INTERNATIONAL REAL ESTATE REVIEW

2014 Vol. 17 No. 1: pp. 109 – 135

Bubble, Bubble – Is there House Price Trouble -- in Canada?

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Canadian and U.S. real estate markets have compared similarly along dimensions such as inflation, mortgage interest rates, population and income growth and other measures. With respect to house prices, however, the series have moved in similar ways at some times, but then significantly diverged by the second quarter of 2007. For example, Canadian and U.S. house price indices reached essentially identical levels in 1987Q2, 1995Q1 and 2007Q2. As a consequence of the U.S. financial crisis and precipitous decline in house prices, the U.S. and Canadian indices have sharply diverged. Our paper examines whether or not the house price indices were driven by fundamentals during these time periods, or whether they diverged from fundamentals. We find that the U.S. house prices closely aligned with fundamentals until the mortgage markets crashed in 2008. We find that Canadian house prices continue to align with fundamentals. However, there have been some significant market changes between the two countries and key housing market measures indicate that Canadian markets are now moving along some paths similar to those taken by the U.S. prior to the crash.

Keywords:

House Prices; Mortgage Markets

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1. Introduction

Recent reports in Canada have begun to question whether there is cause for concern about a house price bubble in at least some markets. For example, a recent RBC Research paper has analyzed the condo market in Toronto and concluded that investors and speculators are not yet enough of a problem to warrant concerns about a bubble.[1] David Madani, an economist at Capital Economics, has concluded Canada's house prices are most certainly in a bubble and expects prices to plummet by 25% over the next couple of years.[2] As well, Standard & Poor's rating services have revised their outlook from stable to negative for seven large Canadian banks due to concerns about high house prices in Canada and high consumer debt levels.[3]

Similar speculation about the existence of a housing bubble occurred during the dramatic rise in U.S. housing prices from 2000 – 2006 and the expectations about the bubble were emphatically realized with the housing price crash in the U.S. (see Case et al. (2003), Goodman et al. (2008), and Malpezzi et al. (2005)). The house price crash continues to affect the housing market recovery in the U.S. and has impacted both the supply and demand of housing in that country. Observation of the outcomes in the U.S. markets contributes to the wariness of economists in Canada. In this research, we explore the link of house prices in both countries to fundamentals in both countries and consider evidence that might have led to the different house price paths since 2008. Among other contributors to the crash may have been the large increase in securitization in the U.S. A similar increase in securitization in Canada may lead to a similar outcome.

2. Literature Review

House prices vary in response to changes in both housing demand and housing supply. There is a large and well-developed literature on housing demand and its components. Olsen (1987) and Whitehead (1998) provide

[1]RBC Research, Current Analysis, July 2012, "Booming Toronto Market does not imply a bubble."

[2]Capital Economics, David Madani, in the Globe and Mail, July 25, 2012, "Housing Market at a Tipping Point."

[3]BloombergBusinessWeek, July 27, 2012, "Consumer Debt Eroding Canadian Banks' Edge as Standard & Poor's Cuts Outlook. Specifically, the S&P report states, "Over the same period [past decade], Canadian house prices have approximately doubled, with compounded real growth in housing prices estimated to be about 5% per year. After a brief correction in 2008, house prices recovered quickly, and are currently almost 10% above the previous 2008 peak, based on Teranet-National Bank Composite House Price Index data. Successive government efforts since 2008 to counteract the stimulatory effect of low interest rates on consumer borrowing and home prices have done less than we expected to counteract the growing level of consumer leverage and housing market risk in Canada."

broad reviews of the early empirical literature. Zabel (2004) expands the concept of housing demand to include the demand for housing services, individual attributes of housing, tenure choice, or spatial allocation of households. Early research focused on estimating demand elasticities (Mayo 1981, Harmon 1988 and Ermisch 1996, among others). For the most part, this literature assumed that parameters were stable over time, and ignored any adjustment to the demand for housing and non-housing goods that results from changes in house prices, incomes, and constraints on access to home ownership. More recently, Bajari, et al. (2010) developed a dynamic structural model in which households solve a life cycle consumption problem with housing treated as an investment good that delivers consumption benefits.

This paper relates to the housing demand research through its incorporation of similar explanatory variables that impact housing demand fundamentals. Hendershott (1980) and Poterba (1984) first introduce the impact of owner costs on house prices, and the subsequent inclusion of interest rates and other owner cost variables have been found in many more recent studies, including, for example, Coleman, et al. (2008). Coleman and co-authors found that the dominance of economic fundamentals and other market characteristics in driving house price returns in the U.S. was more significant in earlier years, before Freddie Mac and Fannie Mae (the government sponsored enterprises, or "GSEs") "pulled back" from the market after 2003 when they were displaced by private issuers of new mortgage products. After the GSEs lost market share, they found that economic fundamentals were less important and became, eventually, insignificant in affecting house price returns. Specifically, the measures of autocorrelation present in their model estimates suggested that the period after 2003 possessed the highest degree of momentum in house prices—what they term to be a "bubble" characteristic. The authors conclude that the subprime market and house price increases jointly impacted the market with the tail wagging the dog – that is, "the subprime market may well have been a joint product, along with house price increases, (i.e., the "tail") of the changing institutional, political, and regulatory environment characteristic of the period after late 2003 (the "dog")."[4] In other research, Wheaton et al. (2008) report that there is broad consensus about the relationship between house prices and employment, population and income.

Research on house prices is also linked to the urban price model developed by Capozza et al. (1989) in which the price of urban land can be decomposed into four elements: agricultural land rent, the cost of conversion, the value of accessibility and the value of expected future rent increases. Since that paper, researchers have often looked at the relationship between house price indices and market fundamentals. For example, Abraham et al. (1996) use house price indices in their empirical analysis, and report that in 1992, the Northeast region of the United States was priced at 30 percent above fundamentals.

[4] See Coleman, LaCour-Little and Vandell (2008), at 272.

Rather than identifying demand parameters or testing a structural model, we focus on the stability of the relationship between housing market fundamentals and house prices over time. We assume that supply parameters other than structure inputs remain constant. This means that even if there is significant variation in supply elasticities across markets, as demonstrated most recently by Saiz (2010), among others, which results from either physical or regulatory constraints that may be endogenous to prices and demographic growth, this does not affect the temporal variation in the relationship between the fundamental variables and housing prices in our models.

