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Remarks by Lawrence Schembri
Deputy Governor of the Bank of Canada
Canadian Association for Business Economics
Kingston, Ontario
25 August 2015

The Long-Term Evolution of House Prices: An International Perspective

Introduction

Thank you for the invitation to speak here today. Every August since 1961, when John Diefenbaker was prime minister and you could buy a house for \$15,000, business and government economists have gathered here in Kingston to discuss issues of the day. CABE has carried on this tradition of convincing economists to attend a conference while everyone else is on vacation. The promise of a good chart is probably all the convincing most of us need. I've got plenty of those for you today.

I want to talk to you about the evolution of house prices and the underlying determinants of their long-term movements. As you know, developments in the housing sector and the related mortgage market are important, for both the Canadian economy and its financial system. My presentation, then, is part of our ongoing effort at the Bank to promote an informed discussion of housing and house prices.

In our quarterly *Monetary Policy Report* and our biannual *Financial System Review* we usually take a “here and now” perspective. But today I want to provide more context by stepping back and looking at house prices in two dimensions:

- across time, over the past 40 years; and
- across countries—in particular, across a group of countries that share economic circumstances and policy frameworks similar to Canada's.

I'll begin with a quick look at some stylized facts about the evolution of house prices. Then, I'll examine their long-run determinants from both the demand and supply sides. Finally, I'll comment on the implications of house prices for financial

I would like to thank Don Coletti, Jason Allen, Brian Peterson, Greg Bauer and Denis Gorea for their help preparing this speech.

Not for publication before 25 August 2015
12:25 Eastern Time

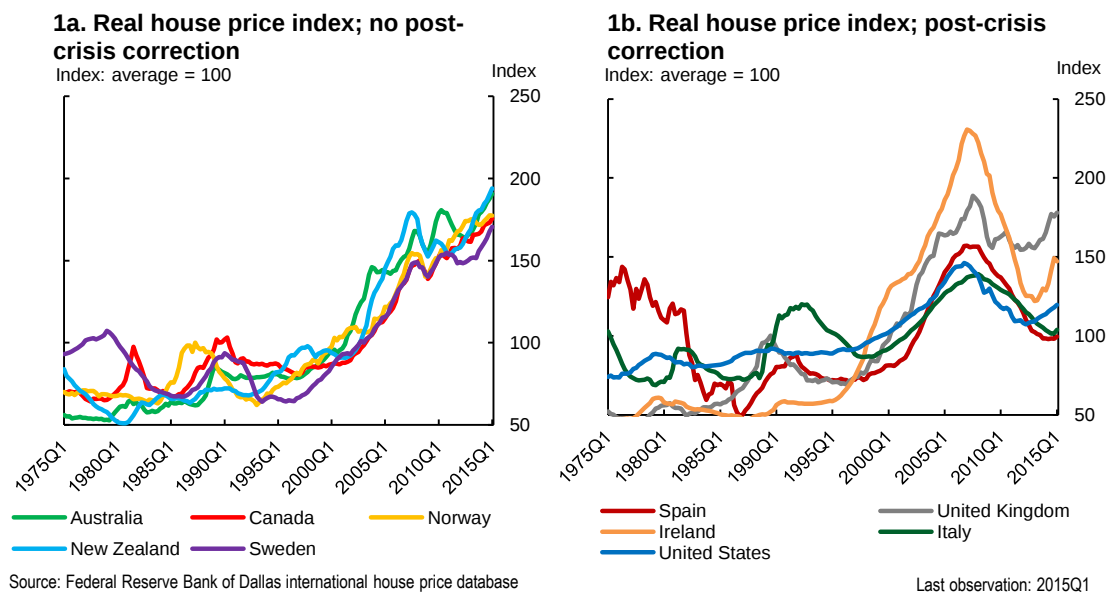
stability and the recent experience with macroprudential housing-related policies, including their complementary interaction with monetary policy.

House Price Trends

Let's start with trends in house prices. **Chart 1** shows indexes of real house prices since 1975 for two sets of advanced economies. **Chart 1a** shows Canada and a set of comparable small, open economies (Australia, New Zealand, Norway and Sweden) with similar macro policy frameworks and similar experiences during and after the global financial crisis.¹ In particular, they did not have sizable post-crisis corrections in house prices.

For comparison purposes, **Chart 1b** shows a second set of advanced economies that did experience significant and persistent post-crisis declines in house prices.²

Chart 1: Real house prices have increased globally since 1995



Three points about these charts.

First, there are notable variations across countries. While there is some common movement, local circumstances clearly matter.

Second, broadly speaking, real house prices across both sets of countries experienced no material upward trend from 1975 to 1995.

Third, a generalized upward movement in house prices began in the second half of the 1990s and is continuing today, even after post-crisis corrections. Real prices remain well above 1995 levels for almost all countries.

These trends suggest that there are common factors at the global level or simultaneously in each country that have arisen over the past 20 years and have pushed up real house prices. Understanding these common and idiosyncratic determinants of house prices is important for both macroeconomic outcomes and financial stability and thus the conduct of monetary and macroprudential policies.

A Framework for Analyzing House Price Trends

To analyze these trends, let's start with some basics. A house is simultaneously both a consumption good and an asset. It delivers a stream of non-financial housing services and, at the same time, is also a store of wealth. For most of us, it is the largest asset we own.

A household's decision to purchase a house depends on the utility of the services it provides, its price, and its ongoing user cost. The user cost includes depreciation, maintenance and interest costs, less the expected price growth. In the housing market, the price is determined by the total demand for housing services and the stock of houses. The equilibrium house price thus depends on the user cost, which includes the expected price appreciation, and this, in turn, depends on the expected evolution of demand and supply factors.

To complicate matters, a number of other dimensions influence the choice of the data being analyzed:

- Housing can be owner-occupied or rented.
- Housing units can be single-family houses or multiple-unit dwellings.
- Housing is a composite good consisting of both a structure and land.
- Housing prices can be for existing or new houses, or both.

For my purposes today, I'll focus primarily on owner-occupied houses, the total of singles and multiples and the composite price for existing houses measured at the national level.³

Demand Factors

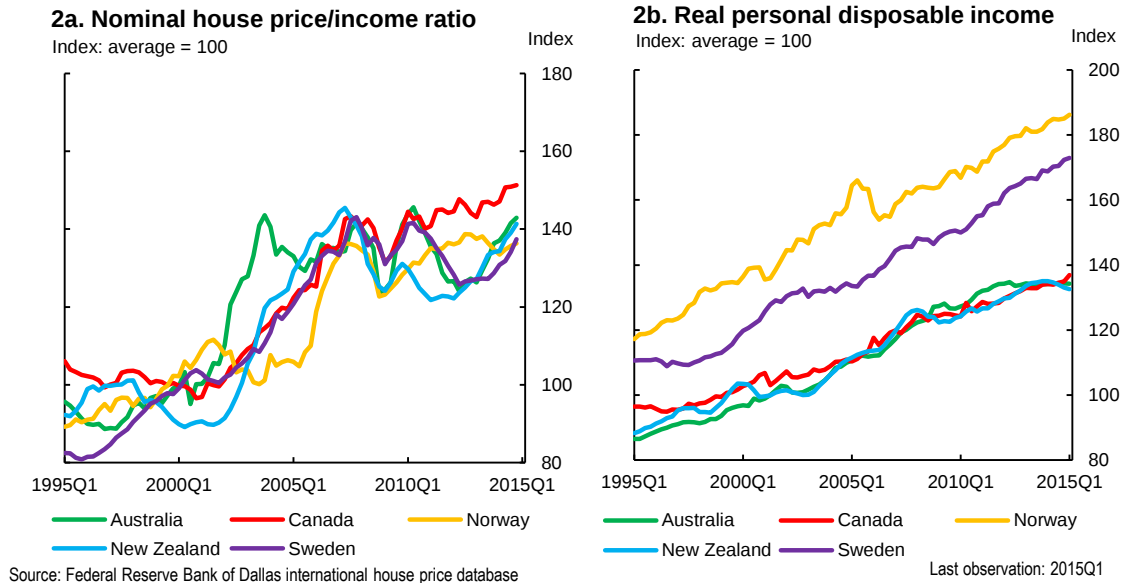
Four broad sets of demand factors have likely contributed to rising real house prices across advanced economies since 1995:

- macroeconomic—rising disposable incomes and lower long-term interest rates;
- demographic—population growth, driven in part by migration, and shifts in age structure and family size;
- credit conditions—broader access to and more efficient funding of mortgage credit due to financial liberalization and innovation; and
- other factors—improvements to the macro-policy framework, international investment, preference shifts and regulatory and tax changes.

