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Fundamental drivers of existing home sales in Canada

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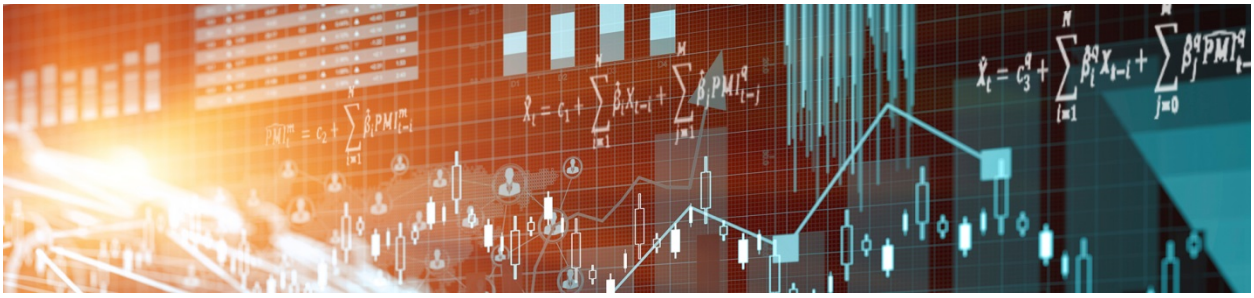

by Taylor Webley

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Fundamental Drivers of Existing Home Sales in Canada

by

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Abstract

Existing home sales' share of Canada's economic pie has been rising in recent years, and variation around this trend has resulted in outsized contributions to changes in real gross domestic product (GDP). In this context, we use a cointegration framework to estimate the level of resale activity across the Canadian provinces that is supported by fundamentals—namely, full-time employment, housing affordability and migration flows—to help look through the volatility. The results suggest that, over longer horizons, resales activity and these fundamentals share a stable relationship, although deviations are sometimes persistent. We also find a robust and positive relationship between house price growth and deviations of existing home sales from fundamentals. While predicting quarterly changes in resales remains very difficult, provincial models improve upon national and naïve benchmarks and provide a useful framework for identifying risks to GDP growth that stem directly from the resale market.

Bank topics: Econometric and statistical methods; Economic models; Housing
JEL codes: C, C2, C22, C23, E, E2, E27, R, R2, R21

Résumé

Le poids des ventes de logements existants dans l'économie canadienne a augmenté ces dernières années, et la variation autour de cette tendance a eu pour conséquence que ces ventes ont contribué de manière démesurée aux mouvements du produit intérieur brut (PIB) réel. Dans ce contexte, nous utilisons des techniques de cointégration pour estimer, dans les provinces canadiennes, le niveau de l'activité de revente qui est soutenue par des facteurs fondamentaux – notamment l'emploi à temps plein, l'accessibilité à la propriété et les flux migratoires –, ce qui nous aide à faire abstraction de la volatilité. Les résultats donnent à penser qu'à plus long terme, l'activité de revente et ces facteurs ont une relation stable, même s'il arrive que des écarts persistent. Nous observons également une relation robuste et positive entre la croissance des prix des logements et les écarts des ventes de logements existants par rapport aux facteurs fondamentaux. Bien qu'il reste très difficile de prédire les variations trimestrielles des reventes, les modèles provinciaux permettent d'obtenir de meilleurs résultats que les modèles nationaux et naïfs, et ils offrent un cadre utile pour cerner les risques pesant sur la croissance du PIB qui sont directement attribuables au marché des reventes.

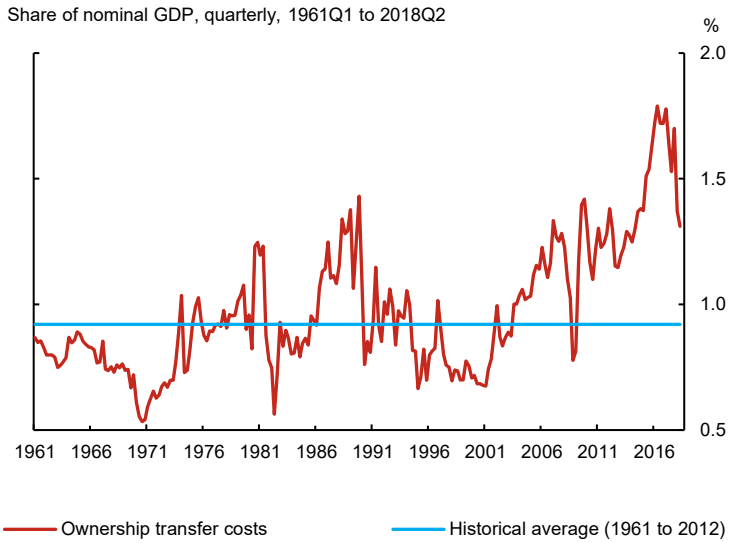
Sujets : Méthodes économétriques et statistiques, Modèles économiques, Logement
Codes JEL : C, C2, C22, C23, E, E2, E27, R, R2, R21

1. Introduction

The Canadian housing market can be broadly split into three forms of investment: (i) the construction of new homes; (ii) renovations to existing homes and the conversion of non-residential structures; and (iii) the services associated with sales of existing homes. The contributions to Canada's gross domestic product (GDP) from residential construction and renovation spending are derived from the investment required to build new dwellings or improve existing ones. In contrast, sales of existing homes (often referred to as resales) are unique. Their contribution to GDP does not come from the home itself, which is simply changing hands, but from the services generated by the transfer of ownership (e.g., real estate commissions, land transfer taxes, legal and inspection fees, etc.).[1]

In recent years, these ownership transfer costs (OTCs) have accounted for more than their usual share of economic activity, driven by the exceptional strength in existing home sales in Vancouver, Toronto and their surrounding areas. While OTCs are the smallest component of residential investment in Canada, their share of Canadian GDP has risen rapidly since 2012, and as of mid-2018 remains well above its historical average despite the recent slowdown in resale activity across the country (**Chart 1**).

Chart 1: Ownership transfer costs' share of GDP has risen strongly since 2012



Sources: Statistics Canada and Bank of Canada calculations

Last observation: 2018Q2

As data over the last year have shown, movements in existing home sales are volatile and can add noise to quarterly GDP growth. A model that can accurately forecast some of this volatility would indeed be useful for nowcasting. But a more helpful tool is one that can look through volatility by anchoring the expected level of resales to key (and less volatile) economic indicators. This paper focuses on provincial-level analysis to provide a richer characterization of Canadian resales since provincial housing markets often appear to evolve independently. Indeed, we find that the aggregation of provincial forecasts outperforms predictions at the national level.

[1] This is why Statistics Canada refers to the component of residential investment in the Canadian National Accounts related to sales of existing homes as "Ownership Transfer Costs." For more details on Statistics Canada's estimation procedure for Ownership Transfer Costs in the National Accounts, see http://www.statcan.gc.ca/pub/13-017-x/2008001/themes/ch09/5213372-eng.htm.

To date, none of the literature provides a satisfactory framework for estimating the level of resales consistent with economic fundamentals in the Canadian context. In a previous Bank of Canada Staff Discussion Paper, Demers (2005) finds that while some economic indicators do a good job of explaining and forecasting residential construction and renovations at the national level, those same indicators perform poorly for resale activity.[2] This paper builds on Demers (2005) and draws on two more recent models for existing home sales in the United States (Krainer 2014; Hubbard 2015) to create a framework to explain demand for existing homes in Canadian provinces.

Overall, we find a strong long-run relationship between resale activity and full-time employment, housing affordability and, for British Columbia, migration flows. We also find that predicting quarterly changes in resales remains difficult due to their volatility, although forecast accuracy is improved by estimating how much existing home sales are above or below what is predicted by key fundamentals (i.e., full-time employment, affordability and migration). Moreover, aggregating provincial forecasts is found to produce national forecasts that are statistically superior to forecasts produced using a national model. The forecasting results also highlight that while deviations from fundamentals are temporary, these gaps can be persistent and do not always disappear gradually; rather, large gaps between resales and fundamentals tend to exist for some time and then close abruptly. By quantifying the divergence between resales and their key economic anchors and calculating the average rate at which they re-converge, this paper provides a robust framework for estimating the risk to GDP growth stemming from the resale market.

The remainder of this paper is structured as follows. In Section 2, we describe the data used and the series constructed for this analysis. Section 3 discusses the empirical framework, findings and what the results imply in practice. Section 4 concludes.

2. Data

Data on existing home sales in Canada are published monthly by the Canadian Real Estate Association (CREA) and extend back to 1980.[3] The explanatory variables can be broadly divided into two categories: (i) demographics (i.e., the stock of people who might choose to buy a home); and (ii) the cost of housing faced by homebuyers. A description of all data used in the analysis can be found in **Table 1**.