The methodology we use is similar to that used in other recent studies which investigate the house price volatility of the past decade by trying to determine if prices deviate from fundamental values or whether a housing price bubble existed and burst (in the U.S.). These "bubble studies" followed from the seminal research of Case et al. (2003). In that research, bubbles were thought to exist when rapid house price increases resulted from expectations of future price increases rather than changes in fundamentals. Recent studies of housing bubbles in the U.S. include those by Goodman et al. (2008), Wheaton et al. (2008) and Mikhed et al. (2009) in the U.S. These studies rely on different but related sets of variables used as explanatory variables for the fundamental drivers of house prices and they employ a variety of empirical techniques. Campbell et al. (2009) also investigate the presence of a house price bubble, but by studying the fundamental determinants of housing's rent-to-price ratio. They find that variation in the rent-to-price ratio reflects expected future risk premia for housing more than movements in the real interest rate. By using the rent-to-price ratio, they are able to abstract from fundamentals that operate on house prices through current rents.

Only limited research has used Canadian data to address this question. In earlier research, we adopted a rolling co-integration innovation technique to look at house prices over time (Clarke et al. (2010)). As in that work, we rely on variables for rent, personal income, population, mortgage rates, a stock index and inflation, and used a fractional co-integration technique to investigate the impacts on house prices. That research indicated that Canadian house prices may have diverged from fundamentals more than U.S. house prices did in the last decade, but it did not look at the period after the divergence of U.S. and Canadian house prices after the mortgage market crash in the U.S. Allen et al. (2009) use survey-based house price data from Royal LePage and Statistics Canada's house price index for new homes to identify which fundamental house price drivers are significant for particular Canadian cities.

Research on house price movements cannot be done without understanding the time series properties of house prices and the fundamental market variables. A co-integrating framework is extensively used to model the

relationship between fundamentals and house prices, and especially in vector error correction models (Abraham et al. (1996), Malpezzi (1999), Capozza et al.(2002), and Meen (2002)) which flow from the stock-flow model of housing used in Poterba (1984), Topel et al. (1988), and DiPasquale et al. (1994).Some researchers, including Gallin (2006), have challenged this approach, by arguing that when using more powerful panel tests with metropolitan area data, the hypothesis that house prices and incomes are not co-integrated cannot be rejected. In the approach we take in this paper, we use a vector error correction model, but only after testing the data for the presence of co-integration.

In the next sections, we discuss why this research matters in the current economic environment, the data we use and the models developed to test our hypotheses.

3. Differences in the Mortgage Markets

Canadian house prices significantly increased in the period 2000 to 2006, as did U.S. prices, but Canadian prices did not experience the dramatic collapse seen in the U.S. in 2007 to 2008 (see Figure 1). One hypothesis is that Canadian house prices did not decline as much, and readily recovered, because they continued to be driven by underlying fundamental factors, such as income and population growth, while those in the U.S. departed from fundamentals.

Other researchers have hypothesized that the differential proportion of investor-owned real estate led to different outcomes. This impact likely varies with the extent to which markets dominated by investors are more volatile than those dominated by owner-occupiers. It could also vary if investors respond differently to changes in different economic factors than owner-occupiers. For example, when markets decline, speculative investors may attempt to liquidate their positions, which exacerbates the downturn through increased supply. In contrast, in owner-occupied markets, downturns are accompanied by a significant drop in transactions and prices tend to be downwardly sticky. Owners, unless they have no option, would not likely try to sell in a down market. They might well rather choose to remain in the home, and sell when prices are higher.

Finally, the degree of securitization may have led to the different outcomes. Canada was relatively slow to securitize, compared to the U.S., with only $8.5 billion of CMHC annual mortgage securitization guarantees in 2001, in a year with $39.9 billion in annual CMHC insurance volumes. This represents about

21% securitized.[5] By 2010, 90% was securitized with securitization of $95.1 billion for annual CMHC insurance volumes of $106.1 billion.[6]

Canadian house prices reached a peak in 2008Q2 at 399.08 and then fell to 373.25 by 2009Q1, recovering fully to 400.53 by 2009Q4. By 2010Q4, the Canadian house price index stood at 412.05. The initial decline in Canadian prices, while a bit sharp, lasted only slightly more than a year. In contrast to the situation in Canada, the U.S. house price index increased until 2007Q1, reaching a peak of 381.69. Prices then continued a steady decline until 2010 with a low of 338.72 in 2010Q2. There was a bit of movement around that value for the last quarters of 2010 with the index value in 2010Q3 at 342.52 and in 2010Q4 at 339.77. Why the crash in the U.S., but not in Canada?

At the time that the U.S. house price index started to dramatically fall, there was considerable concern within Canada about whether or not Canada would follow the U.S. downward path. The sustained upward rise in house prices has been a significant driver of economic growth in Canada, as it had been in the U.S. Canada, like the U.S., had experienced a sustained growth in average house prices which dates from about 1994, similar to the beginning of the U.S. cycle. If that sustained upward movement had been followed by precipitous declines, it is likely that Canada would have borne rising mortgage delinquencies in Canada similar to those in the U.S. A contemporaneous Scotia Bank report noted the following: "With home price appreciation expected to remain positive and return to more normal levels, we do not expect any significant up-tick in delinquency rates, but rather a relatively gradual upward trend toward the historical mean. With that said, evidence of a rapidly deteriorating domestic economy would cause us to revisit this assumption."[7]

The observed differential outcomes across the two countries cannot be readily explained, but may result from a differential divergence from fundamentals. Alternatively, the differential proportion of subprime mortgage products caused the house price decline in the U.S. Canada, with its slower adoption of high loan-to-value requirements and lower credit scores requirements was less impacted by the growth of subprime. Differential access to capital in the two countries may have also been a factor. In both the mortgage-backed and asset-backed securities markets, dramatic increases occurred in the U.S. in the early part of the decade. Canada did not experience that increase in securitization at the same time, although current evidence does reveal a

[5] Canada Mortgage and Housing Corporation, Canadian Housing Observer, September 2011, Canadian Mortgage Funding Sources, 2001- 2010.

[6] In Canada, the CMHC insures nearly all mortgages that are not high loan-to-value mortgages. This means that securitization in Canada primarily occurs on high LTV loans (80 percent or higher).

[7] Scotia Bank, Canadian Non-Bank Mortgage Lenders: Compelling Opportunities in Out-of-Favor Sector, June 10, 2008 at 21.

significant change. We use the data from the two countries to try to disentangle the alternative hypotheses.

