://www.bankofcanada.ca/2021/05/staff-analytical-note-2021-9/>.
4. Our analysis includes the same CMAs selected in the 2019 IMF working paper that assessed house prices in Canada using the borrowing capacity approach.
5. See IMF Working Paper No, 19/248, Assessing House Prices in Canada. Available at: <https://www.imf.org/en/Publications/WP/Issues/2019/11/15/Assessing-House-Prices-in-Canada-48777>.
6. In their IMF working paper assessing Canadian house prices using the borrowing capacity approach, authors Andrlé and Plašil make a distinction between “affordable” and “attainable” house prices given that the down payment is assumed to adjust (that is, maintaining a constant LTV ratio).

In our report, we do not make such a distinction and, consistent with other studies, use “affordability” to characterize house prices. For example, see the Bank of Canada’s housing affordability index (<https://www.bankofcanada.ca/rates/indicators/capacity-and-inflation-pressures/real-estate-market-definitions/>) and Oxford Economics (<http://blog.oxfordeconomics.com/content/us-and-canada-housing-affordability-edged-down-in-q3>).
7. The HPI benchmark price for Halifax is not available and we use CREA’s residential average sale price in its place.
8. For additional detail, please consult: <https://www.crea.ca/housing-market-stats/mls-home-price-index/> and https://www.crea.ca/wp-content/uploads/2019/06/HPI_Methodology-1.pdf.
9. Statistics Canada. Table 34-10-0145-01. Canada Mortgage and Housing Corporation, conventional mortgage lending rate, 5-year term. Available at: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3410014501>.

However, contracted mortgage lending rates are typically discounted for most borrowers. All else equal, lower mortgage lending rates would increase the borrowing capacity of households and improve house price affordability.
10. The average LTV ratio (of 67 per cent) at origination was estimated based on requested data provided by CMHC and includes both insured

and uninsured mortgages. The 2019 IMF analysis assumed an LTV ratio of 80 per cent.

Given the calibration approach used to determine the average household's "normal" debt-servicing ratio, the estimated value of the affordable house price is invariant to the value assumed for the LTV ratio. All else equal, changes to the assumed LTV value are fully offset by changes to the implied DSR.

11. For additional detail on the CIS, please consult: <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5200>.
12. The period 2012 to 2014 was selected to abstract from the pre-global financial crisis commodity price boom, the global financial crisis and subsequent oil price collapse. The 2019 IMF analysis used the 2004-2006 period in its calculations. That said, for most CMAs considered, debt ratios are relatively stable over 2000 to 2019.
13. The 2019 IMF report applied the borrowing capacity approach to Canada, based its analysis on median income households and median house prices. We adopted averages instead given higher quality data on household incomes (that is, by avoiding having to convert family incomes to household incomes) and given the greater visibility of average house prices in public discourse.
14. The March 2021 CMHC report, Migration Trends in Most Populated CMAs (2002 – 2019), is available at: <https://www.cmhc-schl.gc.ca/en/blog/2021/migration-trends-most-populated-cmas-2002-2019>.
15. For the period 2020 to 2024, we maintain our assumptions for the LTV ratio at origination (67 per cent), DSRs (based on their 2012-2014 averages) and amortization period (25 years).

Actual lending rates from CMHC for 5-year fixed rates mortgages for 2020 to 2021 are combined with projected rates over 2022 to 2024. The projected rates are based on an updated PBO outlook for 10-year Government of Canada benchmark bonds plus an assumed premium (of ultimately 226 basis points) for the mortgage lending rate based on its historical average over 2012 to 2021.

For each CMA considered, we project average household income forward from its 2019 level based on the observed growth in average household income at the national level over 2020 and 2021, using aggregate household income data from the National Accounts and estimates of the number of households from Statistics Canada.

Beyond 2021, we use an updated PBO outlook for household income and assume a constant annual increase in the number of households (201,100) based on its 2015-2019 historical average. By construction our approach assumes that growth in average household income in each CMA is the same as growth at the national level. That said, differences in the levels of average household incomes across CMAs are maintained at their 2019 levels (in percentage terms). Future work will consider alternative approaches to projecting average household income by CMA.

16. That is, the household income series updated from PBO's August 2021 Election Proposal Costing baseline.
17. The total debt service (TDS) ratio is also used to assess a household's financial situation when obtaining a mortgage. The TDS ratio is broader than the GDS ratio and includes other debt obligations such as credit card debt and lines of credit.

See CMHC's definitions of GDS and TDS ratios for additional detail. Available at: <https://www.cmhc-schl.gc.ca/en/professionals/project-funding-and-mortgage-financing/mortgage-loan-insurance/calculating-gds-tds>.

However, in the case of uninsured mortgages, for federally regulated lenders, the GDS and TDS ratio thresholds serve as guidelines, as opposed to binding constraints.

18. For example, see: <https://www.ratehub.ca/debt-service-ratios>.