

Canada: Selected Issues Paper

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CANADA

Selected Issues

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Approved by the Western Hemisphere Department

November 24, 2010

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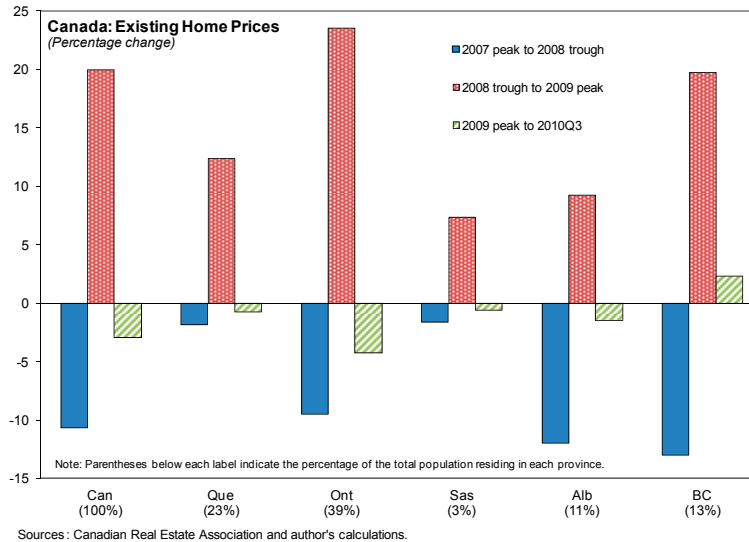
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I. THE POST-CRISIS CANADIAN HOUSING MARKET¹

A. Introduction

1. **Canadian house prices recovered strongly in the post-crisis era but recently stalled.** After falling by over 10 percent from their pre-crisis peak levels, Canadian Real Estate Association (CREA) existing house prices have recovered rapidly following the financial crisis, rising by over 20 percent from their 2008Q4 trough levels.² However, since end-March 2010, house price increases have come to a halt, with prices stabilizing or falling slightly. Across regions, Quebec essentially experienced no declines in house prices even during the crisis, while western provinces suffered double-digit price losses during the crisis, partly reflecting the downward pressures on commodity prices. Ontario and British Columbia experienced rapid house price increases of around 20 percent on average since their crisis-related trough levels, ahead of the introduction of the harmonized sales tax.



2. **This chapter estimates the evolution of equilibrium real home prices in the post crisis period in key provinces.** Specifically, we look closely at fundamental determinants of

¹ Prepared by Evridiki Tsounta.

² There are numerous measures of house prices available in Canada, including new house price index provided by Statistics Canada, existing home prices provided by the Canadian Real Estate Association (CREA) and the Teranet-National Bank existing home price index. While the latter is similar to the Case-Shiller index, CREA's sales weighted index remains the most widely used given its larger sample size (all provinces, more years, all multiple listing sales by realtors). This measure exhibits the largest volatility, including large upswings, does not take into account compositional effects, and in that respect it should represent an upper limit in terms of any deviations from economic fundamentals. Our analysis is based on the CREA index unless otherwise noted.

house price developments in five large Canadian provinces (Alberta, British Columbia, Ontario, Quebec, and Saskatchewan) to come to an assessment about possible deviations from equilibrium prices. Following Tsounta (2009), we use an econometric model to estimate the equilibrium house prices, as determined by demand (derived on the basis of factors such as disposable income and demographic developments) and supply (derived from factors influencing the available housing stock). The specification of these models is a long-run (cointegration) relationship between house prices and their determinants, which is then embedded in an error-correction mechanism. We examine current valuations against economic fundamentals using quarterly regional data—such as disposable income, demographic developments (which also account for inter-provincial and international migration trends) and mortgage credit for the period 1993Q1–2010Q3.

3. Results suggest that home price developments are largely explained by fundamentals throughout Canada, with the possible exceptions of Ontario and British Columbia. While prior to the crisis the commodity boom had pushed house prices in western provinces above levels explained by economic fundamentals, the latest data suggest that house prices are above model predictions only in British Columbia and Ontario (and to a much lesser extent in Quebec and Alberta), possibly related to sharp activity prior to the introduction of the harmonized sales tax in the two provinces, which raised services costs for buying some houses (discussed in more detail later on). Specifically, we find that house prices in Ontario and British Columbia are around 9–14 percent above levels predicted by our econometric model as of the third quarter of 2010. In contrast, house prices in Quebec and Alberta are only slightly above levels predicted by the model while Saskatchewan appears to have house prices below levels dictated by fundamentals even though both of the resource-rich western provinces of Alberta and Saskatchewan had experienced significant deviations from economic fundamentals during the housing and commodity boom period. Despite the limitations of econometric estimates of house-price dynamics, the measured small degree of house price deviations from model predictions coupled with the recent cooling in the housing market suggest that, on the national level, Canadian prices are trending towards levels dictated by economic fundamentals.

4. Analyzing house-price valuations is important for various reasons:³

- *Households' behavior.* As housing represents the largest single asset for most households, changes in its valuation would have important consequences for their balance sheets and thus spending behavior.
- *Financial soundness.* Mortgages and other real-estate related assets also represent an important component of financial institutions' balance sheet (almost a third of chartered

³ Tsounta (2009) provides a more detailed discussion of the macro-financial linkages surrounding the housing sector and the vulnerabilities amid highly indebted Canadian households.

banks' assets, with mortgage credit rising by an average of 7.7 percent per year during 2000–08, then contracting by 4 percent in 2009), implying that housing market developments could have important implications for the health of the financial system, including profitability and soundness.⁴

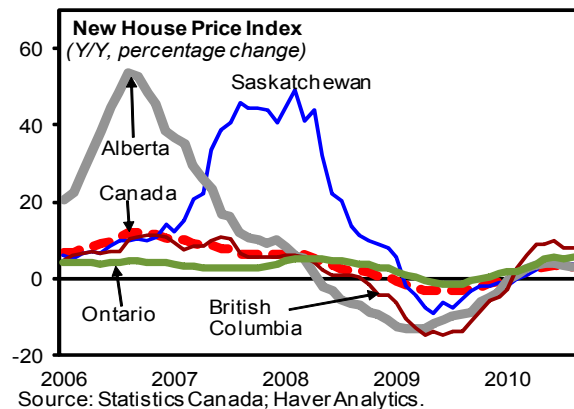
- *Policy Implications.* House prices also affect the consumer price index, and thus inflationary trends and expectations. As a result, understanding housing price dynamics has important implications for monetary policy in its role to preserve price stability as well as financial stability. Last but not least, revenues from real estate transactions (including construction-related income and excise taxes) have an important impact on a country's fiscal position. More generally, the construction sector could have important implications in the overall performance of the economy; it employed 6½ percent of the Canadian workforce (over 1 million) in 2009 and deducted over ½ percentage point from growth (versus a positive average annual contribution of 0.3 percentage points between 1997–2007).

5. **The paper is structured as follows.** The next section analyzes recent housing market developments in Canada. Section III describes the results of our analysis and Section IV concludes.

B. The Ups and Downs Following the Crisis

6. **Similar to most OECD countries, Canadian housing activity and prices were hit hard by the financial crisis.** In particular,

- New house prices experienced a moderate retrieval at the national level (falling by 3 percent in 2009). However, after rising impressively in the west during the commodity boom years, they have plummeted amid the financial crisis and the retrenchment in commodity prices, falling by around 6.5 percent in British Columbia and 10 percent in Alberta in 2009 alone.⁵



⁴ Chapter 5 provides a more detailed discussion of the Canadian mortgage market.

⁵ For example, in late 2006, new house prices in Alberta were 50 percent higher than a year ago (up 97 percent from end-2002 to their peak in late-2007) with more sustained increases in Saskatchewan (up over 120 percent between end-2002 and their peak in mid-2008). In contrast, prices in the rest of Canada exhibited more moderate increases, rising at most by around 13 percent (in Fall 2006) on an annual basis (up 41 percent between end-2002 and their peak in early 2008).

- Teranet-National Bank's existing home price index also shows significant declines amid the financial crisis, especially in the resource-rich western provinces and the financial hub of Toronto (the index records house prices in Canada's six metropolitan areas of Ottawa, Toronto, Calgary, Vancouver, Montreal, and Halifax).

Cumulative Nominal Changes in House Prices
(Percentage change)

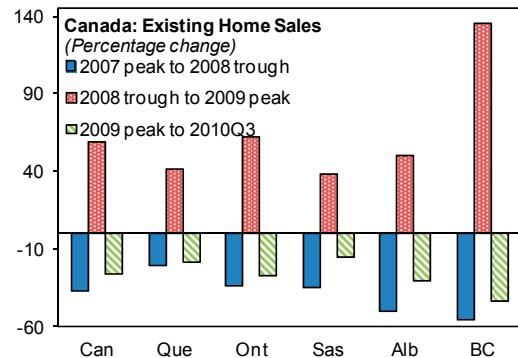
	Peak to trough (crisis)	Since trough to August 2010
Canada	-8.9	17.0
Calgary, AL	-15.4	8.2
Montreal, QU	-1.6	12.9
Ottawa, ON	-4.8	18.5
Toronto, ON	-11.3	23.1
Vancouver, BC	-12.0	17.2
Halifax, NS	-3.8	12.2

Source: Teranet-National Bank and author's calculations.

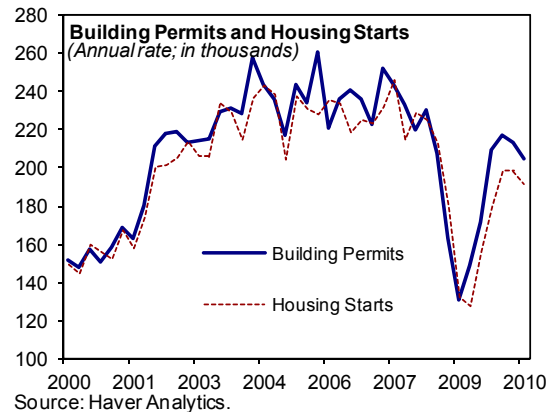
7. **The retrenchment in house prices during the financial crisis also coincided with declining construction and sales activity.** In April 2009, housing starts reached a low not seen since 1996 while building permits were 40 percent down from their all time peak (recorded in December 2005). In regional terms, the west experienced remarkable decreases in housing starts and building permits; for example, in early 2009, housing starts and building permits were around one-fifth the levels recorded in the commodity boom years, while CREA's existing home sales declined by over 35 percent peak-to-trough, with the largest declines experienced in the resource rich provinces of British Columbia and Alberta.

8. **The Canadian housing market recovered strongly following the crisis.** Existing house prices have rebounded in 2010, with British Columbia's Teranet-National Bank existing home price index rising by over 11 percent (year on year) in August 2010 and Ontario house prices rising by around 12 percent (both quality adjusted); smaller increases were recorded in the rest of

Canada. Traditional valuation measures (house price-to-income and house price-to-rent) had reached historic highs during that period (Figure 1). Similarly, housing activity was on the rise with building permits and housing starts almost doubling between February 2009 and March 2010, with particularly large increases recorded in British Columbia. CREA's existing home sales have also more than recovered their crisis-related losses, reaching an all-time high in 2009Q4, with particularly strong sales recorded in Ontario and British Columbia (up 62 and 135 percent, respectively since crisis trough).

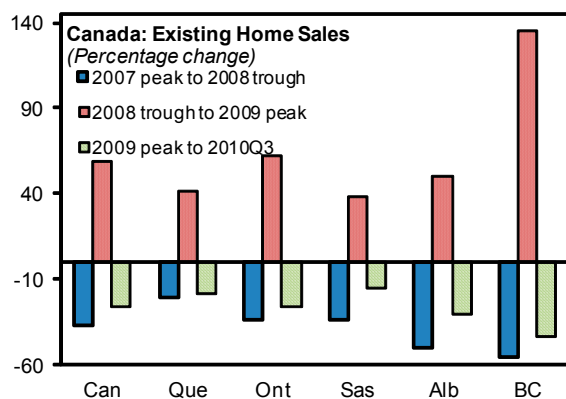


Sources: Canadian Real Estate Association and author's calculations.

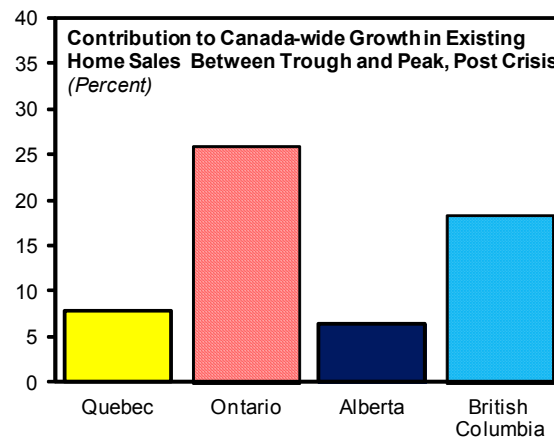


Source: Haver Analytics.

9. **There was a large increase in construction and sales activity in British Columbia and Ontario the last year partly due to the sales tax harmonization.**⁶ Existing home sales reached a historic peak at end-2009 with Ontario and British Columbia accounting for three-fourths of this impressive performance. The large concentration of activity in Ontario and British Columbia could partly reflect pent up activity prior to the introduction of a harmonized sales tax on July 1, 2010. In particular, starting in July an additional tax of 8 percent in Ontario and 7 percent in British Columbia is levied on the purchase of new homes, the renovation of existing homes, and the closing costs for home sales.⁷ While tax rebates would offset the majority of the additional tax on new housing for moderate priced houses (under C\$400,000 in Ontario and under \$525,000 in British Columbia),⁸ costs of services related to the purchase of houses would rise by around 0.6 percent of the selling price.⁹



Sources: Canadian Real Estate Association and author's calculations.



Sources: Canadian Real Estate Association and author's calculation.

10. **The very strong housing economic activity had prompted policy action by the authorities.** In February 2010, Finance Canada (2010) announced a number of steps to support the long-term stability of Canada's housing market and help prevent negative trends from developing. Specifically, effective April 19, 2010, the rules for government-backed insured mortgages were amended as follows:

⁶ The two provinces comprise 50 percent of Canadian economic activity and host over half the Canadian population.

⁷ For more details on the harmonized sales taxes in Ontario and British Columbia, please refer to TD Economics (2010).