While the data on market fundamentals appear quite similar (see Figures 2 – 4), there were definite differences in the responses of Canadian and U.S. government housing agencies to the housing market pressures. For example, the Canadian government has responded to housing pressures with a series of amendments to the rules for origination of government-guaranteed mortgages.[8] In 2008, the maximum amortization period was reduced to 35 years from 40. Further adjustments were made in 2011 and 2012, bringing the maximum amortization period as of July 2012 to 25 years. Other rules that tightened access to credit include setting the minimum down payment to 5%, the maximum refinancing limit to 80% of property value and the total debt service ratio to 40%. Documentation standards for employment and income have become more rigorous and the government will no longer insure mortgages with property prices of over $1 million. The reported goal of these changes is to reduce the total debt load carried by Canadians, although analysts also believe that it is an attempt to cool surging Canadian house prices. When the first changes were announced in July 2008, the Department of Finance in Canada motivated them as "protecting and strengthening the Canadian housing market to ensure Canada's housing market remains strong and to reduce the risk of a U.S.-style housing bubble developing in Canada."[9] The government appeared to hold the view that the boom in Canadian housing prices resulted from fundamental economic factors (e.g., low interest rates, rising incomes and an expanding population), rather than from a housing bubble. Also in 2008, the International Monetary Fund (IMF) suggested that Canada's housing price growth was less than expected and that the market was less vulnerable to a major price correction that housing markets in the U.S. [10] The Canadian government's tighter rules accorded with the IMF and may have ensured less volatility in Canada's housing market than that which occurred in the U.S.

Credit standards were also considerably tightened in the U.S. in the face of the complete collapse of the subprime housing sector. By second quarter 2012, *Inside Mortgage Finance* estimated that 91 percent of the U.S. mortgage market consists of originations of conventional, conforming loans for which Freddie Mac and Fannie Mae carry the credit risk or the government-insured

[8] See Hogue, Robert, "Canada's Mortgage Rules to Tighten Again," RBC Current Analysis, June 21, 2012 and Department of Finance, Canada, "Harper Government Takes Action to Strengthen Canada's Housing Market," 2012-070, June 21, 2012 at http://www.fin.gc.ca/n12/12-070-eng.asp (last accessed August 2, 2012).

[9] Mortgage insurance issued by the CMHC receives a full government guarantee, and applies to 100 percent of the loan, even if the 5 percent down payment is borrowed. Private MI can insure 40 year amortization loans, but will not receive government guarantee. See, www.fin.gc.ca/news08/08--051e.html, last accessed August 21, 2008.

[10] International Monetary Fund, 2008, *World Economic Outlook*, Chapter 3, The Changing Housing Cycle and its Implications For Monetary Policy, April.

mortgages issued through the Federal Housing Administration (FHA) or Veterans Administration (VA) programs.[11] The conforming and FHA loans have different underwriting standards and thresholds, but as recently discussed in Courchane and Zorn (2012), credit standards have recently tightened on both types of loans.

While it is obvious that the dramatic house price declines that occurred in the U.S. did not occur in Canada, to predict what might happen was contemporaneously difficult. In this research, we examine data on the fundamentals, mortgage markets and house prices to see why the Canadian experience has differed to date from that of the U.S. We also speculate about whether Canada is also in the midst of a bubble that may burst.

4. Data

We assembled the data used in this paper from a wide variety of sources. The time frame we consider for our estimations ranges from the first quarter of 1985 to the fourth quarter of 2010. All data are quarterly. We created two parallel datasets, one for Canada and one for the U.S. [12]

For the Canadian house price index, we used the Royal LePage National House Price Survey which reports price movements at the level of the metropolitan area. To create a national index, we weighted these indices based on their 2006 metropolitan population. For the U.S., we used the national index produced by the Federal Housing Finance Agency (FHFA) for "all transactions". The two house price series are shown in Figure 1. We can observe a long period of house price growth in both Canada and the U.S. from the mid-1990s until 2006. As we indicated in the introduction, prices in the U.S. experienced a price decline in the first quarter of 2007 which continued to 2011. While the Canadian prices did not decline until the third quarter of 2008, as seen in Figure 1, Canadian house prices recovered to previous levels while U.S. prices continued to decline.

For each country, six other data items were employed: inflation, mortgage rates, personal income, population, a rental index and the stock market index.[13] We used the consumer price indices published by the Bank of Canada for Canada and the Bureau of Labor Statistics for the U.S. As shown in Appendix Table 1, inflation movements are remarkably similar across the two countries. As each is the other's largest trading partner, and the two

[11] Inside Mortgage Finance Publications, *Inside Mortgage Finance*, July 26, 2012, Mortgage Originations Indicator 2012Q2, Volume 29, Number 30

[12] Data available from authors upon request.

[13] We conducted additional tests by using a variety of other variables suggested by the literature with no major differences to our fundamental results. These variables are immigration levels, gross domestic product, unemployment rates, delinquency rates and other variables used to measure building costs (union wage, wood, iron and steel).

economies are tightly linked, this is not surprising. The measures of mortgage rates are also quite similar. Mortgage rates for the two countries are provided in Figure 2. The data sources for mortgage rates are the Canada Mortgage and Housing Corporation (CMHC) for Canada and the Primary Mortgage Market Survey (PMMS) data produced by Freddie Mac for the U.S. The Canadian values are for a 5-year, fixed-rate, conventional mortgages generally amortized over 25 years, and the U.S. values are those for 30-year, fixed-rate conventional mortgages. The term length selection was based on what is considered common and standard in both countries.

Figure 1 House Price Indices: Canada and U.S.