Since there is no strong empirical guidance for a preferred demographic variable, we start from a broad set of five indicators: the working-age population (25 years and older), the number of households, and three slices of employment (total employment, full-time employment and prime-age employment). On one hand, everyone needs shelter and it is possible that, in the long run, resale activity is simply proportional to the number of people or households in a province. On the other hand, a home is a large investment. Most Canadians rely on mortgage financing to purchase homes and on employment to allow them to save for a down payment.[4] This suggests that resales are likely to evolve proportionally to employment rather than a broader demographic measure. Additionally, interprovincial and

[2] The indicators used in Demers (2005) are the relative price of housing, a demographic factor defined as the share of the population aged 25 to 44 years old, real five-year average mortgage rates, and the labour force participation rate.
[3] CREA's seasonally adjusted data begin in 1988 while its unadjusted data are available back to January 1980. To extend our data set as far back as possible, we splice these series together by manually seasonally adjusting the unadjusted data using a standard X-12 filter. The results presented herein are robust to not backfilling the resale data (for example, see Appendix, **Table A-4**).
[4] According to a 2015 survey by the Canadian Association of Accredited Mortgage Professionals (CAAMP), only 14 per cent of home purchases in Canada did not use a mortgage to finance the purchase between 2013 and early 2015. See https://canadianmortgagetrends.com/wp-content/uploads/2015/06/Spring-2015-Survey-Report.pdf.

international migration flows affect household formation and are motivated by several factors other than employment (Amirault, de Munnik and Miller 2016), so we include them in the analysis as well.

The second category—cost of housing—includes three indicators: the effective mortgage rate, provincial housing affordability indexes and estimates of the user cost of housing. Housing affordability and user costs are included in the analysis to test whether more nuanced measures of the cost of purchasing a home are more effective than simply using the average interest rate paid on new mortgages. Since each of these indicators is constructed using several pieces of data, we provide a brief description of them below.

Table 1: Data sources for cost-of-housing variables

Data	Frequency*	Start date	End date	Source
Existing home sales (NSA)	Monthly	Jan 1980	Sep 2018	Canadian Real Estate Association
Existing home sales (SA)	Monthly	Jan 1988	Sep 2018	Canadian Real Estate Association
Working-age population (25 years+)	Monthly	Jan 1976	Sep 2018	Statistics Canada, CANSIM Table 14-10-0017-01
Employment	Monthly	Jan 1976	Sep 2018	Statistics Canada, CANSIM Table 14-10-0287-01
Full-time employment	Monthly	Jan 1976	Sep 2018	Statistics Canada, CANSIM Table 14-10-0287-01
Prime-age employment	Monthly	Jan 1976	Sep 2018	Statistics Canada, CANSIM Table 14-10-0287-01
Number of households	Census	1980	2016	Statistics Canada, Census program, Bank of Canada calculations
Posted mortgage rates	Daily	Oct 1980	Sep 2018	Bank of Canada
Discounted mortgage rates	Weekly	Jan 1992	Sep 2018	Bank of Canada
MLS home prices (NSA)	Monthly	Jan 1980	Sep 2018	Canadian Real Estate Association
MLS home prices (SA)	Monthly	Jan 1988	Sep 2018	Canadian Real Estate Association
Consumer price index	Monthly	Sep 1978	Sep 2018	Statistics Canada, CANSIM Table 18-10-0004-01
Disposable household income	Annually	1981	2016	Statistics Canada, CANSIM Table 36-10-0224-01
Disposable household income[5]	Quarterly	1981Q1	2016Q4	Conference Board of Canada
Average income tax rate	Annually	1981	2016	Statistics Canada, CANSIM Table 36-10-0224-01
Housing stock depreciation	Annually	1961	2016	Statistics Canada, CANSIM Table 36-10-0099-01
Interprovincial migration	Quarterly	1961Q3	2018Q2	Statistics Canada, CANSIM Table 17-10-0020-01
International migration	Quarterly	1946Q1	2018Q2	Statistics Canada, CANSIM Table 17-10-0040-01

*All data are converted to a quarterly frequency. Daily, weekly and monthly data are converted using a quarterly average. Annual data are converted using linear interpolation.
Note: NSA is not seasonally adjusted, SA is seasonally adjusted and MLS is Multiple Listing Service.

The effective mortgage rate series used in this analysis represents the typical interest rate on a new mortgage. We calculate this using the weighted average of discounted and posted mortgage rates for various mortgage terms, with weights derived from the Canadian Financial Monitor (equation 1).[6]

$$r_t^h = \sum_{m=1}^{M} w_{m,t}[\alpha_{m,t} dr_{m,t} + (1-\alpha_{m,t}) pr_{m,t}] \; - \; \Delta_{y/y} P_{i,t}^{cpi} \qquad (1)$$

[5] The Conference Board of Canada's disposable household income series is a quarterly series derived from the Statistics Canada data found in CANSIM Table 36-10-0224-01. Due to the availability of the series, we use these data as our quarterly income data rather than linearly interpolating the annual income data from Statistics Canada.
[6] "Posted" rates refer to the baseline interest rate that mortgage lenders offer. Often, however, lenders offer mortgages at rates below their posted rate (i.e., "discounted" rates). See http://credit.bankofcanada.ca/financialindicators/eir for more information. The effective mortgage rate is estimated at the national level only due to data availability.

In equation 1,

- r_t^h is the real effective mortgage rate in quarter *t*
- $w_{m,t}$ is the share of total mortgages represented by mortgage type *m* (variable, one-year, three-year or five-year) in quarter *t*
- $\alpha_{m,t}$ is the share of mortgages of type *m* that are discounted (thereby $1 - \alpha_{m,t}$ reflects the share of mortgages of type *m* with a contracted interest rate equal to the posted rate)
- $dr_{m,t}$ is the average discounted mortgage rate available for mortgage type *m* in quarter *t*
- $pr_{m,t}$ is the posted mortgage rate for mortgage type *m* in quarter *t*
- $\Delta_{y/y} P_{i,t}^{cpi}$ is year-over-year growth in the total consumer price index in province *i* in quarter *t*

We then construct provincial housing affordability indexes that represent the average share of a household's disposable income that would be needed to make monthly payments on a new mortgage (equation 2). We augment the formula used to calculate the national housing affordability index on the Bank of Canada's website in two ways: (i) we do not include the cost of utilities; and (ii) rather than assume a constant loan-to-value (LTV) ratio of 95 per cent and an amortization period of 25 years, we set these to the maximum values given the macroprudential regulations in place for mortgages eligible for government-backed insurance.[7] Creating affordability indexes for each province rather than using a national proxy is important, given the heterogeneity in both the level and short-run dynamics of the affordability indexes across the provinces (**Chart 2**).[8]

$$affordability_{i,t} = \frac{\overbrace{\left[\frac{i_t^h/c}{1-\left(1+i_t^h/c\right)^{-nt*c}}\right] * LTV_t * P_{i,t-1}^h}^{mortgage\ payments}}{\underbrace{y_{i,t}/hh_{i,t}}_{per\ household\ income}} \qquad (2)$$

In equation 2,

- i_t^h is the effective mortgage rate in quarter *t*
- c is the number of interest compound periods per year[9]
- n_t is the maximum amortization period eligible for government-backed mortgage insurance in quarter *t*
- LTV_t represents the maximum LTV ratio eligible for government-backed insurance

[7] Utility costs are omitted from the equation since we want to capture only the mortgage component of housing affordability in our analysis. We adjust the LTV and amortization parameters to better capture the share of disposable income required to make mortgage payments for buyers on the extensive margin (i.e., buyers who can only afford a mortgage using the minimum possible down payment and longest possible amortization period) since they are likely to be the ones whose decision to buy a home is most influenced by current levels of affordability. For more information on the Bank of Canada's national index, see http://credit.bankofcanada.ca/financialindicators/hai.

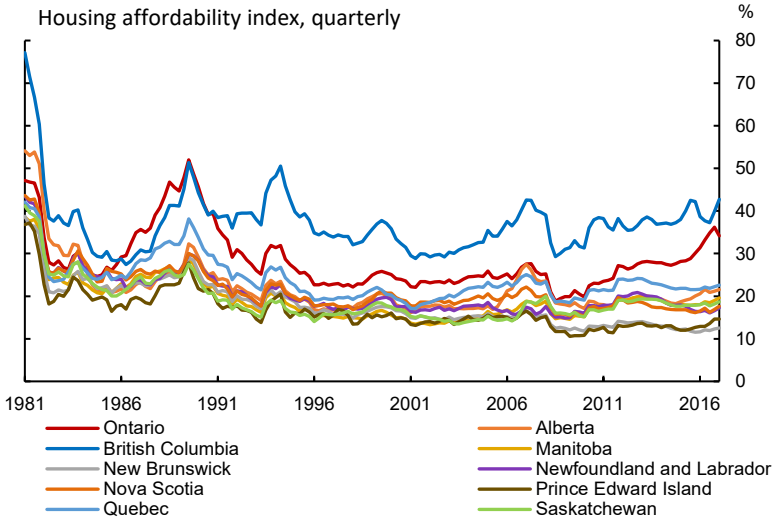
[8] House prices are the primary driver of the heterogeneity in the dynamics of the provincial affordability indexes.