House prices and income

First, let's look at house prices and income. Since 1995, house prices in Canada and the set of comparable countries have increased faster than nominal personal disposable income (**Chart 2a**).⁴ During this period, all of these countries experienced solid income growth, with the strongest growth in Norway and Sweden (**Chart 2b**).

Chart 2: House prices have increased relative to income



During the global financial crisis, these countries also experienced house price corrections. This caused the ratios of house prices to income to decline temporarily, after which they continued climbing.

So why did house prices rise faster than income?

Demographics

There are a number of possible explanations. Consider population growth.

Chart 3a shows population growth rates in our set of comparable countries over two periods, 1975 to 1994 and 1995 to 2015. Population growth rates were the highest in Australia, Canada and New Zealand over the entire sample. Moreover, growth rates increased in all countries, except Canada, in the post-1995 period relative to the pre-1995 period. Therefore, population growth could help explain the rise in house prices relative to income for most countries over the latter part of the sample.⁵

One of the factors that has affected population growth rates is migration. Net migration was highest in Australia and Canada over the entire sample. In addition, net migration increased importantly in all five countries in the second half of the sample period (**Chart 3b**).⁶

In Australia, Canada and New Zealand, the rate of population growth of the approximate house-owning cohort of those aged 25 to 75 declined in the second part of the sample period. This likely reflects the aging of their populations as the postwar baby boom generation moved from youth into middle age (**Chart 4**).

Nonetheless, the growth rate of this cohort still remains well above 1 per cent for these three countries.

Chart 3: Population growth has contributed to house price increases, aided by net migration

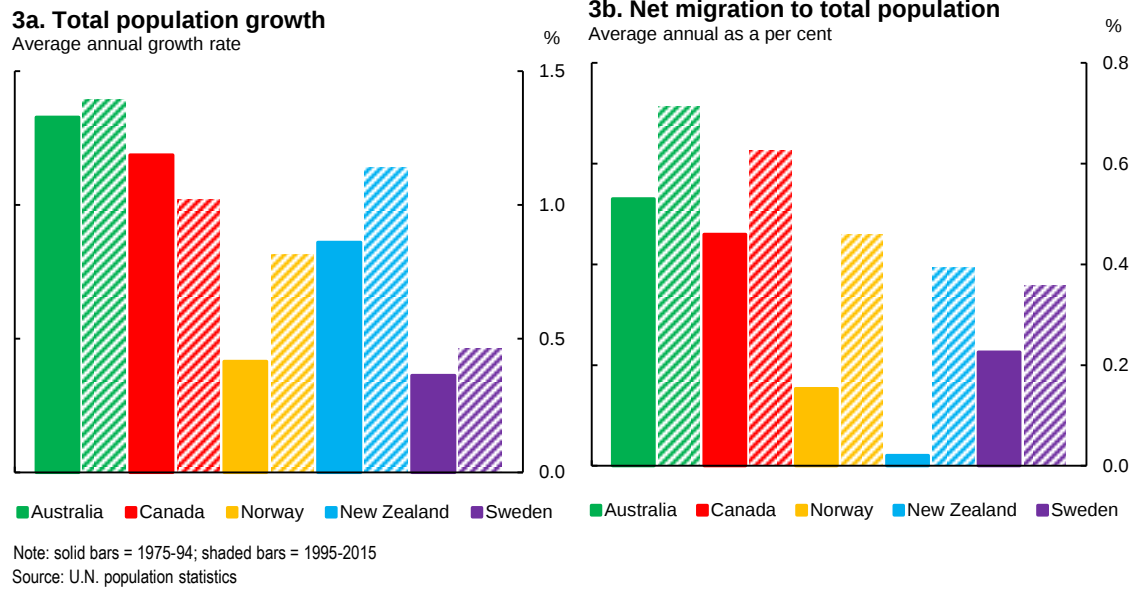
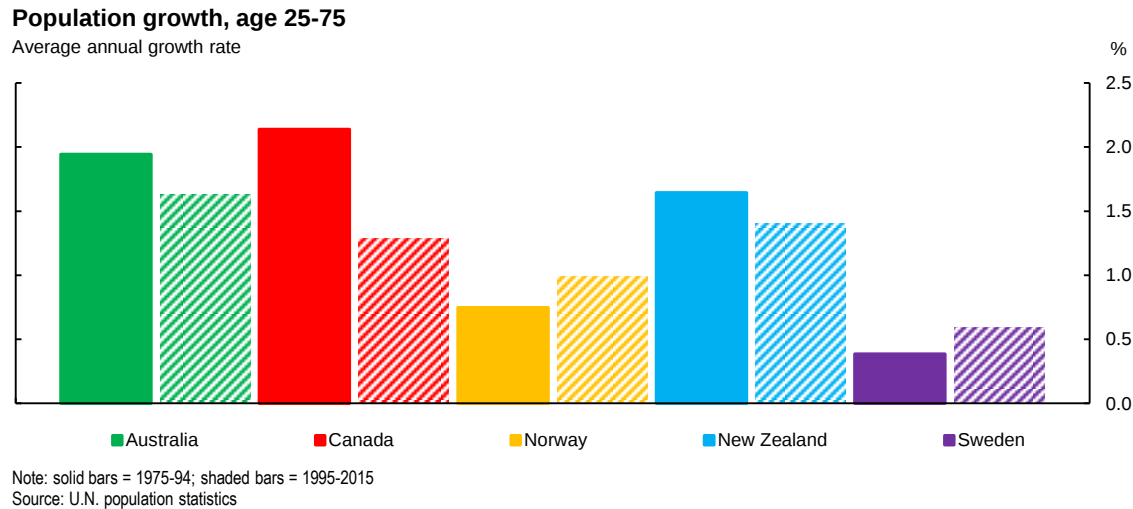