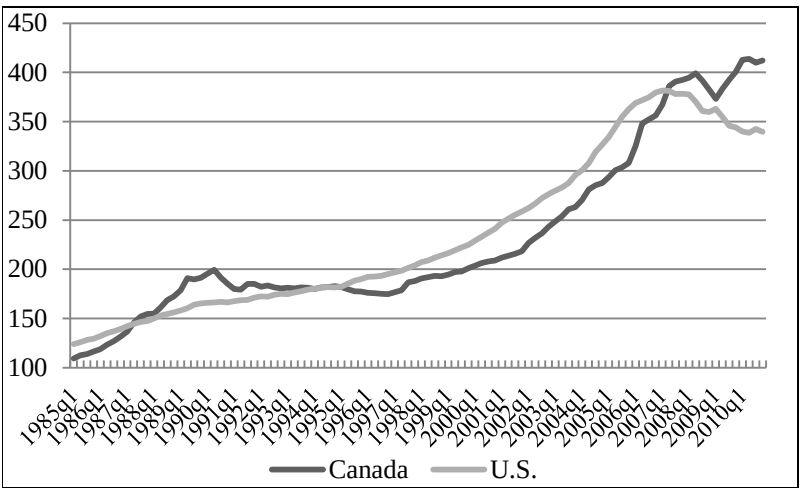
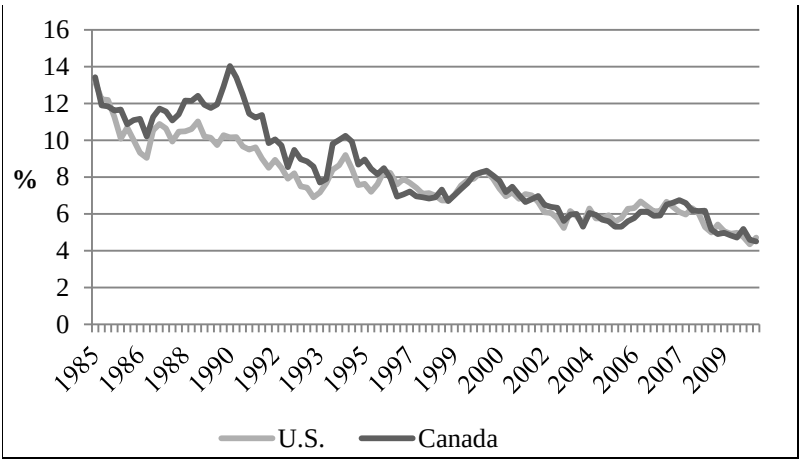


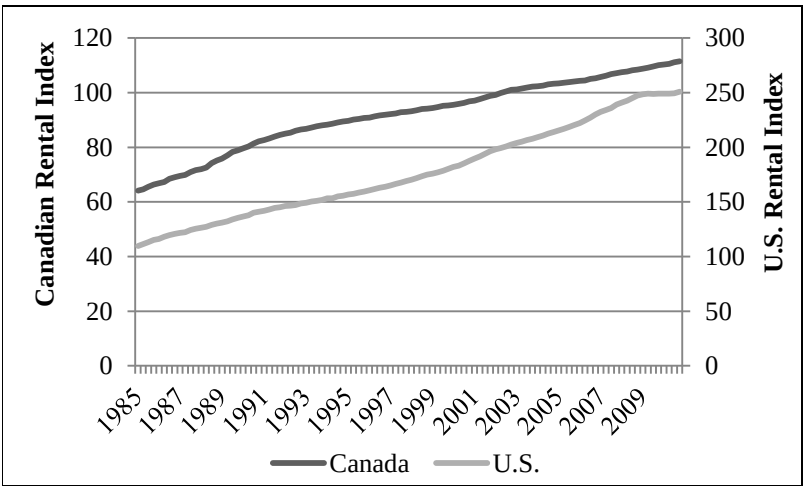
Figure 2 Mortgage Rates



Information for personal income and population are also provided in Appendix Table 1. The personal income in the two countries is based on measures from Statistics Canada and the Bureau of Economic Analysis. Personal income grew at very similar rates, although the U.S. levels are about ten times those of Canada. Statistics Canada produces the Canadian population measure while the Bureau of Economic Analysis produces the U.S. population measure. Population levels are reported annually in both countries and we interpolated these to create quarterly values by using the assumption that growth is uniform within each year. Over the period in question, the Canadian population increased by 32.7% and the American population increased by 31.2%.

For both Canada and the U.S., we use the rental component of the consumer price index for the measure of rents. In Canada, this value is reported by metropolitan area and we created a weighted national value based on 2006 metropolitan population weights. For the U.S., the rent of the primary residence component of the consumer price index is reported as the U.S. city average. Figure 3 plots the two values.

Figure 3 Rental Index



Standard and Poor's (S&P) provides both the Canadian and U.S. stock market indices. The Canadian index used is the S&P TSX Composite and the American index is the S&P 500. Both are shown in Figure 4.

Examination of the data for the endogenous variables contained in Figures 1 – 4 and Appendix Table 1 demonstrates the similarity between the macro economies of Canada and the U.S. Of all the data examined, the most striking deviation between the two countries appears to be the house price movements in 2007 to 2010. Table 1 reports the summary statistics for each series.

Figure 4 Stock Market

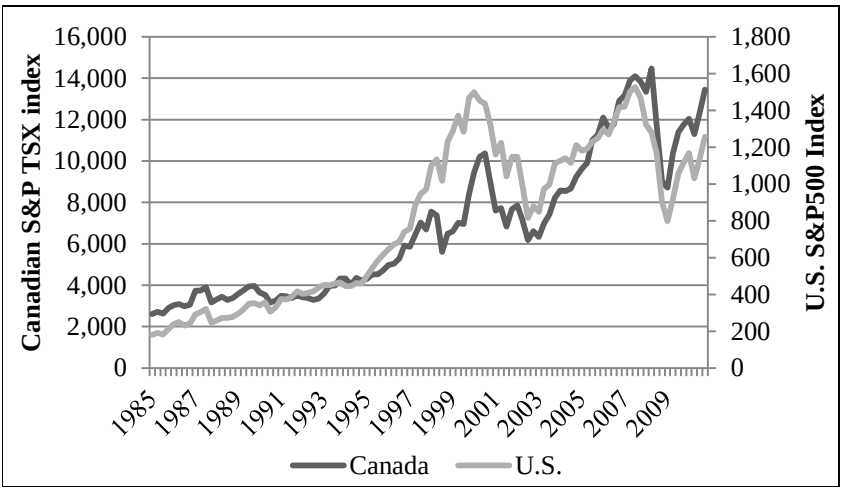


Table 1 Descriptive Statistics (n=104)

	Mean	Standard Deviation	Minimum	Maximum
Canada				
House price index	230.80	85.87	109.41	413.90
Inflation	92.68	14.68	65.90	117.60
Mortgage rate	8.300	2.506	4.500	14.030
Personal income	792.38	258.86	386.55	1,302.12
Population	29,800,000	2,414,193	25,700,000	34,100,000
Rental index	91.77	13.02	64.10	111.50
Stock market index	6,799.08	3,437.02	2,612.81	14,467.03
U.S.				
House price index	235.42	81.98	123.97	381.69
Inflation	162.90	33.88	106.40	219.18
Mortgage rate	7.748	1.921	4.350	13.170
Personal income	7,630.72	2,911.83	3,434.90	12,715.30
Population	274,000,000	22,400,000	237,000,000	311,000,000
Rental index	177.13	42.02	109.50	250.99
Stock market index	805.89	427.54	180.66	1,526.75

5. Methodology and Results

In this section, we will report our stationarity, vector error-correction (VEC) and model results.