⁸ Higher priced new houses would be directly impacted by the harmonization; TD Economics (2010) estimates that a C\$650,000 new house would cost C\$4,500 more in Ontario and C\$2,000 more in British Columbia.

⁹ TD Economics (2010) estimates that 75 percent of all new homes in Ontario are priced at below C\$400,000.

- Require that all borrowers meet the standards for a five-year fixed rate mortgage even if they choose a mortgage with a lower interest rate and shorter term. This initiative was meant to help Canadians prepare for higher future interest rates.
- Lower the maximum amount Canadians can withdraw in refinancing their mortgages to 90 per cent from 95 percent of the value of their homes.
- Require a minimum down payment of 20 percent for government-backed mortgage insurance on non-owner-occupied properties purchased for speculation.

11. **Since spring 2010, the housing market has cooled.** Specifically, CREA's existing home prices have stabilized while home sales in the third quarter of 2010 are down 27 percent from their all-time peak in 2009Q4, with British Columbia's sales plummeting by 44 percent since the recent peak. Similarly, overall building permits are down 10 percent since March 2010 at the national level (down 20 percent in Ontario) while housing starts are down over 18 percent since April 2010 (down over 30 percent in Ontario).

C. Estimation

12. **The analysis is based on an error-correction model examining current valuations against economic fundamentals;** described in detail in Tsounta (2009). In summary, the price measure used is the existing home price from the Canadian Real Estate Association's Multiple Listing Service (MLS) database, and is deflated by each province's CPI for the period 1993Q1–2010Q3. We examine current valuations against economic fundamentals using quarterly regional data—such as disposable income, demographic developments, and mortgage credit. Disposable income and mortgage credit exhibited cyclical movements during the downturn. The analysis is based on an error-correction model, which combines the long-run, cointegrating relationship among the variables in levels and the short-run relationships among the first differences of the variables, separately for each of the five provinces considered, namely Alberta, British Columbia, Quebec, Ontario, and Saskatchewan.

13. **Estimation results reveal that prices in Ontario and British Columbia are somewhat above the levels implied by the model,** in Alberta and Quebec, house prices are essentially at equilibrium, while house prices in Saskatchewan appear to be somewhat lower than levels predicted by fundamentals, in sharp contrast with the experience during the commodity boom years (Figures 2–4). Home prices as measured by the CREA index were found to be around 9–14 percent above model predictions in British Columbia and Ontario at the end of the third quarter of 2010, with the recent cooling in the housing market mitigating some of the earlier larger deviations from model predictions. We find that Ontario's house prices have been above model estimates since mid-2009, while Quebec appeared to have weathered the housing boom and crisis with somewhat moderate deviations from model estimates. British Columbia experienced higher house prices than dictated by the model during the commodity boom, with a

temporary correction during the crisis; however, recent estimates suggest that house prices are above levels dictated by the model, though declining. Given that most house price developments are explained by our model predictions and the degree of uncertainty surrounding such kind of estimations, the Canadian housing market, on the aggregate, does not seem to deviate significantly from levels dictated by economic fundamentals. For reference, according to Klyuev (2008) at the peak of the U.S. housing bubble, price-to-fundamentals deviations using a similar model were of the order of 30–40 percent (the smallest deviation was in the Midwest, at 18 percent).

**House Price Deviation from Model
Predictions, 2010Q3
(In percent)**

Alberta	3.0
British Columbia	9.0
Ontario	14.1
Quebec	7.3
Saskatchewan	-13.5

Source: Author's Estimates.

D. Conclusions

14. House prices declined markedly in Canada with the financial crisis but then recovered strongly. This paper uses an error-correction model to assess the current extent of overvaluation in provincial house prices as measured by the CREA index. Our work generally confirms previous work (e.g., Tsounta (2009), and IMF (2004, 2008, 2009)), which find that while house prices might be a bit on the high side compared to model estimates in some regions, overall they are close to equilibrium. The results—which given the approximations implicit in the model and the difficulties of taking into account all possible factors in analyzing house price dynamics have to be taken with due caution—suggest that the marked increases in house prices, especially in Ontario and British Columbia following the crisis trough, led real house prices to rise somewhat above levels implied by our econometric model. In these two key provinces, the current deviations average at around 9–14 percent. In contrast, Alberta and Saskatchewan house prices are now closer to levels predicted by the model, in contrast to their performance during the commodity boom years.

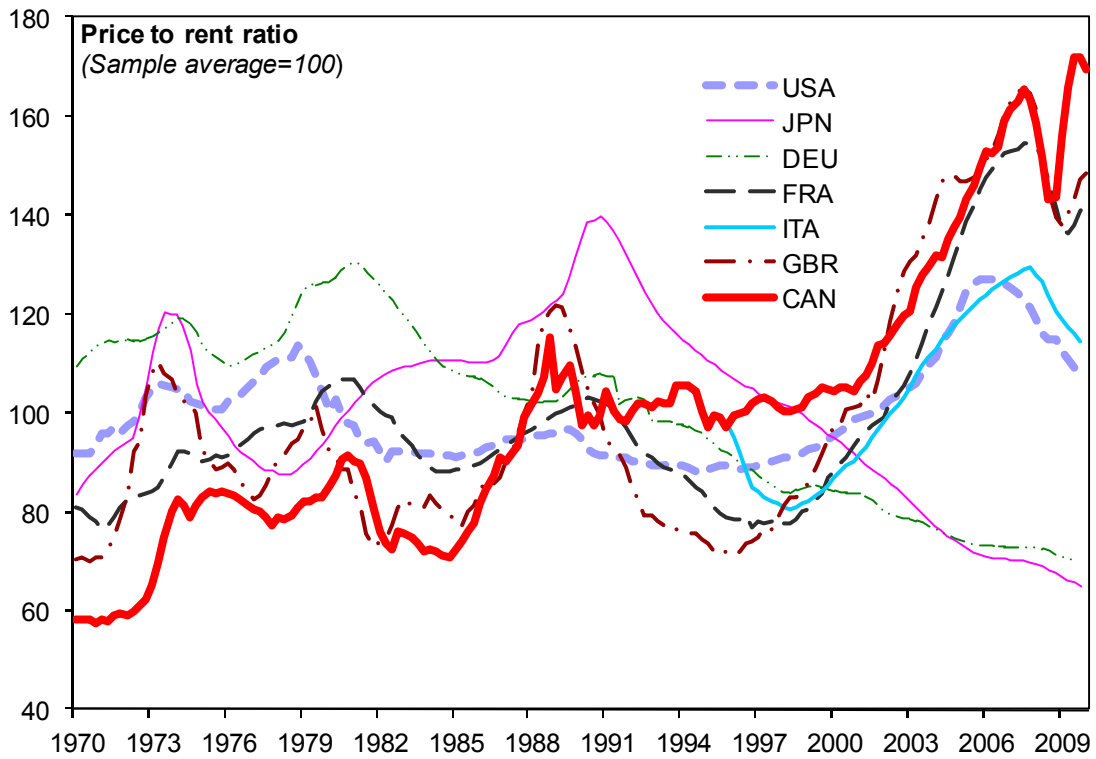
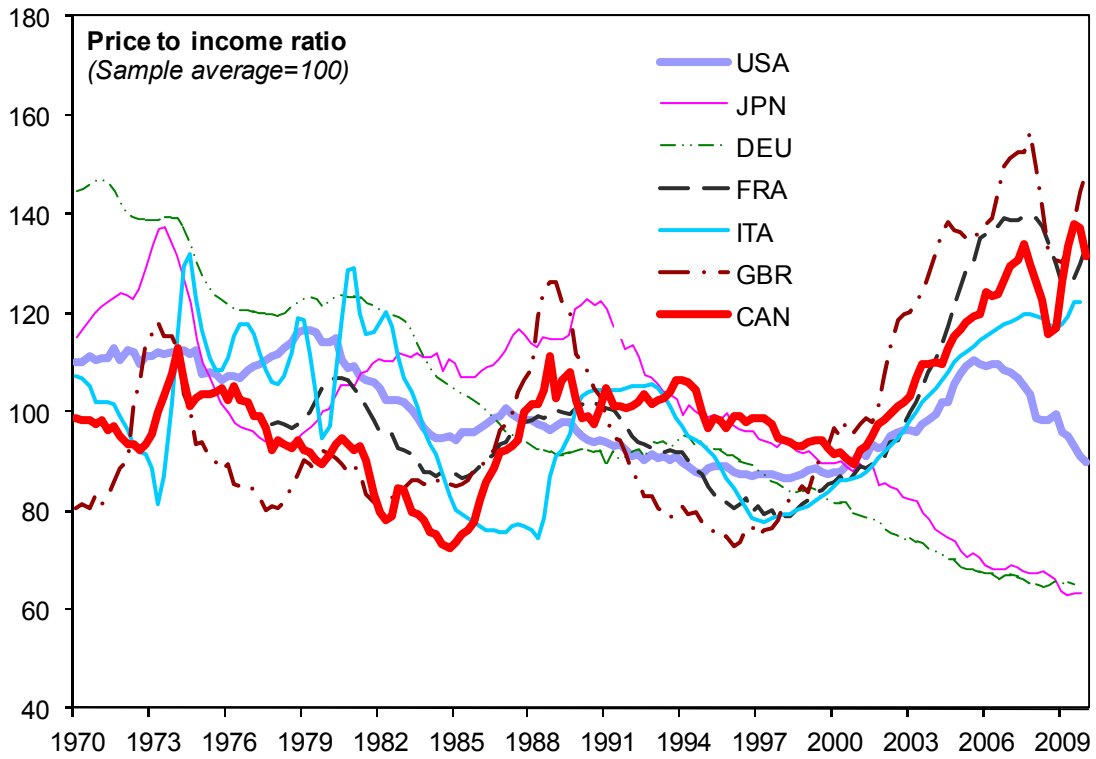
15. The authorities' proactive response in addressing possible housing market concerns in recent years, has been important in explaining Canada's healthy housing market performance thus far. Prior to the crisis, in order to protect the Canadian housing market from bubbles, the authorities had lowered the maximum amortization period for new government-backed mortgages to 35 years, required a minimum down-payment of five per cent for new government-backed mortgages, established a consistent minimum credit score requirement, and introduced new loan documentation standards. These rules, set by the Canadian Mortgage Housing Corporation, limited the risk of relaxation of lending standards, and as such limited Canada's exposure to the subprime market. On the onset of the crisis, the authorities took steps to bolster the housing market by purchasing mortgage-backed securities, expanding the Canada Mortgage Bond program to 10-year (from five-year) maturity, enhancing liquidity, lowering policy and thus mortgage rates, and announcing a temporary home-renovation tax credit as well

as a first-time homebuyers tax credit. As noted earlier, in April 2010, amid concerns for an overheating Canadian housing market, the government tightened mortgage rules for obtaining government-insured mortgages.

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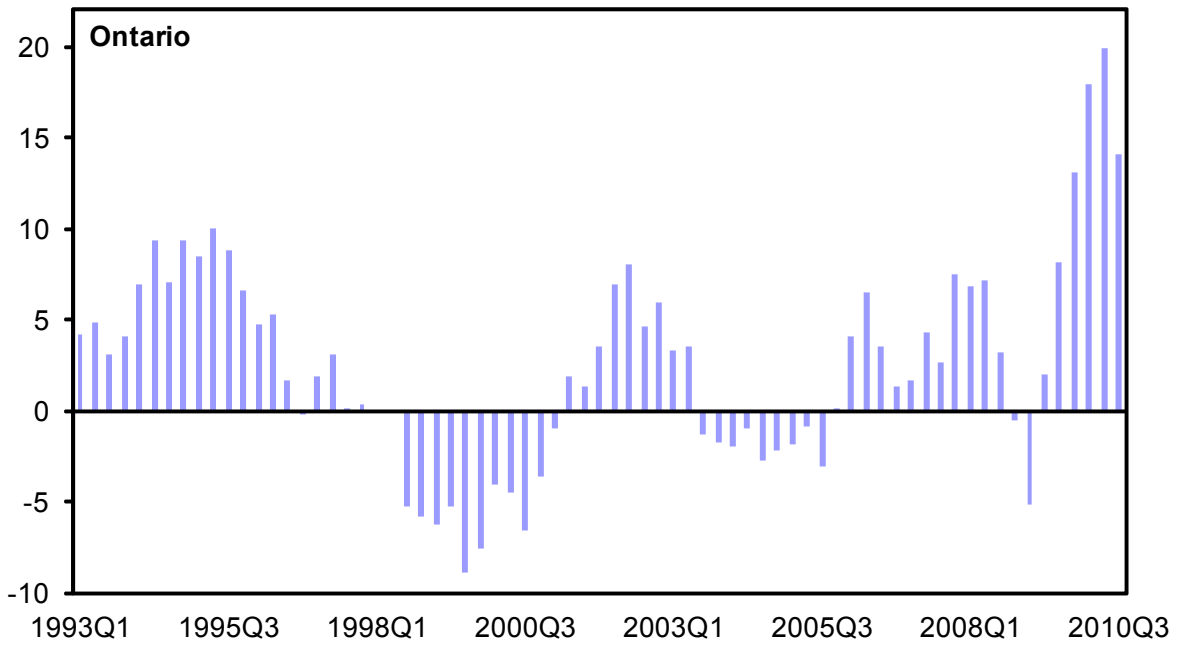
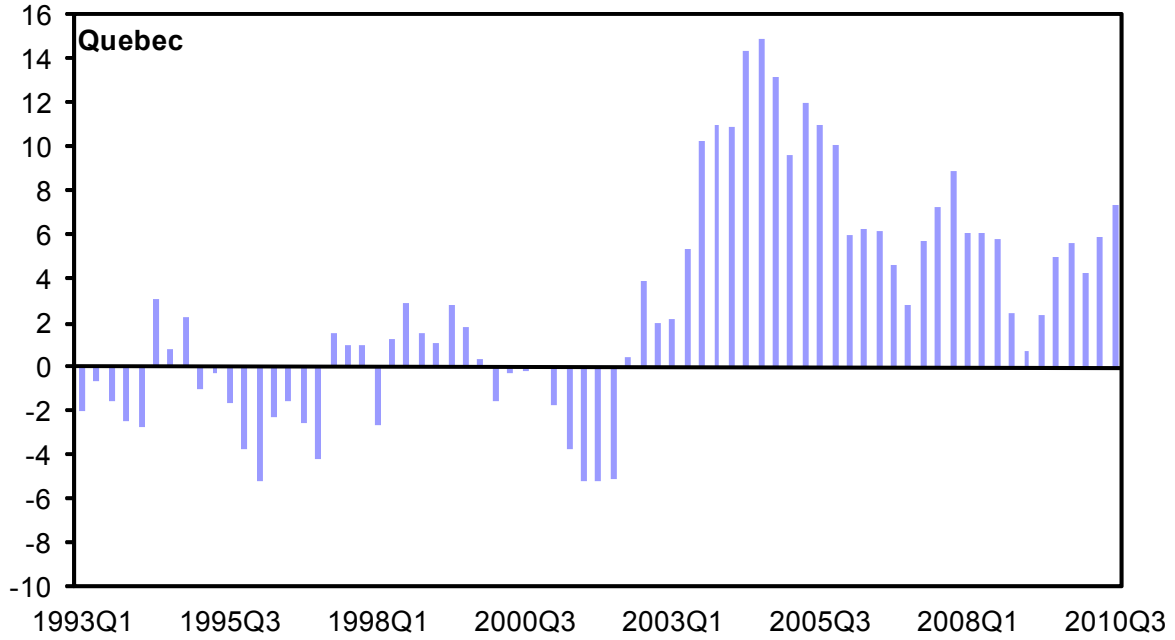
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Figure 1. G-7: Price-to-income and price-to-rent ratios, 1970-2010