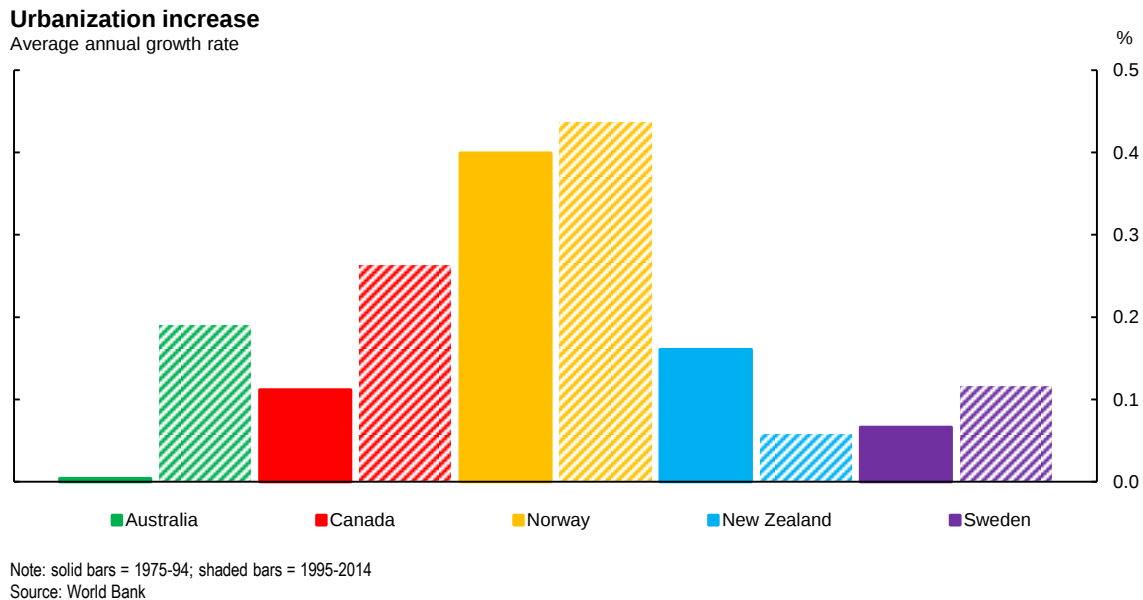
Chart 4: Population growth in house-owning age cohort has declined in some countries



In Canada, it is noteworthy that the average family size decreased from about 3.5 in 1976 to below 3.0 in 2011, a decline of approximately 20 per cent.⁷ Partial evidence suggests that this pattern is similar in the other advanced economies in our sample. This decline in the average family size has supported the rate of household formation, and thus, has partially offset the impact of the lower growth rate of the house-owning cohort on the demand for houses in Australia, Canada and New Zealand.⁸

It is also important to consider *where* population growth is occurring. **Chart 5** shows that over our sample period, the pace of urbanization, measured by the change in the urbanization ratio, has increased since 1995 in all of the countries in the comparable group, except New Zealand.⁹ Australia and Canada are notable for the size of the shift, which could be explained by a number of factors. These include the well-known agglomeration economies of scale provided by urban areas and the location preferences of home-owners, especially younger-age cohorts and recent immigrants.¹⁰

Chart 5: Increasing urbanization is important



The urbanization of the population in Norway also stands out. This could potentially explain why house prices have grown faster in Norway than in Canada, even though population growth in Canada has been higher than in Norway.

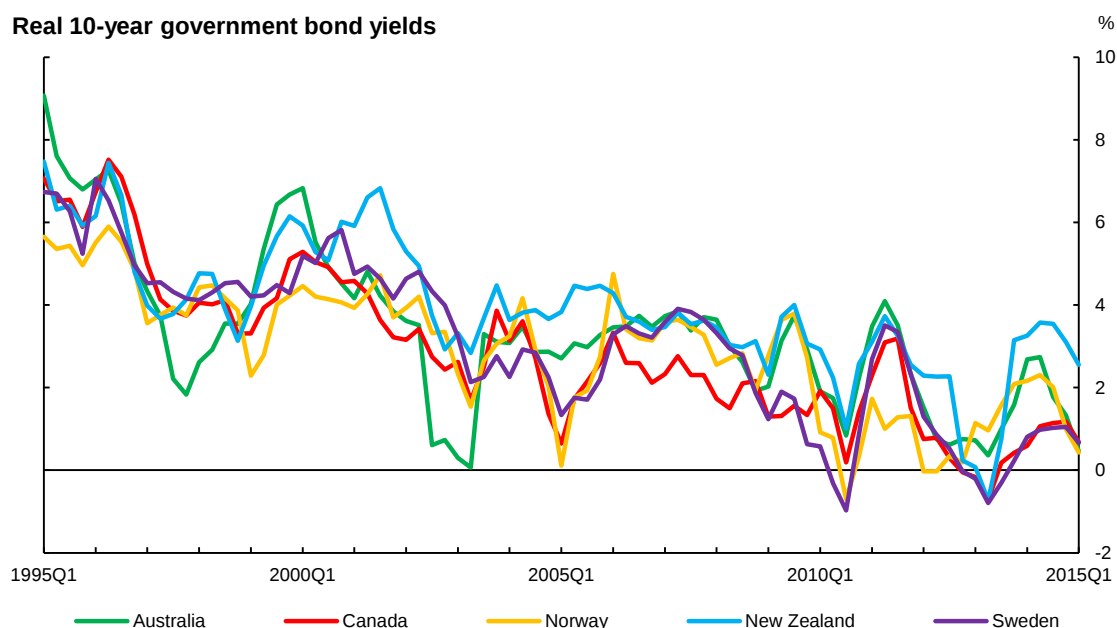
To sum up, population growth and the shift in demand for housing toward urban areas have exerted strong upward pressure on house prices.

Credit conditions

A third demand factor affecting house prices is the improvement in mortgage credit conditions. Lower long-term interest rates and financial liberalization and innovation have improved housing affordability in advanced economies, especially since the mid-1990s. I'll say a few words about each of these changes that have influenced the availability of credit.

Since 2000, real 10-year government bond yields have trended downward across all advanced countries, including those in our comparison group, with a slight increase during the recent financial crisis (**Chart 6**).

Chart 6: Real long-term interest rates have trended downward since 2000



Sources: OECD Economic Outlook, IMF *International Financial Statistics*, OECD Main Economic Indicators, Bank of Canada calculations

Last observation: 2015Q1

The decline in yields has been attributed to higher global savings and stronger monetary and fiscal policy frameworks, which have credibly reduced inflation and risk premiums by increasing macroeconomic stability in the roughly 15-year period (known as the Great Moderation) that preceded the global financial crisis.¹¹ Since the crisis, persistently weak global demand—especially real investment—coupled with sustained low central bank policy rates and large asset purchases has helped to lower long-term interest rates and, in turn, reduce financing costs for financial intermediaries and mortgage rates for households.¹² Other things being equal, this decline has helped improve the affordability of home ownership and support demand for houses.

Credit conditions have been positively affected by financial liberalization and innovation. Recent work by the International Monetary Fund has catalogued the related effects of these two factors on access to housing market finance and mortgage market development across countries.¹³