We used an Augmented Dickey-Fuller (ADF) test to analyze stationarity. Table 2 reports these results, including the trend and one lag. For Canada, we found that the level of the house price index, inflation, the mortgage rate, personal income, population and the stock market index are not stationary. We found that the first differences of all the variables except population are stationary at 5%. For population, the second difference is stationary. None of the levels of the U.S. endogenous variables are stationary, but all of the first differences, including population, are stationary.

Table 2 Results of Augmented Dickey-Fuller Test

		Test Statistic	P-value	Stationary at 5%?
Canada				
House price index	Level	(1.483)	0.835	
House price index	First difference	(4.958)	0.000	Yes
Inflation	Level	(2.536)	0.310	
Inflation	First difference	(9.395)	0.000	Yes
Mortgage rate	Level	(3.029)	0.124	
Mortgage rate	First difference	(8.175)	0.000	Yes
Personal income	Level	(2.672)	0.248	
Personal income	First difference	(4.086)	0.007	Yes
Population	Level	(3.113)	0.103	
Population	First difference	(2.479)	0.339	
Population	Second difference	(6.992)	0.000	Yes
Rental index	Level	(4.171)	0.005	Yes
Rental index	First difference	(5.443)	0.000	Yes
Stock market index	Level	(3.274)	0.071	
Stock market index	First difference	(7.080)	0.000	Yes

(Continued…)

(Table 2 Continued)

		Test Statistic	P-value	Stationary at 5%?
U.S.				
House price index	Level	(0.974)	0.948	
House price index	First difference	(3.425)	0.048	Yes
Inflation	Level	(1.335)	0.879	
Inflation	First difference	(9.430)	0.000	Yes
Mortgage rate	Level	(3.758)	0.019	
Mortgage rate	First difference	(8.484)	0.000	Yes
Personal income	Level	(0.305)	0.989	
Personal income	First difference	(4.675)	0.001	Yes
Population	Level	0.095	0.995	
Population	First difference	(4.723)	0.001	Yes
Rental index	Level	(2.156)	0.515	
Rental index	First difference	(4.522)	0.001	Yes
Stock market index	Level	(1.607)	0.790	
Stock market index	First difference	(6.853)	0.000	Yes

A VEC methodology was used to model the relationship between the house price indices in the two countries and their respective macroeconomic variables. The use of the VEC model follows from the clear interdependencies among house prices, lagged house prices, the other endogenous variables and their lagged values. In addition, the non-stationary nature of the levels of our variables as demonstrated in Table 2 suggests the use of the VEC model.

The standard estimating equation for a VEC model with 4 lags is shown below.

$$\Delta V_t = a + b_1 \Delta V_{t-1} + b_2 \Delta V_{t-2} + b_3 \Delta V_{t-3} + b_4 \Delta V_{t-4} + r V_{t-1} + u_t$$

V is the vector of the time series variables, which are house prices, mortgage rates, stock market return, inflation, population, personal income and rental index. We use 4 lags due to the quarterly nature of our data.

An additional advantage of the VEC model is that the presence of cointegrating relationships does not invalidate the results as is the case with alternative estimation methods such as the standard vector-autoregressive (VAR) model. In fact, our preliminary analysis revealed that the appropriate

rank to use is 4, which is the number of cointegrating relationships in the model.

The resulting VEC model has seven equations that incorporate seven variables: house prices, mortgage rates, inflation, population, personal income, the rental index and the stock market index. The number of observations is 100 and the number of parameters is 26. This same model was estimated once for Canada and then once separately for the U.S.

Table 3 summarizes the results from the two models. The equation for the Canadian house prices had an R-squared of 80.8% while that for the U.S. was 84.8%, which indicate slightly less explanatory power in the Canada than in the U.S. Both models, however, explain much of the variation in house prices as a result of the included model variables.

Table 3 Vector Error-Correction (VEC) Summary of Results

Number of parameters	29			
Number of observations and lags	100, 4			
Timeframe	1986Q1 to 2010Q4			
Equation	**RMSE**	**R-squared**	**Chi-squared**	**P>chi2**
Canada				
House prices	0.012083	0.8084	307.9503	0
Mortgage rate	0.055152	0.4562	61.25253	0.0001
Stock market return	0.078541	0.3856	45.82008	0.0096
Inflation	0.004937	0.7380	205.6451	0
Population	0.000191	0.9966	21453.82	0
Personal income	0.005397	0.8847	560.3252	0
Rental index	0.001857	0.9365	1076.415	0
U.S.				
House prices	0.006618	0.8484	408.4791	0
Mortgage rate	0.050081	0.4942	71.33973	0
Stock market return	0.079026	0.3838	45.47473	0.0104
Inflation	0.006340	0.7340	201.4620	0
Population	0.000211	0.9954	15699.75	0
Personal income	0.006131	0.876	515.9089	0
Rental index	0.002325	0.9442	1235.052	0

Details of the house price equation for Canada and the U.S. are shown in Table 4.[14] This is one of the seven model equations, and for this equation for Canada, current house prices are significantly impacted by changes in house prices lagged one quarter. The Canadian house price equation indicates that a number of other variables significantly impact Canadian house prices. Lagged changes in Canadian mortgage rates have a positive and significant impact on current Canadian house prices. This might be due to a short run increase in transactions as borrowers try to complete home purchase decision before further mortgage rate increases. Changes in the inflation rate in past quarters inversely impact current house prices. As other prices rise, consumers may look for ways to insulate their household budgets from rising costs – and in the face of falling real incomes, household demand fall, and house prices fall. Finally, increases in the Canadian rental index are shown to have a significant impact on Canadian house prices. A past change in personal income (lagged one quarter) also has a positive impact on house prices, although the coefficient is slightly less significant. Finally, the change in population (lagged two quarters) has a large, negative impact on Canadian house prices, albeit of marginal significance. However, other lags have impacts in the opposite direction, which indicate that the changes in population do not have an easily interpretable impact on house prices.