[9] For simplicity, we assume semi-annual compound periods. While variable-rate mortgages are typically compounded on a monthly basis in Canada, adjusting the compound period has no impact on our results and conclusions.

- $P^{h}_{i,t-1}$ is the two-quarter moving average MLS home price in quarter *t-1*[10]
- $y_{i,t}$ is disposable household income in province *i* in quarter *t*
- $hh_{i,t}$ is the number of households in province *i* in quarter *t*

The adjustments made for LTV ratios and amortization periods have their largest impact on the affordability indexes between 2006 and 2012, during which zero per cent down payments and amortizations of 30, 35 and 40 years were made available for loans requiring mortgage insurance (**Chart 3**).[11]

Chart 2: The level and dynamics of housing affordability vary from province to province



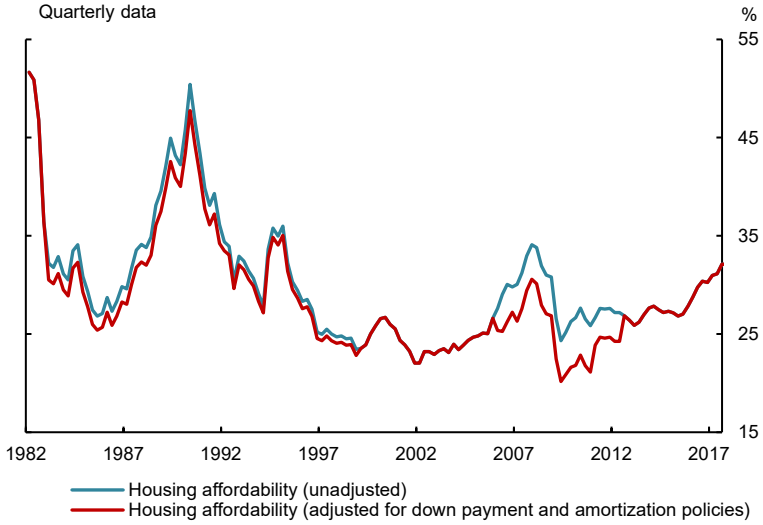
Sources: Canadian Real Estate Association, Statistics Canada, Bank of Canada, and Bank of Canada calculations

Last observation: 2017Q4

[10] Home prices are lagged by one quarter in our calculations to account for the fact that MLS resale and price data are published simultaneously. Using current-quarter prices would therefore require an internal forecast and introduce additional forecasting error into the nowcast of underlying resale demand.

[11] In March 2006, 30-year amortizations were made insurable by the Canada Mortgage and Housing Corporation (CMHC). This was increased to 35 years in June 2006 and then to 40 years in November of that year. CMHC began insuring zero-down mortgages in November 2006 as well. In October 2008, the Department of Finance Canada eliminated insurance eligibility for new 40-year and zero-down mortgages. This was extended to mortgages with amortizations greater than 30 years in March 2011, and subsequently to amortizations greater than 25 years in July 2012.

Chart 3: Mortgage amortization regulations significantly reduced the average servicing costs for new mortgages between 2006 and 2012



Sources: Canadian Real Estate Association, Statistics Canada, Bank of Canada, and Bank of Canada calculations

Last observation: 2017Q4

Finally, provincial series for the user cost of housing (u_t^*) are created to better capture the full opportunity cost associated with investing in a home (equation 3). The user cost of housing is computed by adjusting the effective mortgage rate for housing depreciation rates and house price growth expectations, and scaling this adjusted interest rate by the relative price of housing (Feroli et al. 2012).[12]

$$u_{i,t}^* = \ln\left\{\frac{P_{i,t}^h}{P_{i,t}^{cpi}}\left[i_t^h + \delta_{i,t} - \widehat{\Delta P_{i,t}^h}\right]\right\} \qquad (3)$$

In equation 3,

- u_t^* is the user cost of housing in province *i* in quarter *t*
- $P_{i,t}^h$ is the MLS house price index in province *i* in quarter *t-1* indexed to 100 in 2002
- $P_{i,t}^{cpi}$ is the total consumer price index in province *i* in quarter *t-1* indexed to 100 in 2002
- i_t^h is the effective mortgage rate in quarter *t*
- $\delta_{i,t}$ is the rate of housing stock depreciation in province *i* in quarter *t*
- $\widehat{\Delta P_{i,t+J}^h}$ is a proxy for expected annual growth in house prices[13]

Chart 4 plots each of the three cost-of-housing series at the national level for illustrative purposes. While generally similar over the long run, higher-frequency dynamics for each measure are more distinct. Moreover, their behaviours have been notably different following the 2008 recession, after which

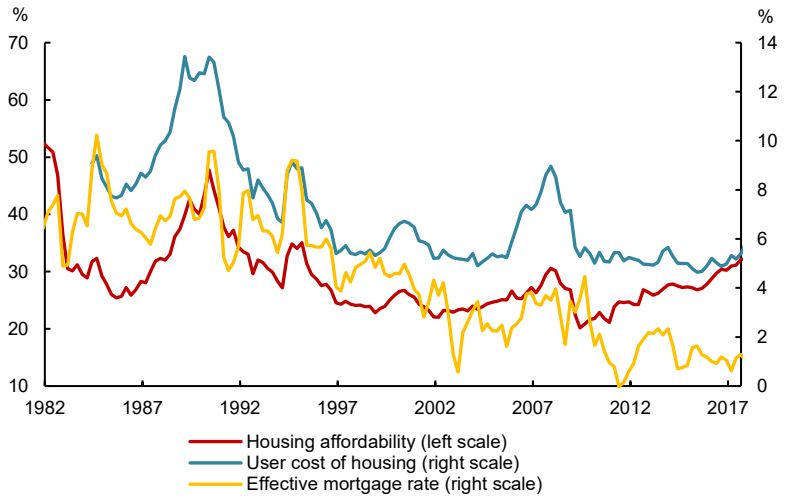
[12] Unlike Feroli et al. (2012), we do not adjust for income tax rates since mortgage interest is not tax deductible in Canada. Adjustments for property taxes and transaction costs by province are also excluded due to data limitations.

[13] House price growth expectations are backward-looking and calculated using a three-year moving average of annualized house price growth. One- and five-year averages were also considered as suggested in Feroli et al. (2012) but are not discussed herein because (i) the one-year moving average generated negative user cost values (preventing the calculation of elasticities) and (ii) the five-year average was generally inferior to the three-year average.

affordability has worsened (owing largely to house price inflation), effective mortgage rates have trended down and the user cost of housing has remained broadly flat.

Chart 4: The three measures of the cost of housing have become more distinct, especially after 2008

Quarterly data



Sources: Canadian Real Estate Association, Statistics Canada, Bank of Canada, and Bank of Canada calculations

Last observation: 2017Q4

3. Empirical framework and results

3.1 Empirical framework

We use a cointegration framework to evaluate the relationship between resale activity and the set of economic fundamentals.[14] Estimations are conducted using fully modified ordinary least squares (FMOLS).[15, 16] Unit root tests are performed on all variables to confirm that the series are non-stationary and FMOLS is a valid technique.[17]

The general specification for the cointegrating equations takes the following functional form:[18]

[14] Cointegration is a statistical relationship whereby a linear combination of multiple non-stationary time series is stationary. A stationary time series is one whose statistical properties are constant over time. The property of cointegration most relevant for this analysis is the tendency of cointegrated time series to evolve together over long periods of time despite having independent growth rates in the short term. For a detailed description of cointegration, see Engle and Granger (1987).

[15] FMOLS is an estimator designed to allow for statistical inference using traditional testing when the variables of interest are non-stationary and cointegrated. FMOLS corrects the problems associated with the traditional ordinary least squares (OLS) estimator in the presence of non-stationary variables by adjusting the data using estimates of the long-run covariance between the variables and their innovations. For more on the FMOLS estimator, see Phillips and Hansen (1990).

[16] In addition to the independent provincial FMOLS regressions, panel regressions were estimated for all specifications discussed in this paper to evaluate whether fundamentals drive resale activity similarly across the provinces, or if there is heterogeneity in the elasticities. Overall, we did not find robust evidence of cointegration in the panel setting and the results were generally inferior. This appears to be driven by the heterogeneity observed in the relationships estimated by the independent provincial equations. For brevity, these results are not discussed in this paper.