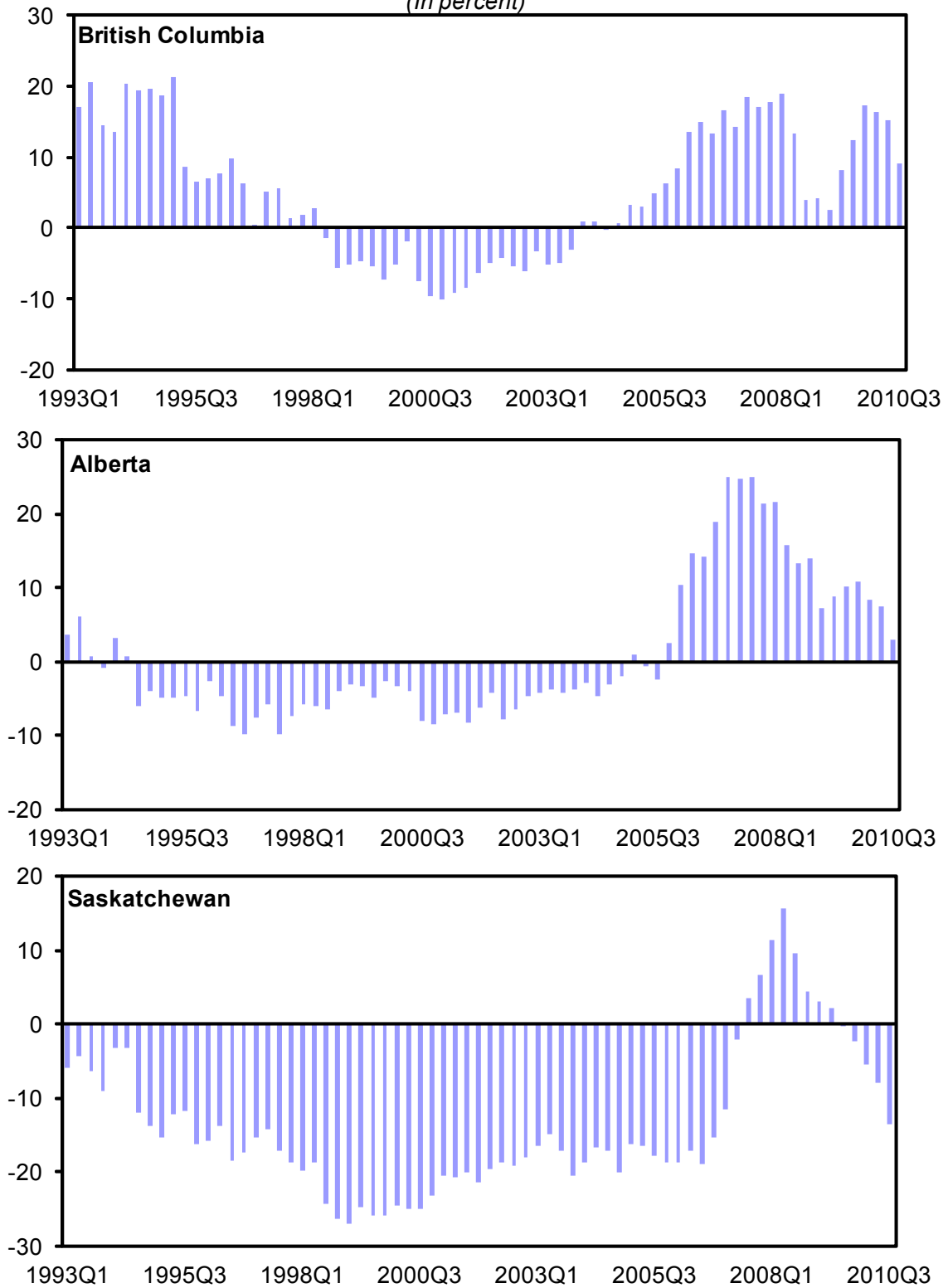
Sources: OECD and author's calculations.

Figure 2. Select Eastern Canadian Provinces: House Price Deviations from Model Predictions, 1993Q1-2010Q3
(In percent)



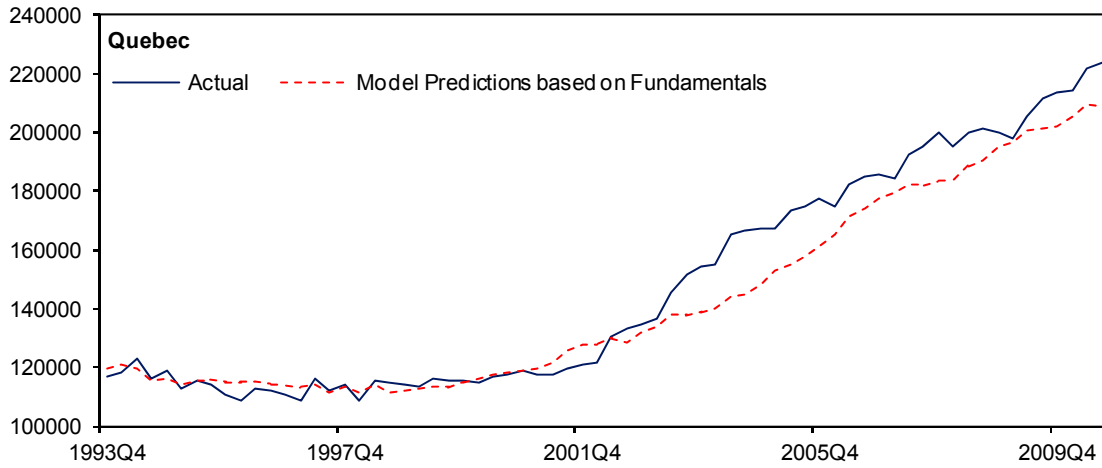
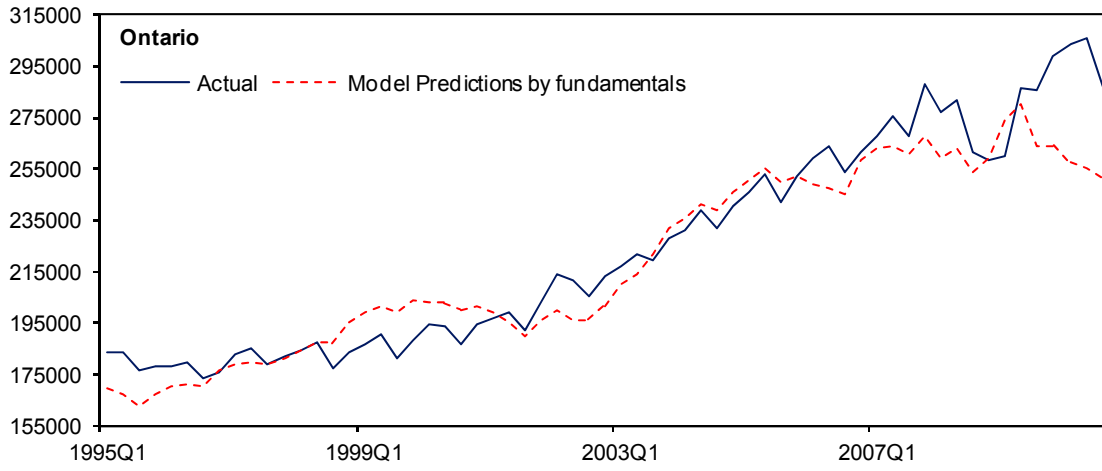
Source: Author's calculations.

Figure 3. Select Western Canadian Provinces: House Price Deviations from Model Predictions, 1993Q1-2010Q3
(In percent)



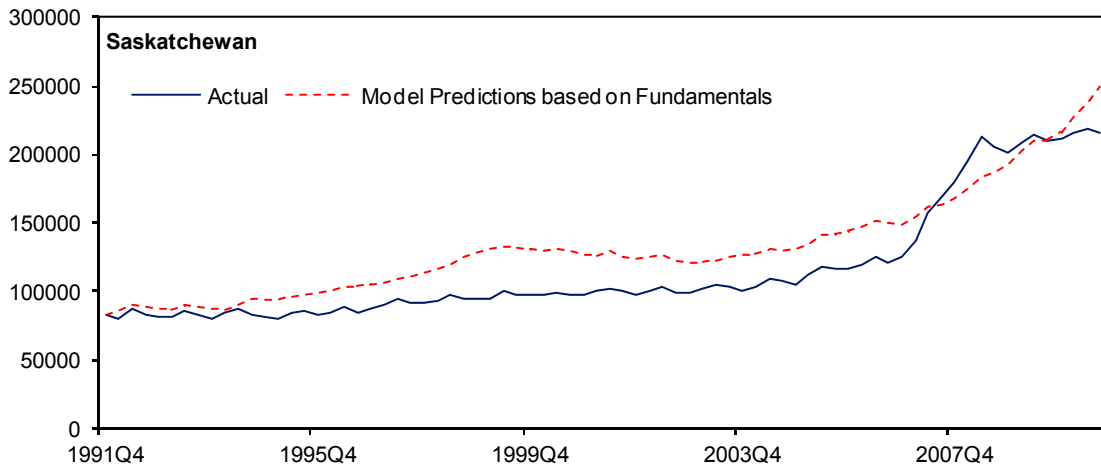
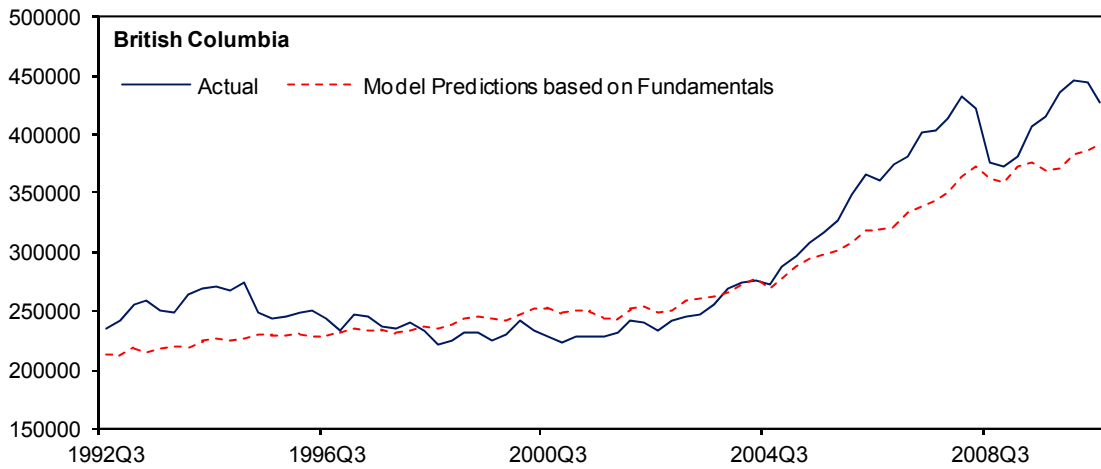
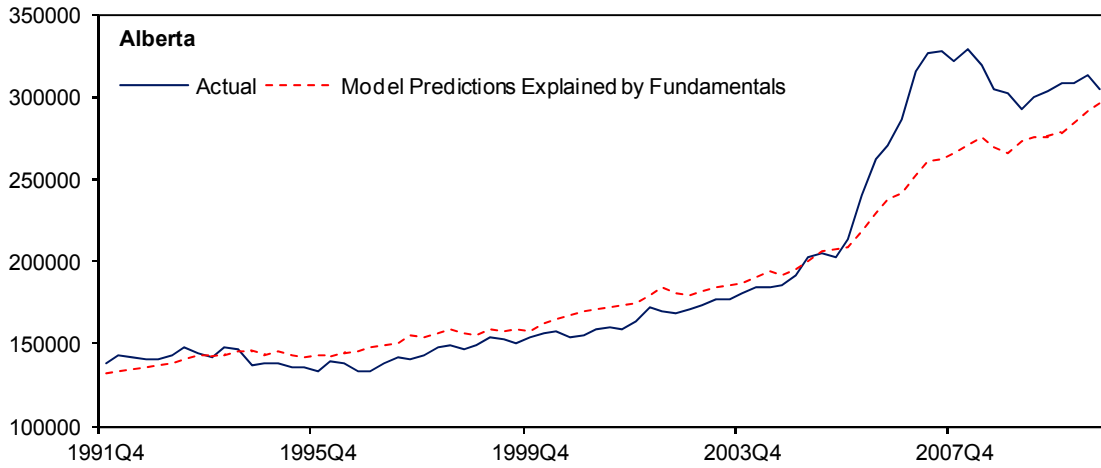
Source: Author's calculations.

**Figure 4a. House Price Dynamics
(In Canadian dollars)**



Sources: Canadian Real Estate Association and author's calculations.