In the U.S., many of the same impacts result, although not with the same level of significance. First, current house prices increase in response to increases in lagged house prices, with highly significant, positive effects that come from changes in house prices lagged one and three quarters, as expected. The change in the last period mortgage rates has a small, negative impact on house prices. Changes in inflation in one quarter past in the U.S. have a small negative impact on house prices while changes in personal income, lagged two quarters, has a small, marginally significant impact on house prices. While the signs are in the anticipated direction, the magnitudes are not large and the significance is marginal. It is only lagged house prices that have a highly significant impact in the U.S. It may be the case that house prices are relatively easy to observe and housing demand by buyers and housing supply by sellers react quickly to observed changes in the market. This effect may have been particularly enhanced by the publicity of the Case-Shiller index in the U.S. at the time of the collapse of the subprime market.[15] At the time house prices started to decline in mid-2007 through to 2008, there was enormous emphasis on the widespread declines throughout the country. During this period, inflation was changing by very little, personal incomes were steady and mortgage rates were at historically low levels.

[14] We indicate significance levels as follows: 99% is shown by P>|z|<=.01, 95% by P>|z|<= .05 and 90% by P>|z|<=.10.

[15] While we use the FHFA housing price index, reported for loans sold in the conventional, conforming market, the Case-Shiller index moved in comparable directions and by comparable amounts during this time.

Table 4 Vector Error-Correction Models - 1985Q1 to 2010Q4 (Only housing price equation shown)

		Canada		U.S.	
Variable	**Level Lagged Diff.**	**Coefficient**	**P>|z|**	**Coefficient**	**P>|z|**
House price index	First	0.231	0.02	0.492	0.00
House price index	Second	-0.141	0.19	0.024	0.87
House price index	Third	0.027	0.78	0.455	0.00
Mortgage rate	First	0.129	0.00	-0.033	0.07
Mortgage rate	Second	0.080	0.02	-0.017	0.32
Mortgage rate	Third	0.053	0.07	0.009	0.55
Inflation	First	-1.127	0.00	-0.301	0.06
Inflation	Second	-0.975	0.00	0.142	0.35
Inflation	Third	-0.314	0.26	0.048	0.71
Population	First	12.004	0.12	0.726	0.80
Population	Second	-17.392	0.06	-1.579	0.58
Population	Third	8.346	0.26	1.328	0.69
Personal income	First	0.544	0.06	-0.013	0.93
Personal income	Second	0.040	0.88	0.228	0.07
Personal income	Third	0.070	0.79	-0.027	0.84
Rental index	First	1.771	0.02	-0.169	0.59
Rental index	Second	1.140	0.07	-0.039	0.91
Rental index	Third	3.251	0.00	0.076	0.81
Stock market index	First	0.030	0.13	-0.004	0.75
Stock market index	Second	0.017	0.35	0.008	0.48
Stock market index	Third	-0.003	0.87	0.006	0.59
Constant		0.001	0.95	0.002	0.79
Error correction term 1		-0.150	0.00	-0.006	0.81
Error correction term 2		-0.136	0.00	0.021	0.24
Error correction term 3		1.445	0.00	0.036	0.78
Error correction term 4		-1.820	0.00	0.419	0.11

Table 5 shows the R-squared values for the house price equation for Canada and the U.S. during short timeframes. We use just three variables here because the shorter timeframe of course reduces our degrees of freedom. We show the results for the model estimated by using mortgage rate, personal income and the rental index.[16] Across the entire timeframe, a house price equation with these three variables in a VEC model had an R-squared of 80.6% for the U.S. and 72.0% for Canada. This is in contrast to the R-squared values of 84.8% for the U.S. and 80.8% for Canada by using all six variables. We then broke the time period into three subperiods based on the pattern of house prices. As seen in Figure 1, a long and sustained period of house price increases for both countries began in 1995. The first period is from the beginning of our sample, 1985Q1 until the 1994Q4. The second period covers this sustained increase, and the third period begins in 2006Q1 when U.S. and Canadian house prices began to diverge. We are interested in the explanatory power of a model based on fundamentals during this period. For the U.S., we find that the explanatory power of the model was highest during the second period (price run-ups) when R-squared was 93.5%. In contrast, the period with the highest R-squared for Canada is the most recent period, from 2006Q1 to 2010Q4.

Table 5 Vector Error-Correction Models(by Subperiods)

R^2 for housing price equation shown		
3-factor model - Mortgage rate, personal income, rental index		
	Canada	**United States**
Full Period		
1985Q1 to 2010Q4	72.0%	80.6%
Subperiods		
1985Q1 to 1994Q4	82.7%	90.3%
1995Q1 to 2005Q4	80.3%	93.5%
2006Q1 to 2010Q4	92.8%	82.7%

[16] We performed checks for robustness by using other sets of three variables to ensure that our selection of variables was not impacting our findings. We should note that mortgage rate was always one of the variables. Although the R-squared result was slightly different depending on which variables were included, the broad pattern of results held across all specifications.

6. Consequences and Predictions

U.S. house prices, right up to the period when house prices declined, continued to closely follow market fundamentals. However, following the fundamentals does not mean that house prices cannot crash. This may not be a typically defined "bubble" bursting, but rather the result of a shock to the system – a shift in the structure of the markets not previously experienced. In the case of the U.S., this "shock" could have been the implosion of the subprime market. The rapid rise of subprime, perhaps a consequence of the increased flow of capital to the U.S. housing market as investors looked for ever higher returns on their capital investments, was a structural change in the U.S. The utter collapse of subprime, throughout 2007 – 2008, was another dramatic structural shift. As reports of widespread delinquencies from subprime loans emerged, investors quickly fled from the market, which led to a rapid increase in early period defaults that further increased concerns about the safety and return of investments in the U.S. housing markets. Fueled by immense publicity over the dramatic drop in house prices, borrowers and investors rapidly changed expectations, which further exacerbated housing price changes. The U.S. has now diverged from fundamentals (with the explanatory power of market fundamentals decreasing from 93.5% to 82.7% after 2006Q1). The question for Canada, who is still closely following fundamentals (explanatory power of just 80.3% before 2006Q1 changed to 92.8% after 2006Q1), is whether any similar "shock" to the system could result in a housing price decline as expectations change.