[17] Augmented Dickey-Fuller, Dickey-Fuller generalized least squares and Kwiatkowski-Phillips-Schmidt-Shin unit root test results can be found in **Table A-1**, **Table A-2** and **Table A-3** of the Appendix.

[18] Except for effective mortgage rates, all variables are in logarithms.

$$resales_{i,t} = \beta_{0,i} + \beta_{1,i} demographic_{i,t} + \beta_{2,i} cost\ of\ borrowing_{i,t} + I\left[\beta_{3,i} inward\ migration_{i,t} + \beta_{4,i} outward\ migration_{i,t}\right] + \epsilon_{i,t} \quad (4)$$

The remainder of section 3 is organized as follows. Section 3.2 summarizes the results from the cointegrating regressions. In section 3.3, we discuss the estimates from the error-correction models, which use the residuals from equation 4 to quantify the average speed at which resales activity converges toward fundamentals. Finally, section 3.4 assesses the forecasting performance of the error correction models relative to various benchmarks.

3.2 Results: Cointegrating regressions

For each province, we regress resale activity on each pairwise combination of the demographic and cost of housing variables discussed in section 2. When employment is used as the demographic variable, a second regression is run to include inward and outward migration flows. $I[\bullet]$ in equation 4 above is an indicator function equal to 1 if the demographic variable is a measure of employment, and equal to zero otherwise.[19] Engle-Granger and Phillips-Ouliaris cointegration tests are performed on the output from every regression to test for cointegration.

We find strong evidence of cointegration—i.e., a long-run equilibrium relationship—between resale activity and fundamentals in all provinces (**Table 2**). While this holds for a range of combinations of explanatory variables, we find the pairing of full-time employment with either effective mortgage rates or housing affordability has the strongest evidence of cointegration across the provinces. Both inward and outward migration are found to consistently improve the cointegrating relationship between resales and fundamentals in British Columbia but not elsewhere.[20]

Table 2: Number of significant cointegration test statistics per regression (p-value < 0.05)[21]

Maximum count = 20 (Engle-Granger and Phillips-Ouliaris tests for 10 provinces)	Effective mortgage rates	Affordability	User cost of housing
Population	15	11	12
Households	14	11	13
Total employment	19	19	18
Prime-age employment	17	10	11
Full-time employment	20	20	18

[19] We do not include migration in the regressions when the population or the number of households is an independent variable, since migration flows have a direct mapping to these demographic variables.

[20] The finding that for British Columbia alone both inward and outward migration are significant and drastically improve evidence of cointegration warrants further investigation but is outside the scope of this paper. Census data suggest that the average household incomes of migrants to that province are not meaningfully different than the rest of the country. Rather, it is possible that the apparent higher propensity of migrants to British Columbia to participate in the housing market might be driven by unique demographic characteristics, such as having a much higher share of older, retired in-migrants (who are more likely to have the savings to buy a home), or the province attracting relatively wealthy international immigrants.

[21] The sample for all tests that populate **Table 2** begins in 1984Q3 to account for the reduced sample caused by the house price expectation component of the user cost of housing.

While the results presented in **Table 2** suggest that full-time employment paired with either housing affordability or effective mortgage rates provides the strongest evidence of cointegration across the provinces, the regression results show that the coefficient on effective mortgage rates is insignificant in several provinces and has the wrong sign in one. Affordability, in contrast, has the correct sign in all provinces and is statistically significantly in 9 of 10 provinces, which suggests that the interaction between interest rates and the level of house prices (and, subsequently, the financial burden of making mortgage payments) is more important in influencing home-buying activity than the level of mortgage rates alone. Consequently, the preferred model specification uses full-time employment and housing affordability in every province (**Table 3**).[22]

Underlying demand for existing homes as estimated by these equations is found to track the broad movements in the data very well (**Chart 5**, panels a to k). Aggregating the fitted values from the provincial regressions also produces an estimate of underlying resale demand in Canada that provides a closer fit to the level of national resale activity than the fitted values from a national regression (**Chart 5a**).

Table 3: Regression coefficients for preferred specification[23]

Dependent variable: ln(resales)
Sample: 1981Q4 to 2016Q4

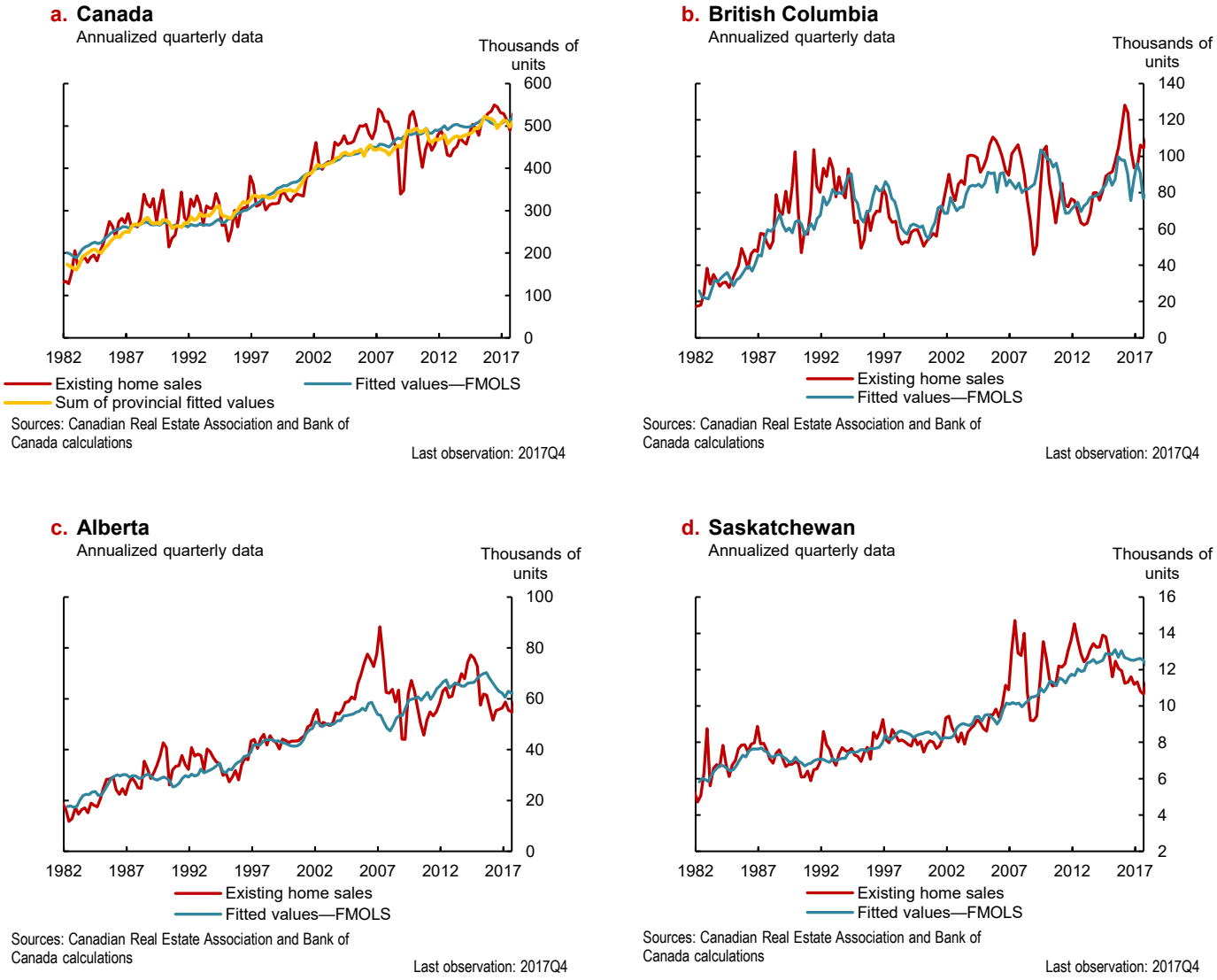
	Full-time employment	Housing affordability	Inward migration	Outward migration	Engle-Granger τ	Phillips-Ouliaris τ
Canada	1.81***	0.27**			-5.25***	-4.95***
British Columbia	1.05***	0.96***	0.81***	-0.61***	-5.45***	-5.58***
Alberta	1.17***	0.60***			-3.29	-3.75*
Saskatchewan	1.96***	0.24***			-5.96***	-5.77***
Manitoba	1.19***	0.09			-5.48***	-6.23***
Ontario	1.63***	0.19***			-6.43***	-5.65***
Quebec	3.72***	0.88***			-5.22***	-4.74***
New Brunswick	3.12***	0.22*			-4.82***	-5.78***
Nova Scotia	1.76***	0.88***			-4.42***	-5.56***
Prince Edward Island	3.41***	0.46*			-4.79***	-6.99***
Newfoundland	2.99***	0.97***			-4.75***	-7.42***

Coefficient significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$

[22] For our regressions, we multiply the housing affordability index by –1 so that an increase in the index represents a rise in affordability (i.e., a fall in the average share of disposable income required to service a mortgage).
[23] While the full-sample Engle-Granger cointegration test no longer finds significant evidence of cointegration in Alberta at the 10 per cent level, the p-value of the test statistic is close at 0.13. This result appears to be driven by the fact that resales were significantly below what would be implied by employment and affordability for almost all of the 1981Q4 to 1984Q3 period that is added to the sample relative to the results found in **Table 2**. This result holds for effective mortgage rates as well, whose Engle-Granger statistic moves slightly above the 0.10 significance threshold when including the 1981Q4 to 1984Q3 period.