**Figure 4b. House Price Dynamics, continued
(In Canadian dollars)**



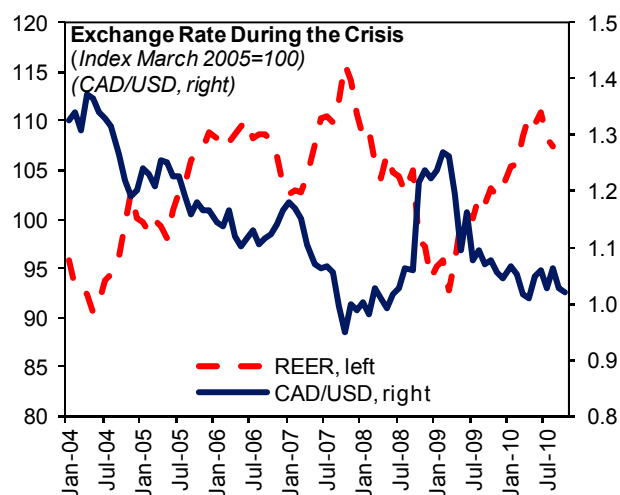
Sources: Canadian Real Estate Association and author's calculations.

II. INTERPRETING CANADA’S CURRENCY MOVEMENTS DURING THE CRISIS¹

The Canadian dollar oscillated sharply during the global financial turmoil in line with other world currencies. Using different statistical tools, we find that this has been driven by “flight-to-safety” effects possibly related to swings in commodity prices—rather than carry-trade activity—similar to what happened with other advanced commodity exporters’ currencies. Results suggest, however, that the link between the CAD/USD and the terms of trade have become more attenuated recently.

A. Background

1. **At the onset of the global financial crisis the Canadian dollar depreciated strongly with respect to the U.S. dollar and in real effective terms.** This is largely believed to have been the result of three forces. First, given Canada’s large net exports of commodities, the collapse in world demand triggered a sharp correction in commodity prices weakening the Canadian dollar. Second, investors flew initially to safety toward U.S. dollar-denominated assets and away from most non-U.S. assets (including Canadian assets) in an aim to protect capital. Finally, Canada’s trade balance started to deteriorate as a result of the drop in U.S. income and relatively modest weakness of domestic demand, putting downward pressure on the loonie. As a result, the CAD/USD bilateral rate rose by 31 percent between May 2008 and March 2009.



Sources: Haver Analytics and Fund staff calculations.

2. **As the crisis matured, an improved global outlook and positive Canadian financial and economic news strengthened the value of the Canadian dollar.** By March 2010, the Canadian dollar had recovered much of its strength on the back of a strong rebound in commodity prices, a rapid economic recovery in Canada in the second half of 2009 and the first half of 2010, a strong fiscal position vis-à-vis peers, and a resilient financial system.

¹ Prepared by Nicoletta Batini and Thomas Dowling (both WHD).

3. **This paper examines possible drivers of the value of the Canadian currency during the crisis.** We use two methods: (1) an uncovered interest parity (UIP) decomposition focusing on portfolio considerations, namely the contribution of expected risks and return factors on Canadian dollar-denominated assets relative to U.S. dollar-denominated assets; and (2) a co-integration analysis that goes beyond relative return and risk factors to focus on long-run fundamental drivers of the Canadian dollar, namely Canada's net foreign asset position and terms of trade. For analytical purposes, we mark the beginning of the financial crisis as February 27, 2007.² This allows us to focus on exchange rate changes over a timeframe more than one year longer than used in existing studies of 2007-2009 crisis-related exchange rate movements. Among these, for example, Fratzcher (2009) rationalizes exchange rate swings during the recent crisis by telling a safe-haven story in which the global nature of the slowdown led investors to believe that negative shocks originating in the U.S. would affect foreign markets even more acutely. Kohler (2010), however, argues that exchange rate movements during this crisis were characterized by both safe-haven effects and carry trade that resulted from interest rate differentials.

4. **Results show that the behavior of the loonie during the crisis seems to have been dominated primarily by safe haven effects and swings in commodity prices.** This is similar to what is found for the Australian and the New Zealand dollar—the currencies of two other advanced commodity exporters.³ By contrast, we find that cumulative revisions to the nominal forward differentials between the Bank of Canada's target for the overnight rate and the Fed Funds rate played a little or no role in the loonie's movements during the crisis, an indication that carry trade activity or other return considerations did not dominate exchange rate changes during the crisis. Section II summarizes the results. An Appendix details the methodology used and the statistical tests.

² The Federal Reserve Bank of St. Louis (2009) also chooses this date to mark the beginning of the crisis. On that day, the Federal Home Loan Mortgage Corporation (Freddie Mac) announced that it would no longer buy the most risky subprime mortgages and mortgage-related securities, spurring a wave of panic toward such assets that in turn led to a series of bankruptcies and the subsequent cascade of well-known events.

³ For results on other countries including Australia and New Zealand, see: Batini, N. and T. Dowling, 2010, "Interpreting Currency Movements During the Crisis", International Monetary Fund Working Paper, forthcoming.

B. Empirical Results

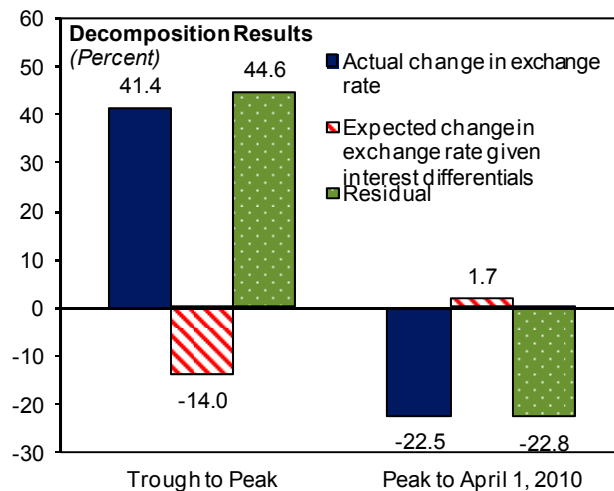
Results Based on the UIP Decomposition Method

5. **The Uncovered Interest Parity (UIP) condition is used to assess the contribution of monetary policy news in the United States to exchange rate developments in Canada during the crisis.**⁴ In practice, the UIP states that:

expected change in exchange rates between two countries	=	difference in interest rates between those two countries	+	difference in risk between the assets of the two countries
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So, theoretically, if the interest rate differential between two countries is 3 percent, then the currency of the nation with the higher interest rate would be expected to depreciate 3 percent against the other currency, controlling for differences in the perceived riskiness of country A's assets relative to country B's assets. Employing the instantaneous forward interest rate differentials in an adapted UIP framework, we can thus decompose exchange rate movements into changes attributable to monetary policy and a residual (see the Appendix for a detailed description of the methodology used).

6. **Results suggest that shifts in the Canadian dollar during the crisis were likely driven by flight-to-safety (first away then into the loonie) rather than by return considerations.** The CAD/USD depreciated by over 40 percent during the initial phase of the crisis (i.e., in the “trough-to-peak” period), then recouping some ¼ of its pre-crisis value by early 2010 (in the “peak-to-April 2010” period).⁵ Changes in expectations about forward



Sources: Bloomberg, Haver Analytics, and Fund staff calculations.

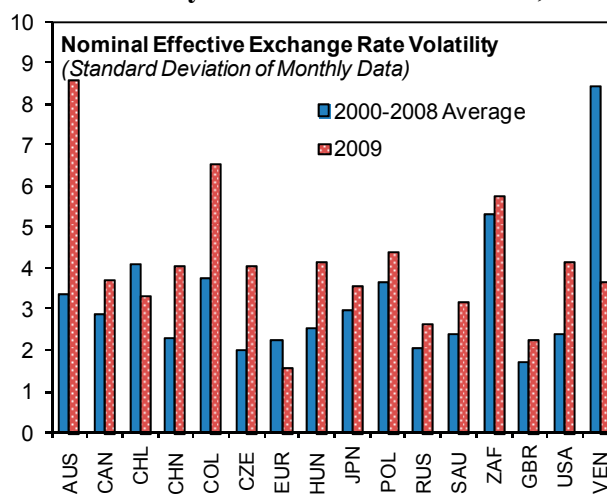
⁴ In theory, the UIP condition is accepted as intuitive, but debate over whether or not UIP is empirically valid continues. For the purpose of decomposition into its components, however, we need only to assume that interest rate differentials and exchange rate movements have a one-to-one relationship, an assumption that seems plausible (see Fisher et al, 1990).

⁵ The trough (11/06/2007) is defined as the minimum exchange rate (Canadian dollar/U.S. dollar) from the start of the crisis to April 1, 2010. The peak (3/9/2009) is defined as the maximum exchange rate from the trough to April 1, 2010.

differentials between Canadian and U.S. interest rates can explain neither the weakening nor the strengthening of the loonie during the crisis: the revisions would have suggested opposite movements in the currency. Thus, the UIP decomposition lends support to the view that swings in the CAD were driven by shifts in investors' sentiment first away and then into Canadian-dollar-denominated assets.

7. **The finding that the weakening of the CAD/USD reflected a flight-to-safety effect is in line with views of exchange rate developments at the time.** Most commentators saw the strength in the U.S. dollar at the beginning of the financial turmoil as a sign of panic and risk aversion, as investors liquidated investments bought at a time when interest rates heavily favored European or other non-U.S. assets. Institutional investors, faced with losses suffered on U.S. investments, were also liquidating overseas assets to meet margin calls. All these factors added to the U.S. dollar's strength as major foreign currencies were sold for U.S. dollars; returns ceased being the driver for investors, instead paving the way for strategies aimed at capital protection. This is in stark contrast to the Asian crisis of 1997–98 and the crisis following the Russian debt default in 1998 during which investors fled the currencies of the countries in crisis.

8. **The likelihood of an initial flight to safety away from the Canadian dollar is corroborated by the steep rise in 2009 in the volatility of the loonie.¹** In Canada, and other commodity exporters like Australia, and South Africa the volatility hike likely reflected increased uncertainty about the course of commodity prices at the onset of the turmoil. Several formerly planned economies—Russia, Poland, the Czech Republic, and Hungary—also saw more exchange rate volatility than other countries, reflecting the depth of the crisis there. Remarkably, the euro saw less volatility in effective terms in 2009 than it did in previous years.



Sources: INS and Fund staff calculations.

9. **The view that then the loonie strengthened because confidence returned also tallies with the conventional wisdom.** The decision in April 2009 of the Bank of Canada to slash rates to virtually zero while promising to hold them until mid-2010 ruled out future revisions to nominal rate differentials vis-à-vis the Fed Funds rate—that was already at the

¹ Volatility is here defined as the standard deviation of monthly exchange rates in a given year.

zero bound. This eliminated any market incentive to speculate on forward differentials between the Canadian and the U.S. dollar, implying that interest rate differentials could not be a driver of changes in the exchange rate after April 2009. According to the UIP set up, the appreciation in the CAD/USD must hence lie in the fact that these currencies started to be seen as safe havens in early 2009 (or that the U.S. lost part of its “heavenliness”). This is likely, considering that like other advanced commodity exporters, Canada experienced a milder recession and a swifter recovery vis-à-vis other advanced G-20 countries thanks to the early rebound in commodity prices.

Results Based on Cointegration Analysis

10. **Co-integration analysis is used as a second tool to unveil potential drivers of the CAD/USD during the crisis.** Along the lines of Coletti and van Norden (1993), Lafrance and van Norden (1995), and Charron (2001), we estimate an error correction model that exploits the long-run relationship between the real exchange rate, commodity prices (measured by the Chain Fisher BoC Commodity Price Index (NSA, 2002=100) deflated by Canadian CPI), and Canada’s net foreign asset position.² In the short-run specification, the model includes the differential between nominal monetary policy rates in Canada versus the United States as well real growth in emerging Asia among the set of exogenous regressors. Thus, while it does not exactly nest the Uncovered Interest Parity model, the model can help gauge whether interest rate differentials drive the exchange rate in the short run.

11. **Statistical tests confirm that, historically, the real exchange rate, commodity prices, and net foreign assets have moved together in the long run** (see the Appendix for more details on stationarity and co-integrating tests). Results indicate that at any point in time about a tenth of the deviation of the Canadian dollar from its fundamentals (i.e., commodity prices and net foreign assets) has been corrected every quarter. Our estimates of the long-run relationship are broadly in line with the previous literature (the long-run coefficient on commodity prices is 0.50, within the 0.5–0.8 range of point estimates for commodity prices in Coletti-Murchison, 1998; and Amano-van Norden, 1993). Importantly, the co-integrating vector is significant in the short-run equation, indicating that in the past, the CAD/USD real exchange rate has tended to slowly re-approach its co-trended variables following shocks. In the short run, the Canadian dollar is also driven by the first lag of the difference in the real exchange rate. However, the differential between Canadian and U.S. monetary policy rates is not statistically significant, thus results do not seem to support short-term interest rate parity between Canada and the United States.

² We also experiment with the terms of trade instead of commodity prices, but results are less stark.

12. **However, we find two signs of parametric instability post 2008, suggesting that the crisis may have changed fundamentally how the CAD/USD adjusts to changes in commodity prices:**

- The long-run relationship displays a break in mid-2008, suggesting that since then the real exchange rate is substantially stronger for given levels of commodity prices and net foreign assets.
- In the short-run specification, the error correction term shows signs of parametric instability in mid-2008 (indeed a slope dummy—with the dummy taking a value of 1 from 2008 Q3 onwards—interacting with the coefficient of the lagged dependent variable is highly significant). The coefficient on the slope dummy is greater than one, likely a sign of the unprecedented volatility of the exchange rate since 2008 and of its possible decoupling from fundamentals.

13. **The finding of a break corroborates the hypothesis that the CAD/USD during the crisis has indeed been dominated by flight-to-safety considerations.** Since expectations about future movements in commodity prices have in part reflected sentiment with regard to commodity exporters' currencies and commodity importers' economic performance during the turmoil, it is however difficult to identify a good model of the intra-crisis exchange rate movements using commodity prices among fundamentals. On the other hand, it is not obvious how to control for “flight-to-safety” effects in an episode like the financial crisis where investors were likely trading off expected volatilities on several currencies at once. Proxies capturing perceptions of volatility on U.S. assets, like changes in the VIX for example, are not statistically significant when included in the error correction model.