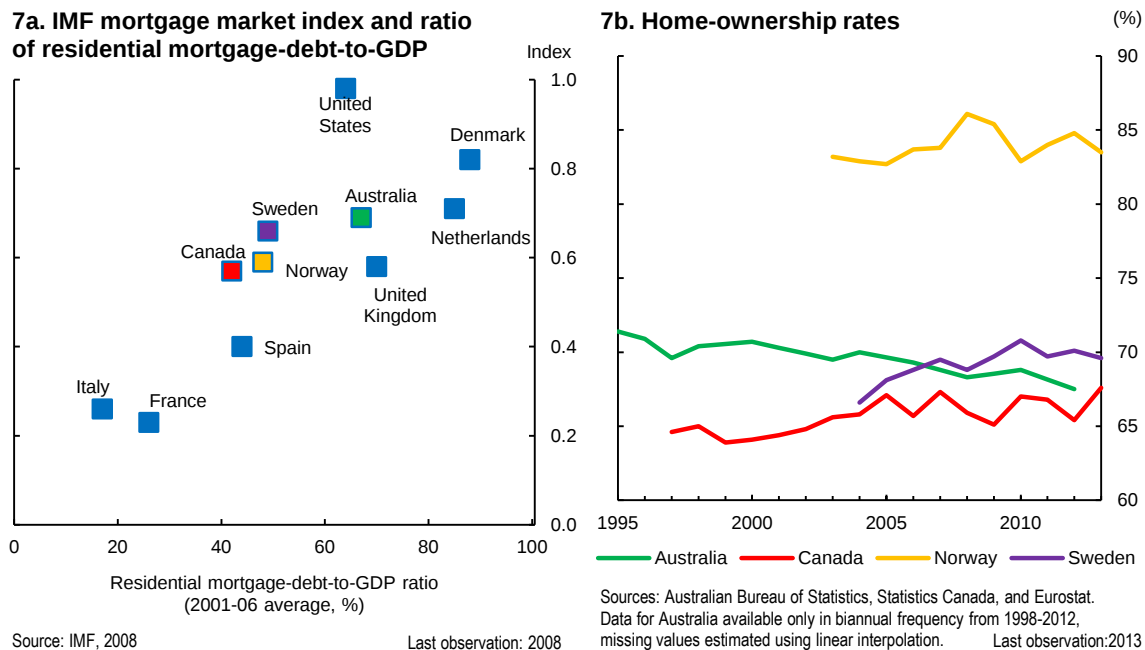
The trend in advanced economies from the mid-1990s until the crisis has been toward higher maximum loan-to-value ratios, longer amortizations for mortgage borrowers and more flexible funding arrangements for mortgage lenders in terms of covered bonds and mortgage securitization. The assessment and diversification of mortgage credit risk have also improved. As a consequence, a broader set of borrowers and lenders has become involved in obtaining and providing mortgage finance.

Chart 7a, shows a positive relationship between a summary index of mortgage finance conditions, constructed by the IMF, which captures both financial liberalization and innovation, and the depth of the mortgage markets across several advanced economies.¹⁴ Although data for New Zealand are not available,

the chart indicates that the other four countries in our comparison group have mortgage finance conditions in place that generate deep mortgage markets and foster broad and often less procyclical access to mortgage finance. Again, other things equal, this supports demand for owner-occupied housing and higher house prices.

Chart 7b shows that home-ownership rates in Canada and Sweden (over a shorter sample period) have risen, suggesting that these changes to mortgage finance have had a positive impact on housing affordability. In Australia, the rate of home ownership has declined. This may be due to a more modest change in mortgage credit conditions. Or, more likely, affordability has been eroded by rapidly rising house prices, which have increased the most in Australia among the comparison group. For Norway, there has been no material change in the home-ownership rate over this limited time period.¹⁵

Chart 7: Housing finance index, mortgage market depth and home ownership rates



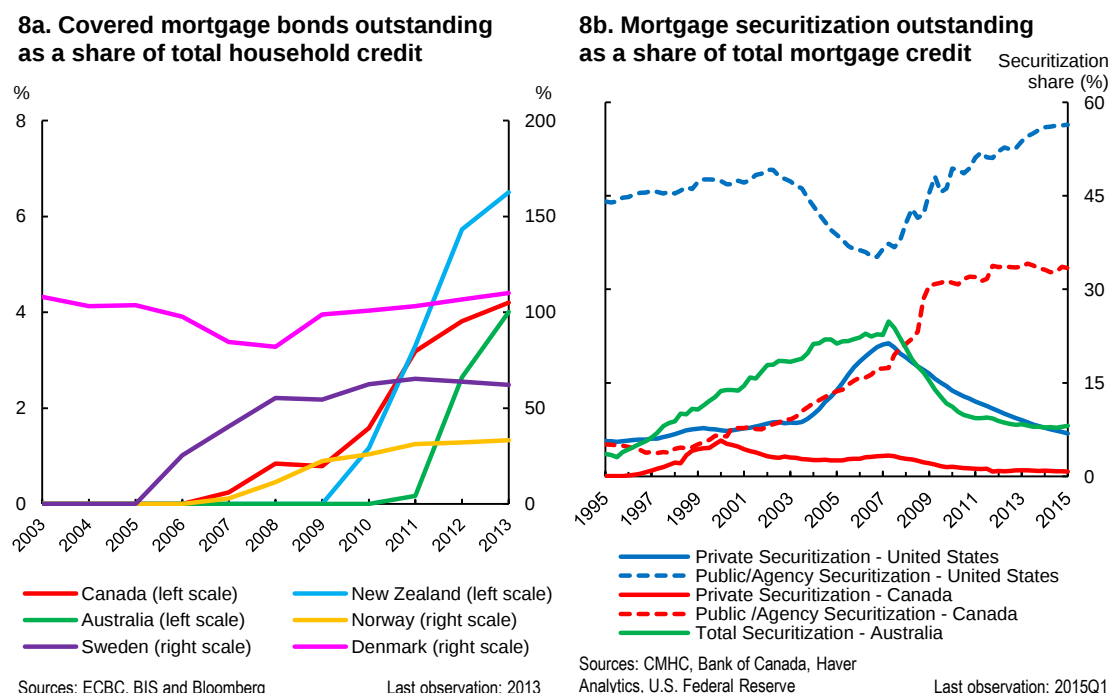
As I noted earlier, important innovations have fostered deeper, more efficient and diversified mortgage financing. I'll comment on the two most significant: covered bonds and securitization.

Covered bonds have been popular in Denmark for a long time. They were introduced and have become more widely used in Sweden and Norway and, to a lesser extent, in Canada, Australia and New Zealand (**Chart 8a**).

These bonds have played a growing role in mortgage finance in the post-crisis period because they are generally viewed as safer than private-label securitization. They give investors access to dual collateral: the mortgages securing the bonds as well as other assets on the issuer's balance sheet should the mortgages prove insufficient.¹⁶

Securitization of mortgages also increased significantly in the pre-crisis period in some countries, especially private-label securitization in the United States (**Chart 8b**). While these vehicles were successful in raising large amounts of mortgage funding before the crisis, they were an important source of financial vulnerability during the crisis because the incentives to originate and securitize subprime mortgages were misaligned and the related risks were opaque and not well priced.

Chart 8: Mortgage funding by covered bonds and securitization has risen



Since the crisis, we have seen a dramatic decline in private-label securitizations of residential mortgages, which has not recovered, despite global financial reform efforts led by the G-20 to address the serious weaknesses in their design.

Publicly supported securitization has continued to play an important role in funding residential mortgages over this period, however, especially in the United States and Canada.

Other factors supporting demand

A number of other related factors have likely supported the demand for houses in our comparison group and in advanced economies more generally.

All of the countries in our comparison group had solid macro and financial policies characterized by

- monetary policy frameworks comprising explicit and credible inflation targets and flexible exchange rates;
- sustainable fiscal positions; and
- effective financial regulatory and supervisory frameworks.¹⁷

As a result, these countries achieved a high degree of macro and financial stability over the post-1995 period; in particular, they kept inflation low. This stability had a number of important consequences. It reduced uncertainty for households and firms. As noted, it also lowered risk premiums and long-term interest rates.¹⁸ And it fostered financial and mortgage market development.

These countries all coped with the crisis and its aftermath relatively well. Economic and financial stability strengthened the demand for houses because it enhanced the perception that they are safe, high-quality assets.¹⁹ Consequently, households may have decided to shift more of their wealth into housing and consume more housing services as their income increased by buying more owner-occupied dwellings over time. This trend was supported by government policies (although not widespread in our comparison group) to promote home ownership, especially for younger and lower income households.²⁰

Supply Factors

Now let's look at the supply factors that have influenced the prices of houses, in particular, regulation and geography. Such supply constraints tend to be most binding in urban areas. Coupled with the observed shift in demand related to population growth in urban areas, supply constraints may have put significant upward pressure on house prices in urban areas in advanced economies.