Chart 5: Provincial existing home sales and their estimated fundamental levels[24]

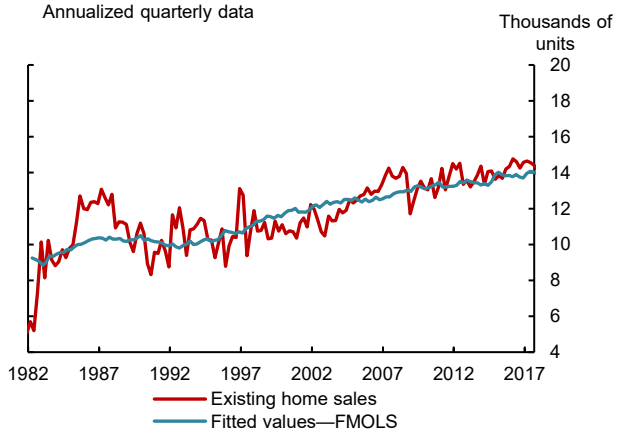
Note: FMOLS is fully modified ordinary least squares in all panels of Chart 5 below



[24] While limited data availability restricted our regression samples to 2016Q4, fitted values in **Chart 5**, panels a to k were created for 2017 using the Conference Board of Canada's estimates for disposable income by province in order to generate estimates of housing affordability. See https://www.conferenceboard.ca/e-data/browsedirectories.aspx?did=24.

e. Manitoba

Annualized quarterly data

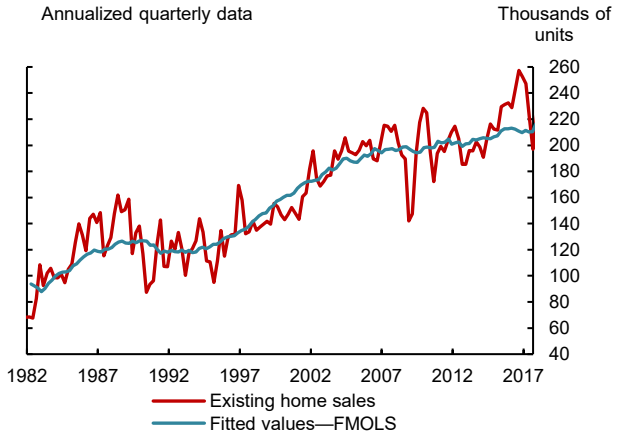


Sources: Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2017Q4

f. Ontario

Annualized quarterly data

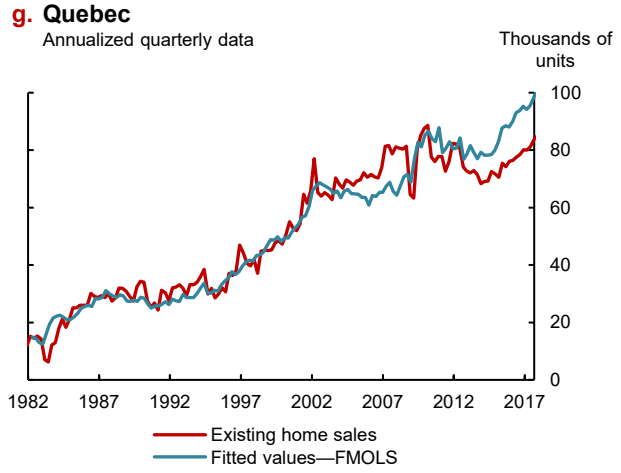


Sources: Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2017Q4

g. Quebec

Annualized quarterly data

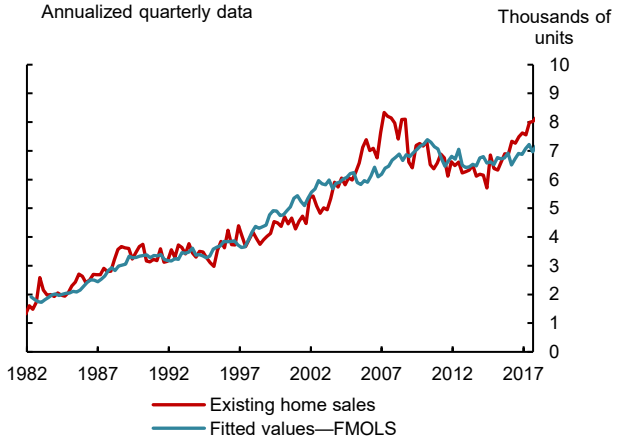


Sources: Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2017Q4

h. New Brunswick

Annualized quarterly data

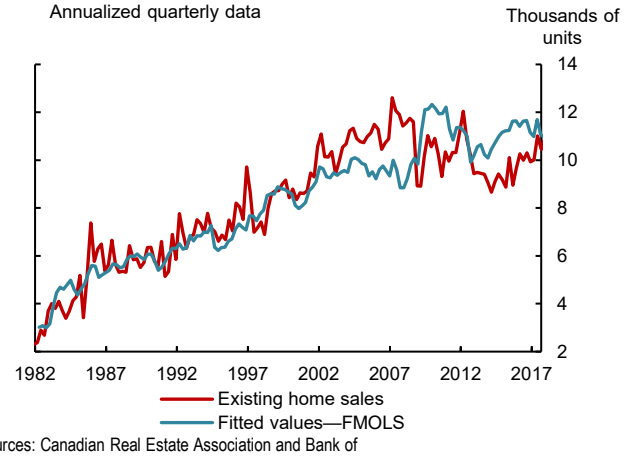


Sources: Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2017Q4

i. Nova Scotia

Annualized quarterly data

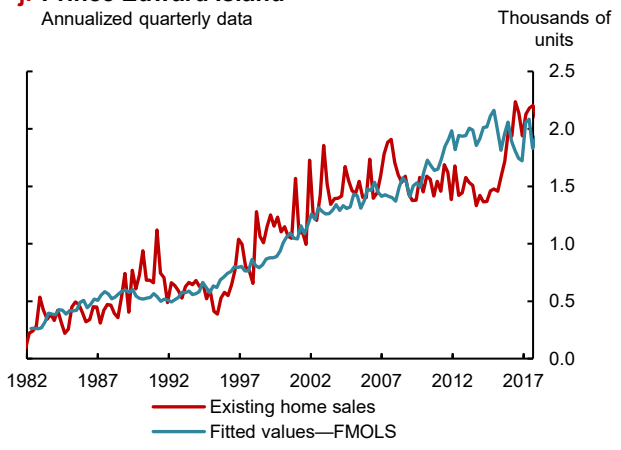


Sources: Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2017Q4

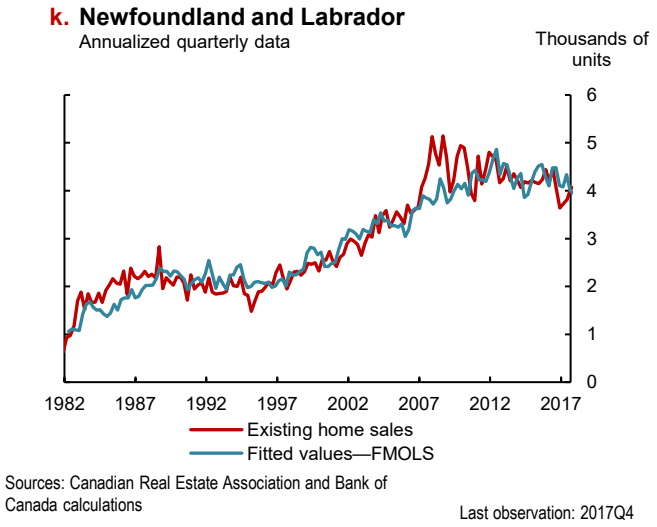
j. Prince Edward Island

Annualized quarterly data



Sources: Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2017Q4



A notable result from the regression analysis is that the elasticities between resale activity and full-time employment are statistically significantly greater than 1 outside of British Columbia, Alberta and Manitoba, implying that a 1 per cent change in full-time employment results in more than a 1 per cent change in resale activity. Over the long run, however, this relationship cannot persist, since it would imply at some point in the future that the number of resales in any given quarter would exceed the number of employed persons.