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APPENDIX 1. METHODOLOGY AND DIAGNOSTIC TESTS

A. UIP Decomposition

To determine the interaction between interest rates and exchange rates, we use the Uncovered Interest Parity (UIP) condition. The UIP's underlying assumptions enable us to identify the contribution of these shocks as the UIP condition holds for any period of time, thereby reducing the amount of noise and allowing for better identification.

In symbols, the UIP condition can be generally expressed as:

$$E_t s_{t+1}^x - s_t^x = i_{t,m}^{US} - i_{t,m}^x + \rho_t \quad (1)$$

Where s_t^x is the spot exchange rate (using the national currency per U.S. dollar); $E_t s_{t+1}^x$ is the expectation of the spot exchange rate in time $t+1$ of country x made at time t ; $i_{t,m}^x$ is the nominal interest rate in country x at time t ; $i_{t,m}^{US}$ is the U.S. nominal interest rate at time t ; and ρ_t is a currency risk premium that varies across periods. The term m requires the interest rates to be comparable, i.e., maturity, type of instrument, etc. Equation (1) states that the expected change in the exchange rate between the country's x currency and the U.S. dollar is equal to the difference in interest rates between these two countries, adjusted for risk.

We use a log-linearized adaptation of the UIP condition following the Bridgen (1997) methodology to determine what portion of the unexpected change is attributable to interest rate differentials. Forward substitution allows us to derive the cumulative forward differentials from the UIP and generates the following generalized expression:

$s_{t+k}^x - E_t s_{t+k}^x = \sum_{j=k}^{n-1} (E_{t+k} \mu_{t+j}^x - E_t \mu_{t+j}^x) - (E_{t+k} s_{t+n}^x - E_t s_{t+n}^x) - \sum_{j=k}^{n-1} (E_{t+k} \rho_{t+j}^x - E_t \rho_{t+j}^x)$	(2)
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where $\mu_{t+j}^x = (i_{t+j}^x - i_{t+j}^{US})$ represents the interest differential between country x and U.S. forward rates. For Canada's trough to peak, t is November 6, 2007; $t+k$ is March 9, 2009; and $t+n$ is the arbitrarily chosen terminal point (e.g., $n = 10$ years).

In Equation (2), the first RHS term is the forward interest differential, precisely, the cumulative revision to nominal forward interest differentials which expresses the expected difference between interest rates in country x and U.S. interest rates over some period. The forward differential is a measure of how much the expected rate of depreciation/appreciation of country x 's currency changed between t and $t+k$, subject to the choice of n . The next term on the RHS is the expected value of the nominal exchange rate of country x 's currency at time n . The last term on the RHS is the net change in country x 's currency risk premium

between t and $t+k$, also subject to the choice of n . Since only the first term is observable, we treat the two other terms as a single residual.

The UIP decomposition requires the use of instantaneous forward rates to calculate the cumulative revision to nominal forward interest differentials. Following Svensson (1994), zero-coupon rates are needed to estimate these instantaneous forward rates. Canada's zero-coupon rates were obtained from the Bank of Canada.

The instantaneous forward rates are provided for the United States (Federal Reserve Bank) while the rates for Canada are estimated using the parsimonious Nelson-Siegel (1987) parametric method, which is preferable to other types of estimation when fitting Nelson-Siegel models as explained in Gurkaynak et al. (2007). The zero-coupon rates are used to estimate the instantaneous forward rates in a two-step process according to the model:

$$r(t, T) = \alpha + \beta_1 \frac{(1 - e^{-\lambda T})}{\lambda T} + \beta_2 \left\{ \frac{(1 - e^{-\lambda T})}{\lambda T} - e^{-\lambda T} \right\} \quad (3)$$

Where $r(t, T)$ is the interest rate at time t , for maturity T ; α is a constant that represents the rate as T approaches infinity; β_1 and β_2 are parameters that define the curvature of the yield curve; and λ is a decay parameter that represents the persistence of short and medium term rates into the long run. To fit Equation (3), we first estimate the parameters α, β_1, β_2 , and λ using ordinary least squares (OLS) iteratively to minimize the sum of squared residuals by varying the parameters with $r(t, T)$ equal to the zero-coupon rates at time t . The initial value for each parameter is set at 1. We then derive the forward rates from Equation (3) by varying T over the maturities desired using the estimated parameters.

To quantify the contribution of changes in U.S. monetary policy on our sample of eight bilateral exchange rates using the UIP condition we follow five steps.

1) First, we identify the trough and peak of the Canadian dollar vis-à-vis the U.S. dollar from the beginning of the financial crisis until April 1, 2010. The trough is defined as the minimum exchange rate (Canadian dollar/U.S. dollar) from the start of the crisis to April 1, 2010. The peak is defined as the maximum exchange rate from the trough to April 1, 2010. Our decomposition results will examine how much of the trough-peak depreciation against the U.S. dollar and how much of the peak-to-April 1, 2010 appreciation can be explained using the UIP condition.

2) Second, for the trough-peak-April 1, 2010 dates, we obtain forward differentials by fitting zero-coupon rates to forward curves following the parametric estimation methodology of Nelson-Siegel.

3) Third, we obtain a measure of “news”. This quantifies what proportion of the change in the overnight nominal exchange rate can be attributed to an expected change—the exchange rate change implied by the interest rate differential according to the UIP— and to an unexpected change over the dates that we examine. This unexpected change is what we will call “news”.

4) Fourth, we decompose the “news” into: (i) changes in the differential between expected U.S. and Canadian interest rates up to some arbitrary terminal point and (ii) a residual term that includes changes in the expected value of the nominal exchange rate at that terminal point and changes in the currency risk premium.

5) Fifth, we attribute the “news” to monetary policy and non-monetary policy factors, based on a set of assumptions about the impact of monetary policy on interest rates at various maturities. This step implies a judgment about the ultimate cause of the change in the exchange rate, which is why we focus specifically on announcements during the crisis that pushed analysts to modify their expectations about the path of official rates.

The table below summarizes what we have discussed so far. Line one lists the actual percentage change of the bilateral exchange rate of country x vis-à-vis the United States. Lines two and three show the breakdown of the exchange rate movement on $t+k$ into the expected change (which we have stated is zero) and the “news”. The fourth and fifth rows of the table summarize the results obtained by applying the above cumulative forward revision and reflect the first term of the RHS of Equation (2). We calculate the term with $n=8$ and $n=12$ to generate a sensitivity band of 8 to 12 years since the value of the term depends on the n chosen. Put otherwise, these rows show how much of the “news” can be explained by changes in the forward nominal differential, once we assume that changes in the risk premium are independent of the changes in the long-run forecast of nominal exchange rates.

Decomposition Results Table

	Trough 11/6/2007	Peak 3/9/2009	Current 4/1/2010
Actual change against:		41.37	-22.49
<i>of which</i>			
Expected		0.00	0.00
"News"		41.37	-22.49
Cumulative revision to nominal forward interest differentials			
range as terminal horizon varies from 8 to 12 years	8 years	-11.54	1.48
	12 years	-16.41	1.86
<i>of which</i>			
Estimated real component		-2.90	0.16
Sensitivity band			
estimated range as p-horizon varies from 4 to 8 years	4 years	-1.64	0.39
	8 years	-4.84	0.16
Residual		44.27	-22.64
Sensitivity band			
estimated range as p-horizon varies from 4 to 8 years	4 years	43.01	-22.87
	8 years	46.22	-22.64

B. Co-Integration Analysis

(i) Model and Data

The general form of the model estimate in this paper is:

$$rer_t = f(pcomm_t, nfa_t, \Delta gdpEA_t, intdiff_t) \quad (1)$$

The sample period used for the estimation is 1992Q4 to 2010Q2.

The variable rer represents the logarithm of the nominal exchange rate expressed as U.S. dollars per Canadian dollar, adjusted for inflation by the ratio of Canada to U.S. GDP implicit price deflators. An increase in the variable denotes an appreciation.

The variable $pcomm$ represents the logarithm of the ratio of the Chain Fisher BoC Commodity Price Index (NSA, 2002=100) deflated by Canadian CPI.

The variable nfa represents the ratio of Canada's net foreign asset position to GDP.

The variable $\Delta gdpEA_t$, represents quarterly GDP growth rate (s.a.a.r) in emerging Asia.

The variable $intdiff_t$ measures the difference between the Canadian target for the overnight rate and the target for the Federal Fund rate.

The operator ‘ Δ ’ represents first differences. t are calendar quarters.

(ii) Empirical Results

Pre-test for Order of Integration

We begin our empirical analysis by examining the time series properties of each series. To this end we use the augmented Dickey-Fuller (1979), the Phillips and Perron (1988) and the Kwiatkowski, Phillips, Schmidt and Shin (1992) tests.¹

The tests suggest that the real exchange rate, real commodity prices, and the net foreign assets to GDP ratio are well characterized by I(1) processes (see Table 1).

Table 1. Tests for Unit Roots and Stationarity (sample period: 1992Q4 to 2010Q2)

Variable	ADF lag length	ADF	PP	KPSS
<i>rer</i>	1	-1.0347	-0.3345	0.6304***
<i>pcomm</i>	2	0.3455	0.5296	0.8974***
<i>nfa</i>	0	-1.2676	-1.2255	1.0615

Note: The asterisks, *, **, and *** indicate that the null hypothesis is rejected at the 10, 5, and 1 per cent level of significance respectively. The number of lags was determined by the Schwarz info criterion (max lag=11) for the ADF tests and by the Newey-West automatic truncation lag selection for the PP tests.

Co-Integration Tests

We use the Johansen (1988) procedure which estimates the system simultaneously, allowing for the possibility of endogenous regressors (Table 2). The preferred system includes the log of the real exchange rate, the log of the Bank of Canada-real-U.S. dollar-non-energy commodity price, and the NFA to GDP ratio in the co-integrating vector. The short-run dynamics include one lag of the first difference of the real exchange rate, as well as two lags of the first difference of commodity prices.

Johansen (1992) demonstrates that estimation and inference on the single equation system will be equivalent to that of the full system only if all other cointegrating variables are weakly exogenous (in the sense of Engle, Hendry, and Richard (1983) with respect to the first variable in consideration in our case, the real exchange rate), and if there is only one cointegrating vector. The Johansen procedure allows us to perform a weak exogeneity test on

¹ It is well known that the two first tests may lack power against the alternative of stationarity if the data do not span a long enough time period. Therefore, we also use the Kwiatkowski, Phillips, Schmidt, and Shin (1992) test, which allows us to test the null hypothesis of stationarity against a unit root alternative.

the full system using the likelihood ratio test described in Johansen and Juselius (1992). This is simply a test of whether the speed of adjustment is significantly different from zero in the equations for the variables tested.

Results reported in Table 3 show that we cannot reject the hypothesis that commodity prices and the NFA-to-GDP ratio are all weakly exogenous, but we can reject weak exogeneity for the real exchange rate. This allows us to estimate the model as a single equation error-correction model (ECM) using non-linear least squares.

Table 2. Co-Integration Tests

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.313685	40.04452	35.19275	0.0139
At most 1	0.123215	14.44806	20.26184	0.2597
At most 2	0.077786	5.506517	9.164546	0.2324

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.313685	25.59645	22.29962	0.0167
At most 1	0.123215	8.941547	15.89210	0.4401
At most 2	0.077786	5.506517	9.164546	0.2324

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 3. Test for Weak Exogeneity: LR Test for Binding Restrictions

<i>Rank (II)</i>	<i>Chi-square(2)</i>	<i>rer</i>	<i>pcomm</i>	<i>nfa</i>
1	20.18613	-30.26778	-0.033030	0.275469

Estimation Results

For model selection we follow the general to specific approach of Hendry (1980). In addition, we focus on parameter stability as the important criteria for model selection. To study the stability of the individual coefficients associated with the I (0) variables, we use the stability test developed in Hansen (1991). The final specification is:

$$\Delta rer_t = \alpha + \beta_1 \Delta rer_{t-1} + \gamma (rer_{t-1} - \zeta_1 pcomm_{t-1} - \zeta_2 nfa_{t-1}) + \beta_2 SlopeDummy \Delta rer_t + \mu_t \quad (2)$$

Estimation results are reported in Table 4 below. Note that the estimated speed of adjustment parameter has the correct sign and a low value (-0.11), which suggest a slow adjustment of the real exchange rate toward its long-run equilibrium value.

Table 4. Estimation Results
(Sample: 1992Q4 to 2010Q2)

Coefficient	Value	Standard Error
β_1	0.1980	0.0938**
β_2	1.0240	0.1472***
γ	-0.1196	0.0679*
ζ_1	-0.5020	0.0319***
ζ_2	0.0062	0.0008***

Note: The asterisks *, ** and *** indicate that the variable is statistically significant at the 10, 5 and 1 percent level of significance respectively.

III. CANADA'S POTENTIAL GROWTH: A POST-CRISIS ASSESSMENT¹

A. Introduction

1. **This paper revises IMF staff's earlier assessment of the impact of the recent financial crisis on Canada's potential growth.** Such assessment is warranted now that economic recovery is underway and the immediate impact of the crisis has been observed; notably private investment during the financial crisis and thus capital accumulation have been impacted, while unemployment rate peaked at 8.7 percent in August, which could possibly affect equilibrium rates of unemployment—both lowering potential growth. While the impact of the financial crisis on total factor productivity (TFP) is not known a priori, it is unlikely that strong growth in TFP would lift Canada's potential growth over the medium-term, given past experience.

B. Main Findings

2. **We find that the potential GDP growth rate in Canada has declined significantly in 2009 and 2010** (by around ½ percentage point compared to 2008 and one full percentage point compared to the period 2004–08). The potential GDP level is also estimated to suffer a permanent decline of about 2 percent vis-à-vis a no-crisis scenario by 2015; a modest loss compared to previous financial crises in industrialized countries (Cerra and Saxena, 2008, and IMF, 2009).² Staff estimates suggest that the loss could be eliminated if investment grows at close to twice the growth rates assumed in the latest WEO projection over the medium term.

3. **The crisis has impacted mostly capital accumulation and to a lesser extent labor input with positive contributions to total factor productivity.**

- *Capital accumulation.* Canada has experienced a large drop in investment since mid-2008, with investment dropping by 18.5 percent during the crisis and so far only recovering by 6¾ percent since the trough, implying that it will take 4–5 years for the capital-GDP ratio to return to its historical average (as assumed in WEO projections).
- *Labor input.* Due to the crisis, the unemployment rate rose from a 30-year low of 5.9 percent in early 2008 to a high of 8.7 percent in mid-2009, now standing at

¹ Prepared by Evridiki Tsounta. This paper is a revised and streamlined version of Estevão and Tsounta (2010).