The regulatory factors include land-use or zoning restrictions that specify, for example, minimum lot sizes or maximum development density; the establishment of greenbelts around urban areas, which represent a more sweeping land-use restriction; and development fees.

In terms of geographical constraints, the most common are bodies of water and landscape features such as mountains, wetlands and other terrain not suitable for residential development.

To what extent are these sorts of constraints affecting house prices in urban areas? **Chart 9** provides some suggestive evidence on the impact of land-use regulations on median price-to-income ratios. Many of the cities with higher ratios also have obvious geographical constraints—Hong Kong and Vancouver are good examples—so the two sources of supply restrictions likely interact to put upward pressure on prices.

To examine the implications of these supply constraints, it is useful to consider the impact of urban population density on house prices.

Chart 10 indicates that, over the period from 1995 to 2014, there was a strong positive relationship between increases in population density and house prices in Canadian urban centres.^{21, 22}

Greater population density, combined with regulatory and geographical constraints, creates price incentives that cause shifts in the available housing mix.²³ In particular, as the prices of single-family homes rise, condos become a more affordable alternative.

Chart 9: Land-use regulation and geographical constraints increase the price-to-income ratio

Median price-to-income ratio and land-use regulation: 2014

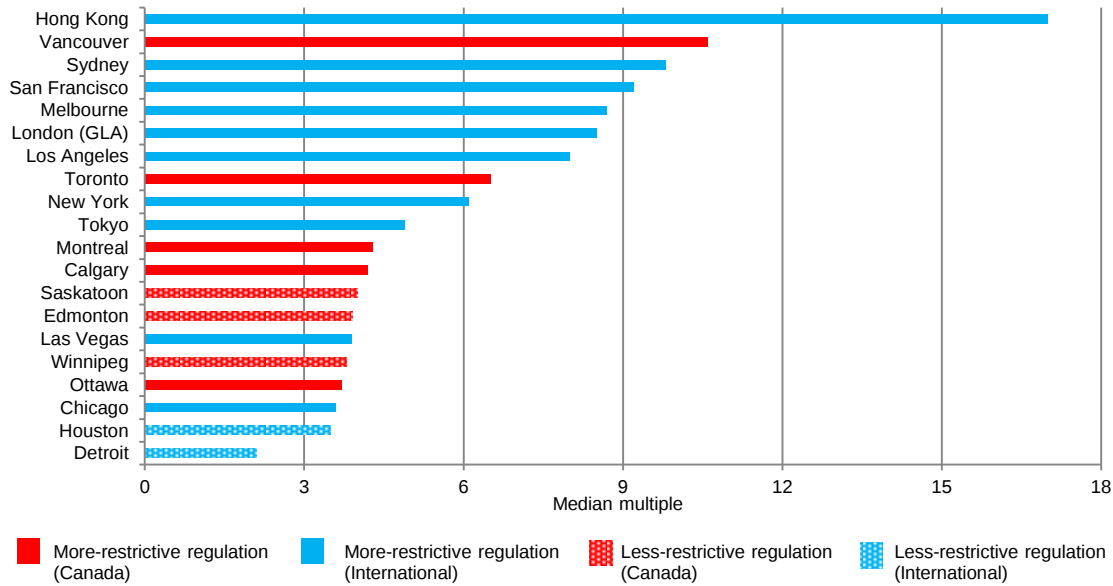
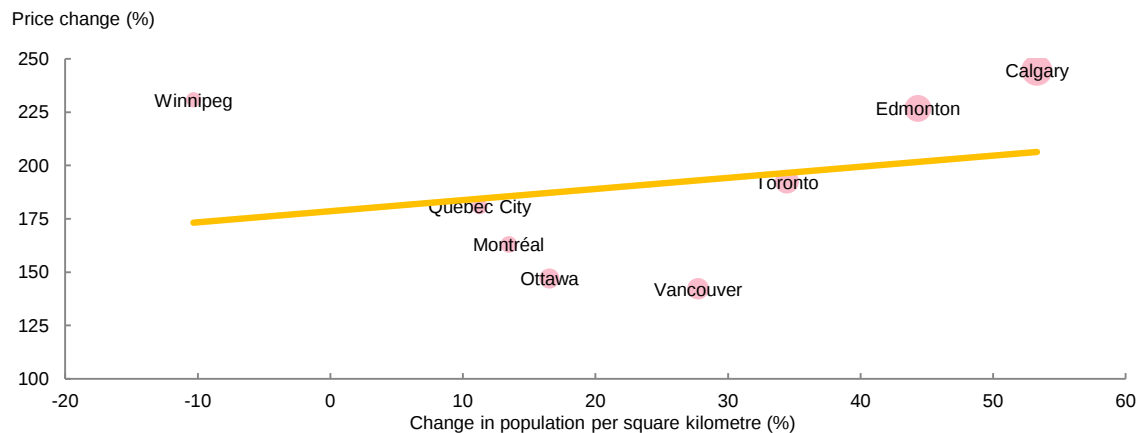


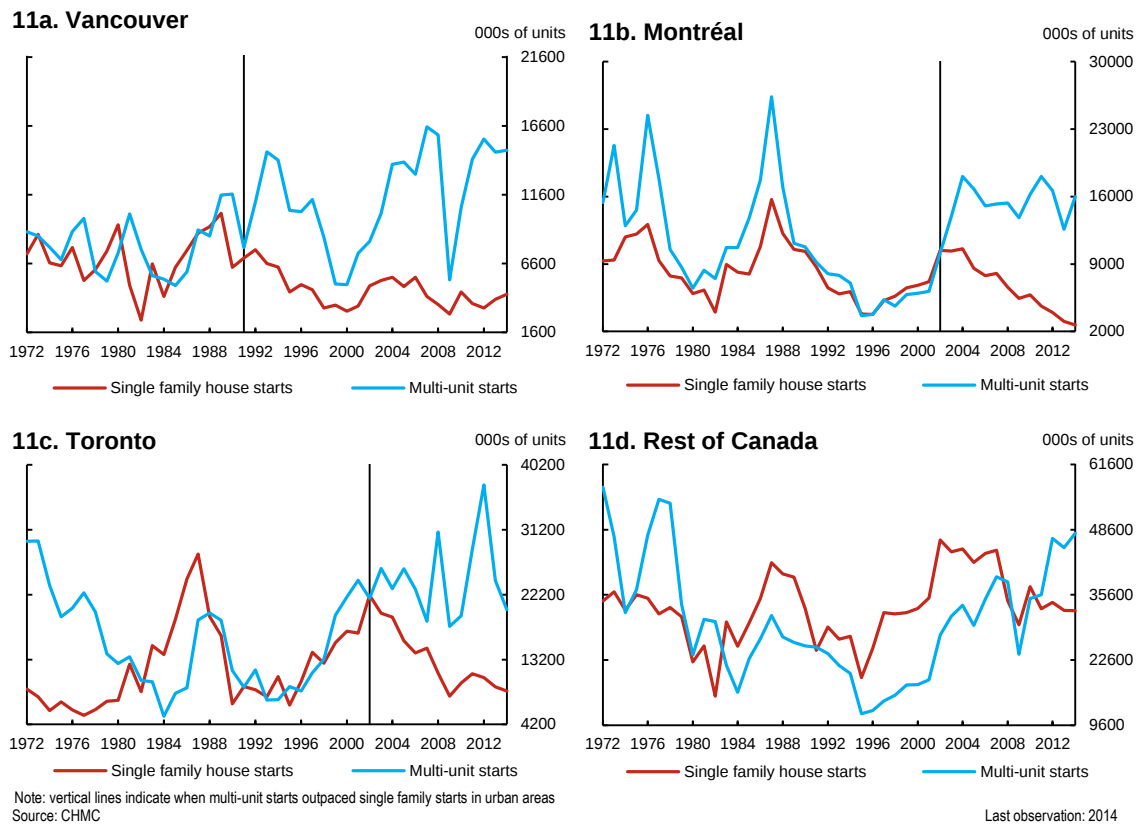
Chart 10: House prices rise with increases in urban density: 1995-2014