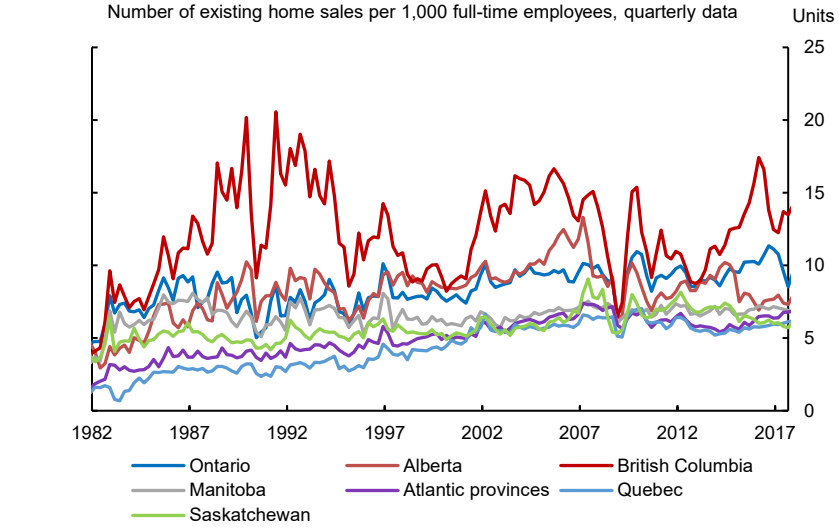
Rather, these elasticities appear to be capturing the upward trends in the ratios of resales per full-time worker across the provinces (**Chart 6**). It is possible that this ongoing shift is related to rising rates of homeownership across Canada over the sample (which itself could be due to factors such as the changing demographic makeup of Canada's population or financial innovation in mortgage lending) or an acceleration in home-buying activity related to "moving up the property ladder." [25, 26] Since the regressions presented in **Table 3** do not control for these factors, it is likely a source of bias in the elasticity between resales and full-time employment.[27]

[25] Census data from Statistics Canada show that homeownership rates in Canada tend to gradually rise with age until age 75, after which rates of ownership fall slightly. Internal Bank of Canada analysis finds that the demographic shift in Canada's population due to the aging of the Baby Boomer generation has resulted in a decades-long structural rise in homeownership rates, as that generation has transitioned through age cohorts that, on average, tend to have higher rates of homeownership. Since rates of homeownership taper off and fall slightly beyond age 75, the continued aging of Baby Boomers will likely contribute to dampening homeownership rates going forward. For more details on homeownership trends in Canada, see http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-014-x/2011002/c-g/c-g01-eng.cfm.

[26] Since the regression specification in this paper estimates a relationship between the log level of resales and the log level of full-time employment, it implicitly assumes that once a person becomes employed, that individual permanently adds to the underlying level of resale activity (rather than adding only one resale in the person's lifetime). Consequently, the constant in the regression captures (among other things) the average contribution to resale activity from moving up the property ladder over the regression sample. However, if the ratio of resales per worker has been trending up over time due to increasing rates of moving up the property ladder, this would upwardly bias the elasticity between resales and full-time employment.

[27] In the cases of British Columbia and Alberta, it is possible that these structural long-run trends have not influenced resale activity as noticeably due to (i) British Columbia's resale sensitivity to migration patterns and exceptionally high baseline level of churn per worker; and (ii) the correlation between persistent oil price movements and deviations from fundamentals in Alberta's housing market since 2000. Manitoba, on the other hand, is characteristically more like the other Canadian provinces, so the cause of the much shallower trend in resales per worker remains unclear.

Chart 6: The ratio of resales to full-time workers has been trending up over time across Canada



Sources: Canadian Real Estate Association, Statistics Canada and Bank of Canada calculations

Last observation: 2017Q4

To control for these factors and test for evidence that the long-run elasticity between full-time employment and resales is 1, we re-estimate the regressions using the ratio of resales to full-time employment as the dependent variable and include a linear time trend. These results are presented in **Table 4**.

Table 4: Trend-adjusted fully modified ordinary least squares regression coefficients

Dependent variable: ln(resales/full-time employment)
Sample: 1981Q4 to 2016Q4

	Housing affordability	Inward migration	Outward migration	Trend	Engle-Granger τ	Phillips-Ouliaris τ
Canada	0.24**			0.003***	-4.86***	-4.64***
British Columbia	0.97***	0.81***	-0.65***	0.00	-5.45***	-5.57***
Alberta	0.62***			0.001	-3.30	-3.76*
Saskatchewan	0.07			0.003***	-5.30***	-5.24***
Manitoba	0.12			0.00	-5.41***	-6.16***
Ontario	0.19**			0.002***	-5.94***	-5.36***
Quebec	0.58***			0.008***	-4.09**	-3.87**
New Brunswick	0.14			0.006***	-3.77*	-4.67***
Nova Scotia	0.96***			0.001	-4.05**	-5.07***
Prince Edward Island	0.33			0.009***	-4.61***	-6.88***
Newfoundland	0.48***			0.005***	-3.71*	-5.92***

Coefficient significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Assuming an elasticity of 1 between resales and full-time employment and controlling for the upward trends in homeownership, we still find strong evidence of cointegration. Indeed, with the exception of Nova Scotia, the provincial trends are significant in the provinces where the unrestricted elasticity was significantly greater than 1 and not significant in British Columbia, Alberta and Manitoba. While the

elasticity between resales and affordability remains insignificant in Manitoba, it becomes insignificant for Saskatchewan, New Brunswick and Prince Edward Island as well. Outside of this, however, the coefficients for affordability in the remaining provinces and the migration elasticities in British Columbia remain similar and statistically significant. Overall, these results reinforce the existence of an underlying structural relationship between the variables of interest. A deeper structural analysis of the steady upward trend in resales per worker is left to future work.

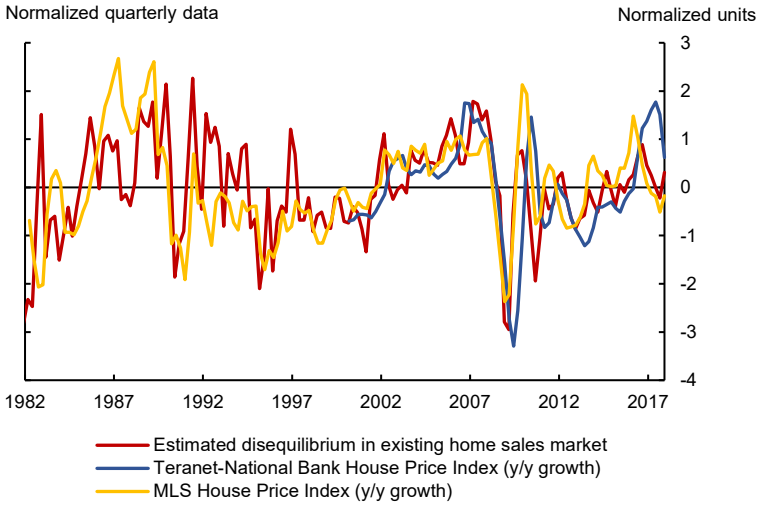
Generally speaking, our elasticities, evidence of cointegration and estimates of fundamentally consistent resale activity are robust to (i) not backfilling our resale data and (ii) omitting the 2008 recession and entire post-financial crisis period.[28] We also find that the results are robust to using a national affordability index (rather than provincial indexes) or an index that is not adjusted for changes in amortization or down-payment regulations, although the evidence of cointegration is weaker.

Finally, we find that there is a robust and positive relationship between house price growth and the estimated gap between resale activity and its fundamentally consistent level. Specifically, periods that are marked by resales that are well above (below) what is implied by full-time employment, affordability and migration tend to be associated with faster (slower or negative) growth in house prices (**Chart 7**). Since this paper investigates the fundamentals driving resales from the perspective of demand, the affordability index is not capturing this relationship since, *ceteris paribus*, changes in house prices only affect housing affordability (and thus underlying resale demand) insofar as they make the cost of home ownership relatively more or less expensive (as opposed to capturing the impact price changes might have on speculative demand or behavioural responses such as "fear of missing out"). As a result, the relationship between the estimated cointegrating error and house price growth is interpreted as evidence that changes in resale demand not driven by fundamentals translate into price pressures in the short run because of relatively slow adjustments in the supply of homes available to buy.[29]

[28] Coefficient results from these regressions can be found in **Table A-4** and **Table A-5** in the Appendix.