² According to Cross (2010), the current recession was milder than the ones in the 1980s and 1990s for Canada; GDP dropped by 3.3 percent over three quarters between the fall of 2008 and the summer of 2009, compared to a GDP decline of 4.9 percent over six quarters in the early 1980s, and a 3.4 percent GDP drop in the 1991–92 downturn over four quarters. Similarly, employment fell just 1.8 percent in the recent recession, compared with 3.2 percent in 1991–92 and 5 percent in 1981–82.

around 8 percent. Similar abrupt adjustments were also observed in the participation rate, which fell from a historic high of 78.6 percent in early 2008 to a trough of 77.6, now hovering at around 78.3 percent. Similarly, hours worked experienced a peak-to-trough drop of over 4 percent, though they have since recovered by over 3 percent.

- *TFP impact.* So far the crisis had surprisingly a positive impact on TFP, which is estimated to have risen by over 2 percent in 2009, after a lukewarm performance in the previous years, possibly reflecting sectoral shocks and the accompanying reallocation of resources.^{3,4} This result is rather surprising since recent research points to negative implications from financial shocks on TFP. The explanation probably lies on several cyclical and composition effects, common during severe recessions—for instance, less skilled workers tend to be fired first and less productive firms tend to be weeded out during recessions; both effects raising observed TFP growth. To avoid this large cyclicity, estimates of potential growth use smoothed TFP growth rates.
- *Output gap.* We find that the output gap reached its widest point in 2009 at 4¼ percent in mid-2009, and is expected to be halved by the end of 2010.

4. **Moving forward, we expect Canada’s potential growth to rise to 2 percent over the medium term, with capital accumulation being the main driving force.** Using a perpetual inventory method, including by accounting for a historical rate of depreciation of around 8 percent a year, we obtain the path for the growth in the capital stock shown in Figure 1 and Table 1, which returns to the pre-crisis recent historical average, bringing the capital-output ratio to its long-term average.⁵ Changes in the participation rate and hours worked due to the crisis are not expected to negatively impact potential growth over the

³ Estevão and Severo (2010) show that financial shocks affect TFP growth through their effect on factor allocation, which in turn depends on an industry’s degree of reliance on external funding and whether the financial shock affects firms differently within each industry. The model presented shows that TFP growth in an industry would decline if banks’ tightened lending standards cause higher heterogeneity in capital costs within an industry. That would force the market equilibrium further away from an optimal allocation of resources as done by, say, a social planner, thus reducing industry’s TFP growth. They show that for the period going from 1990 to 2007 and using data for 31 industries in the United States and Canada, financial shocks indeed tended to lower TFP growth.

⁴ In comparison, U.S. TFP has risen by 2.9 percent in 2009.

⁵ Statistics Canada (2007) indicates that Canada’s depreciation rate is greater than the rates observed in the United States due to higher depreciation in building and engineering construction. While both countries have similar depreciation rates for machinery and equipment asset classes (18 percent on average in the United States and 20 percent in Canada), there is a considerable difference between Canadian and U.S. depreciation rates for buildings and engineering construction (U.S. rate is 3 percent versus an 8 percent Canadian average).

medium term (given the flexibility of the Canadian labor market).⁶ Beyond the crisis, demographic forces will contribute negatively to potential growth, with average hours of work and NAIRU expected to continue their downward trend; the latter has temporarily halted during the crisis.⁷ We also expect that the recent uptick in total factor productivity is mostly a one-off, cyclical effect with minimal implications over the medium term; overall, trend TFP grew by around 0.4 percent a year in the last decade, after falling in the 1990s.⁸

C. Conclusions and Policy Implications

5. **What do our estimates imply for policymakers?** Data suggest that Canada's output gap is still considerably large, implying that the current accommodating stance for monetary and fiscal policies should stay in place. Moving forward, the crisis would have a permanent impact on Canada's potential GDP level, implying that policies to raise potential growth would be worth considering. These could include enabling private R&D investment (which is low in Canada in international comparisons), facilitating internal trade, enabling foreign direct investment and enhancing product market competition, removing obstacles that hinder elderly labor force participation, and ensuring that incentives do not hinder firms from growing larger.^{9,10} Indeed, the authorities are considering or are already implementing many of the recommendations noted above as highlighted in *Advantage Canada* (2006)—the authorities' economic plan to increase Canada's competitiveness, including lowering corporate income taxation (at the provincial and federal level) and eliminating capital taxes,

⁶ Balakrishnan (2008) finds that Canada's labor market is as efficient as the one in the United States, though the data used in the analysis are up to 2004, thus excluding the increasing strains on the Canadian labor market amid the commodity boom, intensified by internal barriers to trade (such as interprovincial mobility barriers). Labor market flexibility is reflected in the significant and immediate impact of the Canadian downturn on the unemployment rate, which increased from 6.2 percent in October 2008 to 8.7 percent in August 2009, now standing at around 8 percent.

⁷ Stats Canada's baseline projections indicate that between 2006 and 2011, working-age population will rise by a cumulative 4.4 percent versus over 13 percent increase in the elderly population. This discrepancy increases over time; by 2031, the elderly population more than doubles (compared to 2006) while the size of the working-age population only increases by 8 percent.

⁸ For a discussion of trend TFP for industrial countries during financial crises, refer to Haugh et al. (2009).

⁹ Pilat (2005) finds that Canada lags many OECD countries in innovative performance and may have some scope for further catch-up. However, it notes that Canadian investment in R&D is unlikely to catch up with the R&D intensity recorded in some OECD countries, as it is limited by the structural composition of the economy—i.e., without a large high-tech industry—and by a relatively small average firm size.

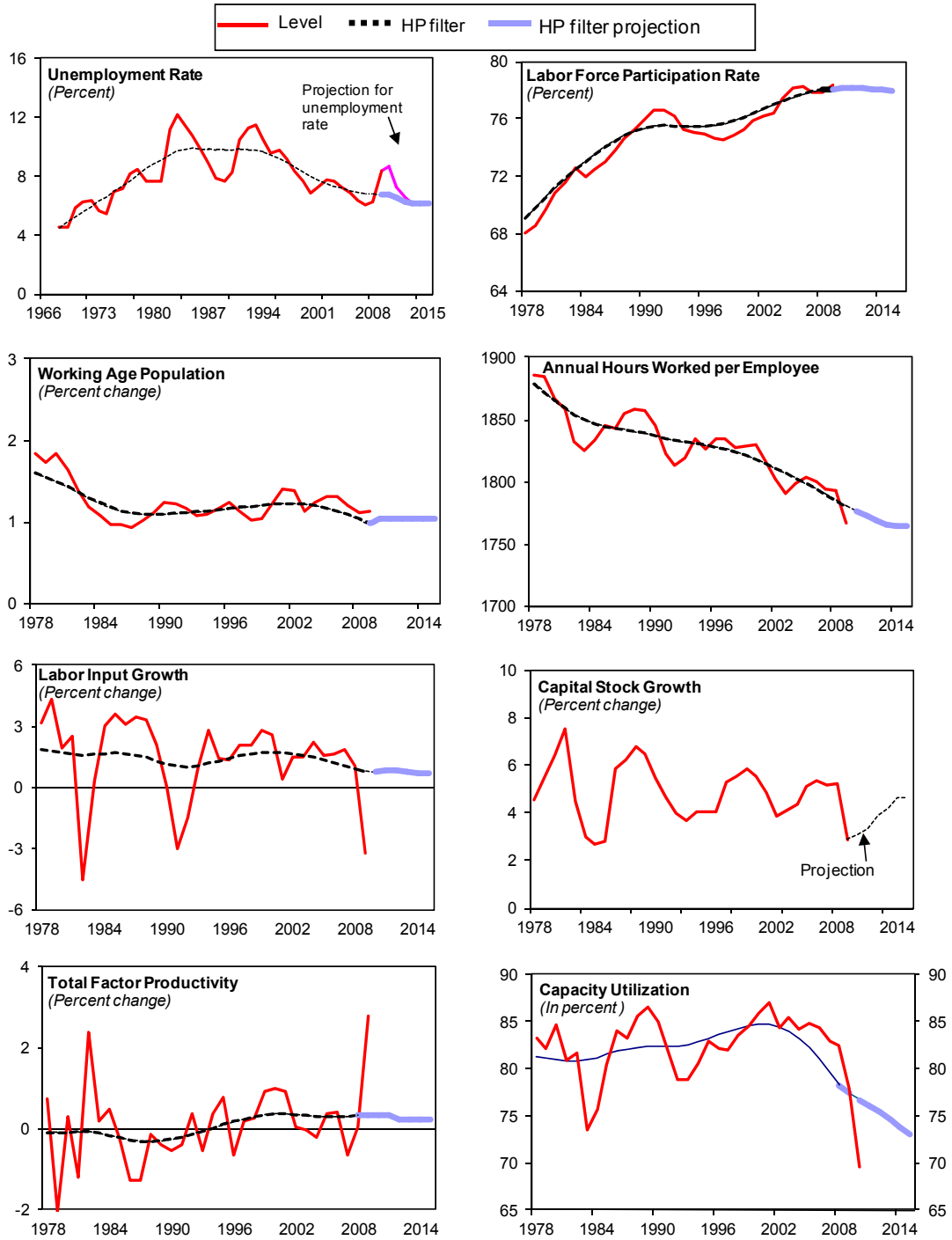
¹⁰ For a more extensive discussion of possible structural reforms that could raise productivity in Canada, the reader is referred to OECD (2004 and 2006) and Bishop and Burleton (2009).

while in the latest Budget they committed to move forward with the recommendations of the *Competition Policy Review Panel* (2008) to enhance competition and productivity.

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Figure 1. Canada: Potential Output Growth



Sources: Haver Analytics, WEO, OECD, and author's calculations.

Table 1. Path for Potential Output Growth Components 1/

	2005-2008	2008	2009	2010	2011	2012	2013	2014	2015
Potential Growth , percentage change	2.4	2.1	1.5	1.6	1.8	1.9	1.9	1.9	2.0
Capital Services, percentage change	3.6	3.2	1.8	2.1	2.5	3.0	3.2	3.4	3.6
Labor Services, percentage change	1.2	0.9	0.8	0.7	0.8	0.8	0.7	0.7	0.7
NAIRU, percentage points 3/	6.9	6.7	6.7	6.7	6.5	6.3	6.1	6.1	6.1
Labor force participation rate, percentage points 4/	77.9	78.1	78.1	78.1	78.1	78.1	78.0	77.9	77.9
Total Factor Productivity, percentage change	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2
Contributions to Potential Output Growth 1/ (Percentage points)									
	2005-2008	2008	2009	2010	2011	2012	2013	2014	2015
Potential Growth	2.4	2.1	1.5	1.6	1.8	1.9	1.9	1.9	2.0
Capital Services 2/	1.4	1.2	0.7	0.8	0.9	1.2	1.2	1.3	1.4
Labor Services	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4
NAIRU 3/	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0
Labor force participation rate 4/	0.1	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
Annual hours worked per employee 5/	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Working age population 6/	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5
Total Factor Productivity	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2

Sources: Haver Analytics, WEO, OECD, and staff estimates.

1/ Output-labor elasticity assumed to be 0.6 and output-capital elasticity assumed to be 0.4, see Sharpe, Arsenault and Harrison (2008).

2/ Trend capacity utilization is calculated using data from Stats Canada (detrended by HP-filter).

3/ Non-accelerating inflation rate of unemployment. HP filter of civilian unemployment rate, 15-64 years (seasonally adjusted).

4/ Trend labor force participation rate calculated by applying the HP filter of the ratio between labor force and working age population.

5/ Trend changes in annual hours work per employee is calculated by applying the HP filter of annual hours worked per employee in the total economy.

6/ Working-age population refers to Canadian population 16-65 years of age. Projections as published by Stats Canada.

IV. THE BUMPY ROAD AHEAD FOR NORTH AMERICAN AUTOMAKERS¹

This chapter examines the development of the Canadian automotive sector vis-à-vis NAFTA partners during the crisis, and reviews the policy support to the sector. Simulating a model of sales of light vehicles in North America estimated on historical data going back to 1960, we find only modest spillovers from an eventual double dip recession in the United States onto Canadian jobs and growth. Yet, even in the absence of a retrenchment in U.S. growth, North American Original Equipment Manufacturers (OEMs) face hard long-term challenges from foreign competitors and risk a permanent loss of market share in the region.

A. Background

1. **The large swings in motor vehicle production have had significant effects on North America’s real GDP growth in the past** (Figure 1). Both the production and sales of autos trended up over the 1990s, peaking in the early to mid-2000s, thanks to buoyant consumer spending and the elimination of residual trade barriers across the region following the implementation of NAFTA.² However, taking the United States as a benchmark, the contributions to growth have been small, on average, during the past two decades and drops in the sector’s output have shaved up to ½ percentage point from GDP growth rates in bad years.

2. **During the 2000s, the industry has undergone two of the largest shocks in the history of the sector.**

- *Energy crisis.* Between 2003 and 2008, the prices of automotive fuels surged to unprecedented levels, discouraging purchases of sport utility vehicles (SUVs) and pickup trucks which have low fuel economy. This has affected sales, especially of the “Big Three” automakers (General Motors, Ford, and Chrysler. See Box 1), who had focused on these vehicles as a result of their popularity and relatively high profit margins.³
- *Financial crisis.* The financial crisis further slashed the demand for and production of automotive products, as consumer credit tightened and home equity loans used to finance car

¹ Prepared by Nicoletta Batini, Thomas Dowling and Grace Bin Li (all WHD). We are thankful to Dennis DesRosiers for providing us with data and a useful conversation.

² The introduction of NAFTA is estimated to have contributed until 2000 to an increase in North American motor vehicle production and sales of around 25 percent, although it is associated with a fall in employment in the United States and Canada (with corresponding gains in Mexico). Within the first ten years of NAFTA’s ratification, the value of NAFTA auto trade almost doubled. Since NAFTA was introduced, both Mexico and Canada have attracted substantial FDI in the auto sector from the United States and from outside the region.