To look at economic factors that might impact house prices, we examine three ratios that reflect the willingness of consumers to incur debt for housing. These three measures include the ratio of total household debt to gross domestic product (GDP), the ratio of the house price index (HPI) to personal income, and the ratio of the rental index to the HPI. These three measures indicate whether consumers are increasingly financially constrained, whether housing consumes a relatively larger share of income and whether rental options are becoming more or less expensive relative to home ownership options. Changes in any of these might impact the demand for housing with a coincident impact on the HPI. The data included for Figures 5-7 are quarterly observations. Time periods reflect differences in the availability of data.

First, Figure 5 presents the ratio of household debt to GDP.[17] As expected, the housing market downturn and the economic recession in the U.S. led to declining levels of housing debt in the U.S. Canada's ratio increased by almost ten percentage points in early 2009, maintaining that level to the present, but not reaching the relative level of that debt found in the U.S. in 2009.

[17] Data series for U.S.: HDTGPDUSQ163N and data series for Canada: HDTGPDCAQ163N from the International Monetary Fund, Financial Soundness Indicators, quarterly, not seasonally adjusted.

Figure 5 Ratio of Household Debt to GDP

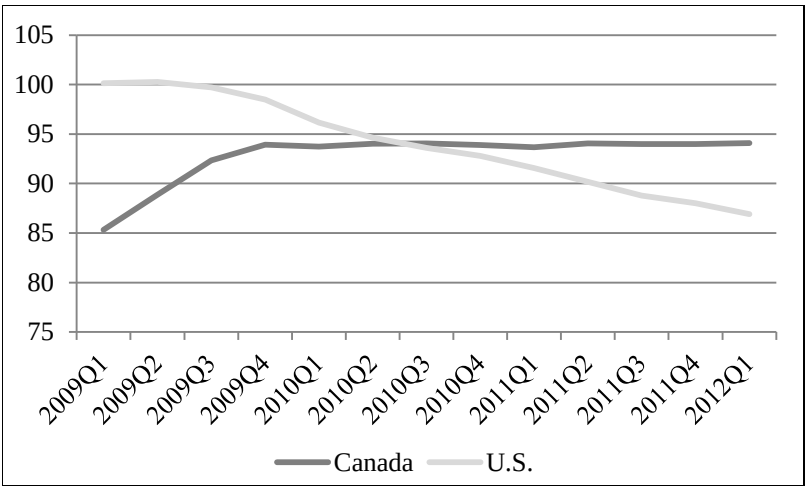
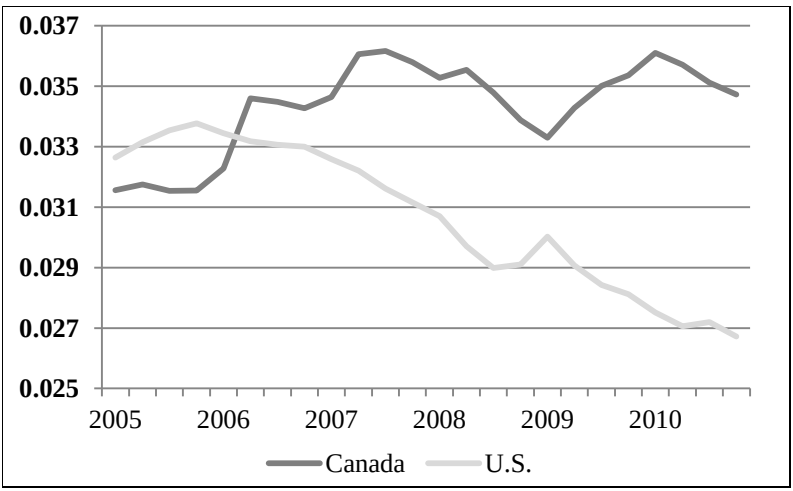


Figure 6 provides the ratio of the house price index for each country to the level of personal income – which shows how relatively expensive housing might be compared to income levels.[18] While at nearly identical ratios in 2006, by 2010, the fall in U.S. house prices led to a significant decline in the ratio for the U.S. Over this period, there was a slight decline in U.S. personal income from midyear 2008 to midyear 2009, but it has otherwise increased. Canada's personal income has continued to rise over that same time period from 1164.19 to 1302.12.

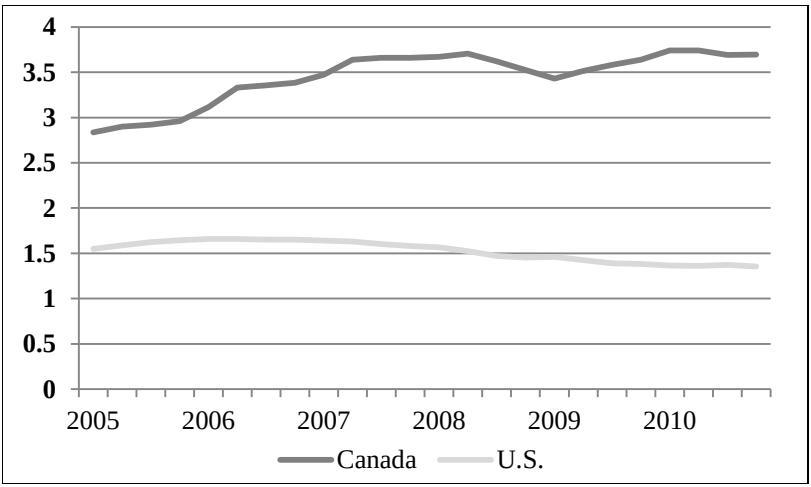
Figure 6 Ratio of House Price Index to Personal Income



[18] The Canadian series are scaled by the relative populations (U.S./Canadian).

Figure 7 provides the ratio of the house price index to the rental index for the two countries, which gives an indication of the relative expense of home ownership. For Canada, the ratio continues to rise, while for the U.S., it has been quite flat since 2009, varying from slightly over to slightly less than 1.5 between 2005Q1 and the end of 2010.

Figure 7 Ratio of House Price Index to Rental Index



Next, in Table 6, we display the changes in securitization volumes in the two countries over the past decade. The U.S. began the decade with a relatively high share of securitized mortgages (54.0%) reached a peak in 2009 (64%) and then slightly declined. Canada's securitization rose more sharply, tripling throughout the decade from 11% in 2001 to 32.7% by 2010. Unlike in the U.S., there has not been a subsequent decline in the securitization share – the change remains positive, if small, through 2010. The level of outstanding mortgage-backed security (MBS) in both countries rose through 2009.