[29] New residential listings data published by CREA support this notion, since they are significantly less volatile than residential resales and generally evolve with a lag relative to sales. Moreover, it is logical to think that the motivation to sell a house is less responsive to price changes in the short run than the motivation to buy. For example, if homeowners want to extract capital gains after a period of strong house price appreciation, they would need sell their house and subsequently purchase a less expensive one, requiring the owners to either downsize in their current area or move to a new area where house price growth has been less pronounced (and thereby homes of equivalent quality have become relatively less expensive).

Chart 7: Deviations of resales from fundamentals are strongly correlated with house price growth



Note: FMOLS is fully modified ordinary least squares, MLS is Multiple Listing Service.
Sources: Canadian Real Estate Association, Teranet and National Bank of Canada, and Bank of Canada calculations

Last observation: 2017Q4

3.3 Results: Error correction models

Table 5 presents the OLS regression results from error correction models (ECMs; equation 5) derived from the provincial cointegration equations. ECMs characterize quarterly *changes* in resales (rather than the level of resales in the cointegrating regressions) using (i) growth in employment, affordability and migration; and (ii) an error correction term (the residual $\epsilon_{i,t}$ from equation 4), which captures the speed at which resales tend to converge toward the level predicted by the cointegrating equation.[30] Four lags of resale growth are included in the ECMs as well, to remove any autocorrelation in the equations' residuals.

$$\begin{aligned}\Delta \ln(resales_{i,t}) &= \gamma_{0,i}\epsilon_{i,t-1} + \gamma_{1,i}\Delta \ln(ft\ employment_{i,t-1}) + \gamma_{2,i}\Delta \ln(affordability_{i,t-1}) \\ &+ \gamma_{3,i}\Delta \ln(inward\ migration_{i,t-1}) \\ &+ \gamma_{4,i}\Delta \ln(outward\ migration_{i,t-1}) + \sum_{j=1}^{4} \Delta \ln(resales_{i,t-j}) + u_{i,t} \qquad (5)\end{aligned}$$

In equation 5,

- $\Delta\ln$ denotes the first difference of the natural logarithm
- $\epsilon_{i,t-1}$ is the residual from the cointegrating regression in quarter $t-1$ for province *i*

We find that quarter-over-quarter changes in resale activity are ultimately very difficult to explain, as evidenced by the relatively low adjusted R^2 of these regressions (**Table 5**). The error correction term ($\epsilon_{i,t-1}$) provides most of the explanatory power for quarterly resale growth and is highly significant and

[30] Inward and outward migration were tested in the dynamic equations for all provinces, to test for the possibility that changes in migration affect resales in the short run despite having no significant long-run effect. These variables were generally found to be insignificant and worsened forecasting performance in all provinces (including British Columbia).

negative for all provinces. The one-quarter lagged change in affordability is found to be significantly related to resale growth in four provinces, insignificant in five and negative in Quebec. Lagged changes in full-time employment and migration are generally insignificant, even in British Columbia.

The strong significance of the error correction coefficient for all provinces reinforces the estimated long-run relationship between resale activity and the independent variables. The error correction coefficients suggest that, on average, roughly 50 to 80 per cent of a disequilibrium in provincial housing markets unwinds in one year. These error correction coefficients, however, must be interpreted carefully. When large gaps open in the housing market, they often remain large for several quarters and close more rapidly than suggested by their error correction coefficients (rather than gradually close along the average path). Thus, while the error correction coefficients presented in **Table 5** represent the average speed at which disequilibria disappear on a quarterly basis, seldom do gaps close in such a linear fashion. As a result, the average time horizons implied by the coefficients are likely the most meaningful information that we can extract from these short-run results.[31] The finding that there is a robust and consistent re-convergence of resales to fundamentals, however, means that this framework can be used to measure the amount of real GDP that could disappear (or reappear) in relatively short order when resales are above (below) the level implied by full-time employment and housing affordability.[32]

[31] For example, the error correction coefficient of -0.28 in Manitoba implies that, on average, 73 per cent of disequilibrium disappears in one year and 93 per cent of it is closed after two. Therefore, rather than strictly expecting 28 per cent of a gap to close in the following quarter, it is more prudent to infer that one should expect most of a gap to close within a year, and that the longer it goes without closing, the higher the risk of a sharp correction toward fundamentals.

[32] A corollary to the robustness of the cointegration results and the significance of the error correction terms is that macroprudential regulation that does not directly affect mortgage rates, LTVs or amortization periods will not affect the long-run level of resale activity. For example, the revised B-20 Guideline mortgage rate stress test introduced in January 2018 forces prospective homebuyers to qualify for mortgages at higher-than-offered interest rates. While this may prevent some homebuyers from qualifying for a mortgage and potentially lead to fewer home sales in the near term, our empirical findings suggest that, over time, these sales will eventually still occur as long as the fundamentals behind the buying decision (i.e., employment and affordability) do not change. This catch-up (or "error correction") would be driven by affected buyers saving for larger down payments or demanding less expensive homes in order to meet the higher mortgage qualification standards.

Table 5: Ordinary least squares regression coefficients for dynamic equations

Sample: 1982Q2 to 2016Q4

	Error correction	Full-time employment	Housing affordability	In migration	Out migration	Adjusted R^2
Canada	-0.23***	-2.91**	0.09	0.18	-0.04	0.36
British Columbia	-0.19**	-1.85*	0.22	0.14	-0.23	0.31
Alberta	-0.16***	0.68	0.27	0.14	-0.05	0.18
Saskatchewan	-0.36***	-1.11	-0.01	0.20**	-0.12*	0.21
Manitoba	-0.26***	-1.62**	0.28**	0.00	-0.09	0.35
Ontario	-0.35***	-1.69	0.06	0.10	-0.05	0.30
Quebec	-0.29***	-0.92	-0.39**	-0.06	0.03	0.28
New Brunswick	-0.19***	-1.36**	0.13	0.05	0.05	0.21
Nova Scotia	-0.23***	-0.28	0.36**	-0.11	0.21**	0.33
Prince Edward Island	-0.29***	-1.79	0.40*	-0.20	0.02	0.21
Newfoundland	-0.17**	0.50	0.56***	0.22***	-0.16**	0.30

Coefficient significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$

3.3 Results: Forecasting performance

The forecasting performance of our equations is assessed relative to several benchmarks—namely, autoregressive (AR) models of various lag lengths and an equation that is the same as our ECM but without the error correction term—by comparing out-of-sample root-mean-squared forecasting errors (RMSFEs) (**Table 6**). Given the lack of significance of employment and migration and the mixed significance of affordability in the dynamic equations, we also test an equation containing only the error correction term and autoregressive terms. The evaluations are done using an expanding window out-of-sample forecast comparison.[33]

Overall, we find that the error correction term improves forecasting performance at some point across the forecasting in most provinces (**Table 6**). In British Columbia and Alberta, the error correction term reduces forecast errors for all forecast horizons. Forecasts for Saskatchewan and Manitoba are also consistently better after T+1 and T+2, respectively. Ontario's forecasts benefit from the error correction term in the first year, after which AR model forecasts begin to perform slightly better. AR benchmarks produce the best forecasts for Quebec and Nova Scotia until very late in the forecast horizon. Finally, the ECMs for New Brunswick, Prince Edward Island and Newfoundland and Labrador all underperform relative to their optimal AR specifications. Generally speaking, however, Diebold-Mariano tests suggest that very few of these improvements are statistically significant.

The most interesting and meaningful result of this exercise is that the national forecasts produced by aggregating the provincial ECM forecasts are drastically better than the forecasts produced using

[33] An expanding window refers to a series of estimations that remove some number of observations from the end of a time-series data set to facilitate "out-of-sample" evaluation. For example, the initial estimation sample in our exercise runs from 1982Q2 to 2002Q1, which results in the first forecast period being 2002Q2. This yields a total of 52 out-of-sample forecasting periods, since the end of the regression sample is 2016Q4 and we are comparing up to T+8 forecasts.

national models (see the row labelled "Sum of provinces" in **Table 6**). Diebold-Mariano tests reinforce two important findings: (i) national forecasts generated by aggregating provincial forecasts are significantly better across all time horizons than the forecasts generated using the national model; and (ii) the aggregated forecasts from the provincial ECM equations generally provide a significant improvement over the aggregated AR forecasts, especially over longer horizons. Overall, while the forecasting improvements are incremental at the provincial level, the aggregation of these improvements results in meaningful gains in forecast performance for Canadian resale activity.