³ In Canada 61 percent of total automotive production is attributable to Ford, GM and Chrysler. In the United States and Mexico the corresponding share is 53 percent and 49 percent, respectively

purchases in the 2000s dried up. Between 2007 and 2009, production, sales, and employment in the sector fell dramatically in the United States, Canada and Mexico (Table 1). By 2009, North America comprised around 14 percent of world production as China emerged as the world's largest manufacturer of motor vehicles (22 percent) as the crisis accelerated North America's downward and China's upward trends in global market shares. While the contraction of the sector was widespread across the region, some automakers were hit harder than others. In particular, the cyclical downturn exacerbated GM's and Chrysler's structural problems, as consumer credit shrank⁴ and confidence tanked, pushing them to the verge of bankruptcy.

Table 1. Auto Industry Performance During the Crisis
(Percent change 2007-2009)

	North America	Canada	Mexico	United States
Automotive Product Production	-43.4	-42.3	-25.7	-47.2
Motor Vehicle Sales	-33.2	-12.3	-31.2	-35.5
Direct Employment in Auto Sector	-25.5	-28.5	-23.3	-32.9

Sources: DesRosiers Automotive Yearbook 2010, Haver Analytics, and Fund staff calculations.

3. **The rapid policy response in Canada and the United States softened the sector's hard landing.** Rescuing GM and Chrysler was unanimously seen as necessary to prevent the failure of dozens of regional part suppliers, which could have dried up the supply of parts, affecting solvent automakers and bringing the sector to a halt. The two rounds of bailouts by the Canadian federal, Ontario, and United States governments, helped both Chrysler and GM file for Chapter 11 in the United States in 2009, averting an outright failure under Chapter 7. (Box 1 provides details of the U.S.–Canada stimulus to the “Big Three”). Additional indirect measures targeting the sector included tax deductions for manufacturers, short-term lending, and the U.S. USD 3 billion federal scrappage program Car Allowance Rebate System (CARS, colloquially known as “Cash-for-Clunkers”).

4. **The global recession left the automotive industry downsized and partly restructured but still standing.** By the end of 2009, the industry still employed a considerable number of workers, contributing to a substantial share of merchandise shipments (Table 2).

⁴ During 2007 nearly 2 million new U.S. cars were purchased with funds from home equity loans. Such funding was considerably less available in 2008.

Table 2. Automotive Industry in 2009

	Direct Employment	Indirect Employment 3/	Percent of Total Employment	Percent of Manufacturing	Percent of Retail Trade	Percent of Merchandise Exports
Canada	109,117	545,585	4.5	9.2	21.3	11.9
United States	666,700	2,713,054	2.6	6.8 1/	16.7	7.7

Sources: Center for Automotive Research, Haver Analytics, Industry Canada, and Fund staff calculations.

1/ Value added by industry.

2/ Mexican data not available at this level of sectoral disaggregation.

3/ Computed by applying a ratio of 1:5 for Canada and 1:4.06 for the U.S.

B. Spillover Analysis: How Would the Canadian Auto sector Weather a U.S. Double-Dip Recession?

5. **The North American automotive industry is very integrated, thanks to the North American Free Trade Agreement** (see Box 1). For example, over $\frac{3}{4}$ of the total Canadian production of light vehicles is sold to the United States every year, and cars produced in Canada contain a maximum of 35 percent of parts produced in Canada, the rest originating in the United States. The U.S. market is the largest in the region absorbing around 85 percent of total North American sales. As a result, shocks to the U.S. economy, like during the recent crisis, have immediate implications for the Canadian and Mexican automotive industries.

6. **We examine the likely cyclical performance of the North American automotive sector under two scenarios for the United States' recovery.** To this end, we estimate a yearly model for North American total vehicle sales, regressing de-trended sales on: the lags of de-trended sales, lags of de-trended U.S. real GDP growth, and the Federal Funds rate to proxy credit conditions in the market for auto loans in the United States.⁵ The estimation sample is 1960–2009, while model simulations end in 2012.

7. **The estimated model fits well historical data, explaining around 85 percent of the variation in North American sales of light vehicles over the sample.**⁶ In-sample forecasts obtained using the model show that around $\frac{3}{4}$ of the drop in sales in the region during the crisis can be justified by the collapse in U.S. output over this period, while the rest of the drop likely reflects a continuation of the downward adjustment to sales that began in 2006. By contrast, easing credit conditions (through the cuts of the Fed Funds rate to near zero) have mildly supported sales.

⁵ The average effective rate on auto loans was not statistically significant when used instead of the Fed Funds rate. We use the Hodrick-Prescott filter to perform the trend-cycle decomposition.

⁶ The estimated coefficient on U.S. output is 7.3 with a t-statistic of 8.1.

8. **We simulate the model deterministically under two scenarios (Figure 2):**

1. *Baseline scenario*: U.S. real GDP growth follows the projection in the October WEO (that implies a sluggish but gradual recovery in 2011 and 2012).
2. *U.S. “double-dip” scenario*: U.S. real GDP growth is assumed negative for two consecutive quarters in 2010Q4 and 2011Q1, depressing yearly growth in 2010 and continuing path of low growth in 2011 and 2012 (0.5 percentage points lower than the October WEO forecast each year).

Table 3. Impact of U.S. Growth on Canadian Automotive Industry Under Alternative Growth Scenarios

		2009	2010	2011	2012
		(Level)	(Annual Change)		
Scenario 1: Baseline	Auto Production (thousand)	1490	233.5	306.4	240.4
	Employment in Auto Sector (thousand)	442	13.2	13.8	10.8
	Exports in Auto Sector (bil. C\$)	44	-1.2	12.4	9.8
Scenario 2: Double-dip	Auto Production (thousand)	1490	208.2	50.0	349.8
	Employment in Auto Sector (thousand)	442	12.1	2.3	15.8
	Exports in Auto Sector (bil. C\$)	44	-2.2	2.0	14.2
Difference (Scenario 1-Scenario 2)	Auto Production (thousand)	...	25.2	256.4	-109.4
	Employment in Auto Sector (thousand)	...	1.1	11.6	-4.9
	Exports in Auto Sector (bil. C\$)	...	1.0	10.4	-4.4

Sources: Desrosiers Automotive Yearbook 2010, Haver Analytics, and Fund staff calculation.

Note: Employment figures differ from Table 2 because of a sectoral aggregation difference. In addition to those directly employed, this figure reflects associated sectors which can be attributed to the automotive industry in their entirety.

9. **Overall results rule out a return to the blockbuster level of North American sales seen in the mid-2000s.** In part, this is in line with the view that sales in the United States in the mid-2000s, which comprises the majority of North American sales, have been abnormally high, and well above their long-run growth of about 0.9 percent per year.⁷ However, under both scenarios, sales in 2011–12 undershoot the long-run trend. In particular, under the baseline, total sales of vehicles in the region would only return to the 1996 level by 2012. Worse still, under the double-dip scenario, sales in North America would still be at their 1994 level in 2012.

⁷ Our baseline forecast is slightly more pessimistic than earlier-in-the-year forecasts by some other analysts like TD Economics and Scotiabank for 2010 (whose projections range between 13.7 and 13.9 millions of units sold for the region, respectively). At 13.8 million units for 2011 our baseline forecasts are also considerable more gloomy than TD Economics, for example, that expects sales to pass the 15 million mark in two years. However, they are much rosier than J.D. Power and Associates that puts sales in the region at below 13 million units following Q3 revisions to the U.S. outlook.

10. **A double-dip scenario in the United States would have very small repercussions for Canada's jobs and growth through the effects on the Canadian auto sector.** Using as guidance the contemporaneous correlations between North American sales and (i) Canada's jobs in the automotive sector;⁸ and (ii) Canada's real GDP growth, we compute the macroeconomic impact of the two scenarios for Canada. We find that job creation would be modestly slower in the case of a U.S. double-dip, with a cumulative difference in jobs created of a mere 10,000 net over 2010–2011.⁹ Auto exports would fare several billions below a baseline scenario in the case of a double-dip recession in the United States (Table 3).

C. Long-Term Challenges

11. **Looking forward, the North American automotive industry faces several additional key challenges and risks.** These include:

- *Changes in the environmental regulation.* Concerns regarding carbon emissions have heightened sensitivity to gas mileage standards. Measures taken in the United States to improve fuel economy may prove problematic to meet for a number of OEMs.¹⁰
- *Consumer preferences.* Consumer sentiment has gradually shifted away from fuel-inefficient vehicles towards smaller-sized cars and hybrids. One question is whether the North America automotive industry, structurally geared to produce larger vehicles with low fuel efficiency, can retool before losing market share to other automakers that already produce smaller and more fuel-efficient cars.
- *Productivity and international competition.* North American auto production has been less productive than many competitors and faces strong competition from other world regions. Significant variation in wages and non-wage costs within the region and relative to abroad makes North American markets individually and collectively highly contestable. It is possible that North America, and Canada within that, sees more of their global market share erode unless it undergoes further restructuring—without which, leaves concerns about the ultimate viability of North America's automotive production.

⁸ Measured by a sectoral employment aggregate that comprises about two thirds of all direct and indirect jobs.

⁹ The simple regression model that we employ predicts a large bounce back of sales from the double dip recession scenario in 2012 which compensates for the loss of sales in 2011.

¹⁰ Canada has historically aligned its Company Average Fuel Consumption (CAFC) with the United States' CAFE standard and so new U.S. standards affect Canada as well. Currently, the CAFE standard is 27.5 miles per U.S. gallon (8.6 L/100 km) and has been set to increase to 30.2 miles per U.S. gallon (7.8 L/100 km) in 2011, and to 35 miles per U.S. gallon (6.7 L/100 km) by 2016.

12. **Failure to address these challenges could result in further erosion of the market share of North American automakers**, particularly of the Big Three, whose market share in the region has fallen for fifteen consecutive years due to: (1) a cost structure that is improved but still higher than the new domestic and (2) a loss of consumer confidence in their products.

13. **However, this need not have an impact on the region's automotive jobs and output as long as import nameplate brands continue to build a substantial supply base inside NAFTA.** The production-to-sales ratio has been consistently in the 80 percent range since 2000. Thus the import leakage has been steady around 20 percent this decade. Importantly, distribution and retail generate significantly more jobs than manufacturing (the ratio of jobs in manufacturing to other sector's jobs being estimated at 1:5–1:7 for the countries in this region), and jobs in these other areas of the value chain would not be put in jeopardy by a change in the composition of OEMs in the region in future years.

Box 1. Canada's Auto Industry and the "Big Three"

The "Big Three" automakers (Chrysler, Ford, and General Motors) have dominated the auto industry in North America for more

than 50 years. Chrysler, Ford, and GM make up around 50 percent of

production in Canada, Mexico, and the United States and 45 percent of sales in

Canada and the United States. In the

United States and Mexico, GM and

Chrysler account for about 1/3 of all

domestic production. In Canada,

however, they combine to account for 43.5 of all vehicle manufacturing.

"Big Three" Light Vehicle Production by Country, 2009

	Canada		Mexico		United States	
	Percent of Total Domestic Production	Percent of Total Domestic Production	Percent of Total Domestic Production	Percent of Total Domestic Production	Percent of Total Domestic Production	Percent of Total Domestic Production
Chrysler	21.4		10.5		8.7	
Ford	16.2		15.7		24.5	
General Motors	22.1		23.8		21.8	
Total	59.7		50.1		55.0	

Sources: OICA, TD, and Fund staff calculations.

Given the importance of the "Big Three" to the North American auto industry, a cross-border bailout package was given to Chrysler and GM to stabilize the sector and prevent further job losses in 2008–09. Under the Canadian and U.S. auto bailout packages, Chrysler received CAD2.9 billion from the Canadian and Ontario governments and USD12.8 billion from the United States government. GM's packages included CAD10.8 billion and USD50.7 billion, respectively. In exchange, both firms completed equity transfers and agreed to undergo restructuring. Ford leveraged assets to raise cash to deal with its debts and did not require government assistance. The first two quarters of 2010 were profitable for both Ford and GM. GM had repaid USD1.5 billion to the United States and CAD1.5 billion to Canada as of September 2010.

The crisis led to a top down reorganization of the Big Three. Chrysler Canada's parent, Chrysler LLC was

reorganized into

Chrysler Group

LLC and partnered

with Fiat. As of

2009, Fiat, the

United Auto

Workers (UAW),

and the U.S.,

Canadian, and

Ontario

governments are shareholders of Chrysler Group LLC. General Motors of Canada is wholly owned by General Motors Company which, after restructuring, is now majority-owned by the U.S.

government with stakes also held by the UAW, Canadian and Ontario governments, and creditors.

Looking forward, Chrysler and GM expect to hold initial public offerings in late 2010–2011.