In Vancouver, bounded on three sides by water with coastal mountains as a backdrop, condo development has dominated housing starts since the early 1990s. We are now seeing a similar shift to condos in Montréal and Toronto (**Chart 11**).²⁴ In recent years, Toronto and Vancouver have seen price growth in single-family houses outpace multiples (mainly condos) by a factor of two to three. About a third of the Canadian housing stock is in Toronto, Montréal and Vancouver so this change is significant. Outside of Canada's big three cities, condos are only now becoming as important as single-family homes.

Given these supply constraints, the increasing urbanization of Canada's population is putting upward pressure on Canadian house prices.

Chart 11: With increasing population density and binding supply constraints, multi-unit starts are dominating in Canada's biggest cities



Policy Implications

In view of these demand and supply factors, which have tended to work together to cause house prices to rise faster than income since 1995 in advanced countries, especially in urban areas, what are the implications for monetary policy and, perhaps more importantly, for financial stability policy?

The advanced economies in our comparison group had similar experiences during and after the global financial crisis. They suffered sizable declines in exports to their major trading partners that were more severely affected by the crisis. Their domestic financial institutions and markets were adversely affected by spillovers from global financial stresses. Liquidity and credit conditions tightened severely.

In response, they loosened monetary policy, with sharp declines in policy interest rates. Their credible inflation-targeting frameworks, flexible exchange rates and resilient financial systems meant that such countercyclical monetary policy easing was effectively transmitted into lower real interest rates along the maturity spectrum. This easing supported the economic recovery by boosting domestic

demand, notably in sectors sensitive to interest rates, such as housing, and caused house prices to recover from declines experienced during the crisis.

But, to date, the global recovery has been weak, so global and domestic interest rates have remained at historically low levels. This has underpinned the demand for, and the prices of, houses in the post-crisis period.

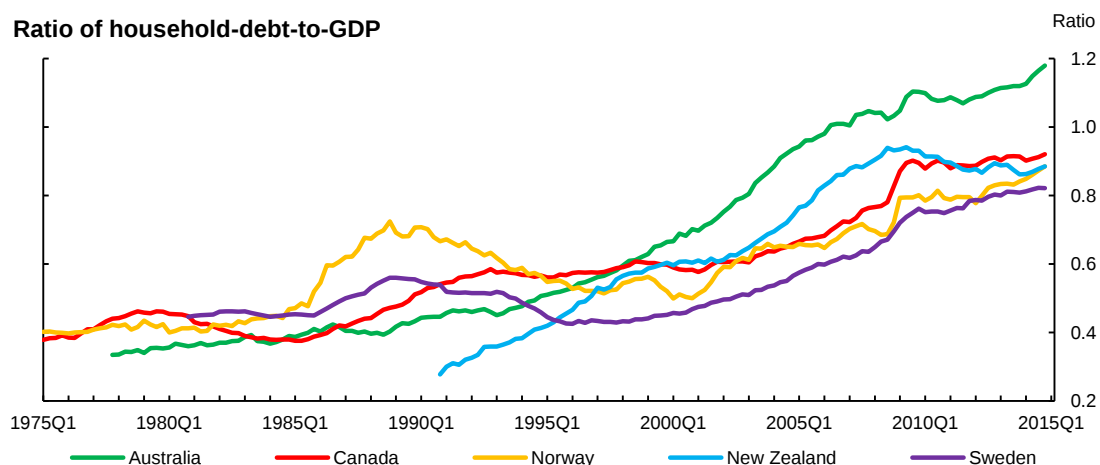
Since elevated house prices have important implications for financial stability, the Bank of Canada is closely monitoring the housing market. In particular, as we noted in recent issues of our *Financial System Review*, rising house prices contribute to two material vulnerabilities that can affect financial stability:

1. Higher house prices are generally associated with higher levels of household indebtedness and leverage.²⁵
2. Higher house prices represent a potential source of asset-price misalignment if influenced by expectations of price appreciation not consistent with evolving fundamentals.²⁶ Such misalignment could suddenly correct and create financial stress.²⁷

The likely trigger for both vulnerabilities would be a major global shock that generated a sharp increase in unemployment and possibly in interest rates as well. If these vulnerabilities were triggered, the adverse impact on the financial system and the economy would be amplified by the exposure of banks and other intermediaries to them.

Now, when we look at the post-crisis experiences of the countries in our comparison group, they have similar levels of household leverage, measured by household debt as a ratio of GDP (**Chart 12**).²⁸ Household leverage has risen along with house prices, as households have taken advantage of low post-crisis interest rates. The one exception is New Zealand, where a modest degree of household deleveraging seems to have occurred. For Canada, the ratio of household debt to GDP has risen since 1975, although the growth of this ratio has notably declined since 2010. For Sweden and Norway, the ratio also grew at a modest pace in the post-crisis period.²⁹

Chart 12: Household leverage has grown, especially since 1995



The inflections in the rate of leverage growth that we see in the chart after the crisis may be due to the macroprudential measures these countries implemented. Such measures have allowed stimulative monetary policy to flow through to households with the capacity to borrow.³⁰

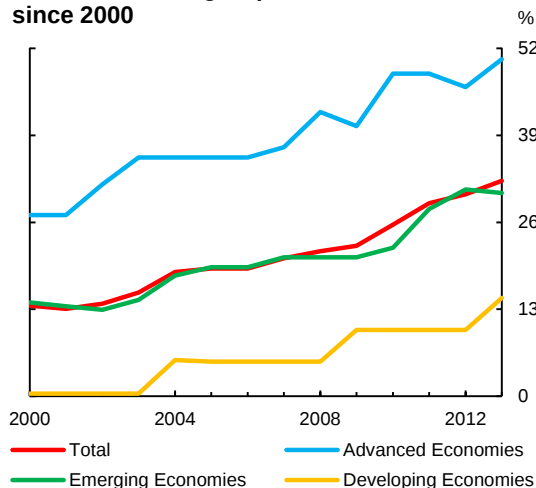
Charts 13a and b draw on recent work by the IMF, which shows that macroprudential policies in the form of maximum loan-to-value (LTV) or debt-to-income (DTI) ratios have tightened across a broad range of countries over the past 10 years.³¹ The IMF's research, as well as that of other economists, has found evidence suggesting that the tightening has helped to:

- reduce the procyclicality of household credit and bank leverage;
- moderate credit growth;
- improve the creditworthiness of borrowers; and
- lower the rate of house price growth.

The most effective macroprudential policies to date appear to have been the imposition of maximum LTV and DTI constraints.³² Increased capital weights on bank holdings of mortgages have also had an impact.³³ While long-term evidence on these instruments is not yet available, permanent measures that address structural regulatory weaknesses and that are relatively straightforward to implement and supervise will likely be the most effective over time.