In the U.S., the change over the decade was from $3.25 to $6.95 trillion, slightly more than a doubling. In Canada, the share of MBS outstanding grew from $50.94 to $339.99 billion, a percentage increase in excess of 500%. This incredibly rapid growth in securitization is a key difference between the mortgage market funding in Canada and the U.S. It is certainly something that could impact the ultimate level of house prices in Canada, but the direction of the impact is unclear at this time.

Table 6 Securitization in Canada and the United States

	Canada				United States			
Year	Total MBS (Billions)	Outstanding Mortgages	Percent	Growth Rate	Total MBS (Billions)	Outstanding Mortgages	Percent	Growth Rate
2001	50.9	462	11.0%		3,251,325	5,678,000	57%	
2002	61.0	498	12.3%	11%	3,509,783	6,437,500	55%	-5%
2003	74.3	543	13.7%	11%	3,910,929	7,239,900	54%	-1%
2004	93.9	603	15.6%	14%	4,380,565	8,271,100	53%	-2%
2005	119.0	663	18.0%	15%	5,131,519	9,386,600	55%	3%
2006	148.2	733	20.2%	13%	5,956,331	10,453,400	57%	4%
2007	190.4	828	23.0%	14%	6,620,636	11,173,100	59%	4%
2008	254.1	891	28.5%	24%	6,827,174	11,070,100	62%	4%
2009	314.2	970	32.4%	14%	6,984,357	10,870,900	64%	4%
2010	339.0	1,038	32.7%	1%	6,609,768	10,526,600	63%	-2%

7. Conclusions

While the U.S. and Canada have shared many of the same fundamental patterns in terms of economic factors that impact housing prices, the two countries significantly diverged in terms of changes in house price indices when U.S. mortgage markets experienced a significant, nationwide downturn in 2008. This paper has addressed several questions by performing and comparing VEC analysis of the housing prices in the two countries.

We have investigated whether or not one country is more closely linked to fundamentals than the other. We find that the changes in fundamentals (first differences) impact house prices in similar ways in the two countries. The model for the U.S. actually has a better fit than the one for Canada over the long term. This finding contributes to the existing literature about whether U.S. house prices declined in the U.S because of a break from fundamentals. We find that indeed, the U.S. downturn was not predicted by a model through the use of these fundamentals, but that overall, the U.S. prices were modeled better than the Canadian prices.

In fact, we find that U.S. prices were best explained by fundamentals during the run-up in prices from 1995 to 2005, while Canada is most closely aligned during the period 2006 to 2010. Our conclusion is therefore that the U.S. downturn was due to a shock not captured by fundamental factors. Factors not captured by the fundamentals model including the higher share of subprime and investor-owned properties, and the dramatic shift in the agency share (Freddie Mac, Fannie Mae and FHA) in the U.S. None of those structural shifts impacted Canada to the degree that they influenced U.S. house prices. At this time, the impact of the falling prices and the rise in subsequent mortgage delinquencies and foreclosures mean that the house price overhang continues to dampen the U.S. recovery.

We have also examined some key ratios related to housing and debt and note that the Canadian values appear more worrisome. It is unclear for just how long Canada's house prices will continue their upward climb.

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Appendix Table 1

While our models used quarterly observations, we present the inflation rate, population and income series in the 12th month of each year for the purpose of comparison. The rates of change will not exactly correspond to those in the text, as they use the full quarterly series for each variable.

Appendix Table 1 Comparisons of Canadian and U.S. Inflation, Population and Income

Year	Month	Inflation Rate Canada	Inflation Rate U.S.	Population Canada	Population U.S.	Personal Income Canada	Personal Income U.S.
1985	12	67.50	109.30	25,842,116	239,069,506	409.42	3,571.00
1986	12	69.90	110.50	26,100,278	241,289,235	435.03	3,763.90
1987	12	72.60	115.40	26,446,601	243,455,649	472.08	4,047.40
1988	12	74.80	120.50	26,791,747	245,676,355	521.37	4,351.10
1989	12	78.10	126.10	27,276,781	248,007,776	561.02	4,649.30
1990	12	81.80	133.80	27,691,138	250,999,634	595.99	4,920.40
1991	12	82.90	137.90	28,037,420	254,526,769	610.72	5,126.10
1992	12	84.40	141.90	28,371,264	258,062,038	623.73	5,490.90
1993	12	85.70	145.80	28,684,764	261,351,847	635.53	5,709.20
1994	12	87.10	149.70	29,000,663	264,511,940	657.54	6,026.60
1995	12	88.50	153.50	29,302,311	267,672,343	678.21	6,304.70
1996	12	90.30	158.60	29,610,218	270,858,868	696.13	6,734.30

(Continued…)

(Appendix Table 1 Continued)

Year	Month	Inflation Rate Canada	Inflation Rate U.S.	Population Canada	Population U.S.	Personal Income Canada	Personal Income U.S.
1997	12	91.00	161.30	29,905,948	274,112,238	725.56	7,175.50
1998	12	91.80	163.90	30,155,173	277,269,404	760.88	7,683.60
1999	12	94.20	168.30	30,401,286	280,466,621	797.67	8,114.70
2000	12	97.20	174.00	30,685,730	283,493,503	857.70	8,707.30
2001	12	97.70	176.70	31,019,020	286,282,016	883.32	8,912.30
2002	12	100.90	180.90	31,353,656	289,003,868	914.09	9,126.80
2003	12	103.00	184.30	31,639,670	291,595,413	945.51	9,578.30
2004	12	105.10	190.30	31,940,676	294,258,671	1,001.49	10,223.10
2005	12	107.30	196.80	32,245,209	296,991,295	1,060.05	10,740.80
2006	12	109.70	201.80	32,576,074	299,931,461	1,128.79	11,504.80
2007	12	112.30	210.04	32,931,956	302,868,731	1,191.65	12,141.40
2008	12	114.20	210.23	33,327,337	305,583,122	1,231.53	12,356.30
2009	12	115.70	215.95	33,739,859	308,200,409	1,239.81	12,239.00
2010	12	117.60	219.18	34,108,752	310,823,152	1,302.12	12,715.30
Rate of Change: 1985 - 2010		74.22%	100.53%	31.99%	30.01%	218.04%	256.07%
Rate of Change: 2000-2010		20.99%	25.96%	11.16%	9.64%	51.82%	46.03%