"Big Three" Light Vehicle Sales, by Country

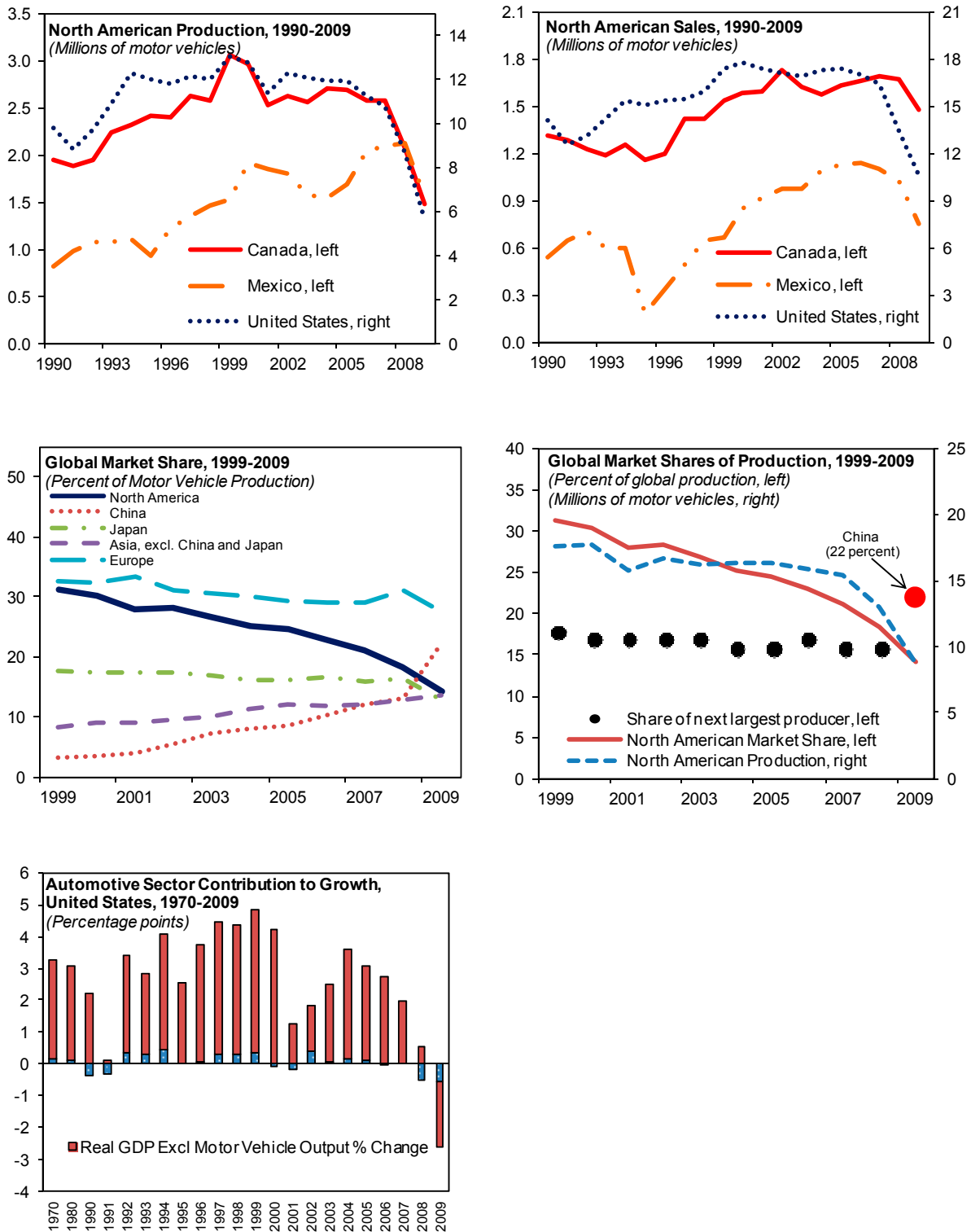
	Canada		Mexico		United States	
	2009	Aug. 2010	2009	Aug. 2010	2009	Aug. 2010
	Mkt. Share	Mkt. Share	Mkt. Share	Mkt. Share	Mkt. Share	Mkt. Share
Chrysler	11.2	10.6	10.9	9.0	8.8	7.4
Ford	15.4	16.4	11.7	15.2	15.3	14.4
General Motors	17.2	17.0	18.3	17.2	19.6	19.4
Total	43.8	44.0	41.0	41.4	43.7	41.2

Sources: DesRosiers, Haver Analytics, Motor Intelligence, Ward's Automotive, and Fund staff calculations.

Continued

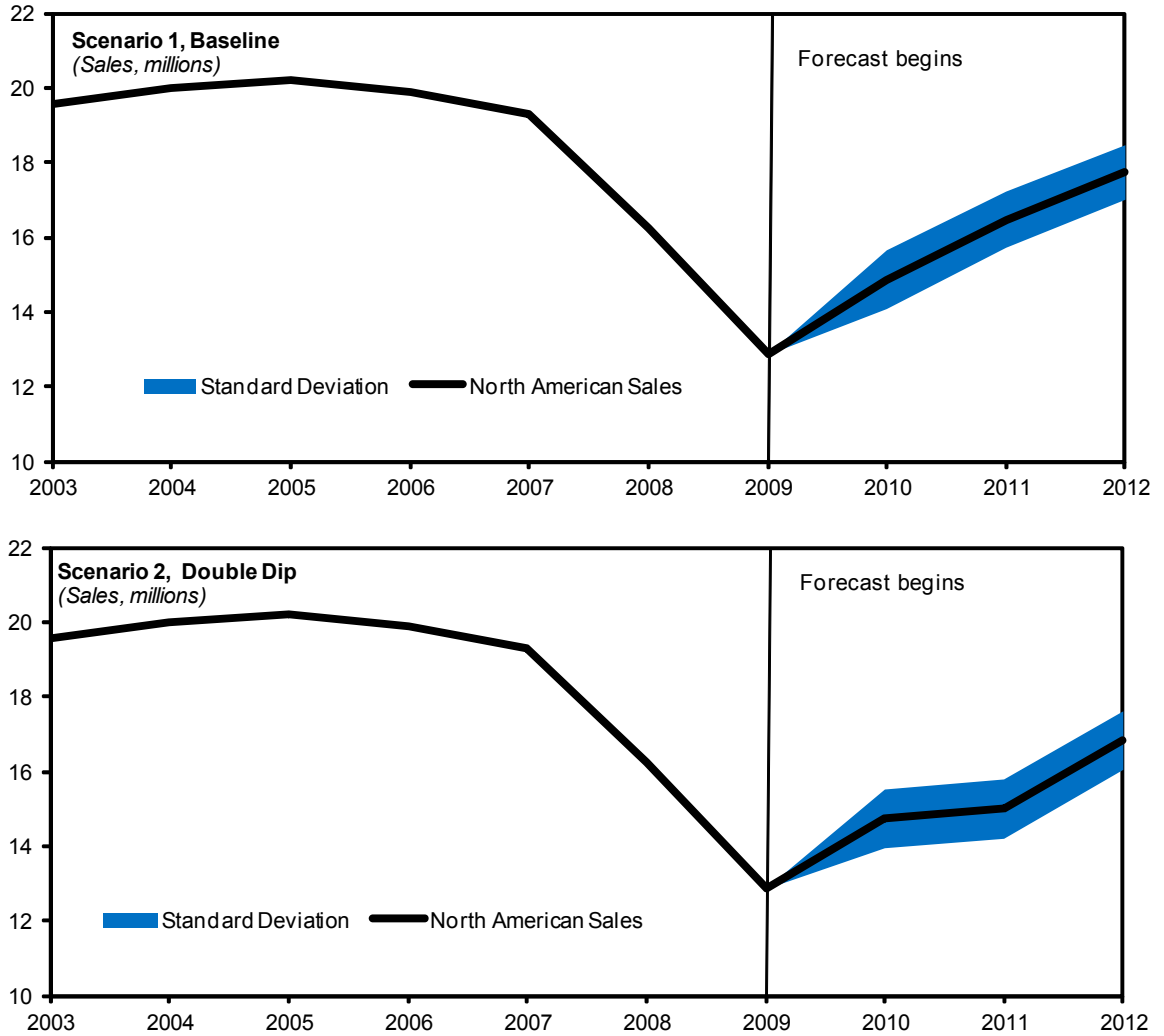
Direct Economic Stimulus Targeting the Auto Industry				
	Canada		United States	
	Debt Obligation (Billions of CAD)	Equity Transfer (Percent)	Debt Obligation (Billions of USD)	Equity Transfer (Percent)
Chrysler a/	2.9	2.0	12.8	9.9
Chrysler Financial Company	none		1.5	
General Motors	10.8	11.7 b/	50.7	60.8 c/
GMAC	none		16.3	56.3 d/
Total stimulus (Debt obligations and equity shares)				
Federal Government	9.7 bil. CAD		76 bil. USD e/	
Ontario Government	4.9 bil. CAD			
Sources: Canada Economic Action Plan Budget 2009, Canada Economic Action Plan First Report 2009, Canada Economic Action Plan Second Report 2009, Canada Economic Action Plan Third Report 2009, Canada Economic Action Plan Fourth Report 2009, Canada Leading the Way on Jobs and Growth: Budget 2010, FinancialStability.gov.				
a/ 3.7 bil CAD commited, 2.9 bil CAD disbursed for Canada.				
b/ In addition, 403 mil. USD of preferred shares were transferred to the Canadian and Ontario governments.				
c/ In addition, 2.1 bil USD preferred stock were transferred to the U.S. government.				
d/ In addition, 10.1 bil. USD preferred stock were transferred to the U.S. government.				
e/ Total is net amount of stimulus.				

Figure 1. State of the Auto Industry



Sources: U.S. Bureau of Economic Analysis, DesRosiers Automotive Yearbook 2010, OICA, and Fund staff calculations.

Figure 2. Projected North American Automotive Sales in Alternative Scenarios



Sources: DesRosiers Automotive Yearbook 2010, TD Economics, and Fund staff calculations.

V. CANADA'S HOUSING FINANCE SYSTEM: POLICY BACKDROP¹

1. **Canada's housing finance system has remained remarkably resilient throughout the recent financial crisis.** This is partly because Canadian public policy, unlike that in the United States, does not explicitly favor homeownership over rental housing in the same way as in the United States. Also, the government maintains direct control over the terms and conditions of mortgage insurance, which is required on mortgages held by regulated deposit-taking institutions and securitization vehicles effectively backed by government guarantees.
2. **In general, Canadian government policy recognizes that homeownership is not the most sensible option (versus renting) for many households.** For example, unlike in the United States, interest on homeowner mortgages is not tax deductible. Also, Canadian lenders are not subject to legislation comparable to the *Community Reinvestment Act* that encourages U.S. depository institutions to lend in low-income neighborhoods. Also, Canadian lenders generally have recourse to borrowers' assets and future income in the event that foreclosure sale proceeds do not cover the outstanding debt, whereas in many U.S. states, this is not the case.² Thus "strategic" defaults are rare in Canada.³
3. **The role of Canada Mortgage and Housing Corporation (CMHC) in the Canadian residential mortgage market is somewhat similar to that of the U.S. Federal Housing Administration (FHA) and Veterans Administration (VA).** For example, they sell mortgage insurance (MI) that protects lenders against losses due to mortgage loan default. However, whereas CMHC MI can cover loans across the quality spectrum, FHA/VA coverage is limited. For example, the FHA only insures high debt-to-income and/or loan-to-value loans, and the VA insures armed forces personnel.⁴
4. **Also, CMHC and the U.S. government-sponsored enterprises (GSEs) play key roles in mortgage securitization markets by guaranteeing timely payment on mortgage-backed securities (MBSs).** Under the *National Housing Act* (NHA), CMHC guarantees timely payment on mortgage-backed securities (NHA MBS) backed by pools of residential mortgages insured against borrower default. CMHC also guarantees timely payment on

¹ Prepared by John Kiff (MCM), based largely on Kiff, Mennill and Paulin (forthcoming).

² Alberta does not always offer recourse to lenders, though this is dependent on both the vintage and nature of the loan. In Saskatchewan, recourse only applies to re-financed mortgages.

³ Strategic defaults are those in which the borrower stops making payments on mortgages where the outstanding loan balance exceeds the home value. See Bhutta, Dokko, and Shan (2010).

⁴ The FHA/VA programs are designed for low-income, first-time homebuyers with very small down payments. To qualify for an FHA loan, a borrower needs less than a five percent down payment. VA MI is only available to U.S. armed forces active duty personnel and veterans, reservist/National Guard members, and some surviving spouses.

Canada Mortgage Bonds (CMBs) which are backed by pools of NHA MBSs issued by Canada Housing Trust. In the United States, Ginnie Mae guarantees the FHA and VA insured loans that it securitizes, and Fannie Mae and Freddie Mac guarantee the “conforming” loans that they securitize. Conforming loans are those that meet underwriting guidelines that are set by the Office of Federal Housing Enterprise Oversight, in terms of loan size, documentation, debt-to-income ratios, loan-to-value ratios, and so on.

5. **However, government-controlled mortgage insurance (MI) plays a bigger role in housing finance in Canada than in the United States.** The *Bank Act* prohibits Canadian federally-regulated lending institutions from providing mortgages without MI issued by approved insurers for loan amounts that exceed 80 percent of the value of the home. Also, MI is required on mortgages securitized through CMHC’s securitization program.⁵ In the United States, MI is only required on FHA/VA loans securitized by Ginnie Mae, and high loan-to-value (greater than 80 percent) loans securitized by Fannie Mae and Freddie Mac. Also, Canadian MI covers 100 percent of the loan, whereas in the United States, private MI typically only covers the amount in excess of 80 percent of the home value.

6. **Due to the regulatory capital reductions provided by MI, banks and other deposit-taking lenders insure their low loan-to-value ratio mortgages.** Mortgages insured by government-owned and –backed CMHC, are assigned a zero risk weight for regulatory capital requirement purposes. Mortgages covered by approved private insurers are assigned a slightly higher weight, but one that is lower than 35 percent on uninsured mortgages. CMHC accounts for about 70 percent of all outstanding MI in Canada, and two private insurers, operating in accordance with rules set out by Canada’s Department of Finance, account for almost all of the rest. The private insurers agree to abide by these rules in order to meet the government’s eligibility standards, and in return for a 90 percent government backstop on their MI business.⁶

7. **The Canadian government uses its control over MI terms and conditions to influence mortgage loan availability.** For example, since 2008 the maximum loan-to-value ratio on insured loans has been 95 percent, amortization terms have been limited to 35 years, and debt service costs have not been allowed to exceed 44 percent of gross income.⁷ As an

⁵ Due to the regulatory capital reductions provided by MI, the majority of Canadian mortgages are insured, even those with loan-to-value ratios below the required threshold.

⁶ The government guarantees that lenders will receive the benefits payable by approved private mortgage insurers, less 10 percent of the original principal amount of the loan, in the event that the insurer is bankrupt or insolvent. This public-private model is close to that advocated in Joyce and Molesky (2009). However, they advocate a full guarantee to provide a level playing field between private insurers and CMHC. They also recommend removing the insurer insolvency condition, saying that it may introduce inadvertent procyclicality.

⁷ For borrowers with lower credit scores (below 680 on the FICO scale), the CMHC and private mortgage insurers set a debt service cost limit at 42 percent of gross income. The CMHC definition of debt service costs include mortgage principal and interest payments, property taxes, and heating expenses, plus other debt

(continued...)

example of this control in action, the rules were tightened in February 2010 to reinforce the long-term stability of Canada's housing market. For example, the maximum amount that could be withdrawn during mortgage refinancings was lowered from 95 percent to 90 percent of the home value. Also, a minimum down payment of 20 percent became required on non-owner-occupied properties purchased for speculation.

payments. For U.S. "conforming" mortgages debt service costs do not include heating costs, and they are limited to 28 percent of gross income. The maximum LTV on "conforming" loans is 80 percent.

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