Table 6: Relative out-of-sample RMSFEs for the dynamic regressions and optimal benchmark*

Sample: 2002Q2 to 2015Q1

	T+1	T+2	T+3	T+4	T+5	T+6	T+7	T+8	RMSFE T+1
British Columbia	0.972	0.908	0.943	0.965	0.952	0.938	0.931	0.923	0.111
Alberta	0.998	0.952	0.964	0.982	0.964	0.953	0.944	0.951	0.101
Saskatchewan	1.077	0.897	0.940	0.958	0.971	0.966	0.930	0.917	0.092
Manitoba	1.059	1.005	0.965	0.983	0.968	0.968	0.963	0.961	0.048
Ontario	0.958	0.913	0.967	0.998	1.013	1.021	1.026	1.026	0.063
Quebec	1.241	1.105	1.082	1.072	1.043	1.034	1.004	1.010	0.075
New Brunswick	1.121	1.077	1.014	1.015	1.005	0.995	1.006	1.005	0.073
Nova Scotia	1.233	1.057	1.039	1.042	1.034	1.029	1.022	1.020	0.091
Prince Edward Island	1.239	1.104	1.051	1.032	1.017	1.027	1.033	1.024	0.123
Newfoundland	1.022	0.997	1.013	1.013	1.004	1.011	1.028	1.019	0.081
Canada	1.026	0.948	0.992	1.030	1.028	1.025	1.018	1.019	0.070
Sum of provinces	0.945	0.856	0.746	0.748	0.639	0.637	0.645	0.594	0.040

*The results in this table represent the ratio of the root-mean-squared forecast error (RMSFE) of the error correction model (ECM) equation divided by the RMSFE of the best-performing benchmark model (AR1, AR2, AR3, AR4 and optimal AR length plus lagged growth in employment and affordability). Numbers below 1 represent better forecasting performance. The last column contains the absolute RMSFEs from the ECM equation for the T+1 forecasts.

4. Concluding remarks

This paper bridges a gap in the empirical literature by creating a novel and robust framework for explaining and predicting the medium- to long-term evolution of existing home sales in Canada and its provinces. Our cointegration models provide a framework that measures the level of resale activity that is explained by fundamentals—namely, full-time employment, housing affordability and (in British Columbia) migration flows. Over longer horizons, we find that resale activity and these fundamentals share a stable relationship and that deviations between them are temporary, although sometimes persistent. Moreover, the deviations between resales and fundamentals are found to have a strong and positive relationship with house price growth and generally improve forecasting performance relative to several benchmarks.

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Appendix

Unit root testing

Table A-1: Unit root test results—augmented Dickey-Fuller tests

Null hypothesis: Series has a unit root

	Resales	Population	House-holds	Employ-ment	Full-time employ-ment	Afford-ability	Effective mortgage rates	User cost	In migration	Out migration
BC	-2.6*	-0.09	0.17	0.1	0.2	-4.92***	-0.95	-2.56	-2.02	-2.13
AB	-1.62	2.4	3.07	0.54	0.11	-4.56***	-0.95	-2.45	-2.35	-2.54
SK	-2.12	-0.38	0.86	0.38	0.5	-6.35***	-0.95	-2.49	-1.62	-2.82*
MB	-2.72*	0.39	1.35	0.04	0.23	-5.83***	-0.95	-1.81	-2.05	-3.18**
ON	-1.87	0.59	0.31	-0.38	-0.32	-3.06**	-0.95	-1.6	-2.87*	-3.04**
QC	-0.79	0.01	-1.82	0.12	0.33	-3.92***	-0.95	-1.63	-2.24	-3.14**
NB	-0.46	-3.22**	-2.28	-1.44	-0.83	-4.96***	-0.95	-1.18	-2.76*	-3.34**
NS	-2.06	-2.14	-3.43**	-1.49	-0.71	-5.34***	-0.95	-1.76	-2.98**	-5.16***
PE	-0.93	0.23	-0.16	-0.07	0.11	-5.4***	-0.95	-1.71	-0.64	-2.89**
NF	-1.81	-1.95	-1.85	-1.3	-1.43	-5.83***	-0.95	-1.68	-3.49***	-2.48

Test statistic significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Table A-2: Unit root test results—Dickey-Fuller generalized least squares tests

Null hypothesis: Series has a unit root

	Resales	Population	House-holds	Employ-ment	Full-time employ-ment	Afford-ability	Effective mortgage rates	User cost	In migration	Out migration
BC	-0.39	0.79	1.26	3.07	2.46	-0.16	-1.25	-2.16**	-1.87*	-1.3
AB	-0.66	0.99	1.59	2.01	1.39	0.19	-1.25	-0.83	-1.84*	-2.56**
SK	-2.05**	0.26	1.63	2.77	1.75	0.17	-1.25	-0.64	-1.62*	-2.58***
MB	-1.11	1.16	1.31	3.46	1.94	0.02	-1.25	-0.43	-1.4	-0.61
ON	-0.3	0.84	0.59	2.3	1.85	-0.72	-1.25	-1.19	-2.16**	-1.22
QC	0.82	0.61	0.16	2.28	1.78	-0.14	-1.25	-0.55	-1.86*	-0.67
NB	1.52	0.31	0.04	1.23	0.95	0.31	-1.25	0.06	-1.63*	-1.58
NS	0.36	0.7	0.16	1.78	1.06	0.15	-1.25	-0.14	-2.76***	-4.13***
PE	0.96	1.56	1.26	2	1.42	0.03	-1.25	-0.58	-0.81	-2.48**
NF	0.04	-0.4	-0.36	0.06	-0.71	0.26	-1.25	-0.35	-3.39***	-2.26**

Test statistic significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Table A-3: Unit root test results—Kwiatkowski-Phillips-Schmidt-Shin tests

Null hypothesis: Series is stationary

	Resales	Population	House-holds	Employ-ment	Full-time employ-ment	Afford-ability	Effective mortgage rates	User cost	In migration	Out migration
BC	0.92***	1.5***	1.77***	1.49***	1.48***	0.25	1.34***	0.4*	0.19	0.65**
AB	1.26***	1.48***	1.75***	1.48***	1.45***	0.78***	1.34***	0.73**	0.75***	0.31
SK	1.23***	1.26***	1.68***	1.31***	1.29***	0.91***	1.34***	0.66**	0.68**	0.36*
MB	1.25***	1.46***	1.73***	1.49***	1.45***	0.9***	1.34***	0.9***	0.45*	0.86***
ON	1.34***	1.51***	1.77***	1.48***	1.46***	0.55**	1.34***	0.98***	0.43*	0.15
QC	1.42***	1.49***	1.77***	1.48***	1.45***	0.83***	1.34***	1***	0.87***	0.54**
NB	1.39***	1.44***	1.74***	1.42***	1.42***	1.45***	1.34***	1.3***	0.28	0.63**
NS	1.3***	1.46***	1.72***	1.43***	1.4***	1.22***	1.34***	1.22***	0.27	0.2
PE	1.41***	1.51***	1.77***	1.5***	1.49***	1.26***	1.34***	1.25***	0.8***	0.29
NF	1.3***	1.38***	1.7***	1.26***	1.05***	1.16***	1.34***	1.04***	0.07	0.66**

Test statistic significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Robustness: Alternative regression results

Table A-4: No backfilled resale data

Dependent variable: ln(resales)
Sample: 1988Q1 to 2016Q4

	Full-time employment	Housing affordability	Inward migration	Outward migration	Engle-Granger τ	Phillips-Ouliaris τ
CAN	1.61***	0.15			-5.44***	-4.86***
BC	1.06***	1.04***	0.94***	-0.54**	-4.68**	-4.62**
AB	1.08***	0.20			-3.62*	-4.49***
SK	1.99***	0.28***			-4.74***	-4.36**
MB	1.30***	-0.03			-5.90***	-6.40***
ON	1.72***	0.13*			-6.56***	-5.23***
QC	3.27***	0.78***			-3.88**	-4.87***
NB	3.64***	0.01			-3.93**	-4.08**
NS	1.67***	0.62***			-3.40	-4.37**
PE	3.23***	0.13			-4.66***	-5.85***
NF	3.33***	1.16***			-5.25***	-7.52***

Coefficient significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Table A-5: Excluding crisis years and beyond

Dependent variable: ln(resales)
Sample: 1981Q4 to 2007Q4

	Full-time employment	Housing affordability	Inward migration	Outward migration	Engle-Granger τ	Phillips-Ouliaris τ
CAN	2.14***	0.25**			-4.54***	-4.58***
BC	1.56***	1.04***	0.57***	-1.12***	-4.74**	-5.49***
AB	1.59***	0.58***			-3.00	-3.61*
SK	2.29***	0.21***			-4.94***	-5.21***
MB	0.63	0.19			-4.40**	-5.12***
ON	1.55***	0.25***			-5.37***	-5.10***
QC	4.67***	0.71***			-5.47***	-4.90***
NB	3.09***	0.23			-3.86**	-4.81***
NS	2.33***	1.02***			-5.54***	-6.94***
PE	4.35***	0.42			-4.90***	-6.88***
NF	2.75***	0.90***			-3.61*	-6.36***

Coefficient significance is indicated by the number of asterisks: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$