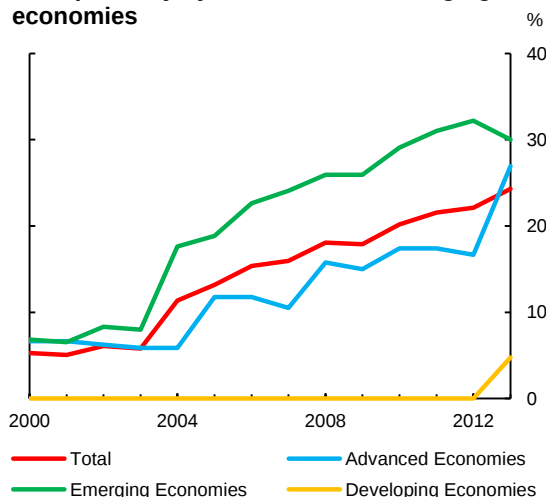
Chart 13: The use of macroprudential policies to address housing vulnerabilities is increasing

13a. Loan-to-value ratio restrictions have increased for all groups of economies since 2000



Source: IMF

13b. Debt-to-income constraints have been used primarily by advanced and emerging economies

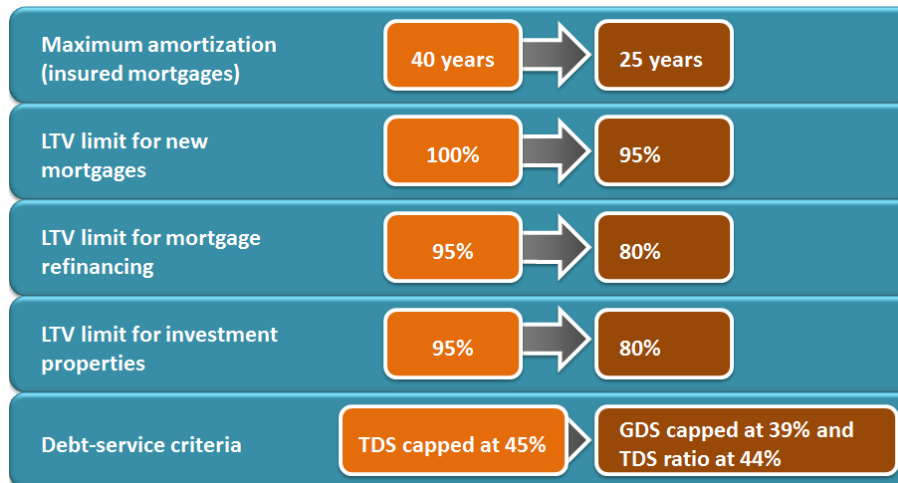


Last observation: 2013

In Canada, we have had four successive rounds of macroprudential tightening, primarily in terms of the rules for insured mortgages (**Figure 1**). I'll mention just a few of the highlights. The maximum amortization period for insured loans has

been shortened from 40 years to 25.³⁴ LTV ratios have been lowered to 95 per cent for new mortgages, and 80 per cent for refinancing and investor properties. These latter two changes effectively eliminate new insurance for refinancing and investor properties. Qualification criteria such as limits on the total debt-service ratio and the gross debt-service ratio, as well as requirements for qualifying interest rates, have also been tightened.³⁵

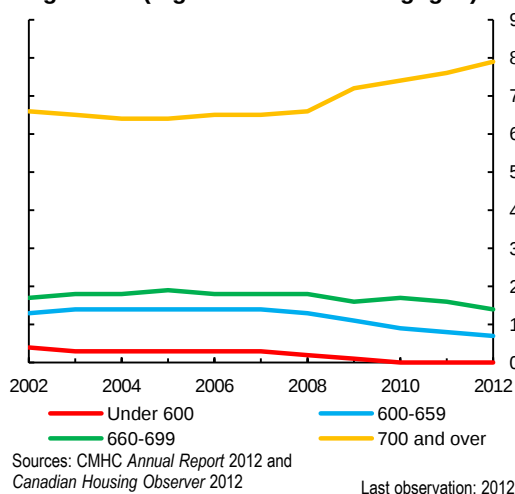
Figure 1: Macroprudential tightening in Canada: 2008-12



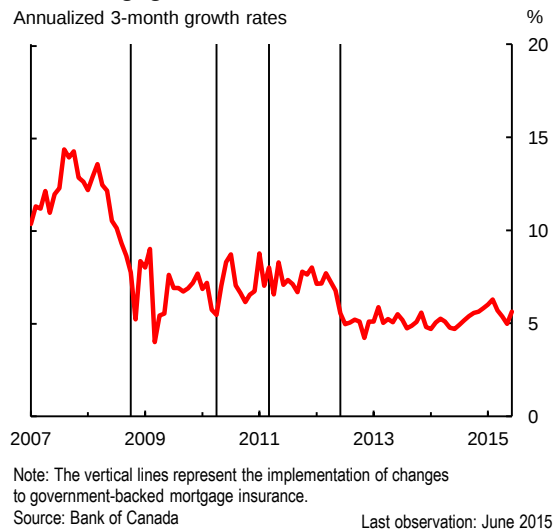
Recent evidence suggests that these measures have resulted in higher average credit scores, which have improved the quality of mortgage borrowing (**Chart 14a**). With respect to household credit growth, **Chart 14b**, shows that the trend growth of mortgage credit declined from 14 per cent in 2007–08 (3-month growth, annualized) to around 5 per cent in 2013–15.³⁶

Chart 14: Canadian post-crisis macroprudential policies have contributed to higher borrower quality and lower household credit

14a. Distribution of credit scores at origination (high-ratio CMHC mortgages)



14b. Mortgage credit



Conclusion

Let me conclude with a few key points from the mountain of facts, graphs and analysis that I have reviewed with you today. As I mentioned at the outset, the purpose of my presentation is to help provide more context for an informed discussion about housing and house prices given their importance to the Canadian economy and the financial system.

First, real house prices have been rising relative to income in Canada and other comparable countries for about 20 years. There are many possible explanations, mostly from the demand side, but also from the supply side.

Second, in terms of demand, demographic forces, notably migration and urbanization, have played a role in the evolution of house prices, as have improving credit conditions through lower global real long-term interest rates and financial liberalization and innovation. There are, of course, other demand factors that warrant more data and analysis, including the impacts of foreign investment and possible preference shifts.

Third, in terms of supply, the constraints imposed by geography and regulation have decreased housing supply elasticity, especially in urban areas. This reduced supply elasticity has interacted with demand shifts toward more urbanization to push up house prices in major cities.

Fourth, the credible and effective macro and financial policy frameworks in place in Canada and the other countries considered here have contributed to a high degree of macroeconomic and financial stability. Consequently, in the face of a protracted global recovery, their countercyclical policies successfully underpinned domestic demand in the post-crisis period. The resulting strength in the housing market has increased household imbalances, but the risks stemming from these vulnerabilities have been well managed by complementary macroprudential policies.

The experience in these countries therefore suggests that macroprudential policies that address structural weaknesses in the regulatory framework are best suited for mitigating such financial vulnerabilities. They reduce tail risks to financial stability and enhance the overall resilience of the financial system.

Thank you. Enjoy these last few days of summer.

Endnotes

1 Although these economies were not at the centre of the crisis, they were severely affected by it and the subsequent recession. They did not experience significant bank failures so the normal channels of mortgage finance continued to operate. Banks in these jurisdictions typically draw on external sources for some of their funding. During the peak of the crisis, these sources largely dried up and banks received temporary liquidity support from public sources. In Canada, for example, the federal government implemented the Insured Mortgage Purchase Program in 2009.

2 These house price measures are indexes, not levels, rebased from the real house price database of the Federal Reserve Bank of Dallas, with the average of each country's index for 2005 representing 100. The charts show house price movements for individual countries relative to their average over the period from 1975 to the first quarter of 2015.

3 Because of these multiple dimensions, as well as regional influences within a country, housing and house prices are intrinsically heterogeneous. Therefore, price measures are necessarily indexes. The SP/Case-Shiller city-level indexes of repeated sales control for quality, but their availability is limited to a few jurisdictions. In Canada, the equivalent to the Case-Shiller is the Teranet/National Bank Composite House Price Index. The Bank of Canada uses this index and the Canadian Real Estate Association MLS Home Price Index, as well as the MLS average for monitoring purposes. These three price indexes have exhibited the same upward trend.

4 Nominal personal disposable income was rebased to be consistent with the rebased house prices in each country, as described in footnote 2.

5 Sweden had the lowest rate of population growth among these countries, but it also experienced the largest increase in real house prices between 1995 and 2015.

6 The home-ownership rate of immigrants is slightly less than that of native-born residents in all five countries. "Indicators of Immigrant Integration: Settling In," OECD Publishing, 2 July 2015, p. 179.

7 "Fifty years of families in Canada: 1961 to 2011," Statistics Canada.

8 In Canada, the evidence indicates that much of the increase in home ownership is among the older cohort of the population, which suggests that longer and healthier life spans may have supported house demand in recent years.

9 For example, the urbanization ratio in Canada increased from 75.61 per cent in 1975 to 77.68 per cent in 1995 and 81.65 per cent in 2014. New Zealand is the most urbanized country in the sample; its ratio was already above 80 per cent in 1975.

10 See, for example, *Agglomeration Economics*, edited by Edward L. Glaeser, National Bureau of Economic Research Conference Report (Chicago: University of Chicago Press, 2010).

11 For more on the decline in real long-term interest rates, see C. Wilkins, "Monetary Policy and the Underwhelming Recovery" (speech to the CFA Society, Toronto, 22 September 2014).

12 For example, in Canada discounted 5-year mortgage rates have declined by about 470 basis points since 2000, from just above 7.25 per cent to 2.55 per cent.

13 See International Monetary Fund "Housing and the Business Cycle" in *World Economic Outlook*, April 2008; and E. Cerutti, J. Dagher and G. Dell'Ariccia "Housing Finance and Real-Estate Booms: A Cross-Country Perspective," IMF Staff Discussion Note, June 2015.

14 See International Monetary Fund "Housing and the Business Cycle" in *World Economic Outlook*, April 2008

15 Comparable time-series data for New Zealand are not available.

16 Since covered bonds are relatively senior in the creditor hierarchy in the event of insolvency, they have a preferential claim over depositors and other debt-holders.

17 All of the countries, except Sweden, are significant commodity exporters. From 2002 until 2014 they benefited from rising commodity prices.

18 Credibly reducing expected inflation also contributes to lower nominal mortgage rates. The effect of this is to spread the real burden of servicing a mortgage more evenly over its term.

19 Foreign investors also perceived these countries as attractive locations to invest in real estate, although the impact of their investment on house demand and prices in the countries is unlikely to be widespread. A recent survey of international real estate investors found that Australia, Canada, Sweden and several other countries represent the "most stable and secure" environments for real estate investment. (See *Foreign Investment Survey*, Association of Foreign

Investors in Real Estate, January 2013.) The IMF, in a review of existing—albeit scarce—evidence, concluded that the impact of foreign investors on real estate prices is not pervasive, but is limited to certain urban markets and at higher price ranges. (See H. Ahir, H. Kang and P. Loungani, *Seven Questions on the Global Housing Markets*, IMF Research Bulletin, September 2014.)

20 Examples of such policies include favourable tax treatment (mortgage interest deductibility, reduced capital gains, tax deferred home-ownership savings programs) and public mortgage guarantees.

21 Given recent rises in house price, the increase for Vancouver shown in Chart 10 is lower than might be expected because the starting point of the sample (1995) was a significant peak for prices in Vancouver. House prices shot up 34 per cent from 1990 to 1995 while other Canadian cities had either negative or minimal growth of less than 10 per cent. From 1995-2005, house prices in Vancouver rose by 48 per cent, but that was outpaced by price increases in other Canadian cities that ranged from 65 to almost 140 per cent. Winnipeg's decline in population density is, in part, due to a 30 per cent increase in its municipal boundaries over this period.

22 This relationship is also true for U.S. cities. See "Urbanization & Canadian REITs," CIBC Institutional Equity Research Industry Update, April 2012.

23 As cities grow, the price of housing in the urban core typically rises faster than in the periphery. This steepening of the "rent curve" reflects the agglomeration economies as well as the higher opportunity cost of commuting. See D. Capozza and L. Helsey, "The Fundamentals of Land Prices and Urban Growth," *Journal of Urban Economics*, 26, no. 3 (1989): 295-306.

24 City authorities have also encouraged condo development to achieve higher densities in certain areas and control infrastructure costs.

25 See, for example, A. Crawford and H. Faruqi "What Explains Trends in Household Debt in Canada?" *Bank of Canada Review* (Winter 2011–12): 3–15.

26 Extrapolative house price expectations may arise during periods of strong house price growth driven by shifts in demand and supply factors. See E. Cerutti, J. Dagher and G. Dell'Ariccia "Housing Finance and Real-Estate Booms: A Cross-Country Perspective," IMF Staff Discussion Note, June 2015

27 The December 2014 and June 2015 issues of the *Financial System Review* examine various estimates of the degree of overvaluation of Canadian houses.

28 The household debt-to-GDP ratio is more consistently measured across countries than the household debt-to-disposable income ratio and is thus more useful for comparison purposes.

29 While the significant reductions in interest rates in the immediate aftermath of the financial crisis increased house affordability in these countries, this gain has been offset by the ongoing increases in house prices. For example, Chart 6 in the December 2014 *Financial System Review* shows that the affordability of houses in Canada has been relatively unchanged since 2008.

30 Evidence in "Debt and (Not Much) Deleveraging" (McKinsey Global Institute, February 2015) suggests that much of the debt in countries in the comparison group is held by relatively high-income households.

31 E. Cerutti, S. Claessens, and L. Laeven, "The Use and Effectiveness of Macroprudential Policies: New Evidence," IMF Working Paper WP/15/61, March 2015.

32 Ibid.

33 Mortgage underwriting standards have also been tightened recently in many countries, as they have implemented the Financial Stability Board's *Principles for Sound Residential Mortgage Underwriting Practices*, April 2012.

34 Uninsured mortgages are still available with longer amortizations; the normal maximum is 30 years.

35 The total debt-service ratio is the percentage of gross annual income required to cover annual payments associated with housing and all other debt obligations. The gross debt-service ratio includes only housing-related payments. Other changes to insured mortgages include a minimum credit score, with limited exceptions; stronger loan documentation standards to ensure the reasonableness of the property value and of the borrower's sources and level of income; mortgage insurance eliminated for non-amortizing home-equity lines of credit; and mortgage insurance now limited to homes with a purchase price of less than \$1 million. In addition, mortgage and mortgage insurance underwriting principles have been made consistent with international standards. See Guidelines B-20 and B-21 issued by the Office of the Superintendent of Financial Institution.

36 Other factors also influenced the growth of mortgage credit over this period. In particular, note that in late 2008–09 the Canadian economy was in a recession. The decline in that period should not be interpreted as a result of the first wave of tightening of the mortgage rules. Similar evidence on the impact of these macroprudential policies is found by I. Krznar and J. Morsink, "With Great Power Comes Great Responsibility: Macroprudential Tools at Work in Canada," IMF Working Paper WP/14/83, May 